

PROCEDURES FOR WEED RISK ASSESSMENT

Plant Production and Protection Division
Food and Agriculture Organization
of the United Nations
Rome, 2004

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INTRODUCTION

BACKGROUND

Invasive plant species affect human health, agricultural and other systems, and their impacts are second only to habitat destruction in terms of loss of biodiversity. These concerns have generated growing international interest in quarantine legislation concerning weeds (see definitions, pp 3-5) and in weed-risk assessment systems to prevent the introduction of new pests and to prioritize existing pests for control. Weed-risk assessment is a new discipline and the first international symposium was held only recently in Australia (Groves *et al.* 2001).

Weed-risk assessment can be conducted at any stage of a species entry and spread into a country or area. The procedures described here are concerned primarily with preventing the entry and initial spread of plant species that are likely to become pests within a country, or which are there and ought to be considered pests. They describe the responsibilities of all participants in the process of plant importation required to halt the spread of weeds. Procedures involving weed-risk assessment for determining which species are prohibited imports, and which are to permitted entry, are described.

These procedures are based primarily on the experience of Australia and New Zealand, two countries that have effective quarantine protocols for preventing the introduction of and spread of unwanted plant species. One reason for the effectiveness of weed-risk assessment systems in these countries is a regulatory environment that enables the official plant protection organizations to restrict the movement of plants across the borders and within the countries. Without such national legislation, weed-risk assessment by itself cannot prevent the entry and spread of weeds.

Because of the growing concern of weed invasions FAO decided to develop draft weed-risk assessment procedures. To this end a set of proposed procedures was prepared by Dr. Peter A. Williams of Landcare Research, New Zealand, for an FAO technical meeting in Madrid 2002. This meeting was attended by weed specialists from several countries as follows: Dr. Dane Panetta (Australia), Ing. Jorge Padron Soroa (Cuba), Mr. Chris Parker (England), Dr. Jacques Maillet (France), Dr. Ricardo Labrada (FAO), Dr. Shunzi Kurokawa (Japan), Dr. Cesar Fernandez Quintanilla (Spain), Dr. Carlos Larios (Spain) Dr. Juan Monte (Spain), Mrs. Dantsey-Barry Hadyatou (Togo) and Dr.Randy Westbrook (USA).

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DEFINITIONS AND ABBREVIATIONS

Definitions given here are from, FAO. 2002: International Standards for Phytosanitary Measures, *Publication No. 5*. Glossary of phytosanitary terms. Secretariat of the International Plant Convention of Food and Agriculture Organization (FAO) of the United Nations, Rome. (<http://www.ippc.int/IPP/En/ispm.jsp>).

applicant/notifier	The party (e.g., seed importer, development agency) that requests permission to import a plant species into an area where it may have quarantine pest status.
area	An officially defined country, part of a country or all or parts of several countries.
bulbs and tubers	A commodity class for dormant underground parts of plants intended for planting (includes corms and rhizomes).
commodity class	A category of similar commodities that can be considered together in phytosanitary regulations.
containment	Application of phytosanitary measures in and around an infected area to prevent spread of a pest
control (of a pest)	Suppression, containment, or eradication of a pest population
ecosystem	A complex of organisms and their environment, interacting as a defined ecological unit (natural or modified by human activity, e.g., agro ecosystem), irrespective of political boundaries.
entry (of a pest)	Movement of a pest into an area where it is not yet present or present but not widely distributed and being officially controlled .
germplasm	Plants intended for use in breeding or conservation programmes.
grain	A commodity class for seeds intended for processing or consumption and not for planting .

IPPC	International Plant Protection Convention , as deposited in 1951 with FAO in Rome and subsequently amended.
micro-organisms	A protozoan, fungus, bacterium, virus or other microscopic self-replicating biotic entity
National Plant Protection Organisation	Official service established by a government to discharge the functions specified by IPPC .
official	Established, authorised or performed by a National Plant Protection Organisation .
organism	Biotic entity capable of reproduction or replication, vertebrate or invertebrate animals, plants and micro-organisms.
pathway	Any means that allows the entry or spread of a pest .
pest	Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products
Pest Risk Analysis	The process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it.
phytosanitary measure	Any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of pests .
plant products	Unmanufactured material of plant origin (including grain) and those manufactured products that by their nature or that of their processing, may create a risk for the introduction and spread of pests .
plants	Living plants and parts thereof, including seeds and germplasm .
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 .

seeds	A commodity class for seeds for planting or intended for planting and not for consumption or processing (see Grain).
spread	Expansion of the geographical distribution of a pest within an area
suppression	The application of phytosanitary measures in an infested area to reduce pest populations.
weed	A plant that is growing where it is not wanted by humans.

PURPOSE

These procedures are concerned only with assessing the risk of a plant species becoming a weed of sufficient importance to be classified as a pest. The official definition of a weed is plant that is growing where it is not wanted by humans, but it is useful to qualify “not wanted” as meaning some effort is made by some party to remove the plant. These procedures are a strictly technical assessment that takes no account of the potential benefits to be derived from allowing the species to be introduced or of not controlling it. The risks and the potential benefits must be balanced in a separate political process that ideally would involve all interested parties, that is not discussed here.

1. RESPONSIBILITIES AND RESOURCES

To be successful, weed-risk assessment requires an appropriate legal, institutional, and social framework that recognizes weeds are the concern of everyone.

1.1 Designation of authorities prior to importation of plant species

Governments should have a competent authority empowered to regulate or otherwise control and, where appropriate, institute procedures for the importation or introduction and release of plant species.

1.2 Use of powers

The authority may exercise its powers by applying national legislation or by using an internationally accepted standard. Import or export of potential weeds for any purpose should be carried out only with the consent of the proper authority.

1.3 Responsibilities of authorities

- Introduce and implement the necessary requirements to regulate the introduction of plant species in their countries, and make provision of effective surveillance and enforcement e.g., port inspections.
- Evaluate the technical dossier prepared by the importer/exporter on all plant species proposed for importation either as the primary material and/or as contaminants e.g., seeds for sowing. Issue permits stating conditions to be fulfilled by the importer/exporter or stating the grounds for rejection.
- Keep records of plant introductions including pathways of introduction and ensure compliance with regulations for the importation of plants.

1.4 Responsibilities of applicant/notifier

- To comply with all the regulations established by the country to control the importation of plant species.
- To prepare a dossier for submission to the authority with each application for the importation of plant species, whether intentional introductions e.g., seeds for sowing, or as unintentional contaminants of this same consignment.
- The information in the technical dossier should be derived from international sources and be aware of the plant quarantine requirements of the country. The information in the dossier should be sufficient to enable the authority to identify potential weeds in the consignment.

1.5 Development of resources

- Regulatory authorities or their agents e.g., research institutions, should develop the capacity to undertake weed-risk assessments. This will necessitate training botanists resourced with appropriate literature and access to international databases and contacts through the Internet. This is becoming increasingly important as the world network of on-line databases and the number of people involved in weed-risk assessment grows.
- Authorities need to place high priority in developing lists of plant species in their countries, including both known weeds and non-weeds, and of species that may potentially enter and become weeds.
- Authorities need to develop weed risk-assessment systems for plant species at all invasion stages ranging from those not yet in the area to those that are present and spreading within the area.
- Education concerning the importance of weeds, including the potential of apparently benign species to become weeds, should be a high priority in all countries.

2. FRAMEWORK

The actions taken to exclude a plant species from a country due to its weed potential must be consistent with existing standards regulating the movement of plant and plant products.

- A quarantine pest is defined as a “pest of potential economic importance in an area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled” (FAO 2001). For the purpose of these procedures, “economic importance” includes actual or potential effects on the functioning of ecosystems and the maintenance of all their component species.
- A Pest Risk Analysis involves “evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it” (FAO 2002).
- A pest capable of further spread, but which is not controlled, would require to be put under control to justify quarantine pest status. Most exotic species, in most countries, have potential for further spread.

- Weed risk-assessment is concerned with the first two formal stages of a Pest Risk Analysis (FAO, *Publication No.2*, 1996). Firstly identifying the pest that may qualify as a quarantine pest in a defined area (usually a country in the case of weeds) and secondly, determining the likelihood of its entry, establishment, spread, and economic importance of its impacts. This may include species already growing in a country that have not yet been classified as pests. The third part of a PRA, managing the risk, is a separate exercise not covered in these procedures.

3. WEED-RISK ASSESSMENT

3.1 Pathways

In order to identify and control the entry and spread of new exotic weeds, their pathways of entry must first be identified. Plants may be introduced into countries via 3 main pathways that will vary between countries according to their economies and the flow of trade goods and people. In most countries a high proportion of plant imports are for urban horticulture, commercial horticulture, or forestry. In several countries these purposeful introductions have been responsible for more than half the exotic weed flora. The second most important pathway has been via contaminated goods and products, such as seeds for sowing or consumption by humans or livestock. This pathway is universally important and is potentially the easiest to monitor because much attention is already paid to such products owing to their potential to spread diseases. The third pathway involves strictly accidental introduction of plants not included in either of the above pathways e.g., attached to clothing. While this pathway has great significance in the minds of many people it is actually the least important, because it usually involves small numbers of propagules, compared with, for example, a ship load of contaminated animal feed. Authorities need to determine the relative risk of these pathways in each country.

3.2 The process of weed-risk assessment

The most effective legislative framework to prevent the entry of new weeds is the concept of a Permitted List of plant species (or defined taxa). If a taxon with the potential to be a pest in an area is not on a list of taxa permitted to be in that area, then it will be prohibited until it has been determined whether it is potential quarantine pest. A formal weed-risk assessment is part of that process. All plants not present in the country i.e., exotic, are deemed to be prohibited until they have undergone assessment. By systematically undertaking weed-risk assessments, countries will develop lists of species that are either permitted entry and those that are prohibited. The latter will include those that are present and officially controlled in the area. Provided these Permitted and Prohibited lists are made publicly available, an applicant may readily determine whether the plant(s) species of concern to them are permitted or prohibited.

3.3 Information desirable for weed-risk assessment

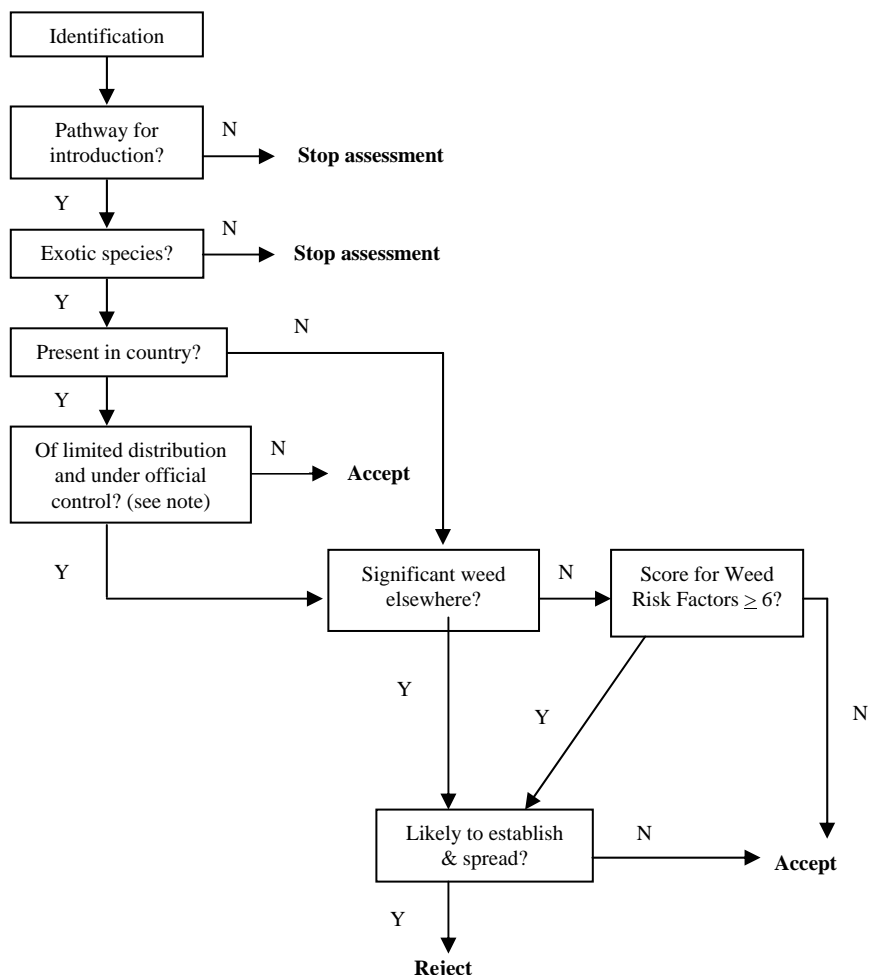
Prior to undertaking the actual weed-risk assessment, as much as possible of the following information should be obtained.

- A taxonomic description and valid scientific name.
- Synonyms of the accepted scientific name and common name(s).
- Whether the PRA was initiated via a pathway, or a potential pest, including:
 - The nature and source of the consignment (e.g., discovered in a corn shipment) and the source of the consignment.
 - The applicant/notifier in the case of proposed purposeful introductions (e.g., a forestry project), and proposed use of the plant. Species required for specialist conditions where some level of control might be possible (e.g., glasshouses) may pose less risk than species proposed for widespread planting in the wild (e.g., erosion control).
 - The location of the discovery of a potential pest inside a country and contact person (e.g., discovery of a new crop weed by a farmer). A specimen and grid reference is highly desirable.
 - The person in authority who received the application or information and the date.
- History of the species and its relatives in other countries.
 - Has the species become a weed elsewhere?
 - Does the species have weedy relatives in the same genus or family in other countries or the receiving country?
 - What effects has the species had where it has become a weed?
- Environmental tolerances.
 - Characteristics of the climate and soils in both its home range and its extended weedy range.
 - Do similar climates and soils exist in the present country? Note however, that many species tolerate a wider range of environmental condition when released from the constraints present in their home range.
- Undesirable traits that have made it a weed elsewhere or that might cause problems in the receiving country (e.g., unpalatable to live stock).
- Plant traits recognized as facilitating the spread and persistence of weeds in at least one kind of ecosystem/agricultural system (e.g., produces abundant small seeds).
- Plant has proved difficult to control in other countries or requires the use of specialized technologies.

- Potential impacts in the receiving country.
The possible effects of each potential pest arising from the attributes summarized above should be stated in order to defend the quarantine pest status of a plant species. It may be possible to describe the likelihood of the following broad classes of effects if the species was to be permitted entry or not placed under official control.
 - Damage to human health.
 - Loss of production in agricultural/horticultural systems.
 - Reduction in population levels of valued native plants and animals.
 - Disruption to natural ecosystems resulting in reduced ecosystem services e.g., lower water supply, reduced tourist attraction.

3.4 Weed-risk assessment systems

There are several weed weed-risk assessment systems in use world wide (Groves *et al.* 2001). The following weed-risk assessment system was constructed in the form of key by Drs. Dane Panetta and Peter Williams for use by countries with limited access to information or resources to undertake weed risk assessments. It embodies the general principles of weed-risk assessment used internationally, while requiring the minimum of information for an unequivocal outcome of accept or reject.



NOTES FOR USE OF WRA KEY

Is the species being assessed already present?

The decision is made to accept a species if it is widespread in the country and not subject to an official control program.

Scoring for Weed Risk Factors (critical score = 6)

Aquatic plant ?	Y=3
Other members of the genus are weeds ?	Y=2
Propagules likely to be dispersed intentionally or unintentionally by human activity?	Y=2
Produces spines, thorns or burrs?	Y=1
Parasitic?	Y=1
Unpalatable or toxic to grazing animals?	Y=1
Host for recognised pests and pathogens?	Y=1
Causes allergies or otherwise toxic to humans?	Y=1
Climbing or smothering growth habit?	Y=1
Produces viable seed?	Y=1
Seed persists for > 1 year?	Y=1
Reproduction by vegetative propagation?	Y=1
Tolerates or benefits from mutilation, cultivation, or fire?	Y=1

NB Where the status of a risk factor is unknown, it should be scored as a 'yes'.

Significant weed status

Significant weed status may be indicated by inclusion on an official list (quarantine or noxious weeds) OR citation in a reference dealing with weed control OR citation in a reference on weeds of agriculture or forestry OR citation in a reference addressing significant invaders of natural ecosystems. Very useful sources for this aspect are: A Global Compendium of Weeds by R.P. Randall (2002); online version at <http://www.hear.org/gcw/index.html>, and Ecoport: <http://www.ecoport.org/>

Likelihood of establishment and spread

The primary consideration is whether the climate in all or part of the target country is suitable for the species. This can be determined either with a computerised climate matching system or more broadly by reference to a climate atlas. If no assessment is made, it should be assumed that climate is suitable. Secondary considerations include whether predominant forms of land use would promote invasion, based upon the behaviour of the plant elsewhere. The existence of suitable land uses will increase the confidence of the prediction, but a positive climate match on its own is considered to be sufficient evidence for likely establishment and spread of the species.

3.5 Scenarios using the weed-risk assessment key

The following two scenarios illustrate how this key would be utilized; assuming countries had appropriate legislation and had adopted the permitted list approach (Section 3.2). A range of events may trigger a PRA and the key may be entered at several points. In the examples below, steps in the key are shown [thus].

- Example 1. Seeds of an unidentified species are discovered in a shipment of corn
 - [Identification] of the species.

- In this case a pathway is known and so the next step is to determine whether it is an [exotic species?].
If it is a native species [stop assessment].
 - If it is an exotic species, its [presence in the country?] is determined.
 - If the species is not present in the country the assessment automatically proceeds to [significant weed elsewhere?] and continues following the arrows until an outcome of [Accept] or [Reject] is obtained.
 - Alternatively, if the species is of [limited distribution in the country, and under official control?], the process also proceeds to [significant weed elsewhere?] and continues until an outcome of [Accept] or [Reject] is obtained.
 - If [Reject], the species is placed on the Prohibited List for the country. If [Accept], it is placed on the Permitted list.
 - Further weed-risk assessments need not be undertaken for this species.
- Example 2. Prohibited and Permitted lists may be compiled independently of the necessity to assess individual species associated with trade goods or requests to import them. In these cases, the starting point may not necessarily be at [identification], but the process of moving through the key would otherwise be the same.
 - For an existing weeds, the outcome of the enquiry as to whether it is of [limited distribution and under official control?] may be negative, not because of an existing classification, but because no assessment has previously been made. In this case, it is still appropriate to proceed through the key to determine whether the outcome is [Accept] or [Reject]. If the latter, a decision is then made whether to declare the species a quarantine pest, place it under official control, and enter it on the Prohibited list. In this way, countries may systematically compile their Permitted and Prohibited lists.

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