United States Department of Agriculture

Technical Advisory Group for Biological Control Agents of Weeds Manual

Interim Edition

This interim edition contains chapters 1 through 5 and Appendixes A, B, C, D, E, F, only; remaining to be released at a later date.

Interim Edition Issued 2016

TAG-BCAW Manual

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1

Introduction

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Purpose

The *Introduction* chapter of the *Technical Advisory Group for Biological Control Agents of Weeds Manual* (TAG-BCAW Manual) provides guidance for the technical advisory group and the scientific community, including petitioners and TAG-BCAW reviewers.

The TAG-BCAW Manual serves the following functions:

- Information guide for other users
- Reference guide for preparing petitions
- Reference guide for preparing test plant lists
- Reference guide for reviewing and evaluating petitions for field release of biological control agents of weeds in the United States
- Reference guide for reviewing and evaluating test plant lists
- Training tool for orienting TAG-BCAW members

Scope

What the Manual Covers

The TAG-BCAW Manual is written specifically for researchers preparing and submitting petitions or test plant lists associated with the proposed release of biological control agents of weeds, and for TAG-BCAW members responsible for reviewing and evaluating submitted petitions and test plant lists.

The manual contains the following chapters:

- Introduction
- Technical Advisory Group
- Petitions and Permitting
- Biological Control of Weeds
- Format and Evaluation
- ESA Compliance

The Technical Advisory Group chapter provides new members with a history of the advisory group, its charter, and insight into the review process that the TAG-BCAW follows.

The Petitions and Permitting chapter provides a flowchart of the petition process and information about APHIS' process for petitioners to follow for obtaining permits.

The Biological Control of Weeds chapter provides basic information about topics such as identification and characterization of biological control agents of weeds, host specificity, and testing methods.

The Format and Evaluation chapter provides formats for petitions for field release and for test plant lists respectively. The checklists are for TAG-BCAW members to follow as they review petitions for field release of biological control agents of weeds and test plant lists. The chapter also provides the evaluation guidelines to facilitate the review, evaluation, and approval processes. TAG-BCAW members use these as they review test plant lists and petitions for field release of biological control agents of weeds. Throughout the evaluation guidelines, TAG-BCAW members are prompted to record their comments on a Reviewer's Comment Sheet.

The ESA Compliance chapter provides an overview of Section 7 of the Endangered Species Act (ESA) and Fish and Wildlife Service's role on TAG-BCAW. Researchers and petitioners are encouraged to read this and the ESA.

The manual contains appendices, a glossary, and an index.

What the Manual Does Not Cover

The manual **does not** cover the following:

- Approval for permits
- Approval for petitions
- Final decisions on the release of biological control agents of weeds

Users

The *Technical Advisory Group for Biological Control Agents of Weeds Manual* (TAW-BCAW Manual) is written for use by TAG-BCAW members and by petitioners. Parts of this manual may be referenced by others, such as experts within the Federal agencies represented on TAG-BCAW, researchers, external reviewers, university experts, foreign nationals who are involved in evaluating biological control agents, and members of international organizations, such as the North American Plant Protection Organization (NAPPO).

The experience level of the TAG-BCAW Manual's users will vary, but TAG-BCAW members should fully understand and communicate their **Agency**'s or organization's current perspective on biological control activities.

Related Documents

Authority

Enabling legislation provides the authority to carry out the mission of protecting American agriculture from plant pests. Legislative Acts are the fundamental authority granted by Congress to the Secretary of Agriculture to promulgate regulations to protect American agriculture. The regulatory authority for taking the actions listed in this manual is contained in the Plant Protection Act (PPA). The PPA provides the authority to prohibit or restrict imports, exports, or interstate movement of biological control agents, plant pests, plant products, plants, noxious weeds, and means of conveyance.

The regulatory authority for taking the actions listed in the manual are contained in the following:

- Endangered Species Act (ESA) (16 U.S.C. 1531 et. seq.)
- National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.)
- Plant Protection Act of 2000 (PPA) (7 U.S.C 7701 et. seq.)
- Coastal Zone Management Act (16 U.S.C. 1451 et. seq.)
- Executive Order 13112 (64 CFR 6184) for Invasive Species

Plant Protection Act of 2000

The Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.) provides the Secretary of Agriculture with the authority to regulate "any enemy, antagonist, or competitor used to control a plant pest or noxious weed."

Cooperating Organizations

The following are cooperating agencies, countries, and organizations for the TAG-BCAW Manual:

- Canada, Agriculture and Agri-Food Canada
- Mexico, SAGARPA-SENASIA-DGSV
- National Plant Board
- United States Department of Defense (USDOD), U.S. Army Corps of Engineers (COE)
- United States Environmental Protection Agency (EPA)
- United States Department of Agriculture (USDA), Agricultural Research Service (ARS)
- USDA, Animal and Plant Health Inspection Service (APHIS)
- USDA, Forest Service (FS)
- USDA, National Institute of Food and Agriculture (NIFA)
- USDA, Natural Resource Conservation Service
- United States Department of Interior (USDI), Bureau of Indian Affairs (BIA)
- USDI, Bureau of Land Management (BLM)
- USDI, Bureau of Reclamation (BR)
- USDI, Fish and Wildlife Service (FWS)
- USDI, National Park Service (NPS)
- USDI, U.S. Geological Survey (USGS)
- Weed Science Society of America (WSSA)

Application

This manual contains information for TAG-BCAW members to use as they review test plant lists and petitions for release. This manual contains instructions for petitioners to follow to prepare and submit a petition; and provides instructions for petitioners to follow to submit an application for a permit.

Conventions

Conventions are established by custom and are widely recognized and accepted. Major conventions used in this manual follow.

Advisories

Advisories are used throughout the manual to bring important information to your attention. Please carefully review each advisory. The definitions coincide with those of the American National Standards Institute (ANSI), and are in the format shown below.

DANGER

DANGER indicates a hazardous situation which, if **not** avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if **not** avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if **not** avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices **not** related to physical injury.

SAFETY

SAFETY is used to indicate specific safety-related instructions or procedures.

Boldface

Boldface type is used to emphasize important words throughout this manual. These words include: **always**, **cannot**, **do not**, **does not**, **except**, **lacks**, **must**, **neither**, **never**, **no**, **nor**, **not**, **only**, **other than**.

Bullets

Bulleted lists indicate there is **no** specific order to follow for the information listed.

Change Bar

A black change bar (see left margin) is used to indicate a change appearing on a revised page. Unfortunately change bars **do not** always appear when text is deleted.

Contents

Every chapter has a table of contents listing **only** the first- and second-level headings with the chapter section.

Control Data

Control data is located at the top and bottom of each page to help manual users keep track of where they are in the manual and to be aware of updates to specific chapters and appendixes in the manual. At the top of each page is the chapter title and first-level heading for that page. At the bottom of each page is the transmittal number (month, year, number), title of the manual, and page number.

Examples

Examples are used to clarify a point by applying to a real-world situation.

EXAMPLE Examples are graphically-placed boxes within the text as a means of visually separating information from other information contained on the page. Examples appear in a box like this.

Footnotes

Footnotes comment on or cite a reference to text and are referenced by number. The footnotes used in this manual include general text footnotes, figure footnotes, and table footnotes.

General text footnotes are located at the bottom of the page after a thin green line half the width of the page and flow numerically throughout a chapter.

When space allows, figure and table footnotes are located directly below the associated figure or table. However, for multi-page tables and tables covering the entire length of a page, the footnote numbers and footnote text **cannot** be included on the same page. If a figure or table continues beyond one page, then the associated footnotes will appear on the page following the end of the figure or table. Each table's footnotes are individually numbered, and will be indicated beginning with footnote number 1.

Heading Levels

Within each chapter and section there are up to four heading levels. The first-level heading is indicated by a horizontal line across both the left and right columns, and the heading follows directly below and across both columns. The second-level heading is in the right-hand column with the text beginning below and is subordinate to the first-level heading. The third-level heading is in the right-hand column with the text following below and is subordinate to the second-level heading. The fourth-level heading is followed by a period, is inside the right column, and is subordinate to the third-level heading.

Hyperlinks to Figures, Headings, and Tables

Figures, headings, and tables are cross-referenced in the body of the manual and are in blue hypertext in the on-line manual.

EXAMPLE See Reporting Problems With or Suggestions for the Manual on page 1-9 to determine where to report problems with this manual.

Indentations

Content information, lengthy quotations, and entry requirements which are summarized from the *Code of Federal Regulations*, import permits, or policies are indented.

Italics

The following items are italicized throughout this manual:

- Cross-references to headings
- Publication names
- Scientific names of commodities

Numbering Scheme

A three-level numbering scheme is used in this manual for figures, pages, and tables. The first number represents the chapter. The second number represents the section. The third number represents the page, table, or figure. Dashes are used in numbering to differentiate from decimal points.

Transmittal Number

The transmittal number contains the month, year, and a consecutively-issued number (beginning with -01 for the first transmittal for each edition and increasing consecutively for each update to the edition). The transmittal number is **only** changed when a specific chapter, section, front matter, or back matter is updated. If **no** changes are made to a specific chapter or section, then the transmittal number for that chapter or section remains unchanged. The transmittal number **only** changes for the entire manual when a new edition is issued or changes are made to the entire manual.

EXAMPLE 04/2016 is the transmittal number for this interim edition and is located in the control data in the footer area of the pages in this manual.

04 is the month the manual was issued.
2016 is the year the manual was issued.

Using the Manual

Review the contents of the manual to get a feel for the scope of the material covered. Glance through the section that you will be using, and familiarize yourself with the organization of the information. Use the table of contents which is listed on the first page of each chapter or section and some appendixes to find the information you need. If the table of contents is **not** specific enough, then use the index to find the topic and corresponding page number or use the pdf search feature.

EXAMPLE To find information about APHIS' perspective on the biological control of weeds in North America, see Animal and Plant Health Inspection Service (APHIS) on **page 2-3-2**.

Reporting Problems With or Suggestions for the Manual

Use Table 1-1-1 to determine where to report problems, disagreements, or improvements which directly affect the contents of the TAG-BCAW Manual.

Table 1-1-1 Where to Report Problems With or Suggestions for the TAG-BCAW Manual

If you:	Then:
Are **not** able to access the on-line manual	CONTACT the Manuals Unit by Email deborah.j.briggs@usda.gov or call 240-529-0357
Have a problem with the content of the manual that requires an answer	CONTACT the TAG-BCAW Executive Secretary Mr. Gregg Goodman **USDA-APHIS-PPQ** 4700 River Road, Unit 133, 4C-01.48 Riverdale, MD 20737 Email: gregg.b.goodman@usda.gov Phone:301-851-2074 Fax: 301-734-5269
Have a question with or suggestion for improving the content of the manual	1. PRINT the Comment Sheet 2. Write your suggestion 3. SEND the completed comment sheet to the TAG-BCAW Executive Secretary by Email or U.S. Mail Mr. Gregg Goodman TAG-BCAW Executive Secretary **USDA-APHIS-PPQ** 4700 River Road, Unit 133, 4C-01.48 Riverdale, MD 20737 Email: gregg.b.goodman@usda.gov
Have a suggestion for improving the formatting (composition, design, layout), grammar, or spelling	CONTACT Debi Briggs in the PPQ Manuals Unit at deborah.j.briggs@usda.gov or call 240-529-0357

Manual Updates

The USDA-APHIS-PPQ Manuals Unit issues and maintains manuals electronically on the Manuals Unit Web site.

Immediate update revisions to the manual are issued and distributed via email to CBP Agriculture Specialists, PPQ employees, current TAG-BCAW members, and subscribers to the USDA-APHIS Stakeholder Registry (go to the Manuals Updates/Import Inspection Manuals/ listed; and check the box for the *Technical Advisory Group for Biological Control Agents of Weeds Manual)*.

Each immediate update contains the following information:

- Link to access and download the on-line manual
- List of the revised pages
- Purpose of the revision(s)
- Transmittal number

Ordering Manuals and Revisions

Although using the on-line manuals is the preferred method, USDA-APHIS employees may order hard copies of manuals from the APHIS Printing, Distribution, Mail Center, and Copier Services Center in Riverdale, Maryland. Visit the Riverdale Print Shop Web site for detailed information and printing costs. The Manuals Unit is **not** responsible for printing costs.

Chapter

2

Technical Advisory Group

Introduction

Contents

Introduction

The *Introduction* section of the *Technical Advisory Group* chapter provides information about the Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW).

Biological Control of Weeds

Biological control can be defined as the deliberate use of natural enemies (competitors, parasites, pathogens, predators, and other organisms) to suppress and maintain populations of a target pest species (insects, mites, plant pathogens, and other pest organisms) below densities that cause economic and/or environmental damage.

Classical biological control of weeds consists of returning to the native range of the target weed, identifying its complex of natural enemies, testing extensively, and releasing one or more host specific, natural enemies to control the target weed. See Biological Control on page 4-1 for basic information. Many organizations are involved in searching, testing, and introducing potential biological control agents of weeds. Some of these organizations include the USDA Agricultural Research Service (ARS); the USDA Forest Service (FS); USGS Biological Resources Division; State departments of agriculture and universities; Agriculture and Agri-Food Canada, and CAB International. Within the United States, the importation and the release of biological control agents of weeds are regulated by USDA-APHIS because the agents may potentially present a plant pest risk.

History

Over the last 50 years, technical advisory groups have assisted researchers and regulatory agencies in evaluating proposed biological control agent introductions for biological control of weeds in the United States.

Subcommittee on Biological Control of Weeds

The Subcommittee on Biological Control of Weeds, the first advisory group, was established in 1957. The initial membership included representatives from the U.S. Department of the Interior's (USDI) Bureau of Reclamation, Bureau of Land Management, and Fish and Wildlife Service; and from the U.S. Department of Agriculture's (USDA) Forest Service and Agricultural Research Service.

The initial responsibilities of the Subcommittee were as follows:

- Advise whether certain plant species targeted for biological control are universally regarded as weeds and recommend a course of action for situations involving conflicts of interest; and
- Recommend non-target plant species to be tested against the phytophagous organisms proposed for introduction.

Through the 1960s the Subcommittee communicated primarily through correspondence, **only** meeting periodically to discuss biological control of weeds. An informal, reciprocal review of proposals began in 1962 between the United States and Canada. In 1969 the membership of the Subcommittee was expanded to include subject matter experts in plant taxonomy, ornamentals, and plant quarantine. At that time, the Bureau of Reclamation dropped its membership.

Working Group

In 1971 the Subcommittee on Biological Control of Weeds became known as the Working Group on Biological Control of Weeds. At this time, the Working Group began contacting Mexican officials concerning U.S. proposals. Canadian and Mexican comments were invited because the Working Group knew that an introduced organism recognizes **no** political boundaries and its introduction needed to be considered on a continental basis. Membership changed over the years because of reorganizations and the need to add members from the Environmental Protection Agency, Cooperative State Research, Education, and Extension Service (now the National Institute of Food and Agriculture), and the U.S. Army Corps of Engineers.

Although the Subcommittee and Working Group were formed to provide advice primarily to the researchers, the Subcommittee's and Working Group's comments could be used by APHIS-PPQ in making decisions about issuing

permits for importation or release. Responsibilities and procedures followed by the Working Group also changed over the years.

Important additional responsibilities taken on by the Working Group were as follows:

- Review proposals to introduce candidate organisms into quarantine facilities; and
- Review adequacy of documentation supporting a proposed field release.

Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW)

In January 1987, the Working Group was replaced by the Technical Advisory Group (TAG), now known as the Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW). Then and now, TAG-BCAW functions under USDA-APHIS Plant Protection and Quarantine (APHIS-PPQ). Its membership continues to be voluntary and now **must** be in accordance with the Federal Advisory Committee Act (FACA). Membership is indefinite until members retire or their Agencies or organizations name someone else. TAG-BCAW is facilitated by an Executive Secretary from APHIS-PPQ. The TAG-BCAW Executive Secretary is **not** a voting member. The TAG-BCAW Chair is elected by its members for a 3-year, renewable term.

Over the years, the TAG-BCAW has adapted to the needs of both researchers and regulatory agencies to better serve when they propose introducing an exotic organism into the United States for the biological control of weeds.

Today the TAG-BCAW, with their scientific expertise, functions as a liaison to the biological control community and APHIS. The TAG-BCAW is able to advise potential petitioners about issues related to test plant lists and host specificity testing and research.

APHIS-PPQ seeks the advice of and recommendations from the TAG-BCAW, and relies on the TAG-BCAW to provide scientifically-justified, unbiased recommendations. APHIS considers TAG-BCAW's recommendations before performing a National Environmental Policy Act (NEPA) analysis; and then considers TAG-BCAW's recommendations on proposed biological control agent of weeds before making a permit decision.

The Plant Protection Act gives APHIS the authority to regulate the importation and release of biological control agents that may potentially present a plant pest risk. These regulations can be found in 7 CFR 330.200.

The expectation is that researchers will involve the TAG-BCAW relatively early in a program to suggest the inclusion of certain test plants, perform, a

NEPA analysis, identify conflicts of interest, and assess risk associated with a release.

TAG-BCAW **does not** inform researchers of areas where a plant species may be considered a weed or a desirable plant. TAG-BCAW members **do not** make final decisions on the approval and permitted action for the release of biological control agents of weeds in North America.

TAG-BCAW members **only** recommend to APHIS-PPQ that a proposed biological control agent be approved or denied permission for release, and recommend to petitioners specific action before they apply for a formal permit.

NOTICE

TAG-BCAW **does not** approve petitions or permits. See APHIS Permitting Process on page 3-1.

In summary, the TAG-BCAW continues to provide APHIS-PPQ with a process in which petitions and test plant lists are reviewed by uninvolved parties from varying perspectives and concerns and varying scientific disciplines. TAG-BCAW continues to serve as a science-based link between the research community and regulatory agencies, and to provide input from stakeholders.

References

Coulson, Jack R. 1992. The TAG: development, functions, procedures, and problems. In: Regulations and guidelines: critical issues in biological control, Proceedings of a USDA/CSRES national workshop; 53–60.

Drea, John J., Jr. 1991. The philosophy, procedures, and cost of developing a classical biological control of weeds project. Natural Areas Journal 11(3); 143–147.

Klingman, Dayton L.; Coulson, Jack R. 1983. Guidelines for introducing foreign organisms into the United States for the biological control of weeds. Bulletin of the Entomological Society of America 29(3); 55–61.

Chapter

2

Technical Advisory Group

Charter

Contents

Introduction

The *Charter* section of the *Technical Advisory Group* chapter describes the TAG-BCAW's charter, mission, objectives, and standard operating procedures.

Charter, Technical Advisory Group for Biological Control Agents of Weeds, October 1997, Revised 2010

Mission

To facilitate biological control of weeds in North America by providing guidance to researchers and recommendations to regulating agencies for or against the release of nonindigenous biological control agents of weeds. This is based on considerations of potential nontarget impacts, conflicts of interest, natural resources, agricultural production, and the Endangered Species Act (ESA) Threatened and Endangered Species List.

Objectives

Incorporate member agencies' concerns and perspectives into planning biological control programs.

Provide an exchange of views, information and advice for individuals who plan to ask various Federal and State regulatory agencies for permission to release these agents into the environment.

Provide recommendations to APHIS-PPQ for use in making permitting decisions.

Expectations

Individuals planning to release a nonindigenous biological control agent should contact the TAG-BCAW early in the research program, particularly for species targeted for the first-time release of a biological control agent in the North America.

TAG-BCAW members review two types of documents: the proposed plant list for host specificity testing (test plant list) and the petition for first-time field release of a nonindigenous organism. TAG-BCAW members may suggest inclusion of certain test plants, identify conflicts of interest, and assess potential risks associated with an environmental release. The person seeking permission to release a biological control agent into the environment addresses these different perspectives. The exchange of scientific information helps Federal regulatory officials evaluate potential effects of the biological control agent of weeds on target and nontarget plants in North America.

Standard Operating Procedures

Duties of TAG-BCAW Members

Duties of TAG-BCAW members are as follows:

- Represent their Agency's or organization's interests by reviewing petitions from the organization's current perspective on biological control;
- Review each petition to evaluate risk to agriculture, human health, and the environment;
- Identify and consult subject matter experts who are familiar with the taxonomy, biology, ecology, and other aspects of the organisms being considered for release and the target weed;
- Provide a written response consolidating their Agency's or organization's comments to the TAG-BCAW Executive Secretary within the deadline;
- Participate in the annual TAG-BCAW meeting; and

- Appoint an alternate within their organization to serve in the absence of the official member.

Duties of the TAG-BCAW Chair

The TAG-BCAW Chair is a TAG-BCAW member, elected by the TAG-BCAW membership to serve a 3-year term. The Chair may serve an unlimited number of terms.

Duties of the TAG-BCAW Chair are as follows:

- Arrange and preside over meetings of TAG-BCAW;
- Assess all TAG-BCAW members' continued involvement on the TAG-BCAW to assist in keeping the respective organizations actively included on the TAG-BCAW;
- Contact TAG-BCAW Agencies and organizations to request a new qualified candidate who can represent that organization and replace non-active TAG-BCAW members;
- Help build consensus among reviewers with divergent viewpoints. The Chair may call meetings or telephone conferences including outside specialists and the involved researcher;
- Maintain records of TAG-BCAW recommendations; and
- Review all recommendations of TAG-BCAW members and provide consolidated recommendations to the petitioner, TAG-BCAW members, appropriate officials in Canada and Mexico, APHIS TAG-BCAW Executive Secretary, and other interested parties.

Duties of the TAG-BCAW Executive Secretary

The TAG-BCAW Executive Secretary is an APHIS employee.

Duties of the TAG-BCAW Executive Secretary are as follows:

- Assign due dates for reviews of all petitions and test plant lists;
- Compile petition and test plant list reviews and forward to the TAG-BCAW Chair;
- Develop with the TAG-BCAW Chair, the TAG-BCAW annual meeting agenda, date, time, and location;
- Facilitate the distribution of petitions and test plant lists to TAG-BCAW members;
- Make all arrangements for the TAG-BCAW annual meeting (daily meeting space, hotel, shuttle, etc.);

- Maintain a filing system and perform other archival functions for TAG-BCAW;
- Maintain the TAG-BCAW Web site and include APHIS permit decisions on the Internet;
- Receive and acknowledge receipt of all submitted petitions and test plant lists;
- Receive and respond to requests to extend review deadlines;
- Serve as the contact for *Technical Advisory Group for Biological Control Agents of Weeds Manual* (TAG-BCAW Manual) maintenance; and
- Transmit recommendations from the TAG-BCAW Chair to APHIS-PPQ.

Duties of USDA-APHIS-PPQ

Duties of USDA-APHIS-PPQ for petitions are as follows:

- Assure compliance with applicable statutes and regulations;
- Conduct training workshops as needed;
- Consider TAG-BCAW's recommendations;
- Evaluate permit requests for movement of biological control agents of weeds by conducting a plant pest risk assessment;
- If a permit application is submitted, then APHIS may initiate the development of environmental and biological assessments when needed;
- May invite the researcher to submit a permit application;
- Perform the APHIS-PPQ permit process for movement of biological control agents of weeds and develop and communicate permitting policy pertaining to movement of these organisms; and
- When the TAG-BCAW recommends to APHIS to release an agent, then APHIS will review the recommendations and if reservations are noted ensure that these are addressed.

Annual Meeting

The TAG-BCAW Chair calls an annual meeting to evaluate the effectiveness of the TAG-BCAW, and to discuss controversial issues relating to biological control of weeds in North America. The TAG-BCAW membership elects a Chair every 3 years, during the annual meeting.

Administration

USDA-APHIS-PPQ will be responsible for the administrative maintenance of Federal Agencies' representation.

Federal Advisory Committee Act (FACA)

TAG-BCAW meetings shall be conducted in compliance with the Federal Advisory Committee Act (FACA).

The law as amended (P.L. 104-4, Sec. 204), states the following:

> Meetings between State, Local, Tribal and Federal Officers - The Federal Advisory Committee Act (5 U.S.C. App.) shall **not** apply to actions in support of intergovernmental communications where:
>
> > (1) Meetings are held exclusively between Federal officials and elected officers of State, local, and tribal governments (or their designated employees with authority to act on their behalf) acting in their official capacities; and
> >
> > (2) Such meetings are solely for the purposes of exchanging views, information, or advice relating to the management of implementation of Federal programs established pursuant to public law that explicitly or inherently share intergovernmental responsibilities or administration.

FACA **does not** apply to meetings of TAG-BCAW because TAG-BCAW members include some Federal officials, some designated State officials, and some organizations. The TAG-BCAW members may contact non-Federal, State, local, or tribal parties to obtain information. Therefore, Canada, Mexico, researchers, industry, and professional or other societies may be contacted on an ad hoc basis.

The TAG- BCAW focuses primarily on providing assistance to the individuals who will seek permits. Secondarily, TAG-BCAW provides a communication conduit within a scientific framework for APHIS.

Membership

APHIS will solicit one representative from each of the following Agencies:

- DOD, U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- USDA, Animal and Plant Health Inspection Service
- USDA, Agricultural Research Service
- USDA, Forest Service
- USDA, National Institute of Food and Agriculture
- USDA, Natural Resource Conservation Service
- USDI, Bureau of Indian Affairs
- USDI, Bureau of Land Management

- USDI, Bureau of Reclamation
- USDI, National Park Service
- USDI, U.S. Fish and Wildlife Service
- USDI, U.S. Geological Survey

APHIS may solicit members who are State or Federal government employees (one each) from the following organizations:

- National Plant Board
- Weed Science Society of America
- Other Federal Agencies expressing interest in participation

Each TAG-BCAW member is a representative of his/her respective Agency or organization. A TAG-BCAW member's **lack** of participation or response to the TAG-BCAW petitions is of concern for all involved. Everyone's best interests are served when all members are active.

The TAG-BCAW Chair will assess each TAG-BCAW member's continued involvement on the TAG-BCAW in trying to keep the respective Agencies or organizations as part of TAG-BCAW. If a current TAG-BCAW member is non-active, then the TAG-BCAW Chair has the prerogative to contact the represented Agency or organization and request a new qualified candidate to represent the Agency or organization and replace the non-active current TAG-BCAW member.

Furthermore, if an organization's representative **does not** provide comments or the representative **does not** request an extension of a petition's documented deadline, then the TAG-BCAW Chair interprets this to mean the organization **does not** oppose the petition.

Chapter

2

Technical Advisory Group

Agencies and Organizations' Perspectives

Contents

Introduction

The *Agencies and Organizations'* section of the *Technical Advisory Group* chapter provides a brief summary of the perspective of each Agency and organization which has a representative on the TAG-BCAW. Members are responsible for reviewing and evaluating submitted petitions for release and test plant lists, and for recommending action based on their Agency's or organization's current perspective on biological control of weeds in North America.

U.S. Department of Agriculture (USDA)

Animal and Plant Health Inspection Service (APHIS)

The biological control activities within APHIS are performed under the regulatory authority of the Plant Protection Act of 2000, which states that, "biological control is often a desirable, low-risk means of ridding crops and other plants of plant pests and noxious weeds, and its use should be facilitated by the Department of Agriculture, other Federal Agencies, and States whenever feasible." The Act also defines a biological control organism as any enemy, antagonist, or competitor used to control a plant pest or noxious weed. The authority to regulate biological control agents is dependent on the agents' plant pest risks.

The Animal Plant Health Inspection Service (APHIS) is involved in biological control activities that aim to safeguard American agriculture and ecosystems and minimize the economic and environmental impacts of nonindigenous pests, weeds, and plant diseases deemed of regulatory significance to APHIS, State departments of agriculture, tribal governments, and cooperators within the United States and American territories.

APHIS biological control activities include the direct involvement of Plant Protection and Quarantine (PPQ) Field Operations (FO) personnel in distributing, releasing, and monitoring approved biological control agents for selected target pests. PPQ, through its FO and Policy Management (PM) units, also provides funds to Federal, State, university, local, and tribal project partners through cooperative trade agreements. Cooperators conduct target pest and biocontrol agent surveys, agent collections and releases, and pre- and post-release monitoring. The PPQ Center for Plant Health Science and Technology (CPHST) unit is also involved in biological control. CPHST scientists develop release and monitoring protocols, rear selected biological control agents, and incorporate biological control into integrated pest management strategies. CPHST provides funding for pre-release research and development efforts with potential biological control agents considered for U.S. release. Finally, the PPQ Pest Permitting Branch is responsible for approving or rejecting initial U.S. introduction and field release of biological control agents and for permitting subsequent interstate distribution and releases. All Agency units engage with other USDA Agencies, organizations, and a wide range of cooperators and customers to develop appropriate Agency legislation and regulations that meet U.S. needs for economical, efficient, and effective biological control programs of weeds.

Agricultural Research Service (ARS)

The Agricultural Research Service (ARS) conducts research using classical and augmentative approaches to discover and develop arthropods and microbes as biological control components for integrated weed management systems in rangelands, croplands, noncroplands, and aquatic sites. ARS searches for and characterizes candidate host-specific biological control agents from foreign sites of origin of invading exotic target weeds. The Agency also discovers and develops endemic and foreign pathogens for inundative or inoculative releases against target weeds. ARS policy is to work with regulatory Agencies such as APHIS, Fish and Wildlife Service, and the Environmental Protection Agency to ensure that all of the Agency's releases/ applications are in accordance with existing laws and regulations.

Forest Service (FS)

The Forest Service (FS) is charged with the management of approximately 190 million acres of national forests and grasslands. The FS recognizes that the invasion of exotic plants is a key threat to continued existence of vulnerable native species, and to the integrity and healthy functioning of unique habitats. Exotic weeds also are a major problem and interfere with the FS' effective management, compromise productivity, and impede the public's enjoyment of these lands.

To control these invaders, vegetation management personnel have available to them a wide range of tools from which they **must** select those that best fit the area, the targeted weed, and local management goals. However, FS recognizes that once a weed has become widely distributed, most conventional management tools provide **only** localized relief or containment. Biological control is usually the **only** realistic approach for many weed infestations. FS is supportive of vegetation management personnel to evaluate the feasibility of using weed biological control. When suitable approved biological control agents are available, managers are encouraged to add them as a control strategy in integrated weed management programs.

When external researchers are testing new biological control agents for weeds that also affect FS lands, the FS actively encourages and supports their research through funding, providing experimental release plots, and participating in joint development programs. When weeds of concern to FS are **not** being targeted by other research agencies, FS researchers may initiate the search for, testing of, and importation of biological control agents.

National Institute of Food and Agriculture (NIFA)

The Land Grant University System and the National Institute of Food and Agriculture (NIFA) have fundamental responsibility for discovering, developing, implementing, and extending technology in support of American agriculture and in concert with America's natural resources. With a Congressional mandate in each State to support agriculture in cooperation with USDA and other Agencies, scientists within the Land Grant University System are greatly involved in the development of pest management strategies and programs for implementation in agricultural, forest, pasture, rangeland, and aquatic and urban environments, including natural and modified systems. This diverse mission also includes the conduct of biological and ecological research in these environments, which often serves as the baseline for development of applied problem-solving research and education efforts.

Among the assets in research expertise which reside within the NIFA-supported Agricultural Experiment Station System, are disciplines that directly support biological control of weeds. Botany, plant ecology, land conservation and taxonomic studies in plants, animals, and microbes are among the many components of that expertise.

An additional component of NIFA is the development and delivery of information in support of biological control and other integrated pest management (IPM) strategies. This educational and implementation system provides support to the public and private sectors who are affected by biological control of weeds, as well as the weed problems themselves.

U.S. Department of the Interior (USDI)

Bureau of Indian Affairs (BIA)

The Bureau of Indian Affairs (BIA) has responsibility for approximately 56 million acres of Indian trust land (land held in trust by the United States for various Indian tribes and individuals). These trust lands are located within 326 reservations (i.e., pueblos, rancheros, missions, villages, communities, etc.). At present, there are 565 Federally recognized American Indian and Alaska Native tribes and villages.

Indian lands exist in all major ecosystems, from the Florida Everglades to the Alaskan Tundra, from hardwood forests to the Pacific rainforest, from the Sonoran Desert scrub to the Great Plains grassland, and include irrigated and dry cropland. These lands have been affected by the entire range of invasive species known in North America.

The BIA and/or tribal governments operate a noxious weed control program on a number of these Reservations. Currently, herbicides are the tool of greatest use. However, the use of herbicides is judicious due to Native American concerns regarding their environment. More recently integrated noxious weed control has been emphasized, including the use of biological control agents. Although success using biological control agents has been noted, insurance of host specificity remains a concern of tribal governments and their constituents. Biological control is a welcomed addition to other noxious weed control tools. Nonetheless plants of economic, cultural, and medicinal value **must** be protected from off-target damage by biological control agents.

Bureau of Land Management (BLM)

The Bureau of Land Management (BLM) is responsible for carrying out a variety of programs for the management and conservation of resources on 253 million surface acres, as well as 700 million acres of subsurface mineral estate. Most of the public lands are located in the Western United States, including Alaska. Public lands make up about 13 percent of the total land surface of the United States and more than 40 percent of all land managed by the Federal Government. The public lands are characterized predominantly by extensive grassland, forest, high mountain, arctic tundra, and desert landscapes. The BLM manages multiple resources and uses, including energy and minerals; timber; forage; recreation; wild horse and burro herds; fish and wildlife habitat; wilderness areas; and archaeological, paleontological, and historical sites. These multiple uses create surface disturbances exposing the public lands to invasive and noxious weeds. As such, the BLM uses biological control of weeds as a component of its integrated weed management program. The policy and use of biological controls are in *BLM Manual 9014* where BLM's policy is stated as follows:

- Encourage the use of parasites, predators, and pathogens in integrated pest management programs to reduce pest organism populations to meet management objectives. This may include the use of domestic livestock to manage vegetation;
- Participate in cooperative integrated pest management programs in area-wide efforts;
- Support efforts to develop new biological control agents to the level possible as one of the tools in a balanced integrated pest management program; and
- Collect and quantify all inventory and monitoring data for all pest management efforts and evaluate the success of failure of them.

A Memorandum of Understanding exists between the BLM and APHIS which describes the interaction between these two agencies and National Environmental Policy Act compliance conditions. Prior to the release of an approved biological control agent, each State's State Office **must** examine the practitioner's *Biological Control Agent Release Proposal* (BCARP), which is notification of a planned release. Once an agent has been released, a *Biological Control Release Record* **must** be filled out within 24 hours after release and kept on record for a minimum of 7 years. All BLM Field Offices submit a comprehensive Integrated Pest Management report to their State Office each year. Final reports are then compiled and reviewed at the National Office. These precautions ensure that **only** approved biological control agents are released and those releases are continually monitored to evaluate efficacy over time

Bureau of Reclamation (BR)

The policy of the Bureau of Reclamation (BR) is to implement integrated pest management (IPM) for the control and management of pests and invasive species. As defined by the Federal Insecticide, Fungicide, and Rodenticide Act, and amended by the Food Quality Protection Act of 1996, "Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks," and "Federal agencies shall use Integrated Pest Management techniques in carrying out pest management activities and shall promote Integrated Pest Management through procurement and regulatory policies, and other activities."

Reclamation views biological control as an important tool in the IPM toolbox. **Only** by using the combined suite of IPM tools, including biological control, can pests and invasive plant species be successfully controlled. In addition, the TAG-BCAW is a vital component in a reviewable and transparent process during the evaluation of proposed biological control agents of weeds.

Fish and Wildlife Service (FWS)

The Fish and Wildlife Service (FWS) strongly supports the development and legal and responsible use of appropriate, safe, and effective biological control agents on nuisance nonindigenous or invasive species. As the basis for approval, biological control organisms and strategies for their use **must** have undergone careful, comprehensive, and transparent testing and evaluation throughout their potential range to ensure their host specificity and determine their effects on all nontarget organisms, especially Federally-listed species or those considered for designation under the Endangered Species Act (ESA). Biocontrol organisms imported into, transported within, and released into the United States should be free of pathogens or parasites, so as **not** to unintentionally introduce other nonindigenous species. Additionally, the media used to ship biocontrol organisms **must not** include other nonindigenous organisms. Approval **must** involve open public review, as well as scientific peer review of test results, environmental risk assessment, and other applicable analyses. If biocontrol organisms are the most effective and appropriate means available, then they should be used on National Wildlife Refuges and other lands and waters under the jurisdiction of the Service.

National Park Service (NPS)

The National Park Service (NPS) relies on an integrated pest management (IPM) approach to manage pest species. The NPS considers biological control an important tool in an IPM strategy. In addition, the NPS management policies recognize the use of biological control agents on NPS lands as one of the limited reasons for releasing non-native organisms on NPS lands. However, the use of biological control agents should be targeted towards non-native species. In that regard, biological control agents **must** be thoroughly and scientifically tested as to their host specificity, safety, and potential effects upon nontarget organisms before release. Biological control agents should be free of parasites and pathogens to reduce the risk of introducing additional non-native species into the United States and creating additional pest management problems. The results of pre-release testing of biological control agents **must** receive critical scientific peer review as well as public review and comment before agents are released.

Biological control is a welcome addition to other noxious weed control tools. Nonetheless, plants of economic, cultural, and medicinal value **must** be protected from off-target damage by biological control agents.

U.S. Geological Survey (USGS)

The United States Geological Survey (USGS) conducts investigations of non-native invasive plants, animals, and disease organisms, including their biology and ecology, vectors and factors in their spread, and their effects on terrestrial and aquatic ecosystems and native biota. The USGS has capabilities in the development and evaluation of methodologies and technologies for early detection of non-native invasive species (NIS), monitoring of invasions, assessment of alternative control methods, and management of NIS, including restoration of impacted habitats. Particular emphasis is on improving the capabilities of Federal land managers to address threats from NIS.

Through its research centers and cooperating universities, USGS conducts research on potential biocontrol agents for selected nonnative plants that are highly invasive in natural ecosystems (e.g., Miconia and strawberry guava in Hawaii). This research frequently includes international collaboration in locating, testing, and assessing potential biological control agents.

In reviewing petitions for release of biocontrol agents, USGS focuses on the appropriateness of the research methodology, post-release monitoring, and the potential biological and ecological effects of proposed control agents. In reviewing test plant lists, the emphasis is on helping to ensure adequate screening of nontarget native species.

Department of Defense (DOD)

U.S. Army Corps of Engineers (COE)

One of the main missions of the Army Corps of Engineers (COE) is to maintain navigable waterways in the United States. This requires **not only** overseeing the actual channels, but also water bodies influencing navigable waterways. Exotic vegetation often impedes the operation of the waterways and requires extensive management operations. Biological control technology is a key component utilized in our integrated management approach for these waterways. In addition, the Department of Defense (DOD) and Army Corps of Engineers (COE) are stewards of a wide range of habitats found on their installations and facilities. Maintaining these natural plant communities is a high priority since many are unique habitats. Petitions are reviewed to ensure that the missions of DOD organizations are **not** negatively impacted by introductions of plant biological control agents.

Environmental Protection Agency (EPA)

The Environment Protection Agency (EPA) perceives the biological control of weeds as valuable in reducing risks from pesticides. EPA also views the biological control of weeds as a vital part of integrated pest management.

National Plant Board

The National Plant Board is made up of the principal plant pest regulatory officials of each of the 50 States. State officials review proposed introductions of live insects, including biological control agents. USDA's permit (PPQ Form 526, Application to Move Live Plant Pests or Noxious Weeds) requires approval from both the receiving State and USDA. The National Plant Board's representation on TAG-BCAW facilitates this approval process and keeps all stakeholders involved from the beginning.

Weed Science Society of America

Members of the Weed Science Society of America (WSSA) are committed to the reduction of herbicide use through adoption of integrated weed management. WSSA views all forms of biological control as important tools for prevention of economic loss due to weeds. Although profitable agriculture is the major focus, reduction of negative impacts on the environment due to agriculture is an important consideration in the selection of weed management tools.

Canada: Agriculture and Agri-Food Canada (AAFC)

Agriculture's trend toward alternative solutions to chemical pesticides has led to an increasing use of biocontrol agents. Agriculture and Agri-Food Canada has a long-term commitment to sustainable agriculture via the safe importation and release of biocontrol agents of weeds. This commitment has produced several success stories which in turn have lessened Canada's dependency on chemical pesticides and taken us in the direction of a cleaner environment. Part and parcel with Canada's success and safety record is its continuing association with TAG-BCAW.

Mexico: SAGARPA-SENASIA-DGSV

Mexican participation in TAG-BCAW has been very useful because biological control of weeds is in development in Mexico. Some weeds are common to Mexico, Canada, and the United States; and cooperative projects could be carried out. A greater number of agents to be imported into Mexico is expected.

Plants that are considered weeds in one country may **not** be considered weeds in another country. Given this, possible conflict of interests and impact on nontarget plants are the main concerns of Mexico. Target weed information **must** be reviewed to focus especially on the beneficial uses in Mexico and the impact on Mexican endangered and threatened species.

Chapter

2

Technical Advisory Group

TAG-BCAW Chair's Perspective

Contents

Introduction

The *TAG-BCAW Chair's Perspective* section of the *Technical Advisory Group* chapter provides the steps the current TAG-BCAW Chair follows when reviewing a petition for release of a proposed biological control agent of weeds and for examining each reviewer's comments and recommendations; and the Chair's overall concept for the TAG-BCAW and for making the final TAG-BCAW recommendation for a petition.

TAG-BCAW Chair's Concept

The TAG-BCAW Chair uses his general understanding of and ideas about how TAG-BCAW helps facilitate the use of proposed biological control agents of weeds in the environment, and specifically about his role as Chair of TAG-BCAW.

The petitions that receive mixed recommendations (some recommended release; some recommended release with reservations; some **do not** recommend release) are the hardest to evaluate. Often this situation is compounded when **only** a few members have reviewed the petition and submitted a recommendation.

In general, TAG-BCAW should take a conservative stance in its recommendations. Determining if the proposed biological control agent of weeds may present a plant pest risk is the key issue. Once a biological control agent of weeds is released, it is difficult to control or manage the organism if the need should arise.

The overall concept to make the final TAG-BCAW recommendation is, "How confident are we in the testing conducted and the information presented to recommend a proposed biological control agent of weeds for release into the environment?"

TAG-BCAW Chair's Evaluation Procedures

Before reviewing each petition as the TAG-BCAW Chair, first review each petition from the perspective of a member representing his or her Agency (for the current TAG-BCAW Chair, the U.S. Army Corps of Engineers).

Then as the TAG-BCAW Chair, evaluate each petition as follows:

1. Look over all the responses other members of TAG-BCAW have submitted.
2. Determine how many responses were submitted.
3. Determine each member's action:
   A. Recommend **without** reservations.
   B. Recommended with reservations.
   C. **Not** recommended.
4. Examine each Reviewer's Comment Sheet; and make notes on the key points each reviewer has made—both negative and positive. Look for similarities in the comments among reviewers.
5. Review the notes of negative and positive points made by all the reviewers; examine each point in detail; and verify the comments made (i.e., "four larvae developed into adults when feeding on a particular plant," or "**No** endangered plant species from the Northwest were tested").
6. Eliminate comments that are invalid or inconsistent with the data presented. May discuss these points with the reviewer to ensure a full understanding of his/her comments.
   A. The majority of points and concerns raised by reviewers are related to host specificity tests and the impact on nontarget plants. Address these comments first, along with the environmental impacts.
   B. When correct and valid points are made about a particular test, examine the petition to determine if additional information has been presented that would explain the comment (i.e., "feeding on a nontarget plant **only** occurred when the larvae were artificially placed inside the stem of the plant").
   C. Taxonomic issues are **always** of concern. The TAG-BCAW members need to know what biological control agent is being tested and what weed is being targeted. When there is a concern about the taxonomic information, you may seek additional reviews from a recognized authority. Often taxonomic issues are raised by a taxonomic authority on the particular group. Sometimes taxonomic issues develop when the researcher is substituting one plant for a threatened or endangered one,

which often requires getting additional information to validate or refute concerns.

D. Comments on petitions for release that address points outside of TAG-BCAW's charge hold little weight (i.e., "since research funding for biological control is scarce, I feel that the researcher should devote his efforts to studying another target plant"). TAG-BCAW is concerned with the use of the proposed biological control agent of weeds and is **not** concerned with setting research priorities.

7. If a reviewer's comments are partially correct and may **not** be completely valid, then attempt to have the reviewer and the researcher discuss the concern.

8. If some of the points **cannot** be resolved after deliberations and discussions between the researcher and the reviewer, then begin weighing the factors that are in contention. Often, reviewing the entire petition is useful when there are mixed views from the researchers.

   ❖ Is there a concern with plant pest risk to nontarget plants?

   ❖ Does the host specificity test cover a reasonable representation of the species identified on the test plant list?

   ❖ Is there a problem with taxonomy?

   ❖ Has this proposed biological control agent of weeds been reviewed previously? If so, what were the points that caused the proposed biological control agent of weeds **not** to be recommended?

   ❖ Has the researcher addressed previous TAG-BCAW questions?

   ❖ Does the researcher appear to be concerned and conscientious in the studies?

9. After re-examining all the significant questions that are unresolved, recommend an action from TAG-BCAW that you believe you can justify.

10. Write a letter to APHIS-PPQ and include the following:

    A. If the recommendation is to release, then include key points about the reason for the recommendation. Identify the minor points or problems that the researcher should address with the reviewer or APHIS before a release is made.

    B. If the recommendation is **not** to release, then include key reasons for the recommendation, such as the following:

       ⇨ Recommend tests that may answer and resolve the questions raised;

       ⇨ Attempt to develop a list of major concerns or questions that caused this recommendation; and

- ⇨ Indicate that the researcher and the reviewers should directly discuss the points further.

11. Provide copies of the letter (sent to APHIS-PPQ) to the researcher, TAG-BCAW members, and other interested parties.
12. TAG-BCAW's response to APHIS is just a recommendation and is **not** a final decision. The recommendation of TAG-BCAW is **not** a majority rule verdict; that is, if eight reviewers recommend release and four reviewers recommend **not** to release, then TAG-BCAW's recommendation is **not** necessarily to release. In addition, unresolved comments from a single reviewer recommending that a proposed biological control agent of weeds **not** be released **does not** mean that TAG-BCAW will recommend against release.

Chapter

3

Petitions and Permitting

TAG-BCAW Flow Chart for Petitions for Field Release and Test Plant Lists

Contents

Introduction

The *TAG-BCAW Flow Chart for Petitions for Field Release and Test Plant Lists* section of the *Petitions and Permitting* chapter provides a flow chart for the documentation flow of petitions and test plant lists.

NOTICE

The Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW) Chair consolidates recommendations that are received from TAG-BCAW members. The *TAG-BCAW Manual* provides an understanding of how the TAG-BCAW Chair reaches a final TAG-BCAW recommendation.

The Technical Advisory Group for Biological Control Agents of Weeds' (TAG-BCAW) entire review process is driven by the APHIS permitting process (see Permitting Process for Weed Biological Agents on page 3-2-2 for more information).

TAG-BCAW Petitions for Field Release and Test Plant Lists Flow Chart

Continue to the flow chart in Figure 3-1-1.

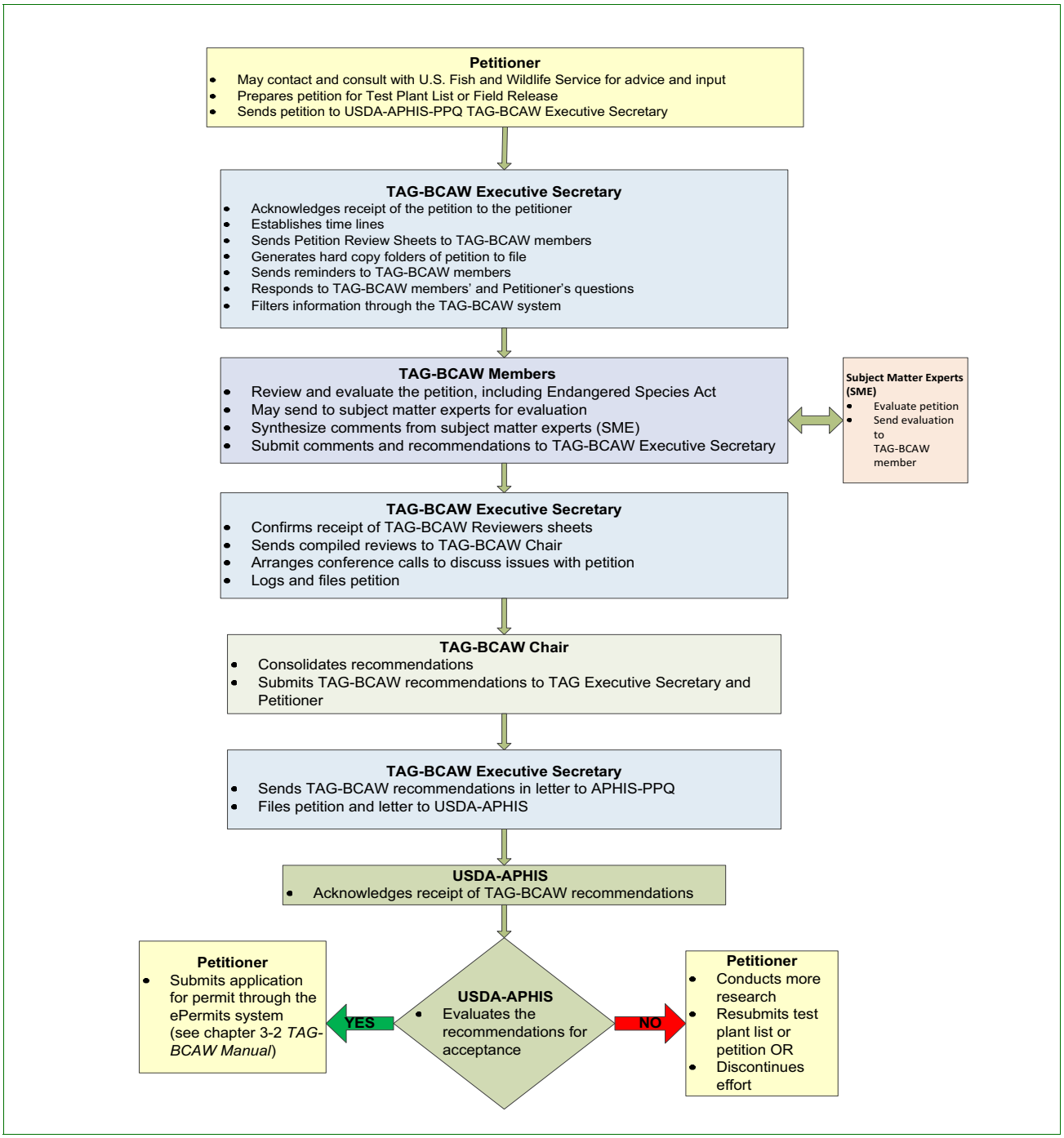

Figure 3-1-1 TAG-BCAW Petition for Field Release or Test Plant List Flow Chart

Chapter

3

Petitions and Permitting

APHIS Permitting Process

Content

Introduction

The *APHIS Permitting Process* section of the *Petitions and Permitting* chapter provides information about APHIS' role in each step of the review process for petitions submitted to the TAG-BCAW for the release of proposed biological control agents of weeds, and the flow of documents used by APHIS when considering whether to issue a permit for the release of such nonindigenous organisms.

APHIS has authority to regulate the importation and interstate movement and release of biological control organisms (because they may potentially present a plant pest risk), noxious weeds, and plant pests under the Plant Protection Act of 2000. APHIS regulates the movement of these organisms in order to prevent the dissemination of plant pests or noxious weeds. These regulations may be found in the Code of Federal Regulations Chapter 7 Part 330.

Permitting Process for Weed Biological Agents

The Plant Protection Act of 2000 (7 U.S.C. 7701 *et seq*.) provides the Secretary of Agriculture with the authority to regulate "any enemy, antagonist, or competitor used to control a plant pest or noxious weed" that poses a potential plant pest risk. APHIS regulates biocontrol organisms because they are plant pests. Before issuing a permit to release a biocontrol organism into the environment, APHIS must comply with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq*.), the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq*.), and Executive Orders (EO) 13112 (64 FR 6183) for Invasive Species and EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations."

TAG-BCAW petitioners may refer to the following pages that describe the content and flow of documents used by APHIS to meet the requirements of the Acts and Executive Orders which includes APHIS' responsibility for the issuance of such permits. An understanding of the various documents APHIS prepares and or reviews conducted should help to clarify this process.

Step 1: Early Input

Researchers should submit a proposed test plant list to the Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW) whether or **not** a proposed biological control agent has yet been identified. The TAG-BCAW, an interagency group, was established to advise weed biological control researchers and to provide the APHIS-PPQ Pest Permitting Branch with a recommendation on the proposed Federal action, issuance of a permit authorizing release to the environment. At this early stage of the review process, TAG-BCAW makes recommendations on the target weed choices and comments on the proposed test plant list for host specificity testing.

Both TAG-BCAW reviewers and researchers should review Federal and State lists of threatened and endangered species prior to host specificity testing. All threatened and endangered species should be considered when designing the test plant list. Candidate species and species proposed for listing should also be considered because they may be listed at any time. Web sites to obtain information on listed species include http://ecos.fws.gov/tess_public/ and http://ecos.fws.gov/ecos/indexPublic.do. Even though a U.S. Fish and Wildlife Service (USFWS) representative participates on the TAG-BCAW review panel, this **does not** substitute for the ESA consultation process.

Petitioners are encouraged to contact the regional offices and local field offices of the USFWS in the areas where the target weed is located, prior to and during the host testing phase in order to obtain advice and guidance regarding any threatened, endangered, or proposed species. The USFWS can also provide

guidance regarding obtaining seeds or samples of these plants or related species that can serve as surrogates for these species.

Step 2: Applying for APHIS Permits for Importation

Permits are required from APHIS for any of the following situations:

- Importation of live biological control organisms into the United States and its Territories (see PPQ 526 Permit for Importation);
- Interstate movement of live biological control organisms (includes movement between any State, territory and the District of Columbia) (see PPQ 526 Permit for Interstate Movement on page 3-4);
- Retaining live biological control organisms in containment facilities after expiration of a permit (see PPQ 526 Permit for Continued Curation on page 3-4); and
- Movement of any live biological control organism from the confines of a containment facility to any other containment facility or for environmental release (see PPQ 526 Permit for Removal from Containment on page 3-4).

All conditions of any permit, including all authorizations and restrictions, remain binding as long as the permit is valid and prior to expiry. Revocation or expiration of any permit requiring containment for the regulated organisms requires devitalization or destruction of all organisms regulated by that permit, or a new permit for the organisms.

Guidance and step-by-step instructions for obtaining each of these types of PPQ 526 permits can be found at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/regulated-organism-and-soil-permits and https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/regulated-organism-and-soil-permits/biological-control-organism-permits.

PPQ 526 Permit for Importation

A PPQ 526 Permit for Importation is needed every time live biological control organisms are imported into the United States and its Territories. A PPQ 526 Permit will require an USDA-APHIS inspection containment facility as the destination, unless the organisms being imported are species having certain exemptions under APHIS regulations 7 CFR 330.200 *et seq.*

Additional information concerning containment facilities can be found at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/plant-pests/containment.

PPQ 526 Permit for Interstate Movement

A PPQ 526 Permit for Interstate Movement is needed every time live weed biological control organisms are moved across State lines between any State of the United States and its Territories. A PPQ 526 permit is required regardless of the use (research, release, etc.). There may be exceptions to the requirement for an interstate movement permit for certain biological control organisms.

PPQ 526 Permit for Continued Curation

A PPQ 526 Permit for Continued Curation is required in order to retain live regulated organisms in containment beyond the expiration of any PPQ 526 permit that requires containment. When continued movement is involved, colonies/cultures of organisms may be kept under a new PPQ 526 Permit for importation or interstate movement when renewed.

PPQ 526 Permit for Removal from Containment

A PPQ 526 Permit for Removal from Containment is required in order to move any live regulated organisms from the confines of an APHIS inspected containment for any reason, including movement between containment facilities regardless of their relative location (in addition to such movements which may be described and permitted in the existing permit).

If movement between specific containment facilities is already described and permitted in an existing PPQ 526 Permit for importation, interstate movement, or continued curation, then an additional 526 Permit is **not** required for such movement.

A PPQ 526 Permit is required to remove a regulated weed biological organism from containment and enables release into the environment after the APHIS approval, following the processes described in Step 3: APHIS Responses to the Recommendation Letter from the TAG-BCAW Chair on page 3-5 and Step 4: Environmental Compliance in Support of Petition for Release on page 3-6.

NOTICE

Keep in mind that any removal from containment **without** safeguards (i.e., escape-proof packaging while moving to another containment facility or a physically separate part of a containment facility) constitutes release into the environment.

Step 3: APHIS Responses to the Recommendation Letter from the TAG-BCAW Chair

After receiving the TAG-BCAW's recommendation, APHIS reviews the recommendation, including reviewers' comments and any information cited by reviewers, and any additional information available to APHIS in order to determine if APHIS will support release of the biological control agent. The decision by APHIS to support - or **not** support - release may or may **not** agree with the TAG-BCAW's recommendation to release (or **not** release), based on all the information APHIS considers. However, historically the TAG-BCAW's recommendation and the subsequent APHIS decision regarding release frequently coincide.

Soon after receipt of the recommendation letter from the TAG-BCAW Chair, APHIS typically writes a letter to inform the Petitioner of the APHIS decision regarding support of the request to release the biological control agent, with a copy to the TAG-BCAW Executive Secretary.

In the cases where APHIS supports the request to release, APHIS may still request that the petitioner provide additional information or clarification, which will be used to support and enhance the environmental compliance documents in the following steps. This additional information or clarification is usually in response to questions or concerns raised by the reviewers or other parties which are often received even with a TAG-BCAW recommendation for release.

When APHIS supports a request for release, the Petitioner may submit an application for removal from containment and environmental release of the biological control agent. See PPQ 526 Permit for Removal from Containment on page 3-4.

NOTICE

An application may be submitted by any individual in accordance with APHIS regulations (7 CFR 330.201 through 330.203), and may be from a party who is **not** the petitioner or researcher, but who is proposing to colonize, increase, or distribute the agent. Upon receipt of the application, APHIS will proceed with the environmental compliance process described in Step 4: Environmental Compliance in Support of Petition for Release on page 3-6.

When release of the weed biological control agent is **not** supported by APHIS, then APHIS will convey the reasons for **not** supporting release in the letter to the Petitioner, and may outline steps to take if the Petitioner wishes to improve the petition. At this point, the decision of the Petitioner or other researchers will be whether to invest additional time and resources to improving the petition and submitting an amended petition to the TAG-BCAW Executive Secretary. The subsequent submission of a new or an amended petition may or

may **not** lead to a recommendation for release or support for release by APHIS. APHIS will deny the application submitted for removal from containment and therefore will **not** proceed with the environmental compliance process described in Step 4: Environmental Compliance in Support of Petition for Release.

Step 4: Environmental Compliance in Support of Petition for Release

Issuance of permits by APHIS for the environmental release of nonindigenous weed biological control organisms is considered a Federal action and triggers compliance with the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA). Steps and procedures APHIS follows to comply with these Acts regarding the proposed release of biological control agent against weeds are described in Compliance with the Endangered Species Act (ESA) and Compliance with the National Environmental Policy Act (NEPA).

The petitioner should apply for a PPQ 526 Permit to remove a weed biological control organism from containment (see PPQ 526 Permit for Removal from Containment on page 3-4) after receipt of a letter from APHIS indicating support of the request to release the weed biological control organisms into the environment of the United States. APHIS proceeds with the steps for environmental compliance with these environmental Acts in response to receipt of the application for the permit to release (removal from containment).

Compliance with the Endangered Species Act (ESA)

According to the ESA, any action that is authorized, funded, or carried out by a Federal Agency **must** comply with the consultation requirements of Section 7 of the ESA. (See Section 7 Consultations on page 6-1 and ESA Compliance on page 6-1.) Although the researcher should have received input from the USFWS or possibly the National Marine Fisheries Service from the beginning, APHIS-PPQ determines if consultation with the USFWS or possibly the National Marine Fisheries Service **must** be conducted at this point in the process. If the proposed release will have **no** effect on listed species or designated critical habitat, then **no** consultation with the USFWS or the National Marine Fisheries Service is required.

Informal consultation with the USFWS or possibly the National Marine Fisheries Service occurs when the release of the biological control organism "may affect, but is **not** likely to adversely affect" listed species or designated critical habitat.

The document required for Section 7 consultation with the Services is a biological assessment (BA). This document is prepared by APHIS and is submitted to the USFWS or possibly the National Marine Fisheries Service.

The BA includes several elements:

1. A description of the action to be considered.
2. A description of the specific area that may be affected by the action.
3. A description of any listed species or critical habitat affected by the action.
4. A description of the manner in which the action may affect any listed species or critical habitat and an analysis of any cumulative effects.
5. Relevant reports, including any EA or EIS.
6. Other relevant information on the action, affected listed species, or critical habitat.

The USFWS reviews the BA, and if they concur with the "may affect, **not** likely to adversely affect" determination, then USFWS will send APHIS a concurrence letter and the consultation process is complete. Once complete, APHIS incorporates the concurrence from USFWS into the environmental assessment (EA), and makes any final changes necessary.

In very rare cases, APHIS may pursue formal consultation with the USFWS. Formal consultation is required when APHIS determines that the proposed release "may affect and is likely to adversely affect" listed species or designated critical habitat. Typically, APHIS **does not** proceed with formal consultation **except** under the unusual circumstances, where the adverse effect may be in doubt, or is likely to be very limited.

Compliance with the National Environmental Policy Act (NEPA)

The document required for National Environmental Policy Act (NEPA) compliance is the environmental assessment (EA), a concise public document that provides evidence and analysis to determine whether a Finding of No Significant Impact (FONSI) can be reached. The EA is prepared by APHIS staff scientists. The EA provides the public with the potential positive and negative environmental impacts, both direct and indirect, that may occur following release into the environment. Petitioners from other Federal agencies **must** also consider their own NEPA implementing procedures specific to any proposed actions.

Once the EA has been completed, APHIS-PPQ publishes a 30-day notice of availability of the EA in the Federal Register to allow public comment on the proposed action. After considering the comments, APHIS does **one** of the following:

- Reaches a finding of **no** significant impact (FONSI); or
- Is unable to reach a FONSI and concludes that preparation of an environmental impact statement (EIS) is required. An EIS is a document prepared in compliance with NEPA when significant impacts are expected from the proposed action

If a FONSI has been reached, APHIS will publish the availability of the FONSI in the Federal Register and post the final EA and FONSI on the APHIS Plant Health Environmental Assessments Web site https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/SA_Environmental_Assessments.

Step 5: Compliance With Executive Order 13175

APHIS, like other Federal Agencies, is bound to comply with various Executive Orders (EO), some of which apply to these proposed actions. EO 13175, Consultation and Coordination with Indian Tribal Governments, was issued to ensure that there would be meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications. Therefore, APHIS implements contact and communication with Federally-recognized tribal governments regarding the proposed environmental release of weed biological control organisms.

Typically, prior to the publication of the EA in the Federal Register, APHIS staff prepares a letter describing the proposed Federal action and requests review and input from Native American Tribes in any area likely to be inhabited or affected by the release of the proposed biological control agent against weeds. If the tribal government requests consultation with APHIS, environmental compliance and other actions in preparation of the proposed release are paused until consultation is concluded.

Chapter

4

Biological Control of Weeds

Introduction

Contents

Introduction

The *Introduction* section of the *Biological Control of Weeds* chapter provides a brief introduction to biological control.

Biological Control

Classical biological control of weeds is a weed control method where exotic natural enemies are used to reduce exotic weed infestations. The practice of weed biological control in the United States began in the 1940s and has resulted in some spectacular successes in the suppression of the targeted weed. One of the earliest and best known examples is the introduction of *Chyrsolina* leaf beetles for control of Klamath weed, a poisonous weed that invaded dairy pastures and rangelands in the western United States and Canada. Classical weed biological control of weeds has also resulted in a number of situations where the exotic control agent becomes established, but fails to suppress the target weed.

Several different kinds of organisms have been used as biological control agents of weeds: insects, mites, nematodes, and plant pathogens; of these, herbivorous insects are the most common weed biological control agent.

Efforts to develop a weed biological control agent consist of the following steps:

1. Foreign exploration in the weed's area of origin.
2. Host specificity studies.
3. Approval of the exotic agent by government regulatory authorities.
4. Release and establishment in areas invaded by the target weed.
5. Post-release monitoring.

Biological control is one of the many weed management options used alone or combined with other management approaches. The use of biological control agents of weeds may be the preferred or **only** tool available in some habitats or situations, although chemical, cultural, and mechanical options have their place, too. Many land managers, ranchers, and farmers use an integrated weed management approach, combining more than one method to control weeds.

TAG-BCAW's mission statement is, "To facilitate proposed biological control agents of weeds in North America by providing guidance to researchers and recommendations to regulating Agencies for or against release of nonindigenous biological control agents of weeds. This is based on considerations of potential nontarget impacts, conflicts of interest, natural resources, agricultural production, and the Endangered Species Act (ESA) Threatened and Endangered Species List." The TAG-BCAW's role in the development of a classical weed biological control agent is to review the information obtained during the host specificity studies and provide a recommendation to the USDA-APHIS-PPQ as to the proposed biological control agent of weeds and its potential for non-target impacts.

The ecological implications of managing exotic species with exotic biocontrol agents intentionally introduced from the native range of the target weeds **must** be thoroughly evaluated before release. Potential risks are systematically evaluated using established, standardized protocols that yield repeatable, scientifically valid and conclusive data.

Historically, biological control has been most effective against large infestations of a single weed species, and has been most successful on weeds that have been introduced into areas where co-evolved natural enemies **do not** occur.

Biological control has several advantages over other types of weed control (Wapshere, et al., 1989). These advantages include long-term or sustained management of the target plant, limited treatment side-effects or nontarget effects, attack restricted to one or a few very-closely related weed species, self-perpetuating agents, and nonrecurring costs.

TAG-BCAW plays a role in evaluating the introduction an exotic organism to control weed infestations by objectively weighing such advantages against potential non-target impacts and conflicts of interest.

Wapshere et.al.'s (1989) article "Recent Developments in Biological Control of Weeds" (see References on page 4-3), provides a review, examples, and a discussion of the advantages and disadvantages of different approaches to biological control of weeds, such as classical, augmentative, inundative, or conservation approaches.

Risk Analysis of Biological Control Agents of Weeds

The aim of host specificity and other pre-release studies of a proposed biological control agent are to produce a body of information for regulatory authorities to perform an ecological risk analysis of the potential for direct damage to economic and native non-target plant species following release of the control agent. Risk analysis consists of three elements: hazard identification, analysis of exposure, and analysis of probability. Hazard identification is achieved through the host specificity testing where the different life stages of the proposed biological control agent that pose the threat are identified and the agent's fundamental host range is described. Analyses of exposure and probability are based on the predicted field host range following release and the predicted actual damage to non-target species.

The fundamental host range of a species is the absolute limit of its host range and is genetically determined. The field host range is the subset of hosts used by a species following its release into the environment and will vary with availability of hosts (e.g., geographic allopatry, host synchrony), genetic variation in host vulnerability (e.g., defense chemicals), and the behavior and physiology of the control agent. The fundamental host range can be defined using no-choice or starvation tests in which a proposed biological control agent is exposed to a non-target plant which **must** be utilized or the agent dies. Information on the field host range is predicted from results obtained during choice tests in the laboratory and in the field. Based on the results of all tests and other behavioral and life history observations, predictions are made on the likelihood that a potential agent will damage a particular plant or group of plants in the environment it is to be released.

References

For more information about biological control of weeds, refer to the following listed references as well as those listed in Biological Control of Weeds on page F-10.

Charudattan, R.; Walker, H.L., eds. 1982. Biological Control of Weeds with Plant Pathogens. New York, NY: John Wiley & Sons, Inc.

Hoddle, M.S. 2004. Restoring balance: Using exotic species to control invasive exotic species. Conservation Biology 18: 38-49.

McFadyen, R.E. 1998. Biological Control of Weeds. Annual Review of Entomology 43: 369-393.

TeBeest, D.O., ed. 1991. Microbial Control of Weeds. New York, NY: Chapman and Hall.

Van Dreische, R.; Hottle, M; Center, T. 2008. Control of Pests and Weeds by Natural Enemies: An Introduction to Biological Control. Blackwell Publishing Ltd.

Wapshere, A.J.; Delfosse, E.S.; Cullen, J.M. 989. Recent developments in biological control of weeds. Crop Protection 8: 227–250.

Chapter

4

Biological Control of Weeds

Identification and Characterization of Agents

Contents

Introduction

The *Identification and Characterization of Agents* section of the *Biological Control of Weeds* chapter provides information that is intended for and is pertinent to all classes of agents, including arthropods, plant pathogens, and nematodes.

Identification and Characterization of Proposed Biological Control Agents of Weeds

Successful classical biological control of weeds requires accurate identification and characterization (biological, chemical, ecological, and phylogenetic) of the proposed biological control agent of weeds.

Target and agent identification and characterization are critical because they have the potential to do the following:

- Affect future evaluation processes
- Influence future assessments of risk
- Provide a gateway to knowledge through published literature and reports

- Preclude introduction of unapproved organisms

Both petitioners and the TAG-BCAW reviewers should consider the following questions when describing an agent:

- What is the agent? (e.g., insect, mite, fungus, bacterium, virus, nematode)
- What is the life cycle of the agent?
- What other information (e.g., biological, chemical, ecological) should be known about the agent?
- Why is this information needed?
- What type of information about the identification and characterization of the agent needs to be documented in the petition?
- How can pertinent information be best conveyed to others?

There are many complex questions associated with the identification and characterization of proposed biological control agents of weeds, target weeds, and close relatives of both. Addressing these requires highly-specialized technical expertise. TAG-BCAW members who are unfamiliar with certain subject areas are encouraged to consult with experts for additional help in verifying information presented in petitions.

Some of the complex questions associated with the identity and characterization of an agent are as follows:

- What is the scientific name of the agent (at minimum, genus and species)? Who determined the name (i.e., taxonomic authority)? What is the level of confidence of this determination?
- How is the agent related to other taxonomic groups?
- Are the voucher specimens deposited in a national museum where they are accessible to scholars and international experts?
- Does the agent (or a closely-related species) already occur in areas likely to be the targeted for agent release?
- Can the agent be differentiated below the species level and if so is it currently resolved and uncontested?
- Can the agent's presence post-release be unambiguously confirmed (e.g., based on sampling evidence that the natural enemy is present, and feeding damage to host plants)?

- How does the agent affect the target weed (e.g., defoliation, stem or root galling, seed destruction, etc.), and is damage caused by a specific life stage of the agent?
- Are the agent's intensity and scale (individual, patch, or population level) of damage on the target weed well characterized?

Approaches, Methods, and Tools for Identification and Characterization of the Agent

Researchers use a variety of approaches, methods, and tools to identify and characterize biological control agents of weeds. A critical challenge for the TAG-BCAW is determining if the approaches, methods, and tools employed confer an appropriate level of confidence in identifications and characterizations.What is the evidence? How is the evidence presented?

Taxonomic Approaches

For proposed biological control agents of weeds, taxonomic identification **must** be provided at minimum to the species level. In some cases, identification below the species level may be necessary. For many microbial groups, sexual and asexual forms exist for a given species. Taxonomy may be based on spore forms or other reproductive characteristics. For other groups, biotypes, genotypes, strains, pathotypes, and subspecies exist. These sub-taxa are characterized in different ways; for example, some may refer to isolates. Isolates are often limited collections made from a specific location, and may **not** represent the entire genetic diversity of the species. Accuracy in naming potential biological control agents of weeds is as important as accurate characterization (biological, chemical, ecological).

Morphological Methods

Conventional morphological methods are often initially used to determine species identity. Physical attributes unique to the species are used to generate a diagnosis that can be used to distinguish the agent from close relatives once it has been released.

Attributes may include:

- Armature (spine, hairs)
- Body shape and size
- Color patterns
- Cuticle surface
- Internal Structures (stylet, reproductive organs, etc.)
- Morphometric parameters

- Physiological (spiracles, pores) structures
- Reproductive structures
- Shape and number of appendage (antennae, legs, palpi, etc.) segments

Functional Analysis

Functional analysis of characteristics, such as part of the host plant utilized, feeding behavior, or infection parameters can also be incorporated into the identification of an agent. In some cases, these methods can provide a more accurate way to identify an agent.

EXAMPLE For example, plant galling arthropods are typically identified from the location (on host plant) and unique morphology of the galls; this approach provides a more certain yet simple identification of the arthropod species than the morphological traits of the arthropod species itself.

Other methods for characterizing an agent involve biological or chemical characterization using a range of available tools.

In some cases, assessments of agent identity **must** extend beyond taxonomy to include the following biological and chemical characterizations:

- Biological traits such as growth on selective media (microbes), phenology, diapause;
- Enzymatic reactions and other chemical analyses;
- Host indexing for characterizing pathogens;
- Disease symptoms/damage patterns;
- Hybridization studies and evaluation of reproductive strategies employed by an agent; and
- Range location and relationship to other ecotypes.

Molecular or Genetic Tools

Identification and characterization of an agent using molecular or genetic tools yields more definitive agent identification and can significantly enhance or reveal complex agent characterizations.

A number of techniques have been used to identify biological control agents:

- Allozymes and proteins: compare data between geographical isolates;
- Amplified fragment length polymorphism (AFLP) and Selective Amplification of Microsatellite Polymorphic Loci (SAMPL): assess variation among individuals of the same species;
- DNA bar-coding;
- DNA sequencing: differentiate species and populations;

- Multiple Arbitrary Amplicon Profiling (MAAP): assess variation among individuals of the same species; includes RAPD, ISSRs, UP_PCR, DAF techniques;
- Microsatellites or Simple Sequence Repeats (SSRs): differentiate species and populations;
- Polymerase chain reaction (PCR): qualitative and quantitative (qPCR) detection of species; and
- Restriction fragment length polymorphism (RFLP): differentiate between closely-related taxa.

Sequencing of diagnostic rDNA regions is now preferred as fast and accurate and decreasing costs. DNA bar-coding uses molecular markers such as COI, CO IIITS, 12S rRNA, 16S rRNA, 18S rRNA, 28S rRNA, and heat shock protein 90 (hsp90), and will distinguish most species, including cryptic species, immature stages, and unknown species. Sequencing technology is rapidly developing. Second generation techniques such as pyrosequencing, sequencing by synthesis and sequencing by ligation are vast improvements on first generation or Sanger sequencing. Third generation techniques are already under development. Molecular data provides the capacity to label agents for later verification.

Challenges

The TAG-BCAW is continually challenged to accurately assess the petitioners' identification and characterization of proposed biological control agents of weeds.

Species identifications or characterizations presented in petitions or test lists may be incorrect. When this occurs, implications are as follows:

- Hampering of access to published information may be due to incomplete names;
- Loss of effort thus far invested toward biologically controlling weeds;
- Misguided sense of confidence using a knowledge base that is inappropriate to the proposed biological control agent of weeds being studied; and
- Potential to improperly assess the risk factors.

Cryptic or Sibling Species

The presence of cryptic or sibling species in shipments of proposed agents received in containment facilities may go unnoticed, depending upon taxonomic status of the group involved. Cryptic or sibling species can cause serious problems in host plant testing, resulting in inaccurate or erroneous assessments of host range and in quarantine operations after the research has been completed and the agent has been approved for release.

In this situation, the wrong or untested species may be included in environmental releases.

EXAMPLE Populations collected from a geographically distant part of a tested agent's range may prove to be a different species, even though the populations appear to be similar.

The unintentional release of cryptic or sibling species has been documented in existing North American weed biological control programs. Researchers and TAG-BCAW reviewers alike can prevent this problem by questioning whether such possibilities might exist in the reported identification process.

Experts

What is an expert? Does the expert have the appropriate breadth of knowledge? Who are the world authorities? What is the expertise of the person who is describing the characterization? **Not** all experts agree, so there may be some confusion relying on them. Since world authorities are **not always** accessible and may **lack** critical knowledge of certain groups, definitive identification is **not always** possible. It is therefore extremely important that individuals of the species approved for release **always** come from the same population tested with a reference collection made of individuals from the population released (see below).

Reference Collections

Reference collections support biological control and hold specimens of proposed biological control agents that have been studied by taxonomists. In some cases, access to reference collections is limited, since collections may be located in foreign museums. Reference collections and hands-on experience may be limited to geographic regions. If these geographic regions fall outside of the main region being studied by taxonomic experts, then the experts may have limited capacity to identify exotic agents.

EXAMPLE Agents from the southern hemisphere and from locations in the Old World may **not** be represented in U.S. reference collections; therefore, definitive identification may **not** be possible by U.S. taxonomists.

As required by NAPPO RSPM No. 7, a reference collection of individuals from the released population **must** be deposited in a national collection. It is recommended that the specimens be deposited in national collections of Canada, Mexico, and the United States to ensure that the experts in North America conducting future taxonomic studies have access to, and include representatives of the biological control agent.

Taxonomic Authority

The petitioner **must** include the name of the recognized taxonomic authority in that particular taxon. If the name of the agent species is **not** listed, then the petitioner **must** include a letter from the expert taxonomist in the particular taxon so stating. Taxonomists may be reluctant to go on record with determinations unless they have a high level of confidence in their assessment. The use of incomplete names is **not** necessarily a limitation, since much of the assessment is based on biological information obtained after collection.

Has the taxonomic authority done historical research on the taxonomy of the relevant taxon? Minor frustrations may occur in assessing the knowledge base because of synonymies (process), revisions to new genera, and other changes in the names by which information on agents is retrieved.

References

For more information about identification and characterization of agents, see References on page F-1.

Abebe, E.; Mekete, T.; Thomas, W.K. 2011. A critique of current methods in nematode taxonomy. African Journal of Biotechnology 10: 312-323.

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NAPPO (North American Plant Protection Organization). 2008. Guidelines for Petition for Release of Exotic Phytophagous Agents for the Biological Control of Weeds. Regional Standard for Phytosanitary Measures (RSPM) No. 7. Available at: http://www.nappo.org/en?sv=&category=Standards%20Decisions&title=Standards

Chapter

4

Biological Control of Weeds

Host Specificity Testing of Arthropods

Contents

Introduction

The *Host Specificity Testing of Arthropods* section of the *Biological Control of Weeds* chapter provides the guidelines for host specificity testing of all arthropod species that are potential classical biological control agents of weeds. These guidelines **must** be read and comprehensively understood by all TAG-BCAW members that review and evaluate petitions submitted for environmental releases of new proposed biological control agents of weeds (i.e., species **not** previously screened and then approved for environmental release).

The sequence of tests described here is an example, and is **not** intended to serve as a definitive checklist. Details of any host specificity tests vary according to the biology and life history of each proposed species. When reviewing the methods section of a petition, evaluate if the petitioner has used an appropriate method for studying the host range of the species.

Host Plant Selection

A strategy based on the Wapshere centrifugal method for selecting plants for host specificity testing is covered under Test Plant Lists on page 5-1. Briese proposed a more advanced approach that uses plant molecular systematics in test plant species choice. Alternative host plant selection strategies may also be used.

The identity of the plants **must** be confirmed, the person identifying the plants **must** be named, and the source of propagative material **must** be clearly stated. The centrifugal testing approach may **not** be appropriate for all organisms, particularly facultative saprophytes (i.e., culturable organisms), thus criteria for selecting test plant species should be clearly stated.

Host Specificity Testing

Host specificity testing is the process of rigorously evaluating a proposed species to determine its field host range. The field host range consists of those plants on which all individuals of the species would consistently develop normally and complete their life cycle in nature. Host specificity testing of proposed arthropod agents begins with field studies of the species when initially discovered in the native range on the target weed.

Once a potential agent has been found feeding on the target weed in the field, the first step is usually to survey the surrounding plants, particularly those in the same family as the target weed. This type of survey can give the researcher a preliminary indication of whether the arthropod is a generalist or specialist herbivore. Similarly, once the species is identified, a literature search will often indicate if the arthropod is likely to have too broad a host range to be considered as a proposed biological control agent of weeds. Species confirmed to be generalist feeders or those with a broad host range are dropped from further consideration. Researchers then focus their efforts on evaluating more promising potential agents under controlled environmental conditions. This evaluation determines if the proposed species' host range is limited enough to make it a feasible biological control agent.

No set protocol or standard procedure is routinely used for host specificity testing. Different tests **must** be developed and implemented for each proposed species, depending upon feeding behavior or the part of the plant on which it feeds.

The individuals used in host specificity testing may be from wild populations collected in the field or from laboratory-reared colonies. Both sources have

advantages and disadvantages which can ultimately affect the results of host specificity testing.

For some species, field-collected material is frequently more readily attainable and cheaper to use than trying to establish and maintain a laboratory colony. A disadvantage of using field-collected individuals is that they may be contaminated with diseases or parasitoids which could ultimately affect their behavior. Furthermore, a researcher is less able to control for age and vigor of field-collected material (e.g., females may already have laid most of their eggs at the time of collection).

Laboratory-reared individuals are easier to control and provide a better opportunity for researchers to observe the arthropod's biology and life history attributes more closely. In addition, laboratory colonies, compared to wild populations, provide a more genetically homogeneous population to work with that is free of diseases and parasites. Unfortunately, laboratory colonies can undergo genetic bottlenecks resulting in behavioral changes or loss of vigor, particularly if the individuals are continuously reared on artificial diets or the colonies are continuously reared through numerous generations. This can be mitigated by periodically introducing field-collected individuals sourced from the original collecting location to laboratory colonies, or by maintaining separate genetic lines of the agent which are periodically crossed to sustain genetic diversity and colony vigor.

Natural populations of a proposed species may be quite small or available **only** for very limited periods of time, while laboratory-reared colonies can provide a large and constant year-round supply of experimental subjects.

In general, proposed species selected for screening or starting a rearing colony should originate from a single and clearly-defined collection site. This ensures that the population of an agent that is to be released retains the same genetic diversity and characteristics as the population that was tested.

Rigidity of Arthropod Behavior: Importance to Host Specificity Testing

As arthropods select host plants and feed on them, they appear to transition smoothly from one behavior to another—walking, stopping, and feeding just as mammals do. Nonetheless, arthropod behavior is generally much less fluid than that of mammals. Insects and mites find, preliminarily assess, then select and feed on hosts in a series of discrete steps, each step mediated by a particular physical or chemical stimulus. In some cases, serio-chemical cues **must** be present for the arthropod to sustain its feeding behavior. If critical stimulus is lacking, then host selection or feeding may be aborted triggering a different behavior, such as flying away to search for another plant.

Not all arthropods have the same sequence of behaviors. Certain steps displayed by one species may **not** be displayed by another. Nevertheless, arthropod behavior is generally considered to be rigid, at least at the gender and life stage within the species level, and this rigidity constitutes an important basis for scientists' confidence in the results of host specificity tests. Under both natural (unmanipulated) field and controlled experimental test conditions, genetically-determined behaviors prevent arthropods from skipping over steps in order to satisfy their need for food.

Immature arthropods usually have host plants selected for them by ovipositing adults. Immature arthropods may therefore have relatively under-developed host discrimination abilities. When arthropods deposit eggs on unsuitable host plants, larvae may or may **not** still attempt to feed. If the host plant is of poor nutritional quality or possesses defensive chemicals, then larvae either may either grow and develop for a time but fail to complete development, or they may complete development but emerge as undersized adults. The production of undersized adults can be indicative of additional deleterious physiological effects; affected adults may also be sterile or less fecund. For some species, such as many root feeders, larvae are able to seek out suitable hosts, so host selection for oviposition is likely more random.

Screening Tests

Current practices involve a tiered approach to non-target testing. The general sequence is no-choice tests on as many test plant list species as possible, followed by multiple choice tests (agent simultaneously exposed to one or more non-target species and the target weed). Tests use standardized observations of feeding or oviposition and measures of development to compare acceptance and suitability of target and non-target plant species. Researchers should strive to conduct tests on the biologically and ecologically relevant phenological stages of test plants. Final testing of the most promising proposed biological agents of weeds is frequently conducted in field cages or as open field tests in the agents' and target weeds' country of origin.

No-choice Plant Tests

During the initial stage of evaluation, all species identified on the test plant list (see Test Plant Lists on page 5-1) are considered to be potentially at risk of attack by the proposed biological control agent of weeds, according to their degree of relatedness to the target weed. The first level of host specificity testing usually concentrates on quick, simple tests to evaluate the response of the proposed organism to the selected plant species. Such preliminary testing is referred to by several different names—first-phase host testing, no-choice testing, starvation testing, or single-plant testing—but usually follows the same general procedure. Published strategies for preliminary testing are further discussed in Testing Methodology for Biological Control on page F-25.

In general, preliminary testing involves placing immatures of the potential agent on the appropriate plant part/phenological stage of the non-target species, either in a container (such as a petri dish) or enclosed on potted plants where they either feed or eventually die because the host is fundamentally unacceptable. Observations of a similar number of immatures of the potential agents placed on the same part of the target weed serves as a positive control.

At the coarsest resolution of host acceptance behavior, arthropods probe test plants with mouth parts or ovipositors in an effort to discriminate between hosts and non-hosts. In general, such minor probing or tasting are **not** considered to be true feeding, and for all practical purposes can be regarded as nonfeeding.

Arthropods may ingest enough material on certain plants to produce droppings. However, if the life span of the organism will be extended but there is little evidence of continued development, then these accepted but unsuitable species can also be discarded as potential host plants. A final category of host-plant interaction is characterized by those plant species on which the proposed biological control agent of weeds readily feeds, grows, and appears to undergo successful development. As potentially accepted and suitable non-target hosts, risks to these plant species **must** be further evaluated using more refined assessments.

Multiple-choice Plant Tests

The next level of host specificity testing aims to approximate more natural conditions where arthropods can freely select both the plant species and part of the plant on which to feed, complete development, or oviposit. These tests typically require a reliable supply of live, healthy, potted plants. Plant parts (at minimum, large healthy bouquets of foliage, flowers, seeds, fruit, roots, or stems) can be acceptably used under certain circumstances. Arthropod behavior is often influenced differently by constituent cues produced by intact test plants, in comparison to elicited cues produced as part of test plant damage or wounding responses. Researchers and TAG-BCAW reviewers alike **must** carefully consider the implications of using plant parts rather than whole plants on test results reported in petitions.

Like the no-choice tests, multiple-choice tests may indicate that although development can be successfully completed on non-target species, it may take significantly longer than for the individuals feeding on the target weed (used as a positive control). Arthropods completing development on non-target species may emerge as smaller and less reproductively fit adults than those produced on the target host.

The main purpose of these secondary feeding tests is to identify and eliminate from further testing non-target plant species that are **not** at risk, and focus additional testing on those species that appear to support normal arthropod development.

Oviposition Testing

Arthropods may complete normal development when confined on nontarget species. This **does not** necessarily mean that nontarget plants would be selected as hosts under (unmanipulated) field conditions. Furthermore, plants **must** first be recognized as hosts before they can be selected by ovipositing females. Oviposition preference is therefore given strong consideration in host specificity testing. Oviposition testing requires larger cages in which mated females can freely move around and choose between non-target and test weed test plants. If oviposition is observed, then the plants are retained under typical field growing conditions to see if eggs will hatch and the larvae will complete their development and produce normal adults.

Like most tests under conducted laboratory conditions, oviposition tests are subject to many limitations. The confined space in the cage or mixing of odors from the enclosed plants can confuse the female into laying eggs on what otherwise would bean unsuitable host. If the foliage of the test plant and the positive control are intertwined, then the female can accidentally deposit eggs on the wrong plant. Some arthropod species use serio chemical or tactile cues to determine if conspecific eggs have already been laid on a plant; if the

number of eggs present exceeds an acceptable threshold, then the female will automatically move on to search for an oviposition site with fewer or **no** eggs.

Because the life span of many arthropod species is relatively short, most females deposit all of their eggs in a fairly restricted oviposition period. If the females **do not** find a suitable host in time, then they may resort to depositing their eggs on any available surface, on what would under normal conditions be considered an unsuitable host. Thus the placement of an egg on a non-target plant may **not** be the result of intentional selection by the female. The importance of using plant material at the appropriate stage of development (phenology) and in a healthy condition for exposure to the proposed biological control agents of weeds is a critical consideration. Results of ovipositing tests **must** be analyzed carefully with a sound understanding and consideration of the biology and ecology of the potential agent.

Oviposition tests are another way to eliminate additional plant species from further testing. These tests can provide useful information on the host specificity of an arthropod species, but they may **not** provide definitive answers to the question of ecological host range.

Field Testing

The most generally-accepted, accurate information on the field host range of a proposed arthropod biological control agent is obtained from tests conducted under natural field conditions. Ideally, nontarget plant species are cultivated alone or in intermixed plots with the target weed in areas where a natural population of the proposed arthropod is known to be present. Arthropods from the surrounding population freely select among the test plants and the target weed for oviposition and subsequent larval development. While this is a much more definitive test, this also has its disadvantages.

Often the foreign country where the field tests are to be conducted will **not** allow North American plants to be introduced and planted due to the risk that they may escape and become weeds. After planting the test plants, the arthropod population in the area may be too low to allow for a realistic assessment. Sometimes this situation can be overcome by enclosing the plants in large cages, collecting the arthropods from the surrounding area (or rearing them artificially in a laboratory), and releasing relatively large numbers in the cage. This remedy may, however, reproduce the cage test biases described above.

Field testing may also include **no**-choice methods (e.g., releasing on critical non-target species patches without the weed present).

Experimental Design

Due to the wide range of variability in behavior and life cycle demonstrated by each arthropod species, using a standard design for all host testing is unrealistic. Therefore, host testing for each proposed agent requires a slightly different and customized experimental design. The design used should be critically reviewed to determine if rigorous enough experimental standards were used and if adequate quality control was followed.

Each design should be reviewed to determine adequacy and standardization of the following:

- Quality of host plant
- Quality of test arthropods
- Number of plants for each plant species tested
- Number of plant species used to represent a genus
- Number of arthropods tested
- Stage of arthropod used in the test
- Replication of tests
- Use of appropriate surrogate plant species in place of rare, threatened, or endangered native plant species
- Use of actual threatened and endangered species

Conclusion

The general process used in host specificity testing begins with field studies of the arthropod when the arthropod is first found and being considered as a potential biological control agent.

The next step is to screen a large number of test plants to eliminate those species or groups that are **not** at risk.

This is followed by further testing under more natural conditions that eliminate additional plant species and identify those that are possibly at risk of attack by the proposed biological control agent of weeds. At this point in the screening process **only** a few plant species require additional testing. These usually require much more complex and comprehensive tests to determine which could possibly be selected by females as a suitable host and can support natural development of the arthropod.

The results of host testing are easy to evaluate if under several different test arrangements arthropods are found to feed and develop **only** on the target

weed. In this case, there is usually **no** question about host specificity. This situation is usually quite rare; if a realistic selection of test plants is used including many related species, then the arthropod is almost **always** found to have a host range of several species.

In the past, if the other plants in the host specificity tests on which the arthropod fed and developed were weeds or were accidentally-introduced plants of **no** known value, then the release of the insect was usually approved.

However, if the non-target plant attacked is a native species or a desirable agricultural or ornamental plant, then the researcher **must** demonstrate, based on phenology, climatic limits, or geographic range, why the proposed biological control agent of weeds will **not** utilize or at least **not** significantly damage, desirable plant species at a population level.

Therefore, the most important parts of host specificity testing to relate to TAG-BCAW and other reviewers are the petitioner's explanation and interpretation of their results, and how they can be used to extrapolate the potential damage the proposed biological control agent of weeds may cause (should the proposed biological control agent be released) to nontarget plants, especially to threatened and endangered species.

References

For more information about host specificity testing of arthropods, see the following listed references as well as those listed in Testing Methodology for Biological Control on page F-25.

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Chapter

4

Biological Control of Weeds

Host Specificity Testing of Pathogens

Contents

Introduction

The *Host Specificity Testing of Pathogens* section of the *Biological Control of Weeds* chapter provides the guidelines for host specificity tests of pathogens that are proposed as biological control agents of weeds. These guidelines are to be read and looked over again by TAG-BCAW members before reviewing and evaluating submitted petitions.

Host Specificity Testing

Host specificity testing of pathogens proposed as biological control agents of weeds (hereafter referred to as pathogens) **must** initially take place under controlled environmental conditions. Frequently these studies are conducted in greenhouses or growth chambers and in quarantine. The use of dew chambers to facilitate fungal infection under controlled conditions is commonplace.

The wide range of problems encountered in raising plants under such conditions might complicate the analysis of test results. A test under conditions that heavily favors disease is the first step to conclude that a negative is a

negative. Then more detailed, quantitative experiments (statistics, etc.) are conducted to clarify what a “non-target effect” actually means. It has been shown that cuticle properties etc., can be different under artificial conditions, leaving plants more susceptible to pathogen attack, and sometimes leading to false positives. Since the cuticle is the primary barrier to infection from foliar pathogens, this may confound results. Therefore, studies conducted in a quarantine facility, with artificial light simulating natural light conditions (daylight, dusk/dawn), would be more approximate of natural conditions.

Many greenhouse coverings exclude ultra-violet light (UV), which when present (as under field conditions) has been shown to be detrimental to many types of pathogens. UV light is known to trigger the production of enzymes in plants that are involved in the immune response to pathogen attack. Hence, field grown plants are often pre-adapted to ward off pathogenic attack.

Protocols and Conditions for Host Specificity Testing

Ascertaining optimum conditions for disease of a target weed is important prior to initiating host range experiments. Although determining optimum conditions for disease may be a lengthy process, it provides the foundation for host range determinations.

Factors that need to be considered include the following:

- Inoculum application method;
- Carrier and adjuvants for inoculum application;
- Concentration of inoculum in the carrier;
- Total volume of carrier plus inoculum to be applied;
- Requirement of the pathogen for free water on the leaf surface (dew period);
- Temperature during dew period and length of dew period; and
- Temperature of growth chamber after dew period.

Physiological Conditions

The physiological condition of the test plants at the time of pathogen inoculation is an important consideration and should be described in the petition. This is often described by the number of leaves at the time of application. Size of the plant, especially height, is a poor indicator since young plants that are exposed to low light levels might be taller than older plants that were grown under high light conditions. Reproductive status of the plants (phenological stage) may also be useful to note. Part of the plant inoculated, e.g., top or bottom surface of the leaf, is also important to document.

Positive Control

The petition may **not** necessarily contain the details of how all the preceding experiments were carried out, as long as the petition clearly shows these factors have been considered.

A positive control is one that is reasonably expected to give a positive response. When the researcher uses a positive control in the host specificity tests, the reviewer can be certain that the researcher is striving for evidence that conditions were favorable for disease and that the pathogen was functional.

In the case of a host specificity test, the target weed with a suitable number of replicates **must** be included in all tests. If the pathogen is a compatible agent, then the target weed will exhibit a strong reaction to the pathogen. Susceptibility of biotypes of the target weed needs to be established before host specificity testing is conducted. A representative biotype can then be used as the positive control in subsequent tests.

Host Plant Selection

A strategy based on the Wapshere centrifugal method for selecting plants for host specificity testing is covered under Test Plant Lists on page 5-1. Another approach is Berner et. al.'s mixed model analysis combining disease ratings and DNA sequences to determine the host range of a pathogen and the use of best linear unbiased prediction (BLUPs) of pathogen host range. Another method takes into account the pathogen's biology (e.g., a rust fungus with primary and alternate hosts in phylogenetically distinct families, host range models based on the known hosts of facultative saprophytes, etc.). Other systems, such as Briese's proposed plant molecular systematics method may also be used.

The identity of the plants **must** be confirmed, the person identifying the plants **must** be named, and the source of propagative material **must** be clearly stated.

Condition of Test Plants

The petitioner should thoroughly describe the conditions under which the test plants were grown. Actively growing plants that are free of arthropods and diseases (i.e., healthy), and that are in a good physiological condition should be used. Where possible, testing leaves of different ages would be advantageous within the same replicate.

The petitioner should describe the phenological stage of test plants (seedlings, vegetative buds, flowers, fruit, seeds). Watering and fertility regimes should be

described, as well as the type and size of containers used. The type of soil used in the pots should be adequately described, since sterile soil can eliminate possible beneficial species that can directly affect susceptibility of plants to diseases such as *Trichoderma* spp. Large plants in small containers often experience nutrient and water stress if application of these factors is **not** frequent enough. Plants that have undergone such stress have activated enzyme systems that can be part of the immune response to pathogenic attack.

Growing Conditions

The growing conditions in the growth facility should be monitored and reported in an appendix to the petition. Critical factors are maximum and minimum air temperatures, duration of these temperatures, and periodic (hourly if possible) reporting of relative humidity, and light spectrum under which the plants were grown. If the petition clearly indicates that these factors were considered, then reporting all of these values in the petition may **not** be essential.

Inoculation Route and Method

The inoculation route (through soil for root pathogens, foliar spray for aerial pathogens, etc.) and inoculation method (use of surfactants, abrasives, wounding, placing inoculated plants under plastic cover, etc.) should be described. The reviewer should be able to assess whether proper route and method of inoculation was used.

Techniques Used for Rating Disease

Another important aspect of host specificity testing is a thorough description of the techniques used for rating disease. Disease incidence and severity should be considered. Incidence is the presence or absence of visual symptoms. Severity involves qualitative and quantitative measures of extent of disease presence. Macroscopic and microscopic evaluation of the infection provides the researcher with a key to use to evaluate any non-target symptoms.

Since there are qualitative factors that **must** be considered, the petition should clearly state what those factors are and how the researcher made the evaluations. Qualitative determinations should be confirmed by some quantitative measure. Macroscopic measurement may be as simple as determining density by counting the number of fungal lesions per leaf and dividing by the size of the leaf. Qualitative terms such as small, medium, and large should be defined in quantitative terms (e.g. 0 to 5 mm, 6 to 10 mm, and >10 mm, respectively). Microscopic measurement which may consist of B&H staining of leaves from initial inoculation to expression enables observation of

a compatible reaction compared to a hypersensitive reaction. Whatever measures are used, the technique should be thoroughly described.

In judging whether the rating system is adequate, the reviewer should determine whether the petition describes the techniques in enough detail that the reviewer could repeat the procedure. The reviewer should then visualize the procedure and make a determination as to whether the techniques employed would yield an accurate picture of the presence and severity of disease. The use of long-accepted techniques, described in a significant body of literature, can help satisfy the reviewer that the techniques are adequate. When well-documented techniques have been used, they should be described in the petition in enough detail to allow those unfamiliar with the literature to visualize what was done. Citations should also be given for those who want to read more.

Disease Symptoms on Nontarget Hosts

In many cases, plant species **other than** the target weed will exhibit some disease symptomatology when challenged with a pathogen under ideal environmental conditions. Those that **do not** can be dropped from further testing.

A phased approach may be used. The first phase is simply plus-and-minus to identify those plant species that are **not** susceptible to get an idea about amounts of disease on potentially susceptible non-targets. The second phase consists of detailed, quantitative if possible, experiments to describe what the disease response means in terms of damage to the non-target.

Another approach is to run side-by-side comparative studies that include a relative of the proposed biological control agent of weeds already in the U.S. or a pathogen on the non-target that is already in the U.S. Infection may occur, but pathogen reproduction may **not**. This is probably acceptable level of risk, depending on the plant species. If the plant so affected is an endangered or threatened species, then determining if the infection causes demonstrable damage to the plant, and stating this finding is desirable. Such damage might be a reduction in growth rate, a reduction in flowering, or a reduction in viability of dispersal organs, such as seeds. However, it should be noted that artificial conditions might favor leaf drop or plants that might **never** flower under greenhouse conditions, and hence assessments obtained under such situations would be dubious.

In another scenario, a small amount of pathogen reproduction may occur, but **no** or little secondary infection might take place, indicating that the pathogen would **not** be able to sustain a population on the non-target species. This may be acceptable risk, but further experimentation is probably prudent in this

situation. Inocula can be collected from this type of infection and used in studies to determine whether the inoculum is viable and infective. If the inoculum is **not** infective, then the risk is probably acceptable.

A measurable secondary infection may occur on nontarget hosts. In this situation, further experimentation is needed. If practical, then field trials (overseas is permissible) can provide insight as to whether these limited types of infection have serious environmental and ecological implications for nontarget plant hosts.

Field Trials

Field trials should be conducted under conditions that favor the growth of the test plants. These conditions should be completely described and should include the following:

- Fertility and irrigation regimes
- Location of the test site
- Planting methods, including between row and within row spacing
- Soil type
- Time of year

In the case of exotic pathogens, these trials will be conducted overseas within the native range of the pathogen (ideally in a location climatically similar to that of the intended release area), before approval for release from quarantine.

Environmental Conditions

Environmental conditions during the growth of the test plants, at the time of inoculation, and during the evaluation period should be monitored and reported. The following factors are important to include:

- Atmospheric humidity
- Rainfall data
- Maximum and minimum air temperature
- Soil temperature
- Solar radiation (indications of photoperiod and cloud cover)
- Wind speed

Physiological Stage of Test Plants

The physiological stage of all test plants at the time of inoculation should be indicated.

Controls

As with controlled environment studies, positive controls should be included. The procedure for evaluating disease should be defined as for controlled environment studies.

References

For more information about host specificity testing of pathogens, refer to the following listed references as well as those listed inTesting Methodology for Biological Control on page F-25.

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Chapter

5

Format and Evaluation

Petitions for Field Release Format

Contents

Introduction

The *Petitions for Field Release Format* section of the *Format and Evaluation* chapter contains a guide for petitioners and researchers to follow when preparing a petition; and provides guidelines for TAG-BCAW members to follow when reviewing and evaluating petitions for the release of biological control agents of weeds.

Format for Petitions for Field Release

The petitioners and researchers will follow the format below when preparing a petition for biological control agent of weeds for field release. The information requested in this format is believed to best demonstrate the potential risks that might be involved in the proposed biological control agent of weeds release and the long-term ecological consequences of a successful release.

The format for the petition for field release contains the following main sections:

- Cover Page
- Summary
- Introduction
- Target Weed Information

- Biological Control Agent of Weeds Information
- Experimental Methodology and Analysis

Cover Page

Prepare a cover page for the petition and include the following information on the cover page:

1. Date of the petition and date of mailing.
2. Name of the petitioner, affiliation, and contact information (petitioner's address, email address, telephone number, fax number).
3. Type of petition: Proposed field release of a *[biological control agent]* of a *[target weed(s)]*. Include order, family, genus, species, author, and geographical origin.
   A. If this petition represents additional information requested by the TAG-BCAW for a previously-submitted petition, then include the TAG-BCAW assigned number of the previous petition.
   B. If providing additional information requested by TAG-BCAW, then address **only** those sections indicated to be of concern to TAG-BCAW; and highlight the specific sections changed. Include a summary of the changes that were made.
4. List of locations where the studies have been conducted.
5. If part of the study has been conducted in a U.S. quarantine facility or facilities, then list the location of each quarantine facility.
6. List the quarantine facility or facilities the petitioner intends the proposed biological control agent of weeds to pass through prior to initial North American releases.

NOTICE

Please be aware that pathogens will require a different type of quarantine facility than that used for arthropods.

7. States or Provinces for initial release in the following countries:
   - Canada
   - Mexico
   - United States
8. Name(s) of those person(s), affiliation, and contact information (address, email address, telephone number, fax number) who will be conducting the release(s) and who will be monitoring the release(s) in North America.

Summary

Include an abstract of the petition, with the following information in the summary:

- Problem
- Approach
- Main findings

Introduction

Include the following information in the petition's introduction:

- Nature of the Problem
- Proposed Action

Nature of the Problem

Give a brief summary (one to two paragraphs) of the problem caused by the weed.

Consider including in the following topics in the summary:

- History of introduction and/or spread of the target weed
- Pending issues about the following:
  - Agent(s)
  - Location of release
  - Taxonomy of proposed biological control agent(s) of weeds
  - Taxonomy of target weed
- Sectors affected and magnitude of program (e.g., agricultural, natural, rangeland)
- Target weed's present distribution in North America

Proposed Action

Provide a statement of the proposed action.

EXAMPLE Proposed action: To introduce a *[biological control agent]* from *[a foreign area]* for field release in *[a specific area]* to control *[target weed]* in *[Canada, Mexico, the United States].*

Target Weed Information

Often detailed information will have been provided in previously-submitted test plant lists or release petitions. This information can be repeated along with additional information in subsequent petitions for field release.

Include the following under the petition's *Target Weed Information*:

- Taxonomy
- Description
- Distribution of the Target Weed
- Taxonomically-Related Plants
- Distribution of Taxonomically-Related Plants
- Life History of the Target Weed
- Impacts of the Target Weed
- Management Options

Taxonomy

Include the following under *Taxonomy*:

1. Full classification, synonymy, and common name; include order, family, genus, species.
2. Cite experts who identified the target weed in North America (name, organizations, locations).
3. List names of experts and publications confirming the presence of the target weed in North America. Include organizations, locations.
4. Problems (and if possible, proposed resolutions) associated with the group's identification or present taxonomy.
5. Origin and location of herbaria containing voucher specimens, and the date of specimen deposit. The voucher specimens referred to here are those used as representatives of the population that occur in the area where the researcher has conducted the studies.

Description

Provide a general description of the target weed, complete enough that the correct identification could be made by a person encountering the weed in the field.

Distribution of the Target Weed

Describe the distribution of the target weed and use maps, as appropriate. Include the following information:

1. Map of Native range (map).
2. Areas of introduction throughout the world (map), pattern of movement, and apparent limits.
3. Present distribution areas in North America (map).
4. Description of the target weed's areas of potential spread in North America.
5. Genetic and phenotypic variability with respect to geographic distribution.
6. Habitats or ecosystems where this weed is found in North America.

Taxonomically-Related Plants

Include the following:

1. Identify both native and non-native plants that are closely related to the target weed;
2. Emphasize economically and environmentally important species; and
3. Identify crops, ornamentals, and native plants including threatened and endangered species and those with cultural or aesthetic value
   - ❖ If possible, identify how closely these plants are related to the target weed; and
   - ❖ If applicable, include identified surrogates.

Distribution of Taxonomically-Related Plants

Describe the distribution and habitats in North America of the taxonomically-related plants identified under Taxonomically-Related Plants above.

Life History of the Target Weed

Explain the life history and general biology of the target weed. Discuss the factors that are believed to contribute to the plant's weediness.

Impacts of the Target Weed

Indicate any and all impacts made by the target weed. Include any potential conflicts. Use the following list as a guide (n**ot** all areas listed below are applicable to all petitions):

1. Beneficial uses—honey bees, forage, ground cover, fruit, etc.
2. Social and recreational impacts—value as ornamentals or other.
3. Impact on threatened and endangered species.
4. Economic losses, including direct control costs.
5. Health—poisonous, allergenic.
6. Regulatory—noxious weed, restricts trade.
7. Effects on native plant and animal populations.
8. Impact of weed control on nontarget plants.
9. Effects on ecosystem functions and ecological relationships.
10. Other, e.g., aesthetic.

Management Options

Describe options for managing the target weed.

1. Historical options—what has been done before and its effectiveness.
2. Current options—biological, chemical, cultural, etc., and effectiveness.
3. Potential options—new herbicides or biological control agents used or released in other countries.

Biological Control Agent of Weeds Information

Include the following under *Biological Control Agent Information*:

NOTICE

If a petition concerning this agent has been previously submitted, then state when and where. Be sure the previously-identified TAG-BCAW concerns are adequately addressed in this submission. Highlight the changes.

- Taxonomy
- Geographical Range
- Known Host Specificity
- Life History
- Population of the Biological Control Agent Studied

Taxonomy

Include the following under *Taxonomy*:

1. Full classification (order, family, genus, species), synonymy, and common names. For pathogens, also include strain, race, or other specific designation (e.g. isolate number, pathovar, etc.).
2. A general description of the proposed biological control agent, including helpful morphology and diagnostic characteristics that could be used to identify the agent in the field.
3. Method for distinguishing the proposed biological control agent in the field and in quarantine (e.g., how the proposed biological control agent will be discriminated from existing related organisms and antagonistic, cryptic, or competing species).
4. Reason for choosing the proposed biological control agent.
5. Taxonomic expert who identified the proposed biological control agent, including the expert's name(s), address, email address, and affiliations (with locations).
6. Problems with identification or with taxonomy. Include citations referencing the issues.
7. For arthropods and pathogens: the origin and locations of voucher specimens, date of specimen deposit, and how the voucher specimens are preserved.
8. For arthropods and pathogens: a description of the methods used to identify life stages.

9. For arthropods and pathogens: If available, DNA analysis or other molecular evaluation.
10. For arthropods and pathogens: Identification/characterization information used to confirm the determination during the evaluation processes and during field colonization efforts overseas.

Geographical Range

Include the following under *Geographic Range*:

1. Origin of the proposed biological control agent—maps and literature citations describing the native range of the agent.
2. If the proposed biological control agent is being used in other countries, then give the names of countries (ISO country names) of introduction and present range and known site efficacy.
3. Expected, attainable range of the biological control agent outside the area proposed for initial release in North America—based on climatic, environmental, and vegetative preferences of the proposed biological control agent.

Known Host Specificity

Include the following under *Known Host Specificity*:

1. Literature records indicating other host plants that have been attacked by the proposed biological control agent.
2. Field host-plant collections and observations of the biological control agent in the area of origin, including maps and data.
3. Literature records known host plant specificity of organisms closely related to the biological control agent, **no** matter where the organisms occur.

Life History

Include the following under *Life History*:

1. Basic biology and life history of the proposed biological control agent (i.e., diapause, resting stages, life cycle, dispersal capability, overwintering, etc. from literature, field observations, and laboratory studies) in enough detail to explain the agent's role in the new environment.
2. Known mortality factors.
3. Extent of damage to or control of the target weed.
4. Extent of damage to or impact on nontarget plants and other organisms.

Population of the Biological Control Agent Studied

Include the following under *Population of Biological Control Agent Studied*:

1. Geographical source(s) (origin) of the biological control agent. If available, include a map and site description. Be as accurate as possible so that the same population can be located if needed.
2. How a pest-free population of the proposed biological control agent was obtained and maintained in quarantine if applicable.
3. Biological control agent studied for the initial release is from the same population used for the studies or the biological control agent for release is identical to those tested (genetic or morphological confirmation).
4. Locations of field studies, lab studies, and quarantine facilities.

Experimental Methodology and Analysis

Include the following under *Experimental Methodology and Analysis* section:

- Test Plant List
- Design
- Positive Controls
- Rationale for Study Design and Execution

Test Plant List

Often a new biological control agent will require alteration of a previously-approved test plant list. If this is the case, then so state and identify and explain the rationale and changes. Include the host test plant list, even if **no** changes were made.

NOTICE

If an acceptable test plant list was already prepared and reviewed by TAG-BCAW prior to preparing the petition, then so state under the *Test Plant List* heading. Highlight any changes made to the test plant list.

If a test plant list has **not** already been prepared and reviewed by TAG-BCAW prior to preparing the petition, then list the test plant(s) and provide the rationale for selecting the plants.

1. List the species of host plants on which the proposed biological control agent was tested.
2. Explain why the listed plant species were chosen to determine the potential feeding range of the proposed biological control agent.
3. Include considerations given to threatened and endangered plant species and economically important plants.
4. See the required Test Plant List Format on page 5-1. Follow this format to help ensure that host specificity of the agent is properly circumscribed.
5. See ESA Compliance on page 6-1 for guidelines to comply with Section 7 and to expedite any review necessary because of protected species.

Design

Include the following under *Design*:

1. Plant parts and growth stages of all plants tested.
2. Source population of the test plants and target weed used in the test.
3. Number of replicates.
4. Number, stage, and age (arthropods) or phase (pathogens) of individual agents including number of males and females (arthropods), target weeds, and test plants in each replicate. May be synonymous with number of replicates depending on test design (i.e., in **no**-choice tests, the number of individual plants of a species is the number of replicates).
5. Details of experimental setup pertaining to overall environmental conditions and study areas.
6. How data were measured, recorded, and evaluated. Include statistical methods used.

Positive Controls

Indicate, under *Positive Controls,* how appropriate positive controls were used in all tests. Target is present at every step in the test process.

NOTICE

The target weed should be challenged with the proposed biological control agent before each testing procedure.

Rationale for Study Design and Execution

Include under *Rationale for Study Design and Execution,* an explanation of why the test procedures were selected and how they are appropriate for the biology of the agent being tested.

Results and Discussion

Include the following under the *Results and Discussion* section:

- Summary of Results
- Protocol for Releasing the Proposed Biological Control Agent
- Post-Release Monitoring
- Benefits and Risks

Summary of Results

Provide a summary of the environmental impacts of this organism as a biological control agent and any risk associated with its release, including the following:

1. Results in relation to host specificity and environmental impact.
2. Relevant citations of related literature, results of host specificity testing, and field observations.
3. Presenting results in a manner that supports the conclusion (tables, graphs, narratives).

Protocol for Releasing the Proposed Biological Control Agent

Include the following under *Protocol for Releasing the Proposed Biological Control Agent*:

1. Methods used to ensure pure cultures and correct identification of the proposed biological control agent to be released, including the following:
   A. For arthropods: species, genus, family, and order.
   B. For pathogens: strain, race, or other specific designation, e.g. isolate number, pathovar, etc. (Make consistent with above.)
   C. Names, affiliations, and locations of identifiers. (Make consistent with above.)
   D. Description of identification methods.
   E. Problems in identification.
   F. Date and place of depository containing voucher specimens.
2. General release protocol to ensure the absence of natural enemies and cryptic or sibling species.
3. Specific location of rearing or culturing facility.
4. Intended sites (States or provinces) for initial release. Timing of release. Release methods to be used.

A. For arthropods: if known, the number to be released.

B. For pathogens: method of preparing inoculum and inoculum concentration.

Post-Release Monitoring

Include the following explanation of the post-release monitoring plan under *Post-release Monitoring*,:

1. When the anticipated initial release of the proposed biological control agent(s) will occur.
2. Groups to best perform monitoring.
3. Monitoring techniques to determine if the proposed biological control agent(s) become established.
4. Monitoring techniques to characterize the spread of the proposed biological control agent and the observed impact (if any) on target and nontarget plants or organisms.

Benefits and Risks

Include the following under *Benefits and Risks*:

1. Provide a comprehensive statement that discloses all relevant known data gaps concerning the proposed biological control agent's and the target weed's biology and ecology.
2. Include the factors that would reasonably influence the probable benefits or possible negative impacts of releasing the biological control agent.
3. Give your perspective, weighing the probable benefits of releasing the agent against the risks associated with the agent.

Potential Environmental Impacts

Include the following under the *Potential Environmental Impacts* section:

- Human Impacts
- Economic Impacts
- Plant Impacts
- Nonplant Impacts
- Abiotic and Edaphic Impacts
- Methods for Mitigation
- Outcome of No Action

Discuss and present a clear picture of the long-term ecological consequences that might result from the successful establishment of the proposed biological control agent in the North American environment. This discussion should go beyond the risk associated with attacks on a few closely-related species of plants, as indicated in the host testing results. The discussion should look at the overall potential impact of populations of this proposed biological control agent building up on the weed in a range of habitats.

This information will be considered by APHIS in an environmental assessment (EA), before the Agency considers issuing a permit.

Continue below.

Human Impacts

Include positive and negative impacts of the proposed biological control agent to humans. Discuss ways to mitigate negative effects.

EXAMPLE Health, recreation, aesthetics, nuisance, poison, allergens.

Economic Impacts

Include a discussion of the potential gains and losses regarding the economic impacts of the proposed biological agent of weeds as follows:

- Aesthetic impacts
- Biological impacts
- Ecological impacts (such as on natural resources, components, structures, and functioning of affected ecosystems)
- Social impacts (such as cultural)

Plant Impacts

Describe the value of proposed biological direct and indirect impacts (positive and negative) of the proposed biological control agent on the target plant population against impacts on nontarget plants. Cover the intended effects on the target weed and on nontargets, including potential impacts on agricultural, horticultural, and threatened and endangered plants.

Abiotic and Edaphic Impacts

Identify the potential abiotic and edaphic impacts of the proposed biological control agent on water, soil, and air resources.

Nonplant Impacts

Describe the indirect impacts (positive and negative) of the proposed biological control agent's release on organisms (**other than** plants) associated with the target weed (directly or indirectly).

Methods for Mitigation

Identify the methods (management and other alternatives) to mitigate potentially undesired effects. Include how to control the proposed biological control agent if there is a problem.

Outcome of No Action

Provide a statement of potential outcomes if the proposed biological control agent is **not** released.

Petitioner's Conclusion

Under the *Petitioner's Conclusion* section, summarize all the results from your study of this proposed biological control agent, its host testing, and your evaluation of the potential environmental impact. Offer your conclusions on the potential risks and benefits regarding the consequences of releasing this proposed biological control agent and its successful establishment in the North American environment throughout the range of its target weed and susceptible nontarget hosts. If available, then include a quantitative risk assessment.

Chapter

5

Format and Evaluation

Petitions for Field Release Evaluation

Contents

Introduction

The *Petitions for Field Release Evaluation* section of the *Format and Evaluation* chapter contains the guidelines for TAG-BCAW members reviewing and evaluating petitions for the release of biological control agents of weeds. Petitioners may use the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds to double-check their petitions before submitting for review.

Evaluation Guidelines—Petitions for Field Release

TAG-BCAW members will follow these evaluation guides when reviewing and evaluating petitions for field release of biological control agents of weeds. Review the information in this section before using to the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds on page 5-2-5.

Petitioners may use the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds on page 5-2-5 to double-check their petitions for field release of a biological control agent prior to submitting the petitions to USDA-APHIS-PPQ.

Agency's or Organization's Perspective

TAG-BCAW members should fully understand their Agency's or organization's current perspective on biological control activities before reviewing the petition. See Agencies and Organizations' Perspectives on page 2-3-1 for brief summaries.

Questions or Concerns During Review and Evaluation

If a TAG-BCAW member reviewing a petition has questions or concerns that **only** the petitioner could answer or resolve, then the TAG-BCAW member should contact the petitioner directly. The TAG-BCAW member should notify the TAG-BCAW Chair of the question(s) asked and the petitioner's answer(s) so other TAG -BCAW members can be kept informed in case they have similar questions.

Sending Petitions Out for Additional Comments

TAG-BCAW members reviewing petitions should proceed with sending petitions for additional comments as follows:

1. Establish timelines for additional reviews, keeping in mind that the time frame for reviewing and evaluating petitions is 6 weeks. Allow time for any subject matter expert(s) to review and evaluate the petition, as well as for you to synthesize comments and recommend action.
2. Decide whether to send the entire petition or a portion of the petition out for comments.
3. Prepare a request for additional comments cover letter with the following information:
   A. Specific guidance on which part of the petition you need the subject matter expert(s) (SME) to review.
   B. Contact information in case the SMEs have questions or concerns. As a TAG-BCAW member, you should remain the individual who directly contacts the petitioner.
   C. Timeline of when you expect a reply from the SME(s).

Petitions for Field Release Checklist

Use the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds (see example on **page 5-2-5**) to see how much of this information was addressed by the petitioner and how thoroughly each topic was covered in the petition for release of the proposed biological control agent.

Recording Comments

Each TAG-BCAW member reviewing a petition will record synthesized comments on a *TAG-BCAW Reviewer's Comment Sheet for Petitions for the Release of Biological Control Agents of Weeds* (see example on **page B-1-2**). If the petition was sent for additional review(s), then list the names and subject matter expert areas in *Block E, Summary Comments* (see example in Figure B-1-2 on page B-3).

Reviewer's Overall Recommendation

After reviewing all sections of the *Evaluation Guidelines—Petitions for Field Release* and completing the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds, each TAG-BCAW reviewer will then use the information to develop an overall evaluation and recommendation from their Agency's or organization's viewpoint on the TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds.

Locating Target Weed Information

For additional references about economic botany, host specificity, plant specification systems, plant taxonomy and distribution, protected species, or submitted petitions, see Table 5-2-1.

Table 5-2-1 Where to Find More Information About Target Weeds

If you need additional information or research references about:	And:	Then:
Economic Botany	→	GO to Economic Botany on page F-1-15
Protected Species	→	GO to Protected Species on page F-1-20
Host Specificity	Arthropods	GO to Testing Methodology for Biological Control on page F-1-25
	Pathogens	GO to Testing Methodology for Biological Control on page F-1-25
Plant Classification Systems	→	GO to Plant Classification System on page E-1-1
Plant Taxonomy and Distribution	→	GO to Testing Methodology for Biological Control on page F-1-25
Submitted Petitions	Current list	GO to TAG-BCAW site
	Historical list	GO to TAG-BCAW site

Locating Biological Control Agent Information

For additional research references about biological control agents, identification and characterization of agents, or host specificity, see Table 5-2-2.

Table 5-2-2 Locating Biological Control Agent Information

If you need information about:	And:	Then:
Biological control agents	→	GO to Biological Control Agents on page F-1-5
Identification and characterization of agents	→	GO to Identification and Characterization of Proposed Biological Control Agents of Weeds on page 4-2-1 and References on page F-1-1
Host specificity	Arthropods	GO to Host Specificity Testing of Arthropods on page 4-3-1 and References on page F-1-1
	Pathogens	GO to Host Specificity Testing of Pathogens on page 4-4-1 and Testing Methodology for Biological Control on page F-1-25

Locating Methods and Approaches Information

For additional information about methods and approaches most commonly used by researchers, then see Table 5-2-3.

Table 5-2-3 Locating Biological Control Agent Information

If you need:	And for:	And:	Then:
Review basic information or research additional references	Host specificity	Arthropods	GO to Host Specificity Testing on page 4-3-2 and Testing Methodology for Biological Control on page F-1-25
		Pathogens	GO to Host Specificity Testing of Pathogens on page 4-4-1 and Testing Methodology for Biological Control on page F-1-25
Testing methodology for biological control operations	→	→	GO to Testing Methodology for Biological Control on page F-1-25

Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds

Use the evaluation checklist in Table 5-2-4 to record how much of this information was addressed by the petitioner and how thoroughly each topic was covered in the petition for field release of the proposed biological control agent of weeds.

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation

Petition Section		Is the following information included?	Yes	No
Cover page (see **page 5-1-2**)		Date of petition and date of mailing		
		Petitioner's complete name, affiliation, and contact information (address, email address, telephone number, fax number)		
		Type of Petition: Proposed biological control agent is clearly identified (order, family, genus, species, author, geographical origin); and target weed is clearly identified (order, family, genus, species, author, geographical origin)		
		If petition is in response to additional information requested by TAG-BCAW, then original petition's TAG-BCAW assigned number		
		If providing additional specific information requested by TAG-BCAW, then **only** the requested sections have been addressed and changed and highlighted; includes a summary of the changes made		
		Locations where the studies have been conducted		
		If part of the study has been conducted in a U.S. quarantine facility or facilities, then the location of each quarantine facility		
		NOTICE Pathogens will require a different type of quarantine facility than used for arthropod agents.		
		Quarantine facility or facilities petitioner intends the proposed biological control agent(s) to pass through prior to initial North American releases		
		States or Provinces for initial release in Canada, Mexico, and/or United States		
		Person's name, affiliation, and contact information (address, email address, telephone number, fax number) who will be conducting the release and monitoring in North America		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Summary		Abstract of the petition with a summary of the problem, approach, and main findings		
Introduction (see **page 5-1-3**)	**Nature of the Problem and Proposed Action** (see **page 5-1-3**)	TAG-BCAW Reviewers: The introduction of the petition should provide a quick overview of the nature of the problem and the petitioner's proposed action 1. Read the petition introduction 2. Determine if you will need additional reviews by subject matter experts within your Agency or organization in order to formulate an informative recommendation from your Agency's or organization's perspective 3. If you determine that you need additional reviews, then see Sending Petitions Out for Additional Comments on page 5-2-2 4. If you **do not** need additional reviews, then review the petition following the guidelines in this checklist 5. Use a TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds (example on **page B-1-2**)		
		There are issues about the taxonomy for either the target weed or the biological control agent		
		You need a subject matter expert to validate the taxonomic information—entomologist, biologist, botanist		
		There are issues about the proposed biological control agent		
		There are issues about the location of the release		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Target Weed Information (see **page 5-1-4**)		*TAG-BCAW Reviewers*: If you need to review basic information or research additional references, then see Table 5-2-1 on page 5-2-3		
		This weed is identified as having been previously targeted as either a previously submitted petition for field release of a biological control agent of weeds or a previously-submitted test plant list		
		If a petition for field release of a biological control agent or a test plant list has been previously submitted, then this includes a discussion of how the weed information compares with previous discussions and the changes are highlighted		
	Taxonomy (see **page 5-1-4**)	Full classification (order, family, genus, species); synonymy, and common name		
		Expert who identified the target weed in North America is cited (name, organization(s), and locations)		
		Experts who confirmed the target weed's presence in North America are listed (organizations and locations)		
		Problems associated with the group's identification or present taxonomy and proposed resolutions (if any)		
		Origin and location of the herbaria containing voucher specimens and date of deposit		
	Description (see **page 5-1-4**)	General physical description of the target weed is complete enough that correct identification could be made by a person encountering the target weed in the field		
	Distribution of the Target Weed (see **page 5-1-5**)	TAG-BCAW Reviewers: Distribution of Target Weed section should provide you with a sense of where the target weed will spread in North America		
		Adequate description and map of native range		
		Adequate description and map of the areas of introduction throughout the world, pattern of movement, and apparent limits		
		Adequate description and map of the target weed's present distribution in North America		
		Adequate description and map of target weed's areas of potential spread in North America		
		Adequate description of genetic and phenotypic variability with respect geographic distribution		
		Adequate description of the habitats or ecosystems where the weed is found in North America		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Target Weed Information (see **page 5-1-4**)	**Taxonomically Related Plants** (see **page 5-1-5**)	Both native and non-native plants that are closely related to the target weed		
		Emphasizes economically and environmentally important species		
		Crops, ornamentals, and native plants including endangered or threatened species that are closely related to the target weed. If applicable, includes identified surrogates		
		Adequate description of how closely these plants are related to the target weed		
	Distribution of Taxonomically Related Plants (see **page 5-1-5**)	Adequate description of the distribution and habitats in North America of those taxonomically related plants identified under Taxonomically Related Plants above		
		If information is lacking, then add comments on the TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds on page B-1-2. Otherwise, see Reviewer's Overall Recommendation Checklist on page 5-2-17		
	Life History of the Target Weed (see **page 5-1-5**)	Adequate explanation of life history of the target weed		
		Adequate explanation of general biology of the target weed		
		Discussion of factors that are believed to contribute to the plants weediness		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Target Weed Information (continued) (see **page 5-1-4**)	**Impacts of the Target Weed** (see **page 5-1-6**)	Information about the impacts and potential conflicts made by the target weed is helpful in evaluating the release of the proposed biological control agent of weeds. Use the following areas of impact as a guide when reviewing a petition. **Not** all areas listed below are applicable to all petitions		
		Beneficial uses: honey bees, forage, ground cover, fruit, etc.		
		Social and recreational impacts: valued as an ornamental or other		
		Threatened or endangered species		
		Economic losses, including direct control costs		
		Health: poisonous, allergenic		
		Regulatory: noxious weed, restricts trade		
		Native plant populations and animal populations		
		Weed control on nontarget plants		
		Ecosystem functions and ecological relationships		
		Other impacts (e.g., aesthetics)		
	Management Options (see **page 5-1-6**)	Historical options for managing the target weed; what has been done before and its effectiveness		
		Current options: biological, chemical, cultural, and effectiveness		
		Potential options: new herbicides, biological control agents used or released in other countries **NOTICE** Petitioner may **not** have information on new chemicals developed.		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Biological Control Agent Information (see **page 5-1-7**)		*If you need to review basic information or research additional references about biological control agents, then see* Biological Control Agent of Weeds Information on page 5-1-7		
		Petition concerning this agent has been previously submitted (when and where)		
		If a petition concerning this agent has been previously submitted, then the previously-identified TAG-BCAW concerns have been adequately addressed in this latest submission and are highlighted		
	Taxonomy (see **page 5-1-7**)	Full classification: ◆ For Arthropods (order, family, genus, species) synonymy, and common name ◆ For Pathogens, also strain, race or other specific designation (isolate number, pathovar, etc.)		
		General description of the proposed biological control agent of weeds, including morphology, and diagnostic characteristics that could be used to identify the proposed biological control agent in the field		
		Reason for choosing this proposed biological control agent		
		Taxonomic expert who identified the proposed biological control agent, expert's information (name, address, email address, and affiliations with locations)		
		Problems with identification or with taxonomy, including citations and referencing issues		
		Look for reference of an authoritative identification Arthropods and pathogens: look for the origin and locations of voucher specimens, date of specimen deposit, how the voucher specimens are preserved		
		More detail is needed because a complex or problem taxonomic group is involved		
		Arthropods and pathogens: description of methods used to identify life stages		
		Arthropods and pathogens: If available, then DNA analysis or other molecular evaluation is included (useful when differentiation among close taxonomic groups is difficult using standard morphometric techniques)		
		Arthropods and pathogens: Voucher methods are appropriate to the taxa or level of science involved		
		Arthropods and pathogens: location of the voucher specimens (recognized taxonomic institutions are the best sources for information about voucher specimens)		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Biological Control Agent Information (continued) (see **page 5-1-7**)	**Taxonomy** (continued) (see **page 5-1-7**)	Arthropods and pathogens: Identification/ characterization information was used to confirm the determination during the evaluation processes (additional collections, long-term rearing, etc.) and during field colonization efforts overseas		
		Method for distinguishing the proposed biological control agent in the field and in quarantine (e.g., how the agent will be discriminated from existing, related organisms from antagonistic, cryptic, or competing species)		
	Geographical Range (see **page 5-1-8**)	This section should provide you with a good understanding of the potential range of the biological control agent		
		Adequate description of the native range of the biological control agent (maps and literature citations)		
		Adequate description of the names of the countries (see list of ISO country names) where the proposed biological control agent has been introduced, its present range, and its known efficacy are shown		
		Potential spread of the biological control agent outside the area proposed for the initial release in North America based on climatic, environmental, and vegetative parameters is shown		
	Known Host Specificity (range) (see **page 5-1-8**)	This section should give you a good sense of other plants the agent utilizes in its native range		
		Literature records indicating other host plants the proposed biological control agent is known to attack		
		Field host-plant collections and observations of the biological control agent in the area of origin including maps and data		
		Literature records for known host plants of organisms closely related to the biological control agent (regardless of where the organism occurs)		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Biological Control Agent Information (continued) (see **page 5-1-7**)	**Life History** (see **page 5-1-8**)	Information provided is specific to the proposed biological control agent (the importance of a biological control agent's life history will vary)		
		Basic biology and life history of the proposed biological control agent are provided in enough detail to explain the proposed biological control agent's role in the new environment		
		Known mortality factors		
		Extent of damage to or control of the target weed		
		Extent of damage to or impact on the nontarget plants and other organisms		
	Population of the Agent Studied (see **page 5-1-10**)	This section should provide adequate information to ensure compatibility in the conditions between the locations of the study site and of the potential release site		
		Geographic source(s) (origin) of the biological control agent population is adequately described so the same population can be located if needed. A map and a description are included if available		
		How a pest-free population of the proposed biological control agent was obtained and maintained in quarantine if applicable		
		Biological control agent studied for the initial release is from the same population used for the studies or the biological control agent for release is identical to those tested (genetic or morphological confirmation)		
		Locations of field studies, lab studies, and quarantine facilities		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Experimental Methodology and Analysis (see **page 5-1-10**)	The description (method and data) should be sufficient for someone who is qualified to repeat the experiment. If you need more information about methods and approaches commonly used by research or to review basic information or research additional references, then see Table 5-2-3 on page 5-2-4			
	Test Plant List (see **page 5-1-10**)	If an acceptable test plant list was already prepared and reviewed by TAG-BCAW prior to preparing the petition, then so states		
		Identifies and explains the rationale and changes to the test plant list; changes are highlighted		
		Includes the host test plant list, even if **no** changes were made		
		Lists the species of host plants on which the proposed biological control agent was tested		
		Explains why the listed host plant species were chosen to determine the proposed biological control agent's potential feeding range		
		Considerations are given to threatened and endangered species and economically important plants		
	Design (see **page 5-1-11**)	Petitioner provides the following information about the design of the tests		
		Part and growth stage of the plants tested		
		Source population of test plants and target weeds used in the tests		
		Number of replicates		
		Number and stage (arthropods) or phase (pathogens) of individual proposed biological control agents (number of males and number of females (arthropods), target weeds, and test plants in each replicate; these numbers may be synonymous depending on the test design (i.e., in no-choice tests, the number of individual plants of a species is the number of replicates)		
		Details of the experimental setup pertaining to overall environmental conditions and study areas		
		Explanation of how the data were measured, recorded, and evaluated and statistical methods used		
	Positive Controls (see **page 5-1-11**)	How appropriate positive controls were used in all tests (positive control is where the target is present at every step in the test process)		
	Rationale for Study Design and Execution (see **page 5-1-11**)	Explanation of why the test procedures were selected and how they are appropriate for the biology of the proposed biological control agent being tested		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Results and Discussion (see **page 5-1-12**)	**Summary of Results** (see **page 5-1-12**)	Results discussed in relation to host specificity and environmental impact		
		Method of presentation is appropriate to show the results		
		TAG-BCAW Reviewer: If the method of presentation is **not** appropriate to show the results, then contact the petitioner directly to ask for the results in another way that would help you better understand the results		
		Interpretation and significance of the results may be different between arthropods and pathogens; as a TAG-BCAW reviewer, you reached the same conclusion as the petitioner through interpretation of the data		
	Protocol for Releasing the Proposed Biological Control Agent (see **page 5-1-12**)	Consider your Agency's or organization's concerns when evaluating this section of the petition		
		Methods used for ensuring pure cultures and correct identification of the proposed biological control agent to be released		
		Arthropods: species, genus, family, and order		
		Pathogens: strain, race, or other specific designation, e.g. isolate number, pathovar, etc. (consistent with above)		
		Names, affiliations, and locations of identifiers (consistent with above)		
		Description of identification methods		
		Problems in identification		
		Date and place of depository containing voucher specimens		
		General release protocol to ensure the absence of natural enemies and cryptic or sibling species		
		Specific location of rearing or culturing facility		
		Intended sites (States or provinces) for initial release		
		Timing of release		
		Release methods to be used		
		Arthropods: if known, the number to be released		
		Pathogens: method of preparing inoculum and inoculum concentration		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Results and Discussion (continued) (see **page 5-1-12**)	**Post Release Monitoring** (see **page 5-1-13**)	Plan for post-release monitoring		
		Monitoring plan adequately describes how the spread and impact of the proposed biological control agent on the target weed and nontarget plants will be determined		
		Monitoring plan adequately describes monitoring techniques to be used to determine if the biological control agent becomes established		
		Monitoring plan adequately describes groups to best perform monitoring		
	Benefits and Risks (see **page 5-1-13**)	Comprehensive statement of potential benefits and risks associated with the agent		
		Comprehensive statement discloses all relevant data gaps concerning the proposed biological control agent's and the target weed's biology and ecology that might reasonably influence the probable benefits or possible negative impacts of releasing the agent. See Risk Assessment on page F-1-21 for additional information		

Table 5-2-4 Checklist for Field Release of Biological Control Agent of Weeds Evaluation (continued)

Petition Section		Is the following information included?	Yes	No
Potential Environmental Impacts	The petitioner should present a clear picture of the long-term ecological consequences that might result from the successful establishment of the proposed biological control agent in the North American environment. The discussion should go beyond the risk associated with attacks on a few closely-related species of plants, as indicated in the host specificity testing results. The discussion should look at the overall potential impact of populations of the proposed biological control agent building up on the weed in a large variety of different habitats			
	Human Impacts (see **page 5-1-14**	Positive and negative impacts of the proposed biological control agent of weeds on humans considered		
		Ways to mitigate any negative effects of the proposed biological control agent of weeds on humans		
	Economic Impacts (see **page 5-1-14**)	Gains and losses regarding the economic impacts: aesthetic impacts, biological impacts, ecological impacts (such as on natural resources, components, structures, and functioning of affected ecosystems), and social impacts (such as cultural) of the proposed biological control agent of weeds		
	Plant Impacts (see **page 5-1-15**)	Value of the proposed biological control agent of weeds introduction on target populations against impacts on nontarget plants, including potential impacts (positive and negative) on agricultural, horticultural, and threatened and endangered plants		
	Nonplant impacts (see **page 5-1-15**)	Positive and negative impacts (if any) of the proposed biological agent's release to nonplant organisms associated with the target weed (directly or indirectly)		
	Abiotic and Edaphic Effects (see **page 5-1-15**)	Potential effects of the proposed biological control agent of weeds on water, soil, and air resources		
	Methods for Mitigation (see **page 5-1-15**)	Mitigative methods are identified for controlling the proposed biological control agent of weeds should a potential problem occur		
	Outcome of No Action (see **page 5-1-15**)	Statement of potential outcomes if the proposed biological control agent of weeds is **not** released		
Petitioner's Conclusion		Petitioner offers conclusions about the potential risks and benefits of releasing the proposed biological control agent of weeds		
		Discussion includes the probability of successful establishment of the proposed biological control agent in the environment throughout the range of its target weed and susceptible nontarget hosts		
		Quantitative risk assessment (a quantitative risk assessment is **not** necessary)		

Reviewer's Overall Recommendation Checklist

After you have finished reviewing the petition and completing the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds, provide an overall assessment of the following items in Table 5-2-5.

Record your overall recommendation on the TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds.

Table 5-2-5 TAG-BCAW Reviewer's Overall Recommendation Checklist—Petitions for Field Release of Biological Control Agents of Weeds

TAG-BCAW Reviewer's Recommendation		Yes	No
Completeness and comprehensiveness in completing the sections of the petition			
Thoroughness in addressing your Agency's or organization's concerns:			
Were your concerns met			
If your concerns were **not** met, then provide a summary of your Agency's or organization's concerns and the reasoning behind them			
Confidence level in the testing conducted and the information presented about the use of the proposed biological control agent in the environment			
If you have concerns regarding the risk of releasing this agent in North America, then provide specific comments			
Recommendation of your Agency or Organization			
Provide the name, affiliation, telephone, fax, and email numbers of the reviewer			
Provide the name(s) of other subject matter experts who provided comments			
Provide the name(s) of other subject matter expert(s)			
Sign and date the Comment Sheet			
Send the completed *TAG-BCAW Reviewer's Comment Sheet for Petitions for the Release of Biological Control Agents of Weeds* to the TAG-BCAW Chair through the TAG-BCAW Executive Secretary	Mr. Gregg B. Goodman TAG-BCAW Executive Secretary **USDA-APHIS-PPQ** 4700 River Road, Unit 133, Office 4C-01.48 Riverdale, MD 20737 Email: gregg.b.goodman@aphis.usda.gov Fax: 301-734-5269		

Chapter

5

Format and Evaluation

Test Plant List Format

Contents

Introduction

The *Test Plant List Format* section of the *Format and Evaluation* chapter provides the format for test plant lists for biological control agents of weeds in North America.

Test Plant Lists

Test plant lists are developed by researchers and petitioners for determining the host specificity of biological control agents of weeds in North America. The test plant list is done as a benefit to the researcher and as a tool to get input from Federal Agencies, whether there is benefit in doing research. This **does not** preclude the Federal Agencies from taking a look at the list included in the petitions when they come in.

A test plant list should be submitted early in the study (before the petition is submitted), when a researcher or petitioner is proposing to target a new weed for biological control.

When the petitioner submits a petition for field release of a proposed biological control agent of weeds, the petition will include an updated test plant list. The updated test plant list contains those plants actually tested based on the TAG-BCAW's evaluation of the original test plant list. (Submitting a test plant list early will allow researchers to understand concerns that various Federal Agencies have in relation to the target and nontarget plants or other organisms.

Preliminary information about a target weed and a proposed biological control agent of weeds may be incomplete at this point in the research. The proposed test plant list may comprise the majority of the available information.

Format for Test Plant Lists

The format for the test plant list is as follows:

- Cover Page
- Introduction to the Test Plant List
- Target Weed Information
- Test Plant List
- Summary Table
- Perspective of Risk

Cover Page

Prepare a cover page for the test plant list with the following information. This information provides the TAG-BCAW with a contact point for questions and with references for tracking.

Include the following information on the cover page:

1. Date test plant list is being submitted to TAG-BCAW.
2. Name of the researcher or petitioner submitting test plant list, (address, email address, telephone number, and fax number), affiliation and a contact point within North America (address, email address, telephone number, and fax number).
3. Name of the target weed, including its order, family, genus, species, and common name(s).
4. State if the weed is targeted for biological control the first time.
5. If this is **not** the first time the weed is targeted, then include the previous petition number assigned by TAG-BCAW.
6. If any proposed biological control agent(s) of weeds, then identify the agent(s).
7. Location.

Introduction to the Test Plant List

Include the following information in the Introduction to the *Test Plant List* section:

- Nature of the Problem
- Proposed Action

Nature of the Problem

Give a brief summary (one to two paragraphs) of the problems caused by the target weed. Items to consider follow:

1. History of introduction and spread of the target weed.
2. Weed's present distribution in North America.
3. Sectors affected and magnitude of program (e.g., agricultural, natural, rangeland).
4. Consensus that the weed is suitable target for control.

Proposed Action

Include the following statement:

> This host plant list is to notify TAG-BCAW of our intent to begin a biological control program for the control of *[weed]*. *[Weed]* has been declared a noxious weed in *[list States]* and is considered a target for biological control. Your comments on the accuracy, appropriateness, and thoroughness of this list is appreciated."

Target Weed Information

Include the following in the *Target Weed Information* section:

- Taxonomy
- Description
- Distribution of the Target Weed
- Taxonomically Related Plants
- Distribution of Taxonomically Related Plants
- Life History
- Impacts
- Alternative Management Options
- Known Host Range of Proposed Biological Control Agent

Taxonomy

Include the target weed taxonomy information, as follows:

1. Full classification (including order, family, genus, species), synonymy, and common name.
2. The taxonomist who identified the target weed, including name(s), organization(s), and location(s).
3. Problems in identification or present taxonomy.
4. Origin and locations of herbaria containing the voucher specimens used as representative of the population that occurs in the area where the researcher has conducted the studies and the date of deposit.

Description

Provide a general physical description of the target weed, complete enough so identification could be made by a person encountering the target weed in the field.

Distribution of the Target Weed

Describe the distribution of the target weed using maps, as appropriate. Include the following information:

1. Native range (map).
2. Areas of introduction throughout the world, pattern of movement, and apparent limits (map).
3. Present distribution in North America (map).
4. Range areas of potential spread in North America (map).
5. Genetic variability.
6. Habitats or ecosystems where this weed is found in North America.

Taxonomically Related Plants

Include the following:

1. Identify the economically and environmentally important plants that are closely related to the target weed. These are crops, ornamentals, and native plants.
2. Identify threatened and endangered species closely related to the target weed.
3. If possible, identify how closely related economic, environmentally important species, and threatened and endangered species are to the target weed.

Distribution of Taxonomically Related Plants

Describe the distribution and habitats in North America of the closely-related (taxonomically related) plants and identified under Taxonomically Related Plants).

Life History

Explain the life history and general biology of the target weed. Discuss the factors that are believed to contribute to the plant's invasiveness.

Impacts

Indicate any and all impacts of the target weed. Use the following list as a guide and indicate the impacts (**not** all areas listed below are applicable to all weeds).

1. Beneficial uses: honey bees, forage, ground cover, fruit, etc.
2. Cultural, social and recreation uses: value as ornamentals.
3. Threatened and endangered species.
4. Economic losses, including direct control costs.
5. Health: poisonous, allergens.
6. Regulatory: noxious weed, restricts trade.
7. Effects on native plant populations.
8. Weed control on nontarget plants.
9. Ecosystem functions and ecological relationships.
10. Other impacts (e.g., aesthetic).

Alternative Management Options

Describe alternative options for managing the target weed and include the following:

1. Historical options: what has been done before.
2. Current options: biological, chemical, cultural.
3. Potential options: new herbicides or biological control agents used or released in other countries.

Known Host Range of Proposed Biological Control Agent

If known, then provide the following information about the proposed biological control agent:

1. Name(s) and taxonomic classifications (order, family, genus, species).
2. Literature records indicating other plants that have been attacked.
3. Field collections and observations, including maps and data.
4. Literature on host range of closely-related species to the proposed biological control agent.

If the host range of the proposed biological control agent of weeds is unknown, then indicate “the unknown.”

Test Plant List

See ESA Section 7 Interagency Cooperation (50 CFR Part 402) Overview on page 6-2 for guidelines to comply and to expedite any review necessary because of protected species. Consult the U.S. Fish and Wildlife Service very early in the project.

Include the following under the *Test Plant List* section:

- Categories of Test Plants
  - Category 1: Genetic types of the target weed species (varieties, races, forms, genotypes, apomicts, etc.) found in North America and the native range.
  - Category 2: Species in the same genus as the target weed, divided by subgenera (if applicable)
  - Category 3: Species in other genera in the same family as the target weed, divided by subgenera (if applicable)
  - Category 4: Threatened and endangered species in the same family as the target weed divided by subfamily, genus, and subgenus
  - Category 5: Species in other families in the same order that have some phylogenetic, morphological, or biochemical similarities to the target weed
  - Category 6: Species in other orders that have some morphological or biochemical similarities to the target weed
  - Category 7: Any plant on which the proposed biological control agent or its close relatives have been previously found or recorded to feed and/or reproduce

Categories of Test Plants

The usual strategy for developing a test plant list for evaluating biological control agents of weeds in North America is based on A. J. Wapshere (1974), *A Strategy for Evaluating the Safety of Organisms for Biological Weed Control*, published in *Annals of Applied Biology*. The strategy is based on the phylogenetic approach, where closely-related species are theorized to be at greater risk of attack than are distantly-related species.

Category 1: Genetic types of the target weed species (varieties, races, forms, genotypes, apomicts, etc.) found in North America and the native range.

Include the following information:

- Genetic variability of the target weed;
- Justification of genetic types selected for testing from those identified;
- Inferences about effects on untested types based on selected types (if any);
- If many types exist, then justification of the number selected for testing;
- References; and
- If references are **not** available, then provide an explanation.

Category 2: Species in the same genus as the target weed, divided by subgenera (if applicable).

Include the following information:

- Detailed information on what is known about the phylogenetic relationship of the target weed to other species in the same genus;
- Information on which species are most likely to be found in the same range and habitat as the target weed;
- Information on any economically, environmentally, and culturally sensitive important plant species of North America found in the genus;
- Justification of species selected for testing from those identified in the same genus as the target weed;
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species;
- If there are many species in the genus, then justification of the number selected for testing;
- References; and
- If references are **not** available, then provide an explanation.

Category 3: Species in other genera in the same family as the target weed, divided by subgenera (if applicable).

Include the following information:

- Detailed information on what is known about the phylogenetic relationship of the target weed to other groups (i.e., subfamilies, genera, species in the same family);
- Information on which groups (i.e., subfamilies, genera, species) are most likely to be found in the same range and habitat as the target weed;
- Information on any economically, environmentally, and culturally sensitive important species found in the family in North America;
- Justification of the species selected for testing from those identified as *Category 3;*
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species;
- If there are many genera in the family, then justification of the number selected for testing;
- References; and
- If references are **not** available, then provide an explanation.

Category 4: Threatened and endangered species in the same family as the target weed divided by subfamily, genus, and subgenus.

Include the following information in a table format:

- All known species in the same **family** as the target weed that are listed as threatened or endangered species or candidates, including the full scientific name (order, family, subfamily, genus, subgenus, species), status, and range in North America (see references for Protected Species on page F-20);
- All species in the same **genus** as the target weed that are listed by the U.S. Fish and Wildlife Service as threatened or endangered or candidates (see Section 7 Consultations on page 6-1 and Protected Species on page F-20);
- All species within the same **genus** as the target weed that are identified as sensitive on designated lists, such as Natural Heritage Program lists, Canadian Province lists, or Mexican State lists
  (The Conservation Directory is a good resource to identify organizations that maintain such lists. See Protected Species on page F-20);
- Which groups (threatened or endangered species) are likely to be found in the same range and habitat as the target weed;
- Justification of the species selected for testing from those identified as *Category 4* or select surrogates, since seeds/plants of threatened and

endangered species can be hard to obtain and may further threaten populations;

- Justification of the surrogates based on phylogenetic, morphological, and/or biochemical similarities;
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species;
- If many threatened and endangered species exist, then justify the number selected for testing; and
- References of threatened and endangered lists consulted.

Category 5: Species in other families in the same order that have some phylogenetic, morphological, or biochemical similarities to the target weed.

Include the following information:

- Outline of families in the same order as the target weed;
- Classification using Angiosperm Phylogeny Classification System and including any additional families listed;
- If using an alternate system of classification, then justification of its use;
- Which families in this order are most closely related to the target weed's family according to phylogenetic studies;
- Discussion of any morphological or biochemical relationship the target weed or its family has with any group (i.e., family, genus, species) in this order;
- Which groups (i.e., family, genus, species) are likely to be found in the same range and habitat as the target weed;
- Any economically, environmentally, culturally sensitive, important species in these groups (i.e. family, genus, species) found in North America;
- Justification of the species selected for testing from those identified as being in *Category 5*;
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species;
- If there are many groups (i.e., species, genus, family), then an explanation of the number selected for testing;
- References; and
- If references are **not** available, then provide an explanation.

Category 6: Species in other orders that have some morphological or biochemical similarities to the target weed.

Include the following information:

- Discussion of any morphological or biochemical relationship the target weed has with any group (i.e., family, genus, species) in other orders;
- Which groups (i.e., family, genus, species) are likely to be found in the same range and habitat as the target weed;
- Any economically, environmentally, and culturally sensitive, important plant species in these groups (i.e., family, genus, species) found in North America;
- Justification of the species selected for testing from those identified as being in *Category 6;*
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species;
- If there are many groups (i.e., family, genus, species), then explain the number selected for testing;
- References; and
- If references are **not** available, then provide an explanation.

Category 7: Any plant on which the proposed biological control agent or its close relatives have been previously found or recorded to feed and/or reproduce.

Include the following information:

- Details, including the full scientific name and range of any plant on which the proposed biological control agent or its close relatives (within the same genus) have been previously found or recorded to feed and/or reproduce;
- Proposal to test all species on which the proposed biological agent of weeds has been found or recorded to feed and/or reproduce;
- Species selected for testing from the plants on which any close relatives have been recorded to feed;
- Justification of the species selected from those identified;
- Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested groups; and
- If many species have been fed/reproduced on by the agents' close relatives, then provide an explanation of the number for testing.

Summary Table

Summarize in a table format, all the species being considered for testing. Include pertinent literature references that are helpful in describing rationale. List the species in phylogenetic order (i.e., distantly- to closely-related to the target weed).

NOTICE

In actual host testing of proposed biological control agents of weeds, **not** all of these plants are expected to be used. Depending on the feeding behavior or life cycle of the agent, the researcher would select representative features similar to those on which the agent normally feeds.

EXAMPLE If the agent's larva overwinter in a large tap root, then annual plants or those with fibrous roots could be disregarded.

Perspective of Risk

Include the following under *Perspective of Risk*:

1. Briefly discuss how the selected species should enable inferences to be made about risk of attack on untested species.
2. Indicate the limits of allowable attack within the phylogenetic hierarchy of the test plant list, and why.
3. Include pertinent literature references that are helpful in describing rationale.

Strategy for Developing a Test Plant List

The following steps are **only** a suggested strategy for developing a test plant list. Follow this strategy along with the Angiosperm Phylogeny Plant Classification System and the references listed in Table 5-3-1 on page 5-3-13.

1. Outline the families in the same order as the target weed using the Angiosperm Phylogeny Group classification.
2. Examine the placement of the target weed family in the Angiosperm Phylogeny Group classification.
3. If the Angiosperm Phylogeny Group places a new family in the order of the target weed, then consider that family when developing a list of *Category 5* plants.
4. If **only** one of the systematists places a new family in the order of the target weed, then consider that family when developing a list of *Category 6* plants. Look for economically or environmentally important species in the new families that occur in the target areas.
5. The references listed in Table 5-3-1 may be useful in developing a list of test plants for each category. See full References on page F-1.

Table 5-3-1 References for Developing a Test Plant List

Helpful References	Categories
The Angiosperm Phylogeny Group Classification	5, 6
Andersen Horticultural Library's Sources List of Plants and Seeds. Issacson, R.T. (1993 or later edition)	1, 2
Hortus Third, A Concise Dictionary of Plants Cultivated in the United States and Canada. Bailey, L.H. and Bailey, E.Z. (1976)	1, 2, 3, 5
A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland. Kartesz, J.T. (1994)	1, 2, 3, 5
Dictionary of Economic Plants. Uphof, J.C.Th. (1968)	2, 3, 5
Families and Genera of Spermatophytes Recognized by the Agricultural Research Service. ARS Technical Bulletin 1796	3, 5
Germplasm Resources Information Network (GRIN) database at https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomyquery.aspx USDA Agriculture Research Service (ARS)	1, 2, 3
Gray's Manual of Botany. Fernald, M.L. (1970)	2, 3, 5
Manual of Cultivated Plants. Bailey, L.H (1951)	2, 3, 5
Mabberley's Plant Book. Mabberley, D.J. (2008)	2, 3, 5, 6
North American floras that include the release areas	2, 3, 5, 6
The PLANTS Database at http://plants.usda.gov/. USDA NCRS. National Plant Data Center, Baton Rouge, LA 70874-4490 USA	2, 3
U.S. Fish and Wildlife Services Endangered Species Program Site at http://www.fws.gov/endangered/. List of endangered and threatened species, including candidate species	2, 3, 4

Chapter

5

Format and Evaluation

Test Plant List Evaluation

Contents

Introduction

The *Test Plant List Evaluation* section of the *Format and Evaluation* chapter provides the evaluation guidelines and the evaluation checklist for TAG-BCAW members to use when evaluating a proposed test plant list. Petitioners may use the checklist to double-check their test plant lists prior to submitting to USDA-APHIS-PPQ.

Evaluation Guidelines for Test Plant Lists

When a test plant list is submitted by a petitioner or researcher, TAG-BCAW members **must** subject the test plant list to as critical a review as would be used for evaluating a petition. Starting a biological control program with the best possible test plant list will ultimately save valuable time, money, and patience for government and public supporters of biological control.

The test plant list you will be reviewing may be either of the following:

- Test plant list for TAG-BCAW evaluation submitted early in the study when a researcher or petitioner is proposing a new weed for biological control, but prior to actually submitting the petition for biological control agent of weeds (TAG-BCAW may make recommendations of plants to be used in the testing process); or
- Test plant list (of plants actually used in the testing process) to TAG-BCAW submitted for the first time along with the petition for biological control agent of weeds.

If the **original** test plant list is being submitted early in the study but prior to actually submitting the petition for biological control agent of weeds, then the TAG-BCAW reviewer will make recommendations on the target weed choice and comments on the proposed test plant list for host specificity testing. This provides the researcher or potential petitioner the opportunity to conduct additional research and field tests of test plants and to adjust the test plant list prior to submitting the actual petition for field release of biological control agent of weeds.

If the **original** test plant list is being submitted for the first time along with the petition for field release of biological control agent, then the petitioner **must** give complete information on the target weed and the biological control agent.

If the updated test plant list is being submitted along with the petition for biological control agent, then the petitioner **must** give complete information on the target weed and biological control agent and have made improvements to the list of plants that have actually been tested based on TAG-BCAW's evaluation of the **original** test plant list. Thoroughly justifying additions to the test plant list is important.

The evaluation guidelines provide a strategy for TAG-BCAW members to evaluate test plant lists to determine host specificity. The strategy is based on A. J. Wapshere (1974), *A Strategy for Evaluating the Safety of Organisms for Biological Weed Control, published in Annals of Applied Biology*. The strategy is based on the phylogenetic approach, where closely-related species are theorized to be at greater risk of attack than are distantly-related species.

Questions or Concerns During Review or Evaluation

If a TAG-BCAW member reviewing a test plant list has questions or concerns that **only** the petitioner or researcher could answer or resolve, then contact the petitioner or researcher directly. The TAG-BCAW member will notify the TAG-BCAW Chair about the question(s) and the petitioner's or researcher's answers, so the other TAG-BCAW reviewers can be kept informed (as they may have similar questions).

Sending Test Plant Lists Out for Additional Comments

TAG-BCAW members reviewing test plant lists should formulate sending test plant lists out for additional comments as follows:

1. Establish timelines for additional review of the test plant list, keeping in mind that the time frame for reviewing and evaluating petitions is 6 weeks. Allow time for any subject matter expert(s) to review and evaluate the petition, as well as time to synthesize comments and recommend action.
2. Decide whether to send the entire test plant list or a portion of the test plant list out for comments.
3. Prepare a request for additional comments cover letter with the following information:
   A. Specific guidance on which part of the test plant list you need the subject matter expert(s) (SME) to review.
   B. Your contact information in case the SMEs have questions or concerns. As a TAG-BCAW member, you should remain the individual who directly contacts the petitioner or researcher.
   C. Timeline of when you expect a reply from the SME(s).

Recording Comments

Each TAG-BCAW member reviewing a test plant list will use the TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds (see example on page page B-1-5), to record any comments.

If you sent the test plant list for additional review(s), then list the names of the subject matter expert(s) in *Block D, Comments/List of Additional Subject Matter Experts* of the comment sheet (see page B-1-5).

Reviewer's Overall Recommendation

After reviewing all sections of and completing the Evaluation Checklist for Test Plant Lists on page 5-4-5 and theReviewer's Recommendation Checklist for Test Host Plant Lists on page 5-4-17, the TAG-BCAW reviewer will then use the information to develop an overall evaluation and recommendation and record on the page B-1-6.

Target Weed Information

To locate references about economic botany, protected species, host specificity, plant classification system, plant taxonomy and distribution, and previously-submitted petitions, see Table 5-4-1.

Table 5-4-1 Where to Find More Target Weed Information

If you need to review basic information or research additional references about:	And is for:	Then:
Economic Botany	→	**GO to Economic Botany on page F-1-15**
Protected Species	→	**GO to Protected Species on page F-1-20**
Host Specificity	**Arthropods**	**GO to Host Specificity Testing of Arthropods on page 4-3-1 andTesting Methodology for Biological Control on page F-1-25**
	Pathogens	**GO to Host Specificity Testing of Pathogens on page 4-4-1 and Testing Methodology for Biological Control on page F-1-25**
Plant Classification System	→	**GO to Plant Classification System on page E-1-1**
Plant Taxonomy and Distribution	→	**GO to Plant Taxonomy and Distribution on page F-1-16**
Submitted Petitions	**Current List**	**GO to TAG-BCAW Web site**
	Historical List	**GO to TAG-BCAW Web site**

Evaluation Checklist for Test Plant Lists

Continue below and use the checklist in Table 5-4-2 to evaluate the test plant lists.

Table 5-4-2 Evaluation Checklist for Test Plant Lists

Test Plant List Section	Is the following information included:	Yes	No
Cover Page (see page 5-3-2)	Date test plant list submitted to TAG-BCAW by the petitioner		
	Name of the researcher or petitioner submitting test plant list, affiliation, and contact point in North America (address, email address, telephone number, fax number)		
	Target weed (order, family, genus, species), common names		
	First time this weed is targeted for biocontrol		
	If this is **not** the first time this weed is targeted for biological control, then lists the previous petition number assigned by TAG-BCAW		
	Proposed biological control agent(s) of weeds (if any)		
	Location		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Introduction to the Test Plant List (see page 5-3-3)		TAG-BCAW Reviewers: The introduction of the test plant list should provide a quick overview of the nature of the problem and the researcher's proposed action. After reviewing, determine if you will need a subject matter expert within your Agency or organization to review the test plant list in order to formulate an informative recommendation from your Agency's or organization's perspective. If you need additional reviews, then follow the guidelines for Sending Test Plant Lists Out for Additional Comments on page 5-4-3. To locate more information about target weeds, see Target Weed Information on page 5-4-3		
	Nature of the Problem (see page 5-3-3)	Brief summary of the nature of the problem (History of introduction and spread of the target weed)		
		Weed's present distribution in North America		
		Sectors affected and magnitude of program (e.g., agricultural, natural, rangeland)		
		Consensus that the weed is suitable target for control		
	Proposed Action (see page 5-3-3)	Brief summary of researcher's proposed action: This host plant list is to notify TAG-BCAW of our intent to begin a biological control program for the control of *[weed]. [Weed]* has been declared a noxious weed in *[list States]* and is considered a target for biological control. Your comments on the accuracy, appropriateness, and thoroughness of this list is appreciated		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Target Weed Information (see page 5-3-3)		Test plant list for TAG-BCAW evaluation was submitted early in the study when a researcher or petitioner is proposing a new weed for biological control, but prior to actually submitting the petition for biological control agent of weeds (TAG-BCAW may make recommendations of plants to be used in the testing process)		
		Test plant list (of plants actually used in the testing process) to TAG-BCAW submitted for the first time along with the petition for biological control agent of weeds		
		This weed has been previously targeted and there is either a previously-submitted petition or a previously-submitted test plant list		
		If there is a previously submitted test plant list or petition, then the current discussion of weed and test plant information is compared with previous discussions		
	Taxonomy (see page 5-3-4)	Full classification (order, family, genus, species), synonymy, and common name		
		Classification goes far enough to address any concerns		
		There is evidence that the identification needs to go beyond species		
		Qualified taxonomist (person's name, organization(s), location(s) who identified the target weed		
		Problem(s) exists with the identification or present taxonomy (if any)		
		Origin locations of herbaria containing the voucher specimen(s) used as representative of the population occurring in the area where the researcher conducted the studies, and date of specimen deposit		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Target Weed Information (see page 5-3-3)	**Description** (see page 5-3-4)	General physical description of the target weed is complete enough that identification could be made by a person encountering the weed in the field		
	Distribution of the Target Weed (see page 5-3-4)	TAG-BCAW Reviewers: This section should provide you with a sense of where the target weed is distributed and will potentially spread in North America		
		Adequate description of the native range (map)		
		Adequate description of the areas of introduction throughout the world, pattern of movement, and apparent limits (map)		
		Adequate description of the present distribution in North America (map)		
		Adequate description of the range areas of potential spread in North America (map)		
		Adequate description of the genetic variability		
		Adequate description of the habitats or ecosystems where the weed is found in North America		
	Taxonomically Related Plants (see page 5-3-4)	Identification of economically and environmentally important plants that are closely related to the target weed		
		Identification of threatened and endangered plants that are closely related to the target weed		
		If possible, a description of how closely related economic, environmentally important species, and threatened and endangered species are to the target weed		
	Distribution of Taxonomically Related Plants (see page 5-3-5)	Adequate description of the distribution and habitats in North America of plants taxonomically related to the target weed and identified under *Taxonomically Related Plants*		
	Life History (see page 5-3-5)	Explanation of the life history of the target weed		
		Explanation of the general biology of the target weed		
		Discussion of factors that contribute to the plant's invasiveness		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Target Weed Information (see page 5-3-3)	**Impacts** (see page 5-3-5)	Information about the impacts made by target weeds are helpful in preparing a risk assessment and evaluating the risk associated with releasing the proposed biological control agent(s) of weeds. Use the following areas of impact as a guide. **Not** all areas will apply to all plants selected for testing		
		Beneficial uses—honey bees, forage, ground cover, fruits, etc.		
		Cultural, social and recreational uses—valued as an ornamental		
		Threatened and endangered species		
		Economic losses, including direct control costs		
		Health—poisonous, allergens		
		Regulatory—noxious weed, restricts trade		
		Native plant communities		
		Weed control on nontarget plants		
		Ecosystem functions and ecological relationships		
		Other impacts (e.g., aesthetic)		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Target Weed Information **(continued)** **(see page 5-3-3)**	**Alternative Management Options** **(see page 5-3-5)**	Historical options—what has been done before		
		Current options—biological, chemical, cultural		
		Potential options—new herbicides, biological control agents used or released in other countries (researchers may **not** have information on new chemicals being developed)		
	Known Host Range of Proposed Biological Control Agent **(see page 5-3-6)**	**NOTICE** The petitioner may **not** have addressed this topic since a test plant list is submitted early in the research.		
		Name and taxonomic classification (order, family, genus, species) of the proposed biological control agent		
		Literature records indicating other plants that have been attacked		
		Field collections and observations, including maps and data		
		Literature on host range of closely-related species to the proposed biological control agent of weeds		
		If host range of the proposed biological control agent is unknown, then stated		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Test Plant List (page 5-3-6)		Review the test plant list to see if the following categories of plants are covered. The species chosen for each category are representative species to be tested		
	Category 1: Genetic types of the target weed species (varieties, races, forms, genotypes, apomicts, etc.) found in North America (see page 5-3-7**)**	Genetic variability of the target weed		
		Justification of the genetic types selected for testing from those identified		
		Discussion of how selected types may or may **not** enable the petitioner to make inferences about effects on untested types		
		Justification of the number selected for testing In the event that many types exist		
		References		
		If references are **not** included, then an explanation		
	Category 2: Species in the same genus as the target weed, divided by subgenera (if applicable) (see page 5-3-7)	What is known about the phylogenetic relationship of the target weed to other species in the same genus		
		Which species are most likely to be found in the same range and habitat as the target weed		
		Economically, environmentally, and culturally sensitive important plant species of North America found in the genus		
		Justification of species selected for testing from those identified in the same genus as the target weed		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species		
		If there are many species in the genus, then justification of the number selected for testing		
		References		
		If references are **not** included, then an explanation		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Test Plant List (page 5-3-6)	Category 3: Species in other genera in the same family as the target weed, divided by subgenera (if applicable) (see page 5-3-8)	Details on what is known about the phylogenetic relationship of the target weed to other groups (i.e., subfamilies, genera, species) in the same family		
		Which groups (i.e., subfamilies, genera, species) are most likely to be found in the same range and habitat as the target weed		
		Economically, environmentally, and culturally sensitive important species found in the family in North America		
		Justification of the species selected for testing from those identified as *Category 3*		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species		
		If there are many genera in the family, then the number selected for testing is justified		
		References		
		If references are **not** included, then an explanation		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Test Plant List (continued) **(see page 5-3-6)**	Category 4: Threatened and endangered species in the same family as the target weed divided by subfamily, genus, and subgenus (see page 5-3-8)	Category 4's information is in a table format		
		All known threatened or endangered species or candidates in the same family as the target weed, and includes the full scientific name (order, family, subfamily, genus, subgenus, and species), status, and range within North America (see references for Protected Species on page F-1-20)		
		All species in the same genus as the target weed that are listed by the U.S. Fish and Wildlife Service as threatened or endangered or candidates (see Section 7 Consultations on page 6-1-1 and Protected Species on page F-1-20)		
		All species within the same genus as the target weed that are identified as sensitive on designated lists, such as Natural Heritage Program lists, Canadian Province lists, or Mexican State lists (*The Conservation Directory* is a good resource to identify organizations that maintain such lists. See Protected Species on page F-1-20)		
		Which groups (threatened or endangered species) are likely to be found in the same range and habitat as the target weed		
		Justification of the species selected for testing from those identified as *Category 4* or select surrogates (since seeds/plants of threatened and endangered species can be hard to obtain and may further threaten populations)		
		Justification of the surrogates based on phylogenetic, morphological, and/or biochemical similarities		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species		
		In the event that many threatened and endangered species exist, then a justification of the number selected for testing		
		References of threatened and endangered lists consulted		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Test Plant List (continued) (see page 5-3-6	Category 5: Species in other families in the same order which have some phylogenetic, morphological, or biochemical similarities to the target weed (see page 5-3-9)	Outline of families in the same order as the target weed		
		Angiosperm Phylogeny Classification System used (see Plant Classification System on page E-1-1) and included any additional families listed		
		If an alternate system of classification used, then a justification of the selection		
		Which families in this order are most closely related to the target weed's family according to phylogenetic studies		
		Discussion of any morphological or biochemical relationship the target weed or its family has with any group (i.e., family, genus, species) in this order		
		Which groups (i.e., family, genus, species) are likely to be found in the same range and habitat as the target weed		
		Any economically, environmentally, and culturally sensitive important species in these groups (i.e. family, genus, species) found in North America		
		Justification of the species selected for testing from those identified as being in *Category 5*		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species		
		If there are many groups (i.e., species, genus, family), then an explanation of the number selected for testing		
		References		
		If references are **not** included, then an explanation		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section		Is the following information included:	Yes	No
Test Plant List (continued) (see page 5-3-6)	Category 6: Species in other orders which have some morphological or biochemical similarities to the target weed (see page 5-3-10)	Discussion of any morphological or biochemical relationship the target weed has with any group (i.e. family, genus, species) in other orders		
		Which groups (i.e., family, genus, species) are likely to be found in the same range and habitat as the target weed		
		Any economically, environmentally, culturally sensitive important species in these groups (i.e., family, genus, species) found in North America		
		Justification of the species selected for testing from those identified as being in *Category 6*		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested species		
		If there are many groups (i.e., family, genus, species), then an explanation of the number selected for testing		
		References		
		If references are **not** included, then an explanation		
	Category 7: Any plant on which the biological control agent or its close relatives (within the same genus) have been previously found or recorded to feed and/or reproduce (see page 5-3-10)	Details, including the full scientific name and range of any plant on which the biological control agent or its close relatives (within the same genus) have been previously found or recorded to feed and/or reproduce		
		Proposal to test all species on which the proposed biological agent of weeds has been found or recorded to feed and/or reproduce		
		Species selected for testing from the plants on which any close relatives have been recorded to feed		
		Justification of the species selected from those identified		
		Discussion of how the selected species may or may **not** enable the petitioner to make inferences about effects on untested groups		
		If many species have been fed/reproduced on by the agents' close relatives, then explained the number for testing		

Table 5-4-2 Evaluation Checklist for Test Plant Lists (continued)

Test Plant List Section	Is the following information included:	Yes	No
Summary Table (see page 5-3-11	Table format summary of all the species recommended for testing in phylogenetic order (i.e., closely-to-distantly related to the target weed)		
Perspective of Risk (see page 5-3-11)	Discussion of how the selected species should enable a TAG-BCAW Reviewer to make inferences about risk of attack on untested species		
	Estimation of the limits of allowable attack within the phylogenetic hierarchy of the test plant list and explanation why		
	References		
	If references are **not** included, then an explanation		

Reviewer's Recommendation Checklist for Test Host Plant Lists

Use the results of the Evaluation Checklist for Test Plant Lists on page 5-4-5 and complete Table 5-4-2.

Read the information in Table 5-4-3 below, and follow the recommendation checklist. Use the TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds to record whether the information in the Test Plant List is complete and comprehensive or if information is lacking completeness. If information is lacking, then record your comment(s) about any concern(s) on the comments sheet, too..

Table 5-4-3 Checklist for Reviewer's Completion of Test Host Plant Lists

Reviewer's Recommendation	Yes	No
Review the completed evaluation Checklist for Test Plant Lists and comments made on the *TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Biological Control Agents of Weeds*, as well as those comments made by other subject matter experts		
Recommend the test plant list either be approved or be returned for revision and additions. Provide reasons for revision and additions		
Provide the name, affiliation, telephone, fax, and email numbers of the reviewer		
Include the names of other subject matter experts who provided comments		
Include your TAG-BCAW member identification number and date the Comment Sheet is submitted to TAG-BCAW Executive Secretary		
Send the completed *TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Biological Control Agents of Weeds* to the TAG-BCAW Chair through the TAG-BCAW Executive Secretary at the following address: Mr. Gregg B. Goodman, TAG-BCAW Executive Secretary **USDA-APHIS-PPQ** 4700 River Road, Unit 133, Office 4C-01.48 Riverdale, MD 20737 Email: gregg.b.goodman@aphis.usda.gov		

Appendix

A

TAG-BCAW Membership

Directory

Contents

Introduction

The *TAG-BCAW Membership* appendix provides a list of TAG-BCAW members with their addresses and phone numbers.

TAG-BCAW Membership Directory

Table A-1-1 TAG-BCAW Membership Directory

TAG-BCAW Members	Phone Number and Email Address
Dr. Sharlene Sing, Acting TAG-BCAW Chair **USDA-Forest Service** Rocky Mountain Research Station 1648 S. 7th Avenue Bozeman, MT 59717-2780	Phone: 406-994-5143 Email: sharlene.sing@usda.gov
Mr. Gregg B. Goodman, TAG-BCAW Executive Secretary **USDA-APHIS-PPQ** 4700 River Road, Unit 133, 4C-01.48 Riverdale, MD 20737	Phone: 301-851-2074 Email: gregg.b.goodman@usda.gov
Mr. Lewis John Cook **USDI-Bureau of Indian Affairs** Rocky Mountain Regional Office 316 North 26th Street Billings, MT 59101	Phone: 406-247-7946 Email: lewis.cook@bia.gov
Ms. Cindy Hall **USDI-Fish and Wildlife Service** 4401 N. Fairfax Drive, Suite 657 Arlington, VA 22203	Phone: 703-358-1831 Email: cindy_hall@fws.gov
Dr. John Goolsby **USDA-Agriculture Research Service, Plains Area** 22675 N. Moorefield Road Moore Airbase, Building 6419 Edinburg, TX 78541	Phone: 956-373-3223 Email: john.goolsby@usda.gov
Mr. Nathan Harms **U.S. Army Corps of Engineers** 3909 Halls Ferry Road Vicksburg, MS 39180-0631	Phone: 601-634-2976 Email: nathan.e.harms@usace.army.mil

Table A-1-1 TAG-BCAW Membership Directory (continued)

TAG-BCAW Members	Phone Number and Email Address
Ms. Terri Hogan, Invasive Plant Program Manager **USDI-National Park Service** Landscape Restoration & Adaptation Biological Resources Division Natural Resource Stewardship and Science 1201 Oakridge Dr., Suite 200 Fort Collins, CO 80525	Phone: 970-267-7306 Email: terri_hogan@nps.gov
Dr. Richard Lee, Acting Integrated Pest Management Specialist **USDI-Bureau of Land Management** National Operations Center Denver Federal Center, Bldg. #50 PO Box 25047 Denver, CO 80225-0047	Ph: 303-236-1734 Email: r5lee@blm.gov
Dr. Peter Mason Research Centre **Agriculture and Agri-Food Canada** K.W. Neathy Bldg. 960 Carling Avenue Ottawa, ON, Canada KIAOC6	Phone: 613-759-1908 Email: peter.mason@canada.ca
Mr. Joseph Milan, Acting Biological Control Specialist **USDI-Bureau of Land Management** 3948 Development Avenue Boise, ID 83705	Ph: 208.384.3487 Email: jmilan@blm.gov
Dr. Robert M. Nowierski **USDA-NIFA** Room 3322 Waterfront Center 800 9th Street, SW Washington, DC 20024	Phone: 202-401-4900 Email: Rnowierski@usda.gov
Mr. Ian Pearse **U.S. Geological Survey**, Fort Collins Science Center 2150 Centre Ave. #C Ft. Collins, CO 80526	Phone: 970-226-9145 Email: ipearse@usgs.gov
Mr. James Pieper, NPS Integrated Pest Management (IPM) Coordinator **USDI-National Park Service** Biological Resources Division Natural Resource Stewardship and Science 1201 Oakridge Dr., Suite 200 Fort Collins, CO 80525	Phone: 970-267-2144 Email: james_pieper@nps.gov
Dr. Michael Pitcairn, National Plant Board Representative **California Dept. of Food and Agriculture** 3288 Meadowview Road Sacramento, CA 95832	Phone: 916-262-2049 Email: mpitcairn@cdfa.ca.gov
Mr. Jose Torres Subdirector de Diagnostico Fitosanitario **SADER SENASICA-DGSV** Carretera Federal Mexico-Pachuca, Km 37.5. C.P. 55740 Tecamac, Estada de Mexico Mexico 55740	Phone: (+52) (55) 5905 1000 ext.51402 Email: jose.torres@senasica.gob.mx

Table A-1-1 TAG-BCAW Membership Directory (continued)

TAG-BCAW Members	Phone Number and Email Address
Ms. Jolene Trujillo Invasive Species/IPM Program Coordinator **USDI-Bureau of Reclamation** Environmental Compliance Division Policy and Administration Denver Federal Center Bldg. 67 PO Box 25007 (84-53000) Lakewood, CO 80225-0007	Phone: 303-445-2903 Email: jtrujillo@usbr.gov
Dr. Te-Ming Paul Tseng**,** Weed Science Society of America Rep. Assistant Professor, Weed Physiology Department of Plant and Soil Sciences **Mississippi State University** Box 9555 Mississippi State, MS 39762	Phone: 662-325-4725 Email: t.tseng@msstate.edu
Dr. Ronald D. Weeks **USDA-APHIS-PPQ Science and Technology** 1730 Varsity Drive, Suite 400 Raleigh, NC 27606	Phone: 1+919-855-7297 Email: ron.d.weeks@usda.gov
Vacant **EPA-Office of Pesticide Programs**	

Appendix

B

Forms

Contents

Introduction

The *Forms* appendix contains examples of comment sheets and forms that are used for evaluating petitions, evaluating test plant lists, or applying for permits for the biological control of weeds.

TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds

Technical Advisory Group (TAG-W) Reviewer's Comment Sheet
for Field Release for Biological Control Agents of Weeds

Section 1: To be completed by the TAG Executive Secretary

Designation Number: Date Request Received:

Date Sent to Reviewers: Review Due Date:

Due Date Revised:

Return Form to:
Gregg Goodman, Executive Secretary
USDA, APHIS, PPQ
4700 River Rd, Unit 133
Office 4C-01.48
Riverdale, MD 20737-1236
Fax (301) 734-5269
Email: Gregg.B.Goodman@aphis.usda.gov

Biological Control Agent(s):
.

Target Weed:

Petitioner's Name and Affiliation:

Please rate your review with one of the following categories:
A = Acceptable CM = Concerns Met
UA = Unacceptable CNM = Concerns Not Met NE = Not Evaluated

Section 2: To be completed by the TAG Reviewers (if needed, use additional sheets). **Please change the circle to an "X" to acknowledge your choice.**

A. **Accuracy, Completeness, and Comprehensiveness:**

	A	UA	NE
Target Weed Information Comments: _	O	O	O
Biological Control Agent Information Comments: _	O	O	O
Experimental Methodology & Analysis Comments: _	O	O	O
Test Plant Comments: __	O	O	O
Results & Discussion Comments: __	O	O	O
Potential Environmental Impact(s) Comments: __	O	O	O
Petitioner's Conclusion Comments: __	O	O	O

Figure B-1-1 Technical Advisory Group (TAG-BCAW) Reviewer's Comment Sheet - Petition for Field Release of Biological Control Agents of Weeds (front)

Please rate your review using one of the categories.

	CM	CNM	NE
B. Thoroughness of Addressing Agency Concerns Comments: __	O	O	O

C. Recommendation of Your Agency Comments: ___

D. Comments/list of Additional specialists': ___

Please change the circle to an "X" to acknowledge your choice.

Recommend without reservations O

Recommend with reservations (Please make specific comments) O

Not recommended O

TAG #: _____

Date: _____

Thank you for taking the time to review this petition and document your recommendations.

Figure B-1-2 Technical Advisory Group (TAG-BCAW) Reviewer's Comment Sheet - Petition for Field Release of Biological Control Agents of Weeds (back)

Purpose

The Technical Advisory Group TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds is used by TAG-BCAW reviewers to comment, evaluate, and recommend action for petitions for field release of biological control agents of weeds.

Instructions

The TAG-BCAW comment sheets are used along with the Evaluation Checklist — Petitions for Field Release of Biological Control Agents of Weeds on page 5-5 and Evaluation Checklist for Test Plant Lists on page 5-5.

Distribution

The TAG-BCAW Executive Secretary distributes a fillable pdf of the TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds to TAG-BCAW members.

Mr. Gregg B. Goodman
TAG-BCAW Executive Secretary
4700 River Road, Unit 133, 4D-01.42
Riverdale, MD 20737

E-mail: gregg.b.goodman@aphis.usda.gov
FAX: 301-851-2074

TAG-BCAW reviewers return the completed TAG-BCAW Reviewer's Comment Sheet - Petition for Field Release of Proposed Biological Control Agents of Weeds to the TAG-BCAW Executive Secretary. The TAG-BCAW Executive Secretary will log in and file the recommendations, then forward to the TAG-BCAW Chair.

TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds

Technical Advisory Group (TAG-W) Reviewer's Comment Sheet
for Test Host Plants Lists for Biological Control Agents of Weeds

Section 1: To be completed by the TAG Executive Secretary

Designation Number: Date Request Received:

Date Sent to Reviewers: Review Due Date:

Due Date Revised:

Return Form to:
Gregg Goodman, Executive Secretary
USDA, APHIS, PPQ
4700 River Rd, Unit 133
Office 4C-01.48
Riverdale, MD 20737-1236
Fax (301) 734-5269
Email: Gregg.B.Goodman@aphis.usda.gov

Biological Control Agent(s):

Target Weed:

Petitioner's Name and Affiliation:

Please rate your review with one of the following categories:
A = Acceptable CN = Concerns Met
UA = Unacceptable CNM = Concerns Not Met NE = Not Evaluated

Section 2: To be completed by the TAG Reviewers (if needed, use additional sheets). **Please change the circle to an "X" to acknowledge your choice.**

A. **Accuracy, Completeness, and Comprehensiveness:**

	A	UA	NE
Target Weed	O	O	O
Information Comments:			
Test Plant List	O	O	O
Comments:			
Summary	O	O	O
Comments:			
Perspective of	O	O	O
Risk Comments:			

Please rate your review using one of the categories.

	CN	CNM	NE
B. Thoroughness of Addressing Agency Concerns Comments:	O	O	O

C. Recommendation of Your Agency Comments:

Figure B-1-3 TAG-BCAW Reviewer's Comment Sheet for Test Host Plant Lists for Proposed Biological Control Agents of Weeds (front)

D. Comments/list of Additional specialists':

Please change the circle to an "X" to acknowledge your choice.

Recommend without reservations O

Recommend with reservations (Please make specific comments) O

Not recommended O

TAG #: _____

Thank you for taking the time to review this petition and document your recommendations.

Figure B-1-4 TAG-BCAW Reviewer's Comment Sheet for Test Host Plant Lists for Biological Control Agents of Weeds (back)

Purpose

The TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds on page B-5 is used for TAG-BCAW members to comment, evaluate, and recommend action about test host plant lists.

Instructions

The TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds is used along with the Evaluation Guidelines for Test Plant Lists on page 5-1 and Evaluation Checklist for Test Plant Lists on page 5-5.

Distribution

The TAG-BCAW Executive Secretary distributes a fillable pdf of the TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds to TAG-BCAW reviewers.

The TAG-BCAW reviewers return their completed TAG-BCAW Reviewer's Comment Sheet for Test Host Plants Lists for Proposed Biological Control Agents of Weeds to the TAG-BCAW Executive Secretary using either of the following:

Mr. Gregg B. Goodman, TAG-BCAW Executive Secretary
USDA-APHIS-PPQ
4700 River Road, Unit 133, 4C-01.48
Riverdale, MD 20737

Email: gregg.b.goodman@aphis.usda.gov

The TAG-BCAW Executive Secretary then logs and files the comments, and sends the TAG-BCAW reviewers' comment sheets to the TAG-BCAW Chair.

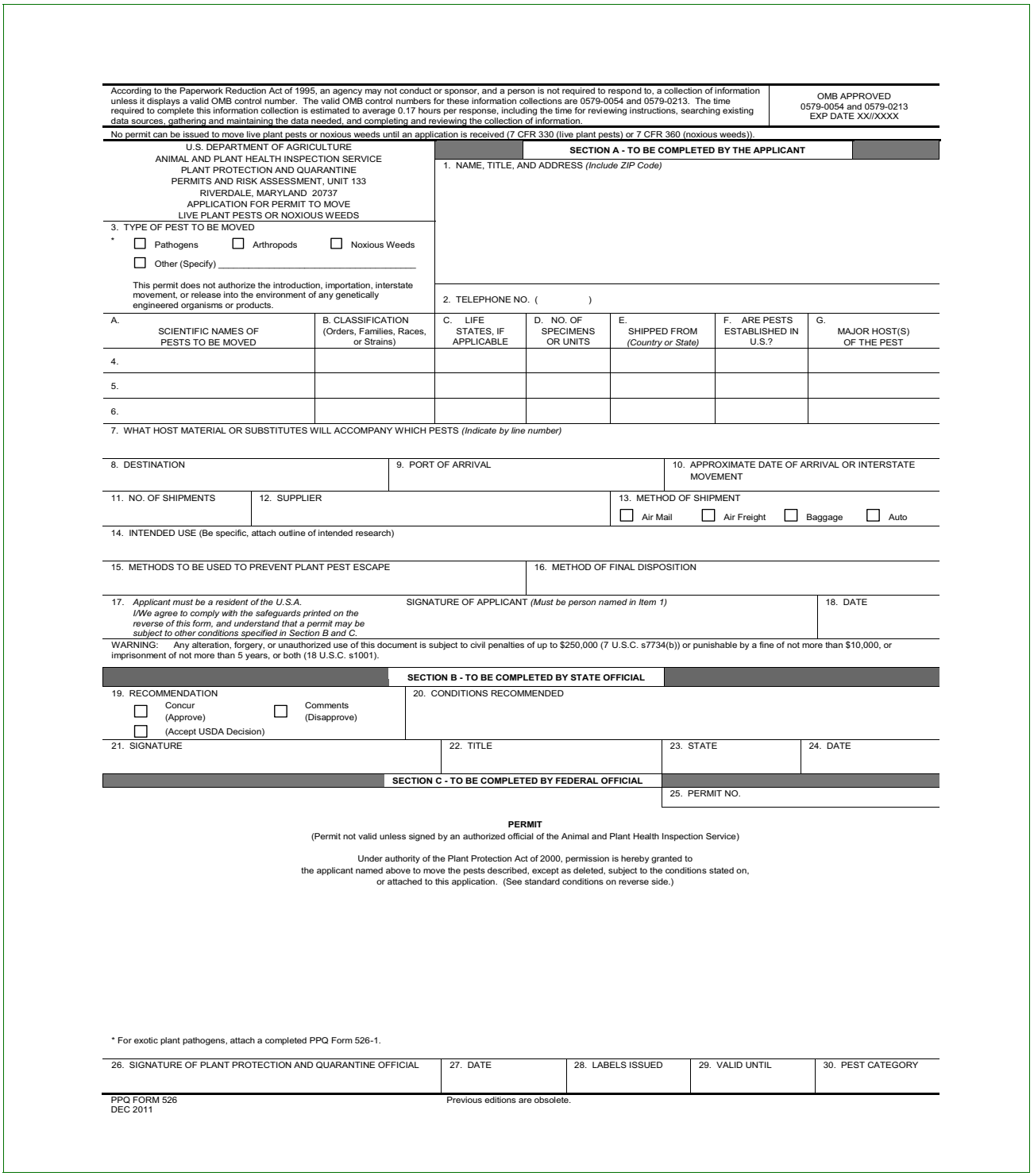
Instructions for Completing an Application for an APHIS Permit

As part of the U.S. Department of Agriculture's (USDA) overall eGovernment initiative to transform and enhance delivery of its programs, services, and information, the Animal and Plant Health Inspection Service (APHIS) launched its electronic permitting system (ePermits). ePermits is a web-based tool that gives customers the ability to apply for a permit, check the status, and view the application online. All PPQ permits are processed through the ePermits system, however, there are two ways to apply for an APHIS permit: on-line or on paper.

Applying for an APHIS Permit

Guidance and step-by-step instructions for obtaining regulated soil and organism permits can be found at Plant Health Import Permits at http://www.aphis.usda.gov/plant_health/permits/organism/biological_control/weeds.shtml.

PPQ Form 526, Application to Move Live Plant Pests or Noxious Weeds



According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid OMB control number. The valid OMB control numbers for these information collections are 0579-0054 and 0579-0213. The time required to complete this information collection is estimated to average 0.17 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

OMB APPROVED
0579-0054 and 0579-0213
EXP DATE XX//XXXX

No permit can be issued to move live plant pests or noxious weeds until an application is received (7 CFR 330 (live plant pests) or 7 CFR 360 (noxious weeds)).

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
PERMITS AND RISK ASSESSMENT, UNIT 133
RIVERDALE, MARYLAND 20737
APPLICATION FOR PERMIT TO MOVE
LIVE PLANT PESTS OR NOXIOUS WEEDS

SECTION A - TO BE COMPLETED BY THE APPLICANT

1. NAME, TITLE, AND ADDRESS *(Include ZIP Code)*

3. TYPE OF PEST TO BE MOVED
* ☐ Pathogens ☐ Arthropods ☐ Noxious Weeds
☐ Other (Specify) _____

This permit does not authorize the introduction, importation, interstate movement, or release into the environment of any genetically engineered organisms or products.

2. TELEPHONE NO. ( )

A. SCIENTIFIC NAMES OF PESTS TO BE MOVED	B. CLASSIFICATION (Orders, Families, Races, or Strains)	C. LIFE STATES, IF APPLICABLE	D. NO. OF SPECIMENS OR UNITS	E. SHIPPED FROM *(Country or State)*	F. ARE PESTS ESTABLISHED IN U.S.?	G. MAJOR HOST(S) OF THE PEST
4.						
5.						
6.						

7. WHAT HOST MATERIAL OR SUBSTITUTES WILL ACCOMPANY WHICH PESTS *(Indicate by line number)*

8. DESTINATION	9. PORT OF ARRIVAL	10. APPROXIMATE DATE OF ARRIVAL OR INTERSTATE MOVEMENT

11. NO. OF SHIPMENTS	12. SUPPLIER	13. METHOD OF SHIPMENT
		☐ Air Mail ☐ Air Freight ☐ Baggage ☐ Auto

14. INTENDED USE (Be specific, attach outline of intended research)

15. METHODS TO BE USED TO PREVENT PLANT PEST ESCAPE	16. METHOD OF FINAL DISPOSITION

17. *Applicant must be a resident of the U.S.A.*
I/We agree to comply with the safeguards printed on the reverse of this form, and understand that a permit may be subject to other conditions specified in Section B and C.
SIGNATURE OF APPLICANT *(Must be person named in Item 1)*

18. DATE

WARNING: Any alteration, forgery, or unauthorized use of this document is subject to civil penalties of up to $250,000 (7 U.S.C. s7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s1001).

SECTION B - TO BE COMPLETED BY STATE OFFICIAL

19. RECOMMENDATION
☐ Concur (Approve) ☐ Comments (Disapprove)
☐ (Accept USDA Decision)

20. CONDITIONS RECOMMENDED

21. SIGNATURE	22. TITLE	23. STATE	24. DATE

SECTION C - TO BE COMPLETED BY FEDERAL OFFICIAL

25. PERMIT NO.

PERMIT
(Permit not valid unless signed by an authorized official of the Animal and Plant Health Inspection Service)

Under authority of the Plant Protection Act of 2000, permission is hereby granted to the applicant named above to move the pests described, except as deleted, subject to the conditions stated on, or attached to this application. (See standard conditions on reverse side.)

* For exotic plant pathogens, attach a completed PPQ Form 526-1.

26. SIGNATURE OF PLANT PROTECTION AND QUARANTINE OFFICIAL	27. DATE	28. LABELS ISSUED	29. VALID UNTIL	30. PEST CATEGORY

PPQ FORM 526
DEC 2011

Previous editions are obsolete.

Figure B-1-5 PPQ Form 526, Application to Move Live Plant Pets or Noxious Weeds

Purpose

PPQ Form 526, Application to Move Live Plant Pests or Noxious Weeds, is the application used to request a USDA-APHIS-PPQ permit for the following activities:

- Import plant pests, including but **not** limited to the following living organisms: biological control organisms, earthworms, honeybees and other pollinating bees, insects, mites, nematodes, slugs, snails; microbes pathogenic to plants or invertebrates; parasitic plants, or other Federal noxious weeds into the environment of the United States
- Ship interstate any of the above **except** entomophagous insects and honeybees
- Release any organisms including those for biological control purposes, from containment into the environment of the United States

NOTICE

Do not use this form (PPQ Form 526) for genetically-engineered plants or genetically-engineered plant pests.

Use APHIS Form 2000 for genetically-engineered plants or genetically-engineered plant pests.

Distribution

See Instructions for Completing an Application for an APHIS Permit on page B-8.

PPQ Form 599, Import Label for Living Regulated Organisms (Red and White)

Figure B-1-6 Example of PPQ Form 599, Import Label for Living Regulated Organisms (red and white shipping label) (adhesive label issued before September 9, 2014, but valid until expiration date on permit)

Table B-1-1 PPQ Form 599, Import Label for Living Regulated Organisms (red and white label) Mailing or Shipping (new plain paper (nongummed) or special adhesive (gummed) label issued starting September 9, 2014)

Purpose

PPQ Form 599, Import Label for Living Regulated Organisms (Red and White), is a red and white shipping label issued by the USDA-APHIS-PPQ Permit Unit to denote shipping or mailing regulated articles into the U.S. The PPQ Form 599 label designates a package as containing living organisms regulated under an APHIS PPQ permit (see PPQ Form 526, Application to Move Live Plant Pests or Noxious Weeds). The organisms (plant pests or pathogens) usually fall into one of the following categories: bees, biological control agents, live insects, noxious weeds, parasitic plants, plant pathogens, plant pests, select agents, snails, or worms.

For shipping or mailing, the red and white label includes the APHIS permit number and the address where inspection is authorized. Inspections usually (but **not always**) occur at a PPQ plant inspection station. The label authorizes movement of a secure and intact package to the address on the label.

APHIS is phasing in the use of printable plain paper (nongummed) labels for permitted Plant Protection and Quarantine imports that require a label. The new, plain paper labels are the ePermits default choice. The plain paper labels are sent via email to the permittee as a PDF attachment. The permittee may then distribute permit labels to shippers by email or regular mail. The shipper is instructed to print the plain paper label using a color, and then attach the label to the package exterior using clear tape.

The permittee may request and be issued plain paper labels, special gum labels, or a combination of both. The permittee needs to specify either plain paper labels or special gum labels for each request. If both types of labels are issued for the same permit, then the label numbers remain sequential. There may be a slight change in appearance of the plain paper (nongummed) labels, because printer ink may vary in color and intensity and the labels will be affixed using clear tape. If there is a failure to print the labels in color, then shipments can and will be refused and/or ordered destroyed.

Distribution

PPQ Form 599, Import Label for Living Regulated Organisms (Red and White Label), is distributed by the USDA-APHIS-PPQ Pest Permitting Branch.

Appendix

C

NAPPO Standard

Contents

Introduction

The *NAPPO Standard* appendix provides the North American Plant Protection Organization (NAPPO) standard that may be used as a reference. This document is a regional (North American) plant protection standard agreed upon by Canada, Mexico, and the United States, outlining the minimum requirements for information to be included in a petition to regulatory officials. Additional information may be required by regulatory officials in one or more of these countries.

NOTICE

Petitioners in Canada and Mexico are required to follow the NAPPO Standard, RSPM 7, which is similar to the format in Format for Petitions for Field Release on page 5-1-1 and Format for Test Plant Lists on page 5-3-2.

Requirements

Each petition should be preceded by a title page, a table of contents, and a summary or abstract.

Petitioners from the United States will follow the procedures as stated in Format for Petitions for Field Release on page 5-1-1 and Format for Test Plant Lists on page 5-3-2. Submitting a TAG-BCAW petition (following the procedures as stated in Petitions for Field Release Format of this manual) satisfies the NAPPO standard for proposed environmental releases in the U.S.

Petitioners from Canada and Mexico will follow the NAPPO standard, RSPM 7 Guidelines for Petition for First Release of Non-indigenous Phytophagous or Phytopathogenic Biological Control Agents from the NAPPO Regional Standards for Phytosanitary Measures. RSPM 7.

Appendix

D

Fish and Wildlife Service Offices

Directory

Content

Introduction

The *Fish and Wildlife Service Offices* appendix provides a list of U.S. Fish and Wildlife Service (FWS) Regional Offices and contact information.

U.S. Fish and Wildlife Service (FWS) Regional Offices

Petitioners and researchers may contact the appropriate U.S. FWS Regional Office early in the petition process for advice and input regarding Section 7 of the Endangered Species Act

Table D-1-1 Directory of U.S. Fish and Wildlife Service (FWS) Regional Offices

FWS Region	Area of Coverage	FWS Office Address	Phone Number
Region 1	Hawaii Idaho Oregon Washington Pacific Islands	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 911 NE 11th Avenue Portland, OR 97232-4181 http://www.fws.gov/pacific/ecoservices/endangered/index.html	503-231-6151
Region 2	Arizona New Mexico Oklahoma Texas	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** PO Box 1306 Albuquerque, NM 87103-1306 http://www.fws.gov/southwest/es/	505-248-6651
Region 3	Illinois Indiana Michigan Minnesota Missouri Ohio Wisconsin	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 5600 American Blvd. West, Suite 990 Bloomington, MN55437-1458 http://fws.gov/midwest/endangered/	612-713-5334

Table D-1-1 Directory of U.S. Fish and Wildlife Service (FWS) Regional Offices (continued)

FWS Region	Area of Coverage	FWS Office Address	Phone Number
Region 4	Alabama Arkansas Florida Georgia Kentucky Louisiana Mississippi North Carolina South Carolina Tennessee	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 1875 Century Boulevard, Suite 200 Atlanta, GA 30345 http://fws.gov/southeast/endangered-species-act	850-877-6513
Region 5	Connecticut Delaware District of Columbia Maine Maryland Massachusetts New Hampshire New Jersey New York Pennsylvania Rhode Island Vermont Virginia West Virginia	Division of Threatened and Endangered Species **U.S. Fish and Wildlife Service (FWS)** 300 Westgate Center Drive Hadley, MA 01035-9589 https://www.fws.gov/northeast/ecologicalservices/endangeredspecies.html	413-253-8615
Region 6	Colorado Kansas Montana Nebraska North Dakota South Dakota Utah Wyoming	*Mailing Address:* Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** PO Box 25486, DFC Denver, CO 80225 *Physical Address:* Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 134 Union Blvd., Suite 650 Lakewood, CO 80228 http://www.fws.gov/mountain-prairie/es/endangered.php	303-236-4046
Region 7	Alaska	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 1011 East Tudor Road Anchorage, AK 99503 https://www.fws.gov/alaska/pages/endangered-species-program	907-786-3323
Region 8	California Nevada	Division of Endangered Species **U.S. Fish and Wildlife Service (FWS)** 2800 Cottage Way, Suite W2606 Sacramento, CA 95825 http://www.fws.gov/cno/es	916-414-6600

Appendix

E

Plant Classification System

Contents

Introduction

The *Plant Classification System* appendix provides information about the plant classification systems that are in use today.

Plant Classification System

The risk of non-target impacts is examined through host specificity testing of the proposed biological control agent of weeds. Post-release monitoring of control agents has shown that the highest level of risk is to those plants most closely related, in terms of phylogenetic (evolutionary) relatedness, to the target plant (Pemberton 2000). Construction of the host test plant list gives higher emphasis to those plants closely related to the target weed and less emphasis to more distantly related non-target plants. This method of test plant list construction is called the "Wapshere method" (after Wapshere (1974) who first proposed the method) or the "centrifugal phylogenetic method." Two things are required for this method to be effective: accurate identification of the target weed and an accurate understanding of the target's phylogenetic relationship with non-target plants.

The field of plant taxonomy and systematics has undergone major changes in the last 30 years. The most profound is the development of molecular taxonomy and a corresponding systematics that has led to a large source of new data for use in phylogenetic analyses and a better understanding of the evolutionary relationships among plant groups.

Changes in nomenclature and modification of phylogenetic hypotheses are on-going. As a result, the best sources of current taxonomic nomenclature and plant phylogenies are Web sites that are updated frequently.

For the current nomenclature of a target weed, petitioners should use accurate databases and consult with a plant taxonomist.

The use of molecular methods has also resulted in changes to our understanding of the evolutionary relationships among plants. In particular, molecular data have identified a number of traditional taxonomic groups that are polyphyletic and comprised of unrelated molecular lineages, that is, groups that have similar morphology due to convergent evolution but **do not** share a most recent ancestor. Conversely, some groups that appear morphologically dissimilar have been found to be closely related. A recent example of a major change to a traditional family is the breakup of the family Scrophulariaceae. Previously, this family contained a number of weedy genera, such as *Linaria*, *Verbascum*, and [now] *Plantago*. Recently, based on molecular data, it has been shown to have been composed of at least five distinct monophyletic groups (Olmstead et al. 2001). While the family Scrophulariaceae still exists, it is now comprised of **only** a few small genera, as each of the monophyletic groups has been merged with other families to which they are more closely related.

A recent description of the phylogeny of plant families based on the latest molecular data was published by Haston et al. (2007) where an evolutionary tree illustrating the phylogeny was presented. Petitioners should consult this paper to learn what families are most closely related to the target weed's family.

Any changes and updates to Haston et al. are posted on the Angiosperm Phylogeny Web site, http://www.mobot.org/mobot/research/apweb/, a Web site maintained by Peter Stevens of the Missouri Botanical Garden. Petitioners are to check this Web site and cite as follows:

"Stevens, P. F. (date of access). Angiosperm Phylogeny Web site. Version #, date of last update."

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Appendix

F

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Introduction

The *References* appendix contains a list of reading material suggested by the Technical Advisory Group for Biological Control Agents of Weeds (TAG-BCAW).

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Recognized Taxonomic Institutions

United States

USDA, ARS, Plant Sciences Institute
Systematic Entomology Laboratory
Bldg. 005, Room 133, BARC-West
10300 Baltimore Blvd.
Beltsville, MD 20705-2350

USDA, ARS
Systematic Mycology and Microbiology Laboratory
Dr. Amy Rossman, Mycology
Bldg. 011A, Room 304, BARC-West
10300 Baltimore Avenue
Beltsville, MD 20705

USDA, ARS
National Germplasm Resources Laboratory
Dr. John Wiersema, Plant Taxonomy
Building 003, Room 124, BARC-West
Beltsville, MD 20705-2350
E-mail: john.wieersema@ars.usda.gov

Canada

Dr. Owen Lonsdale, Collections Manager
Canadian National Collection of Insects, Arachnids and Nematodes
Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada
KW Neatby Building
960 Carling Avenue
Ottowa, ON KIA 0C6
CANADA

Telephone/Téléphone: 613-759-1992
FAX/Télécopieur: 613-759-1927
Email: owen.lonsdale@agr.gc.ca

Mexico

Colecciòn Nacional de Insectos
Instituto de biologia, UNAM
Aprtado Postal 70-153
04510 Mèxico, D.F.
MÈXICO

Telephone 56-22-91-67 ext. 47821
Email: mayorga@ibiologia.unam.mx

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TAG-BCAW Manual

Glossary

Introduction

Use this glossary to find the meaning of specialized abbreviations, acronyms, terms, and words used in this manual. To locate where in the manual a given abbreviation, acronym, or term is mentioned, refer to the index.

Definitions, Terms, and Abbreviations

abiotic. Not pertaining to life or specific life conditions.

APHIS. Animal and Plant Health Inspection Service, USDA.

ARS. Agricultural Research Service, USDA.

BCDC. Biological Control Documentation Center.

BIA. Bureau of Indian Affairs, USDI.

biological assessment (BA). Under the Endangered Species Act, the evaluation of a proposed action's potential effects on listed and proposed species and designated/proposed critical habitat.

biological control agent. A natural enemy, antagonist, or competitor, or other organism, used for pest control (FAO Glossary, 2010; ISPM 3:1995; revised ISPM 3:2005).

biological evaluation (BE). A generic term for all other types of analyses (**other than** a biological assessment). If a listed species or critical habitat is likely to be affected, then the Agency **must** provide the Services (USFWS and NMFS) with an evaluation on the likely effects of the action. Often this information is referred to as the BE.

biological control agents. Organisms that suppress or kill weedy plants without significantly injuring desirable plants (Andres, 1977).

biotype. A group of organisms having the same genotype, but varying characteristics (e.g., strain differences or different physiological characteristics). The organisms sharing a specified genotype; also: the genotype shared or its distinguishing peculiarity. (www.merrian-webster.com/dictionary).

BLM. Bureau of Land Management, USDI.

BR. Bureau of Reclamation, USDI.

CBP. Customs and Border Protection

CFR. Code of Federal Regulations

COE. Army Corps of Engineers.

conference. A process which involves informal discussions between a Federal Agency and the FWS/NMFS under Section 7(a)(4) of the Act (ESA) regarding the impact of an action on proposed species or proposed critical habitat and recommendations to minimize or avoid the adverse effects.

confinement (of a regulated article). Application of official measures for regulated articles to prevent escape. [CPM, 2012]

containment. Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995)

containment facility. Laboratory, greenhouse, or other type of secure installation designed to effectively prevent the escape or entry of organisms. (NAPPO 2012; RSPM 7: 2008; RSPM 12:2008; RSPM 22: 2011; RSPM 27: 2007; RSPM 29: 2008)

control (of a pest). Suppression, containment, or eradication of a pest population. [FAO, 1995]

cryptic or sibling species. Sexually isolated populations with few or **no** tangible recognition characters to set them apart from the general species populations.

CSREES. See NIFA.

diapause. Period of arrested morphological development or suspended animation.

DOD. Department of Defense.

EA. environmental assessment. A concise, public document that briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of **no** significant impact (FONSI).

ecosytem. A dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit. [ISPM 3:1995; revised ICPM, 2001]

edaphic. Of or pertaining to soil, especially as it affects living organisms.

EIS. Environmental Impact Statement. Serves as a broad, comprehensive reference evaluating anticipated environmental effects of alternative planned causes of action. APHIS prepares an EIS to meet its National Environmental Policy Act (NEPA) responsibilities.

environmental impact. Effects on the agriculture, human health, and the environment.

EPA. Environmental Protection Agency.

ESA. Endangered Species Act. ESA as amended, was established in 1973 providing the policies and procedures for protecting endangered and threatened species of fish, wildlife, and plants. An objective of ESA is to provide ways to conserve endangered and threatened species and their habitats. Also, ESA requires APHIS to consult with the U.S. Fish and Wildlife Service (FWS) to ensure that any anticipated program or action is **not** likely to jeopardize the survival of listed species, or is **not** likely to adversely modify or destroy their critical habitat.

exotic species. Alien in origin, to the specific ecosystem under consideration.

FACA. Federal Advisory Committee Act. TAG-BCAW meetings shall be conducted in compliance with the Federal Advisory Committee Act (FACA).

FONSI. Finding of no Significant Impact. A public document that presents the reasons a proposed action would **not** have a significant impact on the environment, based on the results of an EA.

FS. Forest Service, USDA.

FWS. Fish and Wildlife Service, USDI.

habitat. Part of an ecosystem with conditions in which an organism naturally occurs or can establish. [ICPM, 2005]

host range. Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO, 1990; revised ISPM 3:2005).

host specificity testing. The process by which the species of plants at risk from a biological control agent in the field is determined. (NAPPO Glossary, 1999)

incidence (of a pest). Proportion or number of units in which a pest is present in a sample, consignment, field, or other defined population. [CPM, 2009]

infestation (of a commodity). Presence in a commodity of a living pest of the plant or plant product concerned. Infestation includes infection [CEPM 1997; revised CEPM, 1999]

IPPC. International Plant Protection Convention as deposited with FAO in Rome in 1951 and as subsequently amended. [FAO, 1990]

ISPM. International Standard for Phytosanitary Measures [CEPM, 1996; revised. ICPM, 2001]

isolates. Limited taxonomic collections of pathogens made from a specific location, and thus may **not** represent the entire genetic base of the species.

material. Includes living organisms and toxins.

monitoring. An official ongoing process to verify phytosanitary situations. [CEPM, 1996]

morphometric. Relating to measurement of external form.

NAPPO. North American Plant Protection Organization. International organization consisting of representatives from Canada, Mexico, and the United States.

NEPA. National Environmental Policy Act. Congress enacted NEPA in 1969 to ensure that Federal agencies assess the impact of potential environmental consequences before undertaking major programs or projects. Detailed information on the NEPA process is contained in "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act," 40 CFR Parts 1500–1508.

NIFA. National Institute of Food and Agriculture. Formerly CSREES (Cooperative State Research, Education, and Extension Service.)

NPS. National Park Service, USDI.

NMFS. National Marine Fisheries Service.

NRCS. Natural Resources Conservation Service, USDA.

natural enemy. An organism which lives at the expense of another organism in its area of origin and which may help to limit the population of that organism. This includes parasitoids, parasites, predators, phytophagous organisms, and pathogens. [ISPM 3:1995; revised ISPM 3:2005]

official. Established, authorized, or performed by a national plant protection organization. [FAO, 1990]

organism. Any biotic entity capable of reproduction or replication in its naturally occurring state. [ISPM 3:1995; revised ISPM 3:2005]

parasite. An organism which lives on or in a larger organism, feeding upon it. [ISPM 3:1995]

parasitoid. An insect parasitic **only** in its immature stages, killing its host in the process of development, and free living as an adult [ISPM 3:1995]

pathogen. Micro-organism causing disease [ISPM 3:1995]

pest. Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products. Note: In the IPPC, plant pest is sometimes used for the term pest [FAO, 1990; revised FAO 1995; IPPC, 1997; revised CPM, 2012]

petition. A formal, written application to a regulatory Agency seeking approval to release an exotic biological control agent. [NAPPO Glossary, 1999]

phytophagous. Organisms that eat plants.

planting. Any operation for the placing of plants in a growing medium, or by grafting or similar operations, to ensure their subsequent growth, reproduction, or propagation. [FAO, 1990; revised CEPM, 1999]

plants. Living plants.

polyphagous. Feeding on or utilizing a variety of plants.

positive control. Where the target is present at every step in the test process (i.e., treatment in which you would expect a positive response).

PPD. Policy and Program Development.

PPQ. Plant Protection and Quarantine.

quarantine. Official confinement of regulated articles for observation and research or for further inspection, testing or treatment. [FAO 1990; revised FAO, 1995; CEPM 1999]

release. (into the environment) Intentional liberation of an organism into the environment. [ISPM 3:1995]

replicate . Replication of an experimental condition so that the variability associated with the phenomenon can be estimated.

reference specimen. Specimen, from a population of a specific organism, observed and accessible for the purpose of identification, verification, or comparison. [ISPM 3:2005; revised CPM 2009]

seeds. A commodity class for seeds for planting or intended for planting and **not** for consumption or processing. [FAO, 1990; revised ICPM, 2001]

suppression. The application of phytosanitary measures in an infested area to reduct pest populations [FAO, 1995; revised CEPM, 1999]

spread. (of a pest) Expansion of the geographical distribution of a pest within an area [FAO, 1995]

standard operation procedure (SOP). . Codified best laboratory practices for handling biological control agents in quarantine or containment. (NAPPO 2012: NAPPO Glossary, 1999)

SPRO. State Plant Regulatory Official. Contact information for these officials can be found on the National Plant Board Web site. There is also a list of these officials in the *Postentry Quarantine Manual*.

survey. An official procedure conducted over a defined period of time to determine the characteristics of a pest population or to determine which species occur in an area. [FAO, 1990; revised CEPM, 1996]

take. To harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any of these activities.

test. Official examination, **other than** visual, to determine if pests are present or to identify pests. [FAO, 1990]

test plant list. A representative list of plant species that will be subjected to host specificity tests. (Drea, 1991, p. 144)

USDA. United States Department of Agriculture.

USDC. United States Department of Commerce.

USDI. United States Department of the Interior.

USGS. United States Geological Survey, USDI.

voucher specimens. A series of individuals from a specific population deposited in the National Collection(s) of the country. (NAPPO 2012; RSPM 19: 2012; RSPM 27:2007).

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