

Appendix C: Pest Risk Assessment Process

International plant protection organizations (e.g., North American Plant Protection Organization [NAPPO] and the International Plant Protection Convention [IPPC] of the Food and Agriculture Organization of the United Nations [FAO]) provide guidance for conducting pest risk analyses (FAO 1996, NAPPO 1993). “Pest risk assessment” is one stage of the pest risk analysis process and is defined as the “determination of whether a pest is a quarantine pest and evaluation of its introduction potential.” A “quarantine pest” is “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 1999). Further guidance pertinent to U.S. wood importations is contained in 7 CFR 319.40–11. The methods, detailed below, used to conduct this pest risk assessment are generally consistent with guidelines of the named organizations.

A. Collect pathway information.

1. Evaluate data from the United States on the history of past plant pest interceptions or introductions associated with SWPM.
2. Consider other potential pests of SWPM that may not be detected in routine inspections, particularly pathogens.
3. Collect information on how SWPM are used, moved, reused, and disposed of in worldwide commerce.

B. Select representative potential pest species for analysis.

Identify examples of potential pest species that represent combinations of geographic origin, host type, and pest habitat. Select pest species for which biological information is available. Select pest species from a range of insect and pathogen taxa. Include at least one example for each possible combination below, but allow some species to represent more than one combination (e.g., a species might occur both on bark and under bark). Selection of potential pests that may originate from tropical and subtropical regions may include species that occupy temperate habitats such as high-elevation forests. Selection of pest species for analysis is intended to represent an array of the types of exotic organisms that may be transported on SWPM and is not meant to be inclusive of all known pests of concern or of quarantine significance for SWPM worldwide.

<u>Level 1: Pest Habitat</u>	<u>X</u>	<u>Level 2: Geography</u>	<u>X</u>	<u>Level 3: Tree Type</u>
On bark		Tropical and Subtropical		Hardwood
Under Bark		Temperate		Conifer
In Deep Wood				

In an effort to gather information pertinent to the pest risk assessment, specialists in the fields of forest entomology and forest pathology were contacted for input. A preliminary matrix of potential organisms for analysis was compiled and sent electronically for review to subscribers of two mailing lists. Comments were considered in finalizing the list.

C. Prescreen species for quarantine pest status.

Determine whether selected representative plant pests have the potential to cause economic or environmental harm and additionally meet one of the following criteria (7CFR 319.40–11).

1. Nonindigenous plant pest not present in the United States;
2. Nonindigenous plant pest present in the United States and capable of further dissemination in the United States but under “official control”;
3. Nonindigenous plant pest that is present in the United States and has reached probable limits

of its ecological range but differs genetically (e.g., biotypes, pathovars, strains) from the plant pest in the United States in a way that demonstrates a possibility for greater damage potential in the United States;

4. Native species of the United States that has reached probable limits of its ecological range but differs genetically from the plant pest in the United States in a way that demonstrates greater damage potential in the United States;

5. Nonindigenous or native plant pest capable of transmitting another plant pest that meets one of the preceding criteria.

D. Conduct individual pest risk assessments (IPRA's) for the selected pests.

1. Evaluate the selected pest species or groups based upon available biological information and demonstrated or potential plant pest importance. Incorporate existing information from previous pest risk assessments conducted in accordance with 7 CFR 319.40–11, as appropriate. By developing detailed assessments for known pests that may inhabit different locations on SWPM (namely, on the surface of the bark, beneath the bark, and deep within the wood), effective mitigation measures may subsequently be developed to eliminate the known organisms and any similar unknown ones that inhabit the same niches. Omission of any species from analysis or lack of biological information on any given insect or pathogen should not be equated with low risk (USDA Forest Service 1993b).

2. Evaluate the following seven elements for each of the IPRA's and assign a risk value (high, moderate, or low) for each element. Each specific element in the pest risk assessment is assigned an uncertainty code (table C–1), as described by Orr et al. (1993).

Table C–1. Description of uncertainty codes used with specific elements in the individual pest risk assessment process

Uncertainty code	Symbol
Very Certain	VC
Reasonably Certain	RC
Moderately Certain	MC
Reasonably Uncertain	RU
Very Uncertain	VU

The risk value for each element is based on available biological information and professional judgment of the assessment team in accordance with risk criteria described below. Risk criteria serve as guidelines for assigning values of high, moderate, or low pest risk for the seven elements that make up the determination of pest risk potential. Rating elements have different critical components, which necessitates adopting variable numbers of criteria needed for rating levels. Consideration was given only to pests that may be associated in any life stage with the portion of the host plant to be transported in commerce. Where scientific information is lacking on a criterion for a particular organism, an evaluation of the criterion's appropriateness may be made based upon characteristics of closely related organisms. Organism complexes such as an insect vector and associated pathogen are to be rated as a unit; therefore, the term "organism" as used herein pertains to the complex of concern. Where there are wide variations among species within a complex being considered, ratings should be assigned to reflect the greatest level of risk. The risk value for an element may be modified based upon knowledge of important biological characteristics not addressed by the criteria.

A. Likelihood of introduction: Estimate the likelihood that the pest will enter and become established in the United States. Exotic organisms are considered established once they

have formed a self-sustaining, free-living population at a given location (U.S. Congress 1993).

1. *Presence with host or commodity at origin potential*—Likelihood of the plant pest being on, with, or in SWPM at the time of importation.

High risk = Item a applies, *or* five or more of criteria b through h apply.

Moderate risk = Item a does not apply *and* two to four of criteria b through h apply.

Low risk = Item a does not apply *and* one or none of criteria b through h applies.

- a. Organism has been repeatedly intercepted at ports of entry in association with host materials.
- b. Organism has the capability for large-scale population increases.
- c. Populations of organism are widely distributed throughout range of host(s).
- d. Organism has multiple or overlapping generations per year *or* an extended period (several months or more) of colonization activity and therefore has the capability to infest or infect new host material throughout at least one-quarter of a year.
- e. One or more stages of the organism may typically survive in the plant host for an extended time.
- f. Organism has active, directed host-searching capability or is transmitted by such an organism. Colonization activity may be directed by attraction to host volatiles, pheromones, or lights. Organism may generally be associated with recently cut or damaged host material.
- g. Organism has wide host range *or* primary plant hosts are widely distributed in several regions of the world.
- h. Organism is unlikely to be dislodged from host or destroyed during standard harvesting and handling operations.

2. *Entry potential*—The likelihood exists that the plant pest will survive in transit and enter the United States undetected. Important components of this element include the pest's ability to survive transport, which entails such things as the life stage and number of individuals expected to be associated with the host material (SWPM, in this case).

High risk = Item a applies, *or* two or more of criteria b through d apply.

Moderate risk = Item a does not apply *and* one of the criteria b through d applies.

Low risk = None of the criteria a through d apply.

- a. Multiple interceptions of live specimens of organism have been made at ports of entry in association with host materials.
- b. One or more stages of the organism are likely to survive in or on the plant host during transportation.
- c. Organism is protected within host material or is unlikely to be dislodged from host or destroyed during standard handling and shipping operations.
- d. Organism is difficult to detect (e.g., concealment within host material, small size of organism, cryptic nature of organism, random distribution of organism in, on, or associated with host material).

3. *Establishment potential*—A likelihood exists that the plant pest will successfully colonize once it has entered the United States. Some characteristics of this element include the number and life stage of the pest translocated, host specificity, and the likelihood of encountering a suitable environment in which the pest can reproduce.

High risk = Item a applies, *or* three or more of criteria b through f apply *including* item b or c.

Moderate risk = Item a does not apply *or* two or fewer of criteria b through f apply *including* item b or c.

Low risk = None of items a, b, or c apply.

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

4. *Spread potential*—A likelihood exists of the plant pest's spreading beyond any colonized area. Factors to consider include the pest's ability for natural dispersal, ability to use human activity for dispersal, the distribution and abundance of suitable hosts, and the estimated range of probable spread.

High risk = Five or more of the following eight criteria apply.

Moderate risk = Two to four of the following eight criteria apply.

Low risk = One or none of the following eight criteria apply.

- a. Organism is capable of dispersing more than several kilometers 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 owing to their 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.
- h. Organism has the potential to be a more efficient vector of a native or introduced pest.

- B. Consequences of introduction: Estimate the potential consequences if the pest were to become established in the United States.

5. *Economic damage potential*—Estimate of the potential economic impact if the pest were to become established. Factors to consider include the economic importance of hosts, crop loss, effects on subsidiary industries, and availability of eradication or control methods.

High risk = Four or more of the following six criteria apply.

Moderate risk = Two or three of the following six criteria apply.

Low risk = One or none of the following six criteria apply.

- a. Organism attacks hosts or products with significant commercial value (such as 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 the value of property where it is located.
- d. Organism may cause loss of markets (foreign or domestic) because of its presence and quarantine-significant status.
- e. Organism has demonstrated ability to develop more virulent strains or damaging biotypes.
- f. No known control measures exist.

6. *Environmental damage potential*—Estimate of the potential environmental impact if the pest were to become established in the United States. Factors to consider include the potential for ecosystem destabilization, reduction in biodiversity, reduction or elimination of keystone species, reduction or elimination of endangered or threatened species, and nontarget effects of control measures.

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.

- a. Organism is expected to cause **significant** 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 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 or State agencies as endangered, threatened, or candidate. This may include disruption of sensitive or critical habitat.
- d. Organism may attack host with limited natural distribution.
- e. Introduction of the organism would likely result in control or eradication programs that have potential adverse environmental effects.

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

7. *Social and Political Considerations*—Estimate of the impact from social or political influences, or both, including the potential for esthetic damage, consumer concerns, political repercussions, and implications for international trade.

High risk = Two or more of the following four criteria apply.

Moderate risk = One of the following four criteria applies.

Low risk = None of the following four criteria apply.

- a. Damage by organism would likely result in public concerns (esthetics, recreation, urban plantings).
- b. Presence of the organism would likely have domestic political repercussions.
- c. Presence of the organism would likely have international trade implications.
- d. Known effective control measures are likely to have limited acceptance.

E. Estimate unmitigated pest risk potential.

Develop an estimate of the unmitigated plant pest risk potential for each individual pest risk assessment based on the compilation of the risk values for the seven risk elements. The method for compilation was developed by Orr et al. (1993).

1. Step 1—Determine the likelihood of introduction. The overall risk rating for the likelihood of introduction acquires the same rank as the single element with the lowest rating. This is a result of the sequential nature of the elements describing the introduction pathway. For example, if the organism is unlikely to survive transit and therefore rates low for entry potential, the overall pest risk potential will remain low regardless of whether establishment potential or spread potential can be described as high based upon biological characteristics of the organism.

2. Step 2—Determine the consequences of introduction. A rating for consequences of introduction for a specific pest organism or group of organisms with similar habits is derived from individual ratings for economic damage potential, environmental damage potential, and social and political considerations, as shown in table C-2. Social and political considerations are overriding only in special circumstances when the organism does not already demonstrate the capacity for significant economic or environmental effects.

3. Step 3—Determine the pest risk potential. The pest risk potential for each IPRA is determined based on the ratings for likelihood of introduction and consequences of introduction (table C-3).

Table C-2. Method for estimating consequences of introduction for an individual pest risk assessment^a

Economic damage potential	Environmental damage potential	Social and political considerations	Consequences of introduction ^b
H	L, M, or H	L, M, or H	H
L, M, or H	H	L, M, or H	H
M	M	L, M, or H	M
M	L	L, M, or H	M
L	M	L, M, or H	M
L	L	M or H	M
L	L	L	L

^aL, low; M, moderate; H, high.

^bThe three elements that make up the consequences of introduction are not equally weighted. Generally, the consequences of introduction takes on the highest rating given to either economic damage potential or environmental damage potential. Ratings for social and political considerations are factored in only when ratings for both economic damage potential and environmental damage potential are low. In such a case, the rating for consequences of introduction can not be high.

Table C-3. Method for determining pest risk potential^a from likelihood of introduction and consequences of introduction

Likelihood of introduction ^b	Consequences of introduction		
	H	M	L
H	H	H	M
M	H	M	M
L	M or L ^c	M or L ^c	L

^aL, low; M, moderate; H, high.

^bThe overall risk rating for the likelihood of introduction acquires the same rank as the single element with the lowest risk rating.

^cIf two or more of the single elements that determine likelihood of introduction are low, pest risk potential is considered low, rather than moderate, for this assessment.