ExFor

The Exotic Forest Pest Information System for North America

Participant's Guidelines

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Ce document est disponible en français.

Obtener una copia de este documento en español.

Contact the **Project Coordinator** with questions regarding the overall goals of the ExFor project, the content, editing or review of records, or to request special assistance or information.

Contact the **Technical Coordinator** with questions about the web site or the database, or for assistance in submitting records.

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Introduction

The goal of ExFor is to produce a database that provides information on exotic insects, mites and pathogenic organisms with potential to cause significant damage to North American forest resources. The database contains valuable background information on each pest, and serves as a resource for regulatory and forest protection agencies in North America.

In addition, ExFor includes the ***relative importance*** of each pest, based on four basic criteria. In order for an organism to be a pest following introduction to a new area, it must have:

- potential to become established,
- potential to spread within North America following introduction,
- potential to cause economic damage and/or
- potential to cause environmental harm.

Evaluations of pests based on these factors are available to users of ExFor. In order to be useful, each pest must be evaluated using the same criteria, and background information must be as complete as possible.

ExFor is presented as an Internet-accessible database containing information on forest pests that can be used by workers worldwide. Regulatory and forest protection agencies, as well as researchers and field workers in forest health and related fields, will benefit from the ready availability of information on a wide variety of pests with potential to become established in North American forests. The information is presented in such a way as to be useful for many purposes. Although the emphasis in the pest risk assessment model developed for this project is on potential establishment and impact, information on pathways for introduction and means of dispersal is provided in the Pest Facts Sheets. It is anticipated that this information will prove useful for the assessment and management of introduced pests, wood products and other commodities from offshore sources.

ExFor is a dynamic database, with change and development an integral part of its maintenance. New species and new information will be added when available.

This document describes the guidelines to be followed by contributors ExFor in evaluating exotic forest pests and in submitting background information to the database.

Background

ExFor is a joint project of the member organizations of the Insect and Disease Study Group of the North American Forest Commission (NAFC). These organizations are the Canadian Forest Service, the Canadian Food Inspection Agency, SEMARNAT (Sanidad Forestal, Mexico), the United States Department of Agriculture (USDA) Forest Service, and the USDA Animal and Plant Health Inspection Service.

The Project is sponsored by the Insect and Disease Study Group of the North American Forest Commission, and by the North American Plant Protection Organization (NAPPO). The Project is managed by a **Core Group** comprising representatives from each of the participating agencies in Canada, Mexico and the United States.

A Project Coordinator oversees the design and implementation of the Project. The web site is currently being provided and maintained by the NSF Center for Integrated Pest Management at North Carolina State University. Other cooperating universities and research centers include the Universidad Autonoma Chapingo, Colegio de la Frontera Sur, Michigan State University and University of Georgia.

The principles and methods used in ExFor are aligned with those of the International Plant Protection Organization (IPPC) of the Food and Agriculture Organization of the United Nations (FAO) and are supported by the North American Plant Protection Organization (NAPPO), the European and Mediterranean Plant Protection Organization (EPPO) and other international phytosanitary associations.

Participants

The participation of forest pest experts from all over the world is the key ingredient for success of ExFor. Without the advice and information provided by entomologists, plant pathologists, nematologists, and other forest health workers, the database will not serve its purposes. Conversely, workers are also encouraged to use the database as a source of information on forest pests. Information provided by participants can readily be acquired through access to the ExFor Internet site at:

http://spfnic.fs.fed.us/exfor

Forest health workers are encouraged to participate in ExFor by submitting information and ratings on exotic forest pests with which they are familiar in accordance with these guidelines. All contributions will be acknowledged and the Pest Fact Sheets will be presented as authored publications. All ratings will be reviewed by a panel of forest pest experts. The project organizers will retain responsibility for final ratings.

Similarly, contributions of images of exotic forest pests or the damage they cause are gratefully accepted and fully acknowledged. Images for ExFor will be handled by ForestryImages.com at the University of Georgia. To submit images for ExFor, contact the Technical Coordinator, or Keith Douce at the University of Georgia (kdouce@uga.edu).

Comments and feedback on the information available in ExFor are welcomed. A conference system for exchanging information with other users is available through the web site. The database is updated regularly and changes are made as new information becomes available.

Scope

- ExFor includes only forest pests, and excludes agricultural pests. It includes only pests of trees, not pests that attack shrubs or other woodland plants. It includes pests of seeds, cones, seedlings, live trees and any harvested products of trees.

- Pests that threaten the forest resource, as well as those that threaten the timber industry, are evaluated.

- ExFor includes insects, mites, nematodes, fungi and fungus-like organisms, bacteria, parasitic plants, and other disease-causing organisms. It does not include mammals, birds or abiotic agents of disease in trees. It does not include weeds.

- Exotic strains or subspecies of pests that have native strains or subspecies in North America may be eligible for evaluation if evidence of substantial genetic or biological differences is presented to justify inclusion.

- Because virtually every climatic zone is represented in at least a small area somewhere in North America, the scope of this project is not restricted by climate. Nonetheless, ExFor will exclude pests that are believed to be incapable of survival anywhere in North America. Pests may be excluded in cases where no available hosts grow in North America.

Definitions

In order to serve its multiple purposes in both forest health protection and quarantine, ExFor is developed within the framework of key IPPC and NAPPO terms as defined in the NAPPO Compendium of Phytosanitary Terms (Hopper, 1996) and the International Standards for Phytosanitary Measures Glossary of Phytosanitary Terms (FAO, 1997). Although many of these definitions are straightforward, it is important to include them here to ensure consistency of interpretation amongst the many anticipated participants in the Project.

Established - of an introduced pest, present in a country or area, multiplying and expected to continue (NAPPO, 1996)

Establishment - perpetuation, for the foreseeable future, of a pest within an area after entry (NAPPO, 1996; FAO, 1997)

Establishment potential - the likelihood of the establishment of a pest (NAPPO, 1996)

Exotic - from another country; not native to the place where found; foreign (NAPPO, 1996)

Indigenous - native of a particular area; not introduced (NAPPO, 1996)

Introduction - entry of a pest resulting in its establishment (FAO, 1997)

Official - established, authorized or performed by a national plant protection organization (FAO, 1997)

Pathway - any means that allows the entry or spread of a pest (FAO, 1997)

Pest - any species, strain or biotype of plant, animal or pathogenic agent, injurious to plants or plant products (FAO, 1997)

Potential quarantine pest - a pest whose status as a quarantine pest can not be, or has yet to be determined (NAPPO, 1997)

Quarantine pest - a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 1997)

Risk - the chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment, or other things of value (Canadian Standards Association, 1997)

Spread - expansion of the geographical distribution of a pest within an area (FAO, 1997)

Contributing a Pest Record

Information may be submitted to ExFor in English, French or Spanish. Pest records should be entered ***directly into the database*** on the web site at **http://spfnic.fs.fed.us/exfor**

All pest records will be edited and peer-reviewed. Some editing of records for grammar, punctuation and consistency may be done at the discretion of the core group. Authors will be notified when such changes are made.

Additionally, risk ratings will be reviewed by a panel of experts before contributions are made available for public viewing on the web site. Authors' names will appear on Pest Facts Sheets. Records may be modified as new information becomes available. Authors will be notified of substantial changes prior to their release.

Comments on the content of pest records can be posted to a conference system accessible through the web site at **http://spfnic.fs.fed.us/exfor**. Information on how to contact the corresponding author directly is provided at the end of each Pest Fact Sheet.

Creating a Pest Record

Each pest record in ExFor consists of a **pest fact sheet** which outlines the current knowledge of the pest in its present range, and a **pest risk assessment** which evaluates the likelihood of the pest's establishment in North America and the potential impact of the pest should establishment occur. The criteria to be used for the risk assessment are similar to those used within the regulatory agencies of member organizations for pest risk assessments conducted on individual pests or plants and plant products for plant quarantine purposes and are consistent with standards established by the International Plant Protection Convention (IPPC).

Creating a pest record includes four steps:

1. initial screening
2. pest fact sheet
3. pest risk assessment,
4. final evaluation

In the **initial screening**, the evaluator must decide if the pest meets the basic requirements for inclusion in ExFor. If so, the evaluator proceeds to step 2, writing the **pest fact sheet** using the headings and guidelines provided. In step three, **pest risk assessment**, information on the pest in question is reviewed to determine a relative ranking (high, medium, low) for the pest in each of four categories, i.e., establishment potential, spread potential, economic impact potential, and environmental impact potential. In the **final evaluation** stage, the Relative Risk Rating for the pest is calculated using the scores assigned in step 3. Each step is described in detail below.

Documenting the process is a critical element in ensuring consistency and completeness of the information contained in ExFor.

Some **key points** are important to remember while completing the evaluation, in order to maintain the consistency of the ratings:

- Gather information and complete the initial screening (step 1) before proceeding to the pest fact sheet (step 2).

- We strongly recommend that you prepare the Pest Fact Sheet before starting the risk assessment (step 3). Selecting the most appropriate ranking in any one category then becomes relatively straightforward.
- Refer to the definitions when in doubt.
- Keep this document on hand when completing the record, and refer to it.
- ExFor risk assessments do not consider possible pathways or routes of entry for individual pests. Assume that the pest is "at the door" in a life stage or in numbers suitable for establishment of a new colony. Pathways or means of introduction and spread can and should be documented in the Pest Facts Sheet.
- Four criteria are evaluated within the risk assessment process. For each, a number of statements are made which describes factors within the criterion in question. Select all that are applicable to the pest being evaluated. The rating is automatically generated by ExFor based on the number of statements selected and the evaluation scheme described within each criterion description.
- Where no reliable information is available, be cautious. Decisions may be based on information available for a closely related organism. When no information is available, use your best judgement but indicate the level of uncertainty associated with your assessment and the source of uncertainty in the space provided.
- Document everything. Provide a justification for each entry or decision when possible. This allows other reviewers to better understand the basis for your ratings.

Step 1: Initial Screening

In order to be included in ExFor, organisms must meet the following criteria:

1. The pest must be capable of causing economic or environmental damage in North America

AND one of the following:

2. The pest must be absent from North America (e.g., nun moth, *Lymantria monacha)*

OR

Present in North America, but has not yet achieved full potential range (e.g., European larch canker, *Lachnellula willkommii*)

OR

Present in North America, but populations elsewhere must differ biologically or genetically from populations present in North America (e.g., citricola root rot, *Phytophthora citricola*). Documented justification for this selection must be provided.

If both conditions, i.e., geographic distribution and potential economic or environmental impact, have been met, then the pest is a suitable candidate for ExFor.

Step 2: Pest Fact Sheet

The Pest Fact Sheet is intended to provide users of ExFor with all the information necessary to make decisions or plan activities in accordance with the goals of the project as stated earlier. The Pest Fact Sheet format is similar to that used by the European and Mediterranean Plant Protection Organization (EPPO) and other plant quarantine organizations. An adequate level of detail and inclusion of references is required in order that the Pest Fact Sheets will be useful to researchers and forest protection or quarantine officers with no prior knowledge of the pest in question. The Pest Fact Sheet should comprise ***factual*** information about the pest and its impacts in its indigenous habitat, or where it has been introduced to a new ecosystem. If the pest has already been introduced into North America, its impacts in the countries of this continent can also be considered. ***Speculation*** about the economic or environmental impacts of a pest in North America are more properly documented in the justification sections of the Pest Risk Assessment.

The **Pest Fact Sheet** should contain information in the following categories:

PEST IDENTIFICATION
The currently accepted scientific name and authors, synonyms, common names and taxonomic position should be included. Indicate common names as used in English, French, and Spanish rather than direct translations of names from one language to another. If there is not a common name in a particular language, do not include one. Common names in other languages may be included if widely known or used. Indicate the language associated with a common name in parentheses behind the name. For fungi, if there are scientific names for both the teleomorph and anamorph, list the anamorph(s) under synonyms and indicate this relation by use of parentheses [e.g., *Leptographium procerum* (anamorph)].

HOST(S)
Natural hosts reported throughout the pest's present range, and potential hosts based on host range studies or other information should be mentioned. Use scientific names of plant hosts, including family, genus, and species where practical. In order to allow full search capability in the database, do not abbreviate genera.

GEOGRAPHICAL DISTRIBUTION
Worldwide distribution should be recorded by continent. Include descriptions of distribution under the appropriate regional subheadings as follows: Africa, Asia, Australasia & South Pacific, Central America and Caribbean, Europe, North America, and South America. Include listings of countries where the pest is known to occur, when practical. If the pest is present in North America, detailed information on its present distribution should be provided.

Do not include text for regions where the pest does not occur.

BIOLOGY
This section should include a brief life history, description of overwintering and breeding habits, vectors when applicable, or possible limits to distribution.

PEST SIGNIFICANCE

Economic impacts

Environmental impacts

Economic and environmental impacts caused by the pest should be documented in this section. To the extent possible, the text should comprise factual data concerning actual economic impacts caused by the pest in its native range, or in situations where it has been introduced to a new ecosystem (including North America, if appropriate). Potential impacts on international trade should also be mentioned. Speculation about the pest's

potential economic and environmental impacts in North America should be addressed in the justification section of the Pest Risk Assessment (step 3, criteria 3 and 4).

CONTROL MEASURES
Provide general descriptions of control techniques available rather than specific phytosanitary regulations in individual countries.

DETECTION & IDENTIFICATION
Symptoms
Morphology
Identification tests

This section is divided into descriptions of symptoms, pest morphology, and specific testing methods for identification.

MOVEMENT & DISPERSAL
Both natural and man-made means of introduction or dispersal should be described. Mention products, such as crates, pallets, or dunnage, where they may serve as pathways for pest transport. Although pathways are not evaluated in the pest risk assessment, they are nonetheless important in the evaluation of a pest's likelihood of entry under specified conditions. Where records are available for North America, a summary of prior interceptions, introductions and eradication should be included. Identification of potential pathways in the Pest Facts Sheet will greatly enhance the usefulness of the database.

BIBLIOGRAPHY
Do not use abbreviations for journal and book titles. Do not use boldface, italics or other text formatting.

The following examples indicate the standards for citing a book, a journal article, published and unpublished reports, personal communications and a web site:

***Book*:**
Soper, J.H.; Heimburger, M.L. 1982. Shrubs of Ontario. Royal Ontario Museum (ROM), Ontario. 495 pp.

Journal article:
Whitbread, R. 1967. Bacterial canker of poplars in Britain. I. The cause of the disease and the role of leaf-scars in infection. Annals of Applied Biology 59: 123 - 131.

Published report:
FAO. 1979. Poplars and willows in wood production and land use. Published under the auspices of the International Poplar Commission, Food and Agriculture Organization of the United Nations, FAO Forestry Series No. 10. Rome. 328 pp.

Unpublished report:
Anonymous. 1987. Bacterial canker (Xanthomonas populi) of Populus spp. in The Netherlands. Plant Protection Service, The Netherlands, Wageningen, June 19th 1987. Unpublished report.

Personal communications:
Johannson, J.G. 2001. Dr. J.G. Johnasson, Virologist, Centre for Plant Research, Agriculture and Agri-food Canada, Ottawa, ON. Personal communication 22-November-2001.

Web site:

Anonymous (2001). Decay Fungi on Trees. Cornwall County Council, Truuro, UK. Web site: http://www.cornwall.gov.uk/Environment/trees/fungi.htm.

IMAGES

One goal of ExFor to provide high quality images of pests and/or the damage they cause for each pest record. Contributors of records are requested to provide images where possible. The preferred images are those that would be helpful as tools in identifying the pest, based either on the pest's morphology or on typical signs of infection or infestation.

Images for ExFor are handled by ForestryImages.org. The preferred format for submission is 35mm slides, but other types of images, including digital images, will be accepted. For instructions on how to submit images for inclusion as part of an ExFor record, please visit the web site or contact the technical coordinator. See the section on providing images to ExFor, below.

Step 3: Pest Risk Assessment

ExFor defines risk as a function of the likelihood of an adverse event (i.e., establishment of an introduced pest) and the impact of that event, should it occur.

The pest risk assessment stage of the evaluation, therefore, requires consideration of all available information to estimate the pest's potential in four categories, namely establishment, spread, economic impact and environmental impact. For each criterion, read the descriptive statements carefully and select those that apply to the pest in question. ExFor will automatically generate a ranking for the pest based on your selections in each criterion.

CRITERION 1 - ESTABLISHMENT POTENTIAL IN NORTH AMERICA

This factor considers the likelihood that the plant pest will successfully colonize a new area once it has entered North America. It does not include consideration of the pest's likelihood of entry nor the rate at which populations will expand to fill its expected range. Assume that the pest has been found somewhere in North America and estimate its likelihood to become established. Establishment potential is estimated as a proportion of the pest's host range in North America.

When selecting the most appropriate rank for establishment potential, consideration should be given such factors as:

- the number and life stage of the pest likely to be translocated
- host specificity
- availability of adequate host material
- availability of suitable climatic conditions
- ability to reproduce in North America
- availability of vectors or other dispersal agents in North America
- evidence of successful introductions in other world regions
- the anticipated final distribution of the pest relative to its host's or hosts' distribution in North America

Suggested resources for assessing the availability of suitable climatic conditions include plant hardiness zone maps or global climate maps, and expert systems such as CLIMEX (Sutherst and Maywald 1991; Sutherst et al. 1991), BIOCLIM/BIOMAP part of ANUCLIM (McKenney et al. 1998), or BioSIM (Régnière and Sharov 1997).

Those pests that, for reasons of climate, host preference, vector availability or other considerations, are estimated to have little or no likelihood of successfully establishing a population anywhere in North America are not valid candidates for ExFor (see Step 1).

Read carefully the statements that follow and select those that most closely apply to the pest being evaluated.

a. Organism has successfully become established in location(s) outside its native distribution.
b. Suitable climatic conditions and suitable host material coincide with ports of entry or major destinations in North America.
c. Organism has demonstrated ability to utilize new hosts.
d. Organism has active, directed host searching capability or is vectored by an organism with directed, host searching capability.
e. Organism has high inoculum potential or high likelihood of reproducing after entry.

Ex-For automatically generates a rating for **Establishment Potential** based on your selections according to the following guide:

High risk: Statement a applies, or Statement b and two or more of Statements c through e apply.

Moderate risk: Statement a does not apply; Statement b applies <u>or</u> two or more of Statements c through e apply.

Low risk: Statements a and b do not apply; none <u>or</u> only one of Statements c through e apply.

CRITERION 2 - SPREAD POTENTIAL

This criterion considers the likelihood of the plant pest spreading beyond the initial colonized area following its introduction. The rating for spread potential is a reflection of the pest's estimated potential to reach new habitats in North America following its establishment in one or more locales.

Factors to consider include:
- the pest's ability for natural dispersal, e.g., long distance flight, wind-borne transport of spores etc.
- availability of suitable vectors and the ability of the vectors to be naturally dispersed over a distance
- ability to use human activity for dispersal
- the distribution and abundance of suitable hosts
- the pest's reproductive potential
- the likelihood of early detection of a newly established population based on visual observation
- availability of effective means to slow or stop spread from occurring.

Read carefully the statements that follow and select those that most closely apply to the pest being evaluated.

a. Organism is capable of dispersing more than several km per year through its own movement or by abiotic factors (such as wind, water, or vectors).

b. Organism has demonstrated ability for redistribution through human-assisted transport.

c. Organism has a high reproductive potential.

d. Potential hosts have contiguous distribution.

e. Newly established populations may go undetected for many years due to cryptic nature, concealed activity, slow development of damage symptoms, or misdiagnosis.

f. Eradication techniques are unknown, infeasible, or expected to be ineffective.

g. Organism has broad host range.

Ex-For automatically generates a risk rating for **Spread Potential** based on your selections according to the following guide:

High risk: Five or more of the statements apply.

Moderate risk: Two to four of the statements apply.

Low risk: One or none of the statements apply.

CRITERION 3 - ECONOMIC IMPACT POTENTIAL IN NORTH AMERICA

This element considers the potential economic impact of the pest if it were to become established in North America. Assume that it occupies the full extent of its host(s)' range. Consider the economic importance of the host(s) and the direct and indirect economic effects of infestation. Do not consider environmental effects because they are considered in criterion 4. Use all available sources of information, including historical records of the pest's effects in its native range or in other locations, to reach the best possible estimate of the potential economic effects of introduction.

When selecting the most appropriate rank for economic impact potential, consider:

- the relative economic importance of the host(s) in North America
- the direct and indirect economic effects of infestation
- the type of damage caused by the organism to the living tree or to any harvested products
- the impacts on all affected industries, including forestry, nursery trades, recreation etc.
- the increased costs of production that may reasonably be anticipated as a result of infestation by the pest, including the costs of replacement, control, eradication, monitoring
- the loss of revenue that is anticipated due to reduced marketability or the loss of international/domestic markets, loss of aesthetic value affecting recreation industries etc.

Read carefully the statements that follow and select those that most closely apply to the pest being evaluated.

a. Organism attacks hosts or products with significant commercial value (such as for timber, pulp, wood products, wooden structures, Christmas trees, fruit or nut production, syrup production, etc.).

b. Organism directly causes tree mortality or predisposes host to mortality by other organisms.

c. Damage by organism causes a decrease in value of the host affected, for instance, by lowering its market price; increasing cost of production, maintenance, or mitigation; or reducing value of property where it is located.

d. Organism may cause loss of markets (foreign or domestic) due to presence and quarantine-significant status.

e. Organism has demonstrated ability to develop more virulent strains or damaging biotypes.

f. No effective control measures exist.

g. Organism has potential to be a more efficient vector of a native or introduced pest.

Ex-For automatically generates a risk rating for **Economic Impact Potential** based on your selections according to the following guide:

High risk: Four or more of the statements apply.

Moderate risk: Two or three of statements apply.

Low risk: One or none of statements apply.

CRITERION 4 - ENVIRONMENTAL IMPACT POTENTIAL OF THE PEST IN NORTH AMERICA

This element considers the potential environmental impact if the pest were to become established in North America. In selecting the most appropriate ranking for this element, assume that the pest occupies the full extent of its host(s)' range. Consider the environmental significance of the host(s) and the direct and indirect environmental effects of infestation. Use all available sources of information, including historical records of the pest's effects in its native range or in other locations, to reach the best possible estimate of the potential environmental effects of introduction.

When selecting the most appropriate rank for environmental impact potential, consider:

- the environmental significance of the host(s), i.e., dominant vs. minor species
- the degree of damage to the host(s)
- effects on keystone species
- abiotic effects that might result from infestation, e.g. increased erosion, increased fire hazard, change in soil composition
- biotic effects on other species that might occur, e.g. loss of food source, loss of nesting sites, loss of cover resulting in increased predation
- the potential for reduction in sustainability
- the potential for reduction in biodiversity
- potential for ecosystem destabilization to result from the pest's presence
- reduction or elimination of endangered/threatened species
- non-target effects of potential control measures

Read carefully the statements that follow and select those that most closely apply to the pest being evaluated.

a. Organism is expected to cause substantial direct environmental effects, such as extensive ecological disruption or large-scale reduction of biodiversity.

b. Organism is expected to have direct impacts on species listed by Federal, Provincial or State agencies as endangered, threatened, or candidate. An example would be feeding on a listed plant species.

c. Organism is expected to have indirect impacts on species listed by Federal, Provincial or State agencies as endangered, threatened, or candidate. This may include disruption of sensitive or critical habitat.

d. Organism may attack host with small native range.

e. Introduction of the organism would likely result in control/eradication programs that may have potential adverse environmental effects.

f. Organism has demonstrated ability to develop more virulent strains or damaging biotypes.

Ex-For automatically generates a risk rating for **Environmental Impact Potential** based on your selections according to the following guide:

High risk = Item "a" applies, OR item "b" applies, OR two or more of criteria "c" through "f" apply.

Moderate risk = One of the criteria "c" through "f" applies, AND neither item "a' nor item "b" applies.

Low risk = None of the following six criteria apply.

Step 4: Final Evaluation

In the final evaluation stage, the individual ratings for each of the four criteria evaluated in step 3 are used by ExFor to generate a Numerical Score. This figure translates to a Relative Risk Rating that ranges between "very high" and "low," and allows users of ExFor to quickly determine the relative seriousness of pests included in the database.

An organism must both establish a population and be able to spread from the point of entry in order to be a potential pest in North America. If an organism is able to enter North America, but cannot spread effectively, then the limiting factor is the spread. On the other hand, if it can spread rapidly, but the chance of establishment is small, then establishment would be the limiting factor. The impact of damage caused by the potential pest may be economic, environmental or both, but for purposes of risk, it is logical to use the higher of the two in determining a pest's overall risk.

The Relative Risk Rating of individual pests is therefore derived from the scores for probability of establishment and potential impact. In step 3, probability of establishment was estimated in the scores for Establishment Potential and Spread Potential, whereas the impact of establishment was estimated in the evaluation of Economic Impact Potential and Environmental Impact Potential.

ExFor uses the selected statements to determine a rating for each criterion and subsequently calculates the overall numerical score to determine a final risk rating for each pest. The ratings of each of the four criteria in step 3 are assigned a corresponding numerical value by ExFor. A value of 3 is assigned to any "High" score, whereas "Moderate" is valued as 2 and "Low" is 1. A Numerical Score is calculated automatically by ExFor, using the formula for risk, i.e.,

Numerical Score = The lower of (Establishment Potential and Spread Potential) x The higher of (Economic Impact Potential and Environmental Impact Potential).

The risk rating process is subjective. Nonetheless, the exercise serves as a reasonable approach to estimating relative risk of different organisms for the purposes of ExFor.

TABLE 1: NUMERICAL SCORE AND RELATIVE RISK RATINGS

Establishment Potential	Spread Potential	Score Used	Environmental Impact	Economic Impact	Score Used
H	H	3	H	H	3
H	M	2	H	M	3
H	L	1	H	L	3
M	H	2	M	H	3
L	H	1	L	H	3
M	M	2	M	M	2
M	L	1	M	L	2
L	M	1	L	M	2
L	L	1	L	L	1

Final Score:

Lower score of (Establishment Potential and Spread Potential)
X
Higher score of (Environmental Impact and Economic Impact)

Final Score "Relative" Risk Rating:

1 X 1 = 1 (VERY LOW)

1 X 2 = 2 (LOW)

1 X 3 = 3 (MODERATE)

2 X 2 = 4 (MODERATE)

2 X 3 = 6 (HIGH)

3 X 3 = 9 (VERY HIGH)

Degree of Uncertainty

Risk assessment is not an exact science. Uncertainty may arise when information is not available, or when some of the available information conflicts with other information. A considerable amount of professional judgment is required when assigning a ranking in any particular category of information. Participants are asked to indicate their comfort level with the final evaluation, based on the uncertainty inherent in each judgment. When uncertainty is high, participants are asked to identify sources of uncertainty. This is a useful guide to determining "gaps" in the information for the purposes of research planning.

Providing Images to ExFor

Exotic Forest Pest Information System (ExFor) Photographs

In cooperation with The Bugwood Network, The ExFor Coordination Council encourages individuals to submit photographs for inclusion in the ExFor database. Images provided to ExFor will be stored at the ForestryImages.org site, and will be available to any visitor to ExFor or to Bugwood Network sites for any educational use. Information on the Bugwood Network and instructions for submitting images is provided below.

The Bugwood Image Systems and Guidance on Contributing Images

BACKGROUND: Over 17,000 photographs of more than 3,200 subjects taken by over 450 photographers are now available through the Bugwood Image systems (up from 4,500 photographs of 1,200 subjects in available in November of 2001). Most of these images were digitized from high-resolution 35mm slides. Multiple levels of jpeg format images are downloadable and may be copied and used for any non-profit, educational purpose with appropriate credit and copyright notice. Initially, most images were of species and activities related to forestry, but now the systems include images about Invasive and Exotic species affecting, or potentially affecting virtually any agricultural/urban/natural areas in North America, general entomology and Integrated Pest Management in Agricultural systems as well. There are many images of species from other areas of the world, which are, of course, Exotics to North America.

Images are in these systems to be used! All images in these systems are downloadable, and are available for educational purposes with no royalties and fees as long as appropriate credits are given. For commercial applications, the user must contact the photographer and/or organization to develop and obtain specific release arrangements.

The Bugwood Suite of Image Sites comprises the following, complimentary and inter-related websites:

- *ForestryImages* **http://www.ForestryImages.org:** The Source for Forest Health, Natural Resources and Silviculture Images;
- *Invasive.org* **http://www.Invasive.org**: Invasive and Exotic Species of North America;
- *IPMImages* **http://www.IPMImages.org**: The Source for Agricultural Images; and
- *InsectImages* **http://www.InsectImages.org:** The Source for Insect Images.

The Bugwood Image systems utilize a custom-written, fully searchable, relational database-driven system to track and provide scientific, descriptive and photographic credit information. Several search and browse options are available to help locate images, including: scientific and common names, and "keyword" searches of descriptive information about the image.

Each photograph or digital image in these systems will be available for use by everyone with web access for educational purposes, with credits to the photographer, and, if desired some way to depict credit to the Mid-Atlantic group as well. Good quality 35mm slides that clearly show the target species are preferred.

Guidance for Providing Images

From Slides and negatives

- Let us scan them, or send to a Kodak PhotoCD (not PictureCD) provider
- Send Information with slides or complete the on-line form

- Verify that the information on the web is correct

As Digital Images

- There is a new interface for submission (e-mail Ketih Douce at bugwood@uga.edu for access)
- Images are not instantly available
- Images taken by cameras with resolutions > 2 megapixels (MP) are preferred
  (Number of pixels = horizontal resolution x vertical resolution)
- Levels of Digital Cameras

  Acceptable levels:
  - > 1 MP – 640x480 – e.g., original Sony Mavicas, limited use beyond on-screen viewing
  - 1-2 MP – 1600x1200 – Cost is currently ~$200, with limited features and optics

  Preferred levels:
  - 2-4 MP – resolution about 2,272 x 1,704 – Cost is ~$500, comparable to 35mm point and shoot
  - > 4 MP Zoom SLR – 2,560 x 1,920 - ~$1000, higher quality lens and features, uncompressed format (Sony, Minolta, Nikon, Olympus)
  - > 4 MP SLR – 3072x2048 (6.2) - ~$3000, interchangeable lens, approaching film quality and features (Canon, Nikon)

Tips

- Set compression to lowest setting
- Use uncompressed (RAW or TIFF) whenever possible
- Send image uncropped or unedited (as it came off the camera)
- Most digital cameras take images at 4:3 ratio instead of 3:2 ratio used by 35mm film, thus slight cropping must be done

Other Tips and Information

- Help us fill in the holes and gaps: *What do you have images of that we don't?*
- Provide as much information as possible about each image.
- Use available images as examples: *Where would your images fit in?*
- Images in system are available for non-profit, education purposes as long as credit is provided.
- Permission for commercial use must be granted by you, the photographer.

Please send slides/negatives or direct questions to:

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Contacting ExFor

Further information on ExFor may be obtained by visiting ExFor web site at **http://spfnic.fs.fed.us/exfor**, or by contacting the Project Coordinator or the Technical Coordinator. Questions about participating in this global project, or interpreting these guidelines should be directed to the Project Coordinator.

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