CAPACITY DEVELOPMENT

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Pest Status Guide

Understanding the principal requirements for pest status determination

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Abstract

This guide describes the steps that national plant protection organizations (NPPOs) should follow when determining the status of a pest in an area, starting with identifying the pest and the area under consideration. It provides guidance on gathering and evaluating information, assessing sources of uncertainty, and how to use pest records and other relevant information to determine whether a pest is present or absent in the area and then to select the appropriate pest status category, as described in International Standard for Phytosanitary Measures (ISPM) No. 8 (*Determination of pest status in an area*). This includes guidance on determining whether a pest is expected to establish in an area, and whether it is widely distributed or under official control. The guide describes the responsibilities of NPPOs when determining the status of pests within their territories, the requirements for national legislation to support actions relevant to pest status and how pest status determination fits within the international phytosanitary framework. It also describes how the outcomes of pest status determination may be used to support other key activities, such as preparing regulated pest lists, pest reporting, and securing or maintaining market access. Finally, the guide provides a number of case studies from around the world that highlight different aspects of the pest status determination process and how NPPOs deal with particular issues. By providing a deeper understanding of the process and the factors that should be considered when determining pest status, the guide aims to improve consistency in the processes used by NPPOs to make pest status determinations.

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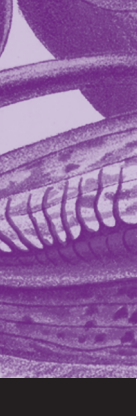
This document was created under the auspices of the Secretariat of the International Plant Protection Convention (IPPC) as a component of the IPPC National Phytosanitary Capacity Building Strategy, which was adopted by the Fifth Session of the Commission on Phytosanitary Measures (2010) of the IPPC. This work has been developed and peer-reviewed by selected experts all over the world under the coordination of the IPPC Secretariat and with the oversight of the IPPC Implementation and Capacity Development Committee. With this multinational team, it is hoped that the guide is globally applicable.

The development of the guide was possible thanks to the financial contribution of the European Commission's project for supporting the implementation of the IPPC (GLO/GCP/725/EC).



Abbreviations and acronyms

CEPM	Committee of Experts on Phytosanitary Measures
CPM	Commission on Phytosanitary Measures
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization of the United Nations
ICPM	Interim Commission on Phytosanitary Measures
IPP	International Phytosanitary Portal
IPPC	International Plant Protection Convention
ISPM	International Standard for Phytosanitary Measures
NPPO	national plant protection organization
PFA	pest free area
PRA	pest risk analysis
RNQP	regulated non-quarantine pest
RPPO	regional plant protection organization
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
WTO	World Trade Organization

Definitions

Area: An officially defined country, part of a country or all or parts of several countries [FAO, 1990; revised ISPM 2, 1995; CEPM, 1999; based on the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (WTO, 1994)]

Area of low pest prevalence: An area, whether all of a country, part of a country, or all or parts of several countries, as identified by the competent authorities, in which a specific pest is present at low levels and which is subject to effective surveillance or control measures [IPPC, 1997; revised CPM, 2015]

Buffer zone: An area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate [ISPM 10, 1999; revised ISPM 22, 2005; CPM, 2007]

Commodity: A type of plant, plant product, or other article being moved for trade or other purpose [FAO, 1990; revised ICPM, 2001]

Consignment: A quantity of plants, plant products or other articles being moved from one country to another and covered, when required, by a single phytosanitary certificate (a consignment may be composed of one or more commodities or lots) [FAO, 1990; revised ICPM, 2001]

Containment: Application of phytosanitary measures in and around an infested area to prevent spread of a pest [FAO, 1995]

Contaminating pest: A pest that is carried by a commodity, packaging, conveyance or container, or present in a storage place and that, in the case of plants and plant products, does not infest them [CEPM, 1996; revised CEPM, 1999; CPM, 2018]

Contamination: Presence of a contaminating pest or unintended presence of a regulated article in or on a commodity, packaging, conveyance, container or storage place [CEPM, 1997; revised ICPM, 1999; CPM, 2018]

Control (of a pest): Suppression, containment or eradication of a pest population [FAO, 1995]

Delimiting survey: Survey conducted to establish the boundaries of an area considered to be infested by or free from a pest [FAO, 1990]

Detection survey: Survey conducted in an area to determine if pests are present [FAO, 1990; revised FAO, 1995]

Emergency action: A prompt phytosanitary action undertaken in a new or unexpected phytosanitary situation [ICPM, 2001]

Emergency measure: A phytosanitary measure established as a matter of urgency in a new or unexpected phytosanitary situation. An emergency measure may or may not be a provisional measure [ICPM, 2001; revised ICPM, 2005]

Endangered area: An area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss [ISPM 2, 1995]

Entry (of a consignment): Movement through a point of entry into an area [FAO, 1995]

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 [ISPM 2, 1995]

Eradication: Application of phytosanitary measures to eliminate a pest from an area [FAO, 1990; revised FAO, 1995; formerly "eradicate"]

Establishment (of a pest): Perpetuation, for the foreseeable future, of a pest within an area after entry [FAO, 1990; revised ISPM 2, 1995; IPPC, 1997; formerly "established"]

Free from (of a consignment, field or place of production): Without pests (or a specific pest) in numbers or quantities that can be detected by the application of phytosanitary procedures [FAO, 1990; revised FAO, 1995; CEPM, 1999]

Harmonization: The establishment, recognition and application by different countries of phytosanitary measures based on common standards [FAO, 1995; revised CEPM, 1999; based on the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (WTO, 1994)]

Host range: Species capable, under natural conditions, of sustaining a specific pest or other organism [FAO, 1990; revised ISPM 3, 2005]

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]

Incursion: An isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future [ICPM, 2003]

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]

Inspection: Official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations [FAO, 1990; revised FAO, 1995; formerly "inspect"]

Intended use: Declared purpose for which plants, plant products or other articles are imported, produced or used [ISPM 16, 2002; revised CPM, 2009]

Interception (of a pest): The detection of a pest during inspection or testing of an imported consignment [FAO, 1990; revised CEPM, 1996]

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

International Standard for Phytosanitary Measures: An international standard adopted by the Conference of FAO, the Interim Commission on Phytosanitary Measures or the Commission on Phytosanitary Measures, established under the IPPC [CEPM, 1996; revised CEPM, 1999]

International standards: International standards established in accordance with Article X paragraphs 1 and 2 of the IPPC [IPPC, 1997]

Introduction (of a pest): The entry of a pest resulting in its establishment [FAO, 1990; revised ISPM 2, 1995; IPPC, 1997]

Lot: A number of units of a single commodity, identifiable by its homogeneity of composition, origin etc., forming part of a consignment [FAO, 1990]

Monitoring: An official ongoing process to verify phytosanitary situations [CEPM, 1996]

Monitoring survey: Ongoing survey to verify the characteristics of a pest population [ISPM 4, 1995]

National plant protection organization: Official service established by a government to discharge the functions specified by the IPPC [FAO, 1990; formerly "plant protection organization (national)"]

Non-quarantine pest: Pest that is not a quarantine pest for an area [FAO, 1995]

Official: Established, authorized or performed by a national plant protection organization [FAO, 1990]

Official control: The active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests [ICPM, 2001]

Outbreak: A recently detected pest population, including an incursion, or a sudden significant increase of an established pest population in an area [FAO, 1995; revised ICPM, 2003]

Pathogen: Microorganism causing disease [ISPM 3, 1995]

Pathway: Any means that allows the entry or spread of a pest [FAO, 1990; revised FAO, 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 ISPM 2, 1995; IPPC, 1997; CPM, 2012]

Pest diagnosis: The process of detection and identification of a pest [ISPM 27, 2006]

Pest free area: An area in which a specific pest is absent as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained [ISPM 2, 1995; revised CPM, 2015]

Pest free place of production: Place of production in which a specific pest is absent as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period [ISPM 10, 1999; revised CPM, 2015]

Pest free production site: A production site in which a specific pest is absent, as demonstrated by scientific evidence, and in which, where appropriate, this condition is being officially maintained for a defined period [ISPM 10, 1999; revised CPM, 2015]

Pest record: A document providing information concerning the presence or absence of a specific pest at a particular location at a certain time, within an area (usually a country) under described circumstances [CEPM, 1997]

Pest risk (for quarantine pests): The probability of introduction and spread of a pest and the magnitude of the associated potential economic consequences [ISPM 2, 2007]

Pest risk (for regulated non-quarantine pests): The probability that a pest in plants for planting affects the intended use of those plants with an economically unacceptable impact [ISPM 2, 2007]

Pest risk analysis (agreed interpretation): The process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it [ISPM 2, 1995; revised IPPC, 1997; ISPM 2, 2007]

Pest risk assessment (for quarantine pests): Evaluation of the probability of the introduction and spread of a pest and the magnitude of the associated potential economic consequences [ISPM 2, 1995; revised ISPM 11, 2001; ISPM 2, 2007]

Pest risk assessment (for regulated non-quarantine pests): Evaluation of the probability that a pest in plants for planting affects the intended use of those plants with an economically unacceptable impact [ICPM, 2005]

Pest risk management (for quarantine pests): Evaluation and selection of options to reduce the risk of introduction and spread of a pest [ISPM 2, 1995; revised ISPM 11, 2001]

Pest risk management (for regulated non-quarantine pests): Evaluation and selection of options to reduce the risk that a pest in plants for planting causes an economically unacceptable impact on the intended use of those plants [ICPM, 2005]

Pest status (in an area): Presence or absence, at the present time, of a pest in an area, including where appropriate its distribution, as officially determined using expert judgement on the basis of current and historical pest records and other information [CEPM, 1997; revised ICPM, 1998]

Phytosanitary certificate: An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements [FAO, 1990; revised CPM, 2012]

Phytosanitary certification: Use of phytosanitary procedures leading to the issue of a phytosanitary certificate [FAO, 1990]

Phytosanitary import requirements: Specific phytosanitary measures established by an importing country concerning consignments moving into that country [ICPM, 2005]

Phytosanitary legislation: Basic laws granting legal authority to a national plant protection organization from which phytosanitary regulations may be drafted [FAO, 1990; revised FAO, 1995]

Phytosanitary measure (agreed interpretation): Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests [ISPM 4, 1995; revised IPPC, 1997; ICPM, 2002]

Phytosanitary procedure: Any official method for implementing phytosanitary measures including the performance of inspections, tests, surveillance or treatments in connection with regulated pests [FAO, 1990; revised FAO, 1995; CEPM, 1999; ICPM, 2001; ICPM, 2005]

Phytosanitary regulation: Official rule to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests, including establishment of procedures for phytosanitary certification [FAO, 1990; revised ISPM 4, 1995; CEPM, 1999; ICPM, 2001]

Place of production: Any premises or collection of fields operated as a single production or farming unit [FAO, 1990; revised CEPM, 1999; CPM, 2015]

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 [FAO, 1990; revised IPPC, 1997; formerly "plant product"]

Plants: Living plants and parts thereof, including seeds and germplasm [FAO, 1990; revised IPPC, 1997]

Plants for planting: Plants intended to remain planted, to be planted or replanted [FAO, 1990]

Point of entry: Airport, seaport, land border point or any other location officially designated for the importation of consignments, or the entrance of persons [FAO, 1995; revised CPM, 2015]

Post-entry quarantine: Quarantine applied to a consignment after entry [FAO, 1995]

Production site: A defined part of a place of production, that is managed as a separate unit for phytosanitary purposes [CPM, 2015]

Prohibition: A phytosanitary regulation forbidding the importation or movement of specified pests or commodities [FAO, 1990; revised FAO, 1995]

Provisional measure: A phytosanitary regulation or procedure established without full technical justification owing to current lack of adequate information. A provisional measure is subjected to periodic review and full technical justification as soon as possible [ICPM, 2001]

Quarantine: Official confinement of regulated articles, pests or beneficial organisms for inspection, testing, treatment, observation or research [FAO, 1990; revised ISPM 3, 1995; CEPM, 1999; CPM, 2018]

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, 1990; revised FAO, 1995; IPPC 1997]

Regional plant protection organization: An intergovernmental organization with the functions laid down by Article IX of the IPPC [FAO, 1990; revised FAO, 1995; CEPM, 1999; formerly "plant protection organization (regional)"]

Regulated area: An area into which, within which or from which plants, plant products and other regulated articles are subjected to phytosanitary measures [CEPM, 1996; revised CEPM, 1999; ICPM, 2001]

Regulated article: Any plant, plant product, storage place, packaging, conveyance, container, soil and any other organism, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved [FAO, 1990; revised FAO, 1995; IPPC, 1997]

Regulated non-quarantine pest: A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party [IPPC, 1997]

Regulated pest: A quarantine pest or a regulated non-quarantine pest [IPPC, 1997]

Spread (of a pest): Expansion of the geographical distribution of a pest within an area [ISPM 2, 1995]

Suppression: The application of phytosanitary measures in an infested area to reduce pest populations [FAO, 1995; revised CEPM, 1999]

Surveillance: An official process which collects and records data on pest presence or absence by survey, monitoring or other procedures [CEPM, 1996; revised CPM, 2015]

Survey (of pests): An official procedure conducted over a defined period of time to determine the presence or absence of pests, or the boundaries or characteristics of a pest population, in an area, place of production or production site [FAO, 1990; revised CEPM, 1996; CPM, 2015; CPM, 2019]

Systems approach: A pest risk management option that integrates different measures, at least two of which act independently, with cumulative effect [ISPM 14, 2002; revised ICPM, 2005; CPM, 2015]

Technically justified: Justified on the basis of conclusions reached by using an appropriate pest risk analysis or, where applicable, another comparable examination and evaluation of available scientific information [IPPC, 1997]

Test: Official examination of plants, plant products or other regulated articles, other than visual, to determine if pests are present, identify pests or determine compliance with specific phytosanitary requirements [FAO, 1990; revised CPM, 2018]

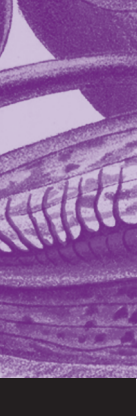
Tolerance level (of a pest): Incidence of a pest specified as a threshold for action to control that pest or to prevent its spread or introduction [CPM, 2009]

Transience: Presence of a pest that is not expected to lead to establishment [ISPM 8, 1998]

Transparency: The principle of making available, at the international level, phytosanitary measures and their rationale [FAO, 1995; revised CEPM, 1999; based on the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (WTO, 1994)]

Treatment (as a phytosanitary measure): Official procedure for killing, inactivating, removing, rendering infertile or devitalizing regulated pests [FAO, 1990, revised FAO, 1995; ISPM 15, 2002; ISPM 18, 2003; ICPM, 2005; CPM, 2021]

Note: These definitions are sourced from the IPPC *Glossary of phytosanitary terms* (ISPM 5). This list includes only those glossary terms that are used in this guide. The glossary is updated annually based on decisions taken by the IPPC Commission on Phytosanitary Measures. The complete and updated glossary is maintained at: https://www.ippc.int/en/publications/glossary-phytosanitary-terms. The definitions above are accurate as of May 2021.

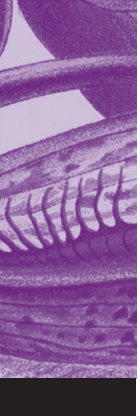


Names of pests

Scientific name, order and family	Common name
Agrilus planipennis Fairmaire (Coleoptera: Buprestidae)	emerald ash borer
Alternaria alternata (Fr.) Keissl. (Ascomycota: Pleosporales)	(causative agent of many leaf spots, rots, blights, etc.)
Anoplophora chinensis (Forster) (syn. *Anoplophora malasiaca* (Thomson)) (Coleoptera: Cerambycidae)	citrus longhorned beetle
Anthonomus eugenii Cano y Alcacio (Coleoptera: Curculionidae)	pepper weevil
Busseola fusca (Fuller) (Lepidoptera: Noctuidae)	maize stalk borer
Cactoblastis cactorum Berg (Lepidoptera: Pyralidae)	cactus moth
Ceratitis capitata (Wiedemann) (Diptera: Tephritidae)	Mediterranean fruit fly (medfly)
Clavibacter michiganensis subsp. *insidiosus* (McCulloch) Davis *et al.* (Micrococcales: Microbacteriaceae)	(causative agent of blight, root rot and wilt diseases in lucerne)
Cydalima perspectalis (Walker) (Lepidoptera: Crambidae)	box tree moth
Diabrotica virgifera virgifera LeConte (Coleoptera: Chrysomelidae)	western corn rootworm
Dickeya dianthicola Samson *et al.* (Enterobacterales: Pectobacteriaceae)	(causative agent of stunt and wilt diseases in ornamental flowers such as carnations and dahlia, and blackleg of potato)
Edwardsiana crataegi (Douglas) (Hemiptera: Cicadellidae)	apple leafhopper
Edwardsiana froggatti (Baker) (Hemiptera: Cicadellidae)	apple yellow leafhopper
Erwinia amylovora (Burrill) Winslow *et al.* (Enterobacterales: Erwiniaceae)	(causative agent of fireblight)
Frankliniella occidentalis (Pergande) (Thysanoptera: Thripidae)	western flower thrips
Leptinotarsa decemlineata (Say) (Coleoptera: Chrysomelidae)	Colorado potato beetle
Lobesia botrana (Denis & Schiffermüller) (Lepidoptera: Tortricidae)	European grapevine moth
Phyllosticta vaccinii Earle (Botryosphaeriales: Phyllostictaceae)	(causative agent of fruit rots and leaf spots)

Scientific name, order and family	Common name
Planococcus minor (Maskell) (Hemiptera: Pseudococcidae)	Pacific mealybug
Popillia japonica Newman (Coleoptera: Rutelidae)	Japanese beetle
Ralstonia solanacearum (Smith) Yabuuchi *et al.* (Burkholderiales: Burkholderiaceae)	(causative agent of bacterial wilt in potato)
Schistocerca gregaria (Forskål) (Orthopetera: Acrididae)	desert locust
Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae)	fall armyworm
Taraxacum officinale F.H. Wigg. (Asterales: Asteraceae)	dandelion
Tetranychus kanzawai Kishida (Prostigmata: Tetranychidae)	kanzawa spider mite
Thaumatotibia leucotreta (Meyrick) (Lepidoptera: Tortricidae)	false codling moth
Xanthomonas fragariae Kennedy & King (Lysobacterales: Lysobacteraceae)	(causative agent of angular leaf spot, leaf blight and vascular collapse of strawberry)

Introduction



ABOUT THIS GUIDE

The objective of this guide is to provide general guidance to contracting parties, national plant protection organizations (NPPOs), and public- and private-sector stakeholders at a national, regional and global level, on the main requirements for the determination of pest status, thus supporting the implementation of International Standard for Phytosanitary Measures (ISPM) No. 8 (*Determination of pest status in an area*) and other relevant ISPMs.

ISPM 8: *Determination of pest status in an area*

This standard describes the use of pest records and other information to determine pest status in an area. Pest status categories are defined and a description of the use of pest status for pest reporting is provided. This standard also provides guidance on the possible sources of uncertainty associated with information used to determine pest status.

This guide describes the responsibilities of NPPOs when determining the status of pests within their territories and discusses how pest status determination fits within the international phytosanitary framework. The requirements for national legislation to support actions relevant to pest status are described in relation to the International Plant Protection Convention (IPPC) and the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement).

The guide then goes on to describe the steps that NPPOs should follow when determining the status of a pest, starting with identifying the pest and the area under consideration. It provides guidance on gathering and evaluating information, assessing sources of uncertainty, and how to use pest records and other relevant information to determine whether a pest is present or absent in the area and then to select the appropriate pest status category. This includes guidance on evaluating whether a pest is expected to establish in an area, and whether it is widely distributed or under official control. Flow charts are provided to show the decision processes that are critical to successfully determining the status of a pest. These flow charts lay out the steps to follow when a pest is considered to be either "present" or "absent" from an area and are intended to help NPPOs select the appropriate pest status category for the pest and area under consideration. The structure of the manual follows the steps in the flow charts.

The last part of the guide discusses how the outcomes of pest status determination may be used in pest reporting and when determining whether a pest meets the criteria to be considered a regulated pest. It offers recommendations for establishing regulated pest lists and for pest reporting and also discusses pest status in the context of market access. Case studies that illustrate the steps followed by an NPPO to determine pest status and that otherwise support the contents of the *Pest status guide* are provided.

Users of the guide are encouraged to provide feedback on the guide to help strengthen future editions of the guide and other training resources.[1]

PEST STATUS IN THE INTERNATIONAL PHYTOSANITARY FRAMEWORK: THE INTERNATIONAL PLANT PROTECTION CONVENTION

The international framework for determination of pest status includes obligations to establish lists of regulated pests, to report changes in pest status, to support the categorization of pests, and to support the development of appropriate phytosanitary measures. These obligations are specified in several relevant articles of the IPPC and supported by the SPS Agreement. The IPPC outlines clear responsibilities on the part of the NPPO and contracting parties related to pest status determination (Table 1).

[1] Send email to ippc@fao.org

Table 1: Responsibilities of contracting parties and national plant protection organizations in the IPPC context

Functions of the NPPO related to pest status determination	IPPC articles or ISPMs
Specific surveillance within their territories with the object of reporting the occurrence, outbreak and spread of pests	Article IV.2(b), ISPM 6 and ISPM 17
The establishment and update of lists of regulated pests, using scientific names; such lists to be made available to the IPPC Secretariat, to regional plant protection organizations of which they are members and, on request, to other contracting parties	Article VII.2(i) and ISPM 8
The distribution of information within the territory of the contracting party regarding regulated pests and the means of their prevention and control	Article IV.3(a) and ISPM 17
Surveillance for pests, and the development and maintenance of adequate information on pest status. This pest status information should be used to support the categorization of pests, and for the development of appropriate phytosanitary measures. The NPPO is obliged to make pest status information available to contracting parties on request.	Article VII.2(j)
The protection of endangered areas and the designation, maintenance and surveillance of pest free areas and areas of low pest prevalence	Article IV.2(e), ISPM 4, ISPM 22 and ISPM 26
The conduct of pest risk analyses	Article IV.2(f), ISPM 2, ISPM 11 and ISPM 21
The issuance of phytosanitary certificates relating to the phytosanitary regulations of the importing contracting party for consignments of plants, plant products and other regulated articles	Article IV.2(a), ISPM 7 and ISPM 12
Contracting party obligations in support of the functions of the NPPO	
Report the occurrence, outbreak or spread of pests	Article VIII.1(a) and ISPM 17
Choose whether to regulate pests that are not capable of establishment in their territories but could cause economic damage if they gained entry. Any phytosanitary measures applied to prevent the introduction and spread of such pests must be technically justified.	Article VII.3 and ISPM 8
Not to require phytosanitary measures for non-regulated pests	Article VI.2 and ISPM 20
Ensure, as conditions change or as new facts become available, that phytosanitary measures are promptly modified or removed if found to be unnecessary	Article VII.2(h) and ISPM 20
Contracting party obligations in relation to international cooperation	
Cooperate with one another to the fullest practicable extent in achieving the aims of the IPPC	Article VIII.1 and ISPM 1
Cooperate in the exchange of information on plant pests, particularly reporting the occurrence, outbreak or spread of pests that may be of immediate or potential danger, in accordance with procedures established by the Commission on Phytosanitary Measures (CPM)	Article VIII.1(a) and ISPM 17
Cooperate, to the extent that is practicable, in providing technical and biological information necessary for pest risk analysis	Article VIII.1(c)

ISPMs: ISPM 1 (*Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*); ISPM 2 (*Framework for pest risk analysis*); ISPM 4 (*Requirements for the establishment of pest free areas*); ISPM 6 (*Surveillance*); ISPM 7 (*Phytosanitary certification system*); ISPM 8 (*Determination of pest status in an area*); ISPM 11 (*Pest risk analysis for quarantine pests*); ISPM 12 (*Phytosanitary certificates*); ISPM 17 (*Pest reporting*); ISPM 20 (*Guidelines for a phytosanitary import regulatory system*); ISPM 21 (*Pest risk analysis for regulated non-quarantine pests*); ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*); ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae)*).

REQUIREMENTS FOR NATIONAL LEGISLATION TO SUPPORT ACTIONS RELEVANT TO PEST STATUS

Determination of pest status in an area is a vital component of various activities undertaken to implement the IPPC and its ISPMs and is covered by the principles described in ISPM 1 (*Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*) and elaborated in other ISPMs.

ISPM 1: *Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*

This standard describes phytosanitary principles for the protection of plants that are embodied in the International Plant Protection Convention (IPPC) and elaborated in its International Standards for Phytosanitary Measures. It covers principles related to the protection of plants regarding the application of phytosanitary measures to the international movement of people, commodities and conveyances, and the principles inherent in the objectives of the IPPC. In this context, "plants" include cultivated and non-cultivated (or unmanaged) plants, wild flora and aquatic plants.

Responsibility and accountability for determining pest status rests with the contracting party. Pest status should be determined by the NPPO responsible for the area under consideration. To comply with this responsibility, NPPOs should be supported by appropriate legislation that provides for a national phytosanitary system with the appropriate mandate. The national legislation should identify the NPPO as the sole national authority responsible for the implementation of the provisions of the IPPC, and give the NPPO the mandate to: (i) determine pest status, (ii) carry out surveillance, (iii) adopt appropriate phytosanitary measures to verify and maintain pest status, and (iv) report the occurrence, outbreak and spread of pests.

The national legislation should provide the NPPO with the mandate to prepare a list of regulated pests. This will serve to define the pests that will be subject to regulatory control and serve as the basis for both the approval of surveillance programmes, including surveillance of areas under cultivation and of wild flora (Article IV, paragraph 2(b)), and the setting of import requirements. The NPPO should be legally mandated to maintain records and evidence to support the determination of pest status. This should include an obligation to keep records of pest outbreaks, approved phytosanitary measures and their justification, and the results of operational procedures to monitor, suppress or eradicate a pest. The national legislation should also define the roles and responsibilities of those stakeholders who support the NPPO in delivering its mandate related to the identification of pest status and the establishment and update of lists of regulated pests.

The NPPO should be mandated to undertake appropriate surveillance to support the determination of pest status, inform reporting of the occurrence, outbreak and spread of pests, and evaluate the success of control and eradication measures. In the case of pest occurrence, legislation should provide the NPPO with the ability to declare an area as infested or subject to quarantine, and to adopt measures to eradicate or contain the spread of the pest. Regulatory controls should restrict the movement of certain plants, plant products and regulated articles within areas of the country (or, in collective agreement with other NPPOs, within areas that extend over more than one country), including the establishment and maintenance of buffer zones. The NPPO should have legislation in place that allows it to detain and, if necessary, seize consignments with regulated articles to prevent or restrict pest movement. This authority should extend to all regulated articles, including goods, vehicles and conveyances. The national legislation should provide the NPPO with the authority to implement emergency phytosanitary measures.

Contracting parties should also ensure that the following provisions are included in their phytosanitary legislation or in official procedures:

- the establishment and maintenance of facilities for diagnostics or appropriate access to up-to-date diagnostic services to ensure that pests are properly identified; and
- mandatory domestic reporting (e.g. by research institutions, diagnostic laboratories, non-governmental organizations, industry, growers, local government or scientific groups) to the NPPO on detection or suspected presence of:
  - regulated pests,
  - pests new to an area, host or pathway,
  - pest outbreaks.

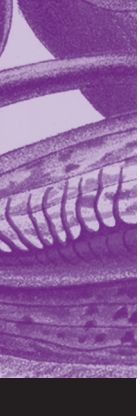
RESPONSIBILITIES OF NATIONAL PLANT PROTECTION ORGANIZATIONS IN DETERMINATION OF PEST STATUS

National plant protection organizations are responsible for determining pest status within their territories. The NPPO should base their determination of pest status on the most reliable and timely information available. The NPPO should also maintain pest records and supporting evidence and should re-evaluate the status of pests when appropriate. The following sections of this guide describe the main steps that an NPPO should follow in order to determine the status of a pest.

National plant protection organizations may need this pest status information when undertaking activities such as:

- pest risk analysis (PRA);
- establishing and updating lists of regulated pests;
- exchanging information as outlined in the IPPC;
- planning national, regional or international surveillance and pest-management programmes;
- establishing and maintaining pest free areas (PFAs), areas of low pest prevalence, pest free places of production and pest free production sites;
- responding to new pest detections and changes in pest prevalence or distribution in their territories;
- developing contingency plans for emergency response;
- responding to new scientific information, such as revisions in taxonomy or reports of pests with an unexpected or expanding geographical or host range;
- considering market-access requests and reviewing existing import trade;
- establishing phytosanitary regulations to prevent the entry, establishment and spread of pests, based on the outcome of PRA;
- responding appropriately to pest interceptions on imported goods and conveyances;
- establishing and maintaining lists of pests that are present in an area;
- issuing phytosanitary certificates and complying with the phytosanitary regulations of importing countries;
- preparing market-access submissions (see the Market Access Guide);
- responding to non-compliance reports from trading partners.

Steps in pest status determination



The steps that NPPOs should follow when determining pest status in their country are summarized in Figure 1 and elaborated in sections 1–9 in this guide.

The NPPO should begin by specifying both the pest and the area under consideration. Pest status should be determined for a particular pest relative to an area identified by the NPPO. Gathering information is a key step in the process of determining pest status. The NPPO should compile and evaluate all the available relevant information, including pest records, pest reports and scientific information about the presence, distribution, biology and economic importance of the pest. Other relevant information, such as a description of any official control measures and any factors that are likely to limit or prevent establishment, should also be noted.

The completeness and reliability of the different data sources used to support the pest status determination process should also be carefully evaluated. When an NPPO is not able to determine pest status, the NPPO should indicate that this is the case. It is good practice to identify and record any significant gaps in the available information and to note any areas of uncertainty. If there is insufficient reliable information available, the NPPO may need to carry out additional surveillance before completing the pest status determination process.

If there is sufficient reliable information, the NPPO should determine whether the pest is present or absent in the area. Once presence/absence has been determined, the NPPO can select the appropriate pest presence or pest absence category. Pest status should always be described according to the categories identified in ISPM 8.

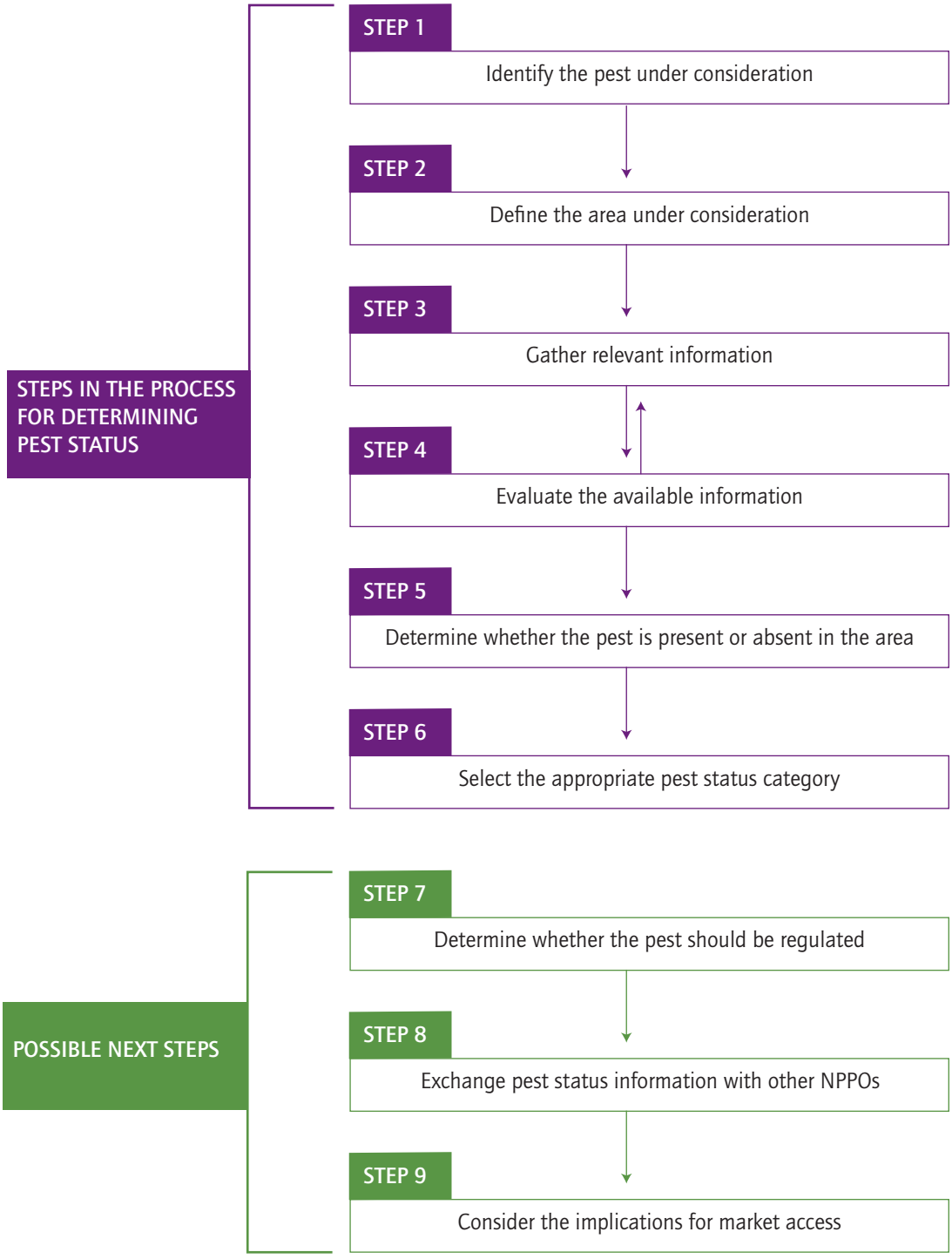
The process for determining pest status should be transparent and well documented so that the information that was used, the sources of that information, the uncertainties regarding data or conclusions, and the rationale used to arrive at a conclusion are clearly demonstrated. To this end, the information used to make a pest status determination should be recorded in the form of a pest status report.

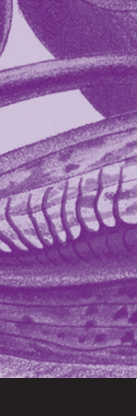
The purpose of a pest status report is to document the scope of the pest status determination, document the steps followed and record the key source or sources of information and evidence used to make the decision. The information in the pest status report supports the pest status determination that has been made and will make it easier to review the status of a pest when new information becomes available. The pest status report may also be used when there is a request from a trading partner to justify a particular pest status decision. A checklist for a sample pest status report is provided in Appendix 1. The scope of the pest status report can be easily expanded and included as part of a pest categorization or a PRA, if needed.

The NPPO is responsible for determining appropriate retention times for the pest status reports and the supporting information, taking into account that the information may be needed to support declarations of pest status.

The name of the person making the pest status determination, the date on which the pest status determination was made, and the date of the report should be noted in the pest status report.

Figure 1: Process for determining pest status





STEP 1.
Identify the pest under consideration

The first step in categorizing the status of a pest in an area is to specify the identity of the pest, including:

- scientific name (genus and species);
- describing authority (name of the scientist who first published this scientific name);
- synonyms;
- taxonomic position (order and family);
- common name for the relevant taxonomic group (e.g. insect, mite, mollusc, nematode, plant, fungus, virus).

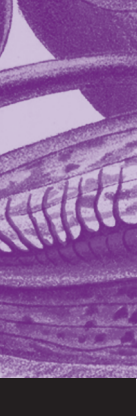
In some circumstances, it may be appropriate to specify the subspecies, strain, race or biovar of the pest, or any combination of these.

STEP 2.
Define the area under consideration

Pest status should be determined for an area identified and specified by the NPPO.

The status of a pest is often determined for an entire country. However, there may be good reasons for determining the pest status for areas smaller than a country. This is most common for large countries or countries with distinct geographical, biogeographical or bioclimatic regions.

For example, NPPOs in large countries may determine pest status in different administrative areas, such as different states or provinces, or in regions identified by distinct bioclimatic zones. In other cases, an NPPO may decide to determine the pest status of individual islands or other areas that are defined by natural geographical barriers to the spread of the pest, such as mountain ranges or deserts. It is also possible for a group of countries to determine pest status collectively; this might be the case for countries that have a common trading area.



STEP 3.
Gather relevant information

Gathering information is an essential step in the process of determining pest status. The determination of pest status is based on relevant information compiled from different sources and times. This information generally includes pest records, but it can also include pest reports and general information about the presence, distribution, biology and economic importance of a pest, or experimental evidence that a pest cannot survive the conditions in a given area. Biological information might include information about the organism's life cycle, dispersal capacity, global distribution, host or vector associations, experimental evidence of temperature tolerances, and so on.

Relevant sources of information for pest status determination may include:

- pest records;
- surveillance;
- reference collections of plants, insect pests, mites, molluscs and plant pathogens;
- scientific literature, reports and other written information:
  - peer-reviewed journals and books,
  - published documents that are not peer-reviewed;
- expert judgements;
- databases, websites and other online information sources.

3.1 PEST RECORDS

A pest record provides information concerning the presence or absence of a specific pest at a particular time and location (see ISPM 6 (*Surveillance*)). It can also include information on the host or hosts, damage observed and other relevant information pertaining to that single observation. Pest records are used in conjunction with other information to make a determination as to the status of a given pest in the area under consideration. Pest records should be properly and accurately documented and should be preserved in a permanent archive (i.e. be retained for an unlimited period). It is the responsibility of NPPOs to provide accurate information on pest records upon request.

The following basic information should be included in a pest presence record, when possible:

- current scientific name, previous scientific name or names of the organism (synonyms), name of the person that first described the species (describing authority), and any appropriate subspecific terms (strain, biotype, etc.);
- taxonomic position of the pest;
- scientific name and taxonomic position of the host or hosts, as appropriate;
- location: country, state or province, county, address, locality (a named feature that can be found on a topographic map or on a geobrowser such as Google Earth), geographical coordinates, elevation;
- year and month collected;
- name of collector;
- identification method or diagnostic procedure;
- identification date and name of identifier;
- location of voucher specimen or specimens.

Pest records, either alone or in combination with other evidence, may also be used to document pest absence. Pest absence records should include:

- survey method;
- survey date;
- survey location;
- screening method or diagnostic procedure;
- hosts or habitats inspected;
- name of person who carried out the survey, sampling, screening or diagnostic procedure.

When there are numerous pest records from a country or region, the confidence in the pest status determination is greater. It is important to

examine any pest records which appear to be unusual. For example, detecting a pest outside of its known geographical or bioclimatic range, or in an area with no known hosts or at an unusual time of year, may provide an indication of an expanding distribution. However, while unusual pest records may be an indication of new information about a pest, if they are uncorroborated by other information or pest records they could be erroneous or unreliable or represent an interception or failure to establish.

3.2 SURVEILLANCE

Surveillance is one of the core activities of NPPOs and it underpins several other key activities, including the determination of pest status in an area. In fact, surveillance is the main source of the pest records used for pest status determination.

ISPM 6: *Surveillance*

ISPM 6 (*Surveillance*) describes the requirements for surveillance, including the components of a national surveillance system. An IPPC guide on Plant Pest Surveillance is also available.

Surveillance programmes may include general surveillance and specific surveillance. Both types of surveillance may be used to support NPPO declarations of pest status:

- General surveillance: a process whereby information on pests of concern in an area is gathered from various sources. Sources may include national or local government bodies, research institutions, universities, museums, scientific societies (including those of independent specialists), producers, consultants, the general public, scientific and trade journals, unpublished data, and the websites of other NPPOs or international organizations (e.g. the IPPC, regional plant protection organizations (RPPOs), the Convention on Biological Diversity).
- Specific surveillance: a process whereby information on pests of concern in an area is obtained by the NPPO over a defined period. The NPPO actively gathers specific, pest-related data. Specific surveillance includes surveys that are conducted to determine the characteristics of a pest population or to determine which species are present or absent in an area.

General surveillance may be used to determine the pest status in an area, but it may also provide the context for undertaking specific surveillance. The NPPO may decide that the results obtained from general surveillance are sufficient to determine the pest status in an area. In other situations, the NPPO may use information obtained from general surveillance to supplement information gathered from specific surveillance. Specific surveillance should include the collection of both pest presence and pest absence records. The result of every observation or sample taken should be recorded, including when the pest was not found. Data on pest absence collected during surveys can be used by NPPOs to support a country's pest status and PFAs, and its trade and market access.

The data obtained from both specific surveillance and general surveillance may include the following:

- pest records;
- description of survey method;
- specifics of trapping or sampling effort (e.g. trapping density, frequency of sampling);
- maps;
- geographical location of pest observation;
- voucher specimens;
- information about host plants and host damage;
- information about prevalence (i.e. how common the pest is) and distribution;
- information about changes in prevalence and distribution (for example, from comparisons with survey data from previous years).

Gathering the information for pest status determination and carrying out specific surveillance can be time-consuming and costly. It may be necessary for an NPPO to prioritize its surveillance and other activities related to pest status determination in order to meet obligations and make the best use of available time and resources. Prioritization could consider the following factors:

- regulatory status of the pest;
- potential economic or biological consequences of the pest;
- importance of associated trade or market-access activities;
- need to support or justify emergency measures;
- availability of recognized diagnostic protocols.

Pest status example

Western corn rootworm (*Diabrotica virgifera virgifera*)

In the 1990s and 2000s, NPPOs across Europe carried out extensive delimiting surveys for the western corn rootworm, *Diabrotica virgifera virgifera* LeConte (Coleoptera: Chrysomelidae) – a North American pest of maize. By using pest-specific pheromone traps and recognized surveillance protocols, this network of national surveys revealed the spread of the pest across Europe over a number of years (Kiss *et al.*, 2005). Western corn rootworm is currently considered to be present in more than 20 countries in Europe. Specific surveillance has also been used to determine that this pest is absent from several other European countries. Additional information on the distribution of western corn rootworm is available at: https://gd.eppo.int/taxon/DIABVI/distribution.

Using an appropriate survey methodology is especially important if the surveillance results are to be used as evidence for declaring absence. However, if a pest is detected by surveillance that uses less rigorous survey methods, it can still be used to indicate presence, provided the NPPO has confidence in the pest diagnosis (e.g. if voucher specimens are available and the identity of the organism can be verified by the NPPO).

Ideally, NPPOs should establish good working relationships and strong communication channels with stakeholder groups that carry out surveillance independently from the NPPO. This could include sharing official survey protocols, providing training on appropriate methods to be used for surveillance, providing guidance on reporting new pest detections, recording and sharing surveillance results, and submitting samples or specimens for identification or confirmation.

3.3 REFERENCE COLLECTIONS

Reference collections, where pest specimens are preserved and kept long-term for future use, are an invaluable resource for an NPPO. Some reference collections are recognized nationally and internationally, some may be research collections held by universities, and others may be held by private institutions or even individuals. Some collections are very broad in scope and may include specimens collected in other countries, while others may be focused on particular taxonomic groups or particular geographical regions.

Specimens in reference collections can be an important source of pest records and other information that can be used for pest status determination, provided they are accompanied by reliable information about where and when the specimen was collected. For example, specimens in a reference collection may be used to confirm the presence of a pest in a country or in a particular area that is under consideration. They can also be used as a reference to help confirm a pest diagnosis. Reference collections may also be used to revisit existing pest records in situations where diagnostic methods have improved, or in cases of taxonomic revision. While reference collections may be used to indicate the presence of an organism in a particular location at a particular time, they generally do not provide information about the prevalence of the organism in an area.

In some instances, the absence of pest specimens in a well-established, comprehensive, national reference collection may be used, along with information from general surveillance or other evidence, to support the status "absent: pest not reported".

Specimens in a reference collection should include the following information if they are to be used to support pest status determination:

- genus, species, describing authority;
- identifier name, year of identification;
- collection location: country, state or province, county, address, locality (a named feature that can be found on a topographic map or on a geobrowser such as Google Earth), geographical coordinates, elevation;
- collection date;
- collector name;
- collecting method, habitat or host.

See case study 1 for an example of the use of reference collections in pest status determination

3.4 SCIENTIFIC LITERATURE, REPORTS AND OTHER WRITTEN INFORMATION

Reports and scientific publications may contain information that is critical to making a pest status determination, including:

- pest records;
- pest reports;
- pest lists;
- pest prevalence and distribution information, including maps (e.g. results of surveillance carried out independently of the NPPO);
- pest fact sheets and other biological information about life cycle, host associations, vectors, ability to establish in the environment, natural dispersal, economic importance, etc.;
- results of scientific research;
- pest-management information;
- crop-production information;
- climate information and models.

The information used to make a pest status determination may come from a variety of different places and each of these sources can be classified as either a primary or secondary source. A primary source is the original study, document, object or eyewitness account where the information first appeared. For instance, if a scientific study is performed, the primary source is the initial report that is prepared by the scientist who performed the research. A secondary source is a document that is written about the primary source and may be written either by the same author as the primary source or by a different author. Secondary sources are often documents that report, analyse, discuss, interpret or summarize primary sources.

Ideally, it is best to look at primary information sources to evaluate pest status, but this may not always be possible. Articles that report original studies or that record the detection of a pest in an area, whether it be in the field, protected cultivation, or a botanical garden, are primary sources of information. Sometimes a single primary source is referenced in a number of secondary sources and this can give the false impression that there have been numerous records of a pest, when in fact there has only been one. Book chapters are often secondary sources, but in some cases they may be primary sources. Review articles are considered to be secondary sources because they compile the data from primary research publications. Pest reports that do not refer to the primary source could be considered unreliable.

Pest lists

Lists of organisms that are present in a region or country can be a very useful guide to pest presence. It is helpful to understand the criteria used to include organisms in such lists (sometimes called "faunas" or "floras"). For example, the *Checklist of beetles of the British Isles* (Duff, 2012) includes species that have been reliably recorded from the British Isles as possible residents. Exotic species that are only known from casual importation and have never formed established populations are listed in an appendix.

National plant protection organizations should use the pest status categories outlined in ISPM 8 to describe the status of a pest in an area. However, it is important to acknowledge that there are many different terms and phrases that have been used to describe the prevalence and distribution of pests in the scientific literature, pest data sheets, historical pest reports, pest lists and other written information. It may be difficult to interpret what some of these terms and phrases really mean and whether they might be considered equivalent to any of the terms in ISPM 8. Appendix 2 provides general guidance on some commonly used phrases, together with a list of pest status terms and suggestions on what the equivalent ISPM 8 category might be.

3.4.1 Peer-reviewed journals and books

Peer-reviewed publications include:

- publications reporting a survey for a particular pest or group of organisms, or of a particular host plant;
- publications reporting an outbreak of a pest in a new area;
- reports of pest presence in a new area – for example a report of the first record of a pest in a country or region;
- results of research into the biology of a pest;
- reviews of a pest or pests in association with a particular host plant, crop, forest ecosystem or natural area;
- book chapters on pests or a crop, forest ecosystem or natural area.

3.4.2 Published documents that are not peer-reviewed

Extension-service reports, articles, bulletins, alerts, personal communications, and other published documents that are not peer-reviewed may provide useful information for general surveillance that will help NPPOs to determine pest status.

Reports that have not been through the anonymous peer-review process that is used by most scientific journals could potentially be less reliable if they have not been through equivalent processes for checking the data, but there may well have been rigorous checking by co-authors or colleagues in the same organization as the authors. Therefore, in general, although non-peer-reviewed publications are likely to be less reliable than peer-reviewed publications, this will not always be the case. Reading the details of pest reports and evaluating them based on some of the criteria listed in the third column of Table 2 (section 4.10) will be a better guide to reliability than basing a decision solely on whether the publication is peer-reviewed or not.

3.5 EXPERT JUDGEMENTS

An expert is a person with specific knowledge or skills in a particular subject area. Different experts may contribute to pest status determination, including taxonomists, agronomists, ecologists, researchers and industry specialists.

Experts may be able to provide information that is not available from other sources, such as unpublished pest records, experimental data and surveillance results. Experts may also be able to give an indication of economic importance, crop-damage observations, and so on. In addition, expert opinions can be useful for interpreting existing data on pests, identifying pests and forecasting the potential for pest establishment. Expert judgements may be helpful in reducing uncertainty when there are incomplete or contradictory scientific data.

3.6 DATABASES, WEBSITES AND OTHER ONLINE INFORMATION SOURCES

There are numerous databases, websites and other online resources that can be consulted and which may provide useful information for pest status determination.

Online information sources that may be helpful in pest status determination could include:

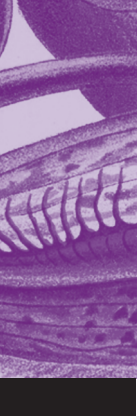
- databases and websites maintained by the IPPC Secretariat, the Food and Agriculture Organization of the United Nations (FAO), or phytosanitary authorities;
- global pest, taxon and commodity databases and other abstract compilation services;
- RPPO databases of quarantine pests for the region, which may include distribution data, quarantine status, host data and national reports concerning numerous pest species;
- information published by NPPOs, including regulated pest lists, lists of pests associated with particular commodities, reports of outbreaks of pests, and results of specific surveillance;
- online sources of national climate data, geographical information or maps, maintained by other national government authorities;
- industry and producer websites that may have information on pest prevalence, pest distribution, crop production and pest management;
- other online information sources and list servers, including university websites, passive-surveillance networks (e.g. citizen-science websites), news websites, and blogs.

Databases and websites that compile records from numerous sources are secondary sources, rather than primary sources of pest information. The reliability of the database or website as a whole will depend on the level of verification that is carried out before a pest record is included within the database or website. Databases and websites are likely to be less reliable if pest records have been included without a reference to the original source of the information. If references are included, it may be beneficial to check each pest record in a database or on a website to assess the reliability of the pest record.

Some websites allow members of the public to submit records of insects or other organisms they have spotted. Pest records from such sources can be hard to verify and unless the contributor of the record is known to have expertise related to the organism being reported, the records may be considered unreliable. Photographs submitted to such websites can often be of inadequate quality to enable identification

with any certainty and it may be difficult to verify where photographs were actually taken. Therefore, NPPOs might wish to provide guidance to the general public and to the owners of such websites on how to increase the quality and reliability of this information and to ensure that the NPPO is notified when new pests are reported in an area. Examples of online information sources and information-exchange platforms are provided in the Bibliography at the end of this guide.

See case study 2 for an example of how data gathered by citizen scientists may be helpful for determining pest status



STEP 4.
Evaluate the available information

When making pest status determinations, the NPPO should evaluate the available information and identify gaps and potential sources of uncertainty. It is important to ensure that the information used to determine pest status is relevant to the pest and to the area under consideration.

The NPPO has the sole authority and responsibility to determine pest status based on available information. The NPPO's decisions on the pest status in its jurisdictional territory should be based on the most reliable evidence available and should prevail over any incorrect or outdated information in the scientific literature. The quality and completeness of the information, the age of the information, the methodology used to obtain the information, and the extent to which the methods and interpretation of results are accepted and agreed upon by experts should all be considered when evaluating the information that has been gathered.

The quality and completeness of the information gathered will dictate the reliability of the pest status determination. As a general principle, the more information you gather, the stronger the weight of the evidence and the easier it is to justify the pest status determination. Having multiple pieces of information that support the same conclusion, especially if they are from several independent sources, is more convincing than having a single pest record or pest report. A single pest record or single information source is likely to be insufficient to make a pest status determination. The reliability and usefulness of the available evidence depends on factors such as the age and quality of the data, consistency of results, and relevance of the information.

Sometimes it may be difficult or impossible to determine pest status because there is insufficient information or because of uncertainty associated with the available information. When an NPPO is not able to determine pest status, the NPPO should indicate that this is the case.

Examples of where there is insufficient information include situations where the NPPO may not have carried out specific surveillance for a pest. This could be the case for pests that are not regulated and that have never been reported to cause economic damage, but where a pest status determination is required in order to secure market access. In other situations, where a pest has been newly detected in an area, the NPPO may have collected a single specimen but has not had the opportunity to complete an investigation or a delimiting survey. This could also occur when the NPPO receives a specimen or photograph of a specimen from a member of the public or from border personnel but has not yet completed its investigation or has not been able to obtain a validated pest record or specimen. In all of these situations, the NPPO may need to carry out additional surveillance before completing the pest status determination.

Uncertainty often arises when there are insufficient or missing data, inaccurate data, or unreliable information sources. Analysing the quantity of evidence and the reliability of the information may be particularly important when different sources of information provide different or conflicting conclusions. The most common ways of addressing information gaps, contradictory information and other sources of uncertainty is to gather additional information. In many cases, this means that the NPPO will need to carry out additional specific or general surveillance. In other cases, it may be important to evaluate the reliability of individual pest records and other data. Experts may be called upon to review the available information and form an expert judgement on the reliability of the existing data, based on their knowledge and experience.

ISPM 8 identifies a number of potential sources of uncertainty, including:

- limited information on pest biology;
- taxonomic revisions or ambiguity;

- contradictory or outdated information;
- difficulties with, or unreliability of, surveillance methodologies;
- difficulties with, or unreliability of, diagnostic methodologies;
- insufficient information on pest–host associations;
- unknown aetiology;
- detection of signs or observation of symptoms without finding the pest;
- insufficient information on the pest distribution in an area;
- unreliability of the information sources.

These sources of uncertainty are elaborated below.

4.1 LIMITED INFORMATION ON PEST BIOLOGY

Biological factors such as the pest's life cycle, means of dispersal, host range and host sequence, and rate of reproduction may influence the interpretation of pest records and may influence the design of surveillance and control programmes, the interpretation of survey data and the level of confidence in the categorization of a pest as not widely distributed.

The natural dispersal capacity of different groups of pests varies considerably. For example, most nematodes do not move more than a metre through the soil within their lifetime (Lambert & Bekal, 2009), although factors such as flood water and the movement of farm equipment can greatly increase the rate of spread. Other groups such as some fungi can disperse as airborne ascospores by wind over tens of kilometres (Hietala *et al.*, 2018; Zhang *et al.*, 2014). For many insect species, the adults have a much greater dispersal capacity than the juvenile stages. As a result, immature stages of pests are more likely to be found in close proximity to the hosts they developed in or on, whereas adults may have dispersed a distance from the hosts they developed on. Therefore, if immature stages are found on host plants that were not recently imported, this is likely to represent an established population. If only adult stages are found, they may have dispersed from recently imported hosts to the location where they are found or recorded.

When evaluating pest records, it is important to determine whether the record represents an established population of the pest in the location of the record. Some pest records can relate to detections of pests on recently imported products; alternatively, records may be indicative of migrant pests that are unable to establish. The probability of a pest being able to establish in the area being assessed is an important consideration. If there is a PRA, factors which are likely to limit establishment in all or a portion of the area under consideration may have already been considered. If there is no PRA available, NPPOs could consider evidence from laboratory studies (e.g. Kimura, 2004), from climatic modelling (e.g. Nacambo *et al.*, 2014) or a comparison of the climate in the current distribution of the pest with the climate in the new area or country. Szyniszewska & Tatem (2014), for example, showed that the Mediterranean fruit fly (medfly), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), was unlikely to establish in the northern parts of the United States of America or in Canada but had the potential to establish in large parts of Asia. In situations where a pest is likely (e.g. because it has established in a neighbouring country with a very similar climate) or very unlikely to establish (e.g. tropical pests intercepted in areas with cold winters), a quick decision can be made on establishment potential, as discussed by Baker, Eyre and Brunel (2013). Another consideration is whether or not suitable hosts are present and the number and distribution of these hosts. For example, pests that feed exclusively on temperate plants such as apples are very unlikely to establish in areas where apples are not grown, such as deserts or tropical areas.

Biological evidence may support the conclusion that the pest cannot establish. For example, there may be data showing that the hosts of a particular pest are not present in the country of concern. Laboratory studies showing that a pest is unable to survive sub-zero temperatures would provide evidence that a pest will not establish in temperate regions.

Some countries may be geographically isolated and have effective quarantine systems and phytosanitary measures in place on import pathways to prevent the introduction of regulated pests. In this case, general surveillance combined with geographical isolation, an effective quarantine system and phytosanitary measures on import pathways may be sufficient to conclude that a pest is absent.

For pests that have caused significant damage, especially those that have caused damage in several countries, there are likely to be readily available fact sheets or other publications to make an assessment of biology and ecology possible. However, some plant

pathogens and invertebrates may be unknown, or rarely known as pests in their country of origin, but can be a threat to countries where they are introduced. In such cases, it can be more difficult to gain an understanding of the biology of the organism and it may be necessary to make judgements based on the biology of similar species and factors such as the origin of any associated plant products.

4.2 TAXONOMIC REVISIONS OR AMBIGUITY

As scientific understanding of taxonomic groups develops, the delineations between species, subspecies and strains of pests can change. This could result in situations where pest records indicate the presence of a pest, but the taxonomic nomenclature is ambiguous or the identification or diagnostic methods are outdated. The taxonomic revision of groups of organisms can sometimes lead to an understanding that two or more species should be considered a single species or that a single species should be split into two or more species.

For example, at one time, the citrus longhorned beetle (Coleoptera: Cerambycidae) was thought to be two different species. In 2002, however, *Anoplophora malasiaca* (Thomson) as referred to by Adachi (1994) was synonymized with (i.e. determined to be the same species as) *Anoplophora chinensis* (Forster) by Lingafelter and Hoebeke (2002).

Therefore, when evaluating pest records, you should determine whether at the time a pest record was made the understanding of the pest species was the same as when the pest status was determined. If a species has been split or grouped, there may be doubts surrounding historical pest records. If there are voucher specimens, there may be an opportunity to re-examine them to determine to which of the two new species the record relates. If there are differences in distribution or host preferences for the newly described species, it may be possible to determine to which species the record is likely to be referring.

See case study 3 for an example of how taxonomic revision may impact pest status

4.3 CONTRADICTORY OR OUTDATED INFORMATION

Outdated information may be an unreliable indicator of the current status of a pest in an area and a recent pest record may provide more certainty than an old pest record. Scientific understanding about species distribution and the reliability of identification tools may change and improve over time. Also, pest distribution is not static and pests continue to be introduced and spread through human activities. Finally, pest distribution and prevalence change in response to host distribution and climate change. As such, older pest reports may not accurately reflect the current status of a pest and should be corroborated.

4.4 DIFFICULTIES WITH, OR UNRELIABILITY OF, SURVEILLANCE METHODOLOGIES

Information about the surveillance method used to obtain individual pest records can help NPPOs evaluate the reliability of the detection. This is likely to be particularly important for NPPOs when determining that a pest is absent from an area. For surveillance data to be considered reliable evidence that a pest is absent, the NPPO would need to verify that the sampling techniques were effective, the surveillance locations were appropriate, the number of sampling locations was sufficient, and surveys were conducted during the appropriate season and crop stage to maximize the chance that the target pest would be detected if it were present. In addition to sampling intensively in any particular year, the repetition of surveillance over more than one year can increase confidence that a pest is absent.

The inclusion of the surveillance protocol in the pest status report is especially important if NPPOs are trying to determine whether a pest has a restricted distribution in their country. The location where a pest is recorded should be geographically mapped as precisely as possible, using geographical coordinates of the sites if feasible, in order to ensure that the pest information is precisely linked to the area under consideration.

The sampling protocol is also likely to be important if pest records are the result of observational data only. Observational data can be reliable for easily recognizable pests or for those that cause characteristic symptoms, but would be very unreliable for pests that require microscopic examination to confirm

the species or cause symptoms that could also be attributable to other factors.

The time of year that samples have been taken or surveys conducted is important information to consider when evaluating pest records. For many pests, the life stage that is easiest or possible to detect is only detectable for part of a year or at a certain growth stage of a crop. If sampling or surveying has been carried out throughout the time of year when the pest is easiest to detect, then this will provide good evidence as to whether a pest is present or absent in a country. However, if sampling or surveying has been carried out at a suboptimal time of year to detect a pest, then this will be weak evidence for determining pest status. For example, in temperate parts of the world, some foliar pests may only be detectable on deciduous trees when the trees have leaves on them. Surveys carried out during the winter may be ineffective at detecting such pests. Likewise, in tropical parts of the world, pest populations may be undetectable during rainy seasons and only detectable during dry seasons. If a pest has been recorded at a time of year when it is unlikely to be detected, this could be another indication of unreliability.

4.5 DIFFICULTIES WITH, OR UNRELIABILITY OF, DIAGNOSTIC METHODOLOGIES

Pest records should include information about the identification method or diagnostic procedure used to identify the pest. Reviewing the details of how a pest was identified is an important step in assessing the validity of a pest record. It is important to be aware that the peer-review process for publications is based around the text in a manuscript and does not involve reviewers checking the identity of specimens. However, if the peer-reviewers have expertise in identifying the pest in question or pests in the same group they may have highlighted possible flaws in the diagnostic process, which then might have been addressed prior to publication.

Confidence in the pest record is higher when an internationally recognized diagnostic protocol, such as those associated with ISPM 27 (*Diagnostic protocols for regulated pests*), has been followed, particularly if the pest diagnosis was also carried out or confirmed by a recognized expert. If no internationally recognized diagnostic protocol is available for a particular organism, then it is important to consider how the diagnosis was carried out, including whether appropriate tools and methods were used to complete the diagnosis, whether the diagnosis was carried out by a person with adequate knowledge and training, and whether there is a voucher specimen available that can be used to confirm the diagnosis if there are any concerns.

ISPM 27: *Diagnostic protocols for regulated pests*

This standard sets the framework for the content of diagnostic protocols, their purpose and use, their publication and their development. Diagnostic protocols for specific regulated pests are included as annexes to this standard.

When assessing the reliability of a pest record it is important to consider the level of skill and experience of the identifier. This might involve reviewing the identifier's credentials, including their publication history or their experience in identifying the pest or other organisms in similar taxonomic groups. Of course, the skills and experience required to make an accurate determination will depend on how difficult the organism is to identify, as pests differ in the level of expertise needed for their identification. Larger organisms that have a distinct appearance or that cause characteristic symptoms may be relatively easy for a non-expert to identify accurately (e.g. Colorado potato beetle, *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae)). However, you may have less confidence in pest records prepared by non-experts if the organism is microscopic or requires considerable expertise or specialized laboratory equipment to reliably identify it or differentiate it from other closely related species.

In other situations, the NPPO may need to develop diagnostic capacity or seek external expertise to assist with pest diagnosis (e.g. voucher specimens may be sent to specialists in other parts of the world). The diagnostic protocols used by the NPPO should be current and should consider factors such as sensitivity, specificity and reproducibility in order to generate reliable pest records.

When a pest is found for the first time in a country, scientists may decide to send voucher specimens to a specialist in another country, particularly a country where the pest is present, in order to confirm the identity of the organism. For example, in 2002, voucher

specimens of emerald ash borer, *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), were sent from the United States of America to an expert in Slovakia to confirm their identity (Haack *et al.*, 2002). Reference collections in countries where a pest is present may have a large number of specimens available to check the specimens against.

4.6 INSUFFICIENT INFORMATION ON PEST–HOST ASSOCIATIONS

If there is insufficient information on the association of the pest with its host, it may also be difficult to determine whether the pest is widely distributed in the area under consideration or not. When a pest is widely distributed, it means that it is found throughout the area where hosts are available and environmental conditions are suitable for the development of the pest. If it is not widely distributed, then it means that its distribution is restricted to only a portion of its potential range. If the host range of the pest is not known, then it may not be possible to determine whether it is distributed throughout its potential range. To determine host range, studies on host susceptibility might be necessary, especially in the case of a pest that has been recently introduced to an area.

4.7 UNKNOWN AETIOLOGY

Aetiology is the study of the cause of diseases. If the aetiology is unknown it means that the pathogen or causal agent of the disease is unknown. Although it may be possible to describe the distribution and economic impact of the disease, it is not possible to carry out a pest status determination if the identity of the pest under consideration cannot be specified. Additional research would first need to be carried out to identify the causal organism. The fact that the pest status cannot be determined without this information should be recorded.

4.8 DETECTION OF SIGNS OR SYMPTOMS OF A PEST WITHOUT FINDING THE CAUSAL ORGANISM

There may be situations where the signs or symptoms associated with a particular pest may be observed, and the identity of the pest that caused the damage is known, but the pest itself is not found because it is either no longer present or alive. Specific surveillance would result in pest records that document the presence of damage but no living pests. This might be expected to be the case if a treatment is applied and the pest is no longer present but the signs and symptoms of the pest remain. In these situations, additional surveillance should be carried out to verify that the treatment was effective and that the pest is "absent: no longer present".

4.9 INSUFFICIENT INFORMATION ON PEST DISTRIBUTION IN AN AREA

In some cases, even if the available pest records provide accurate information about the location where the pest was collected, there may be insufficient information available to determine whether the pest is widely distributed or not (see 4.6 and 6.1.1 for a description of "widely distributed" and "not widely distributed"). Additional specific surveillance may be needed in order to gather additional pest records and complete the pest status determination.

Having reliable, accurate data about the geographical location where a pest was found is essential in order for an NPPO to determine pest status in an area. The level of precision about the geographical location where the pest was found may differ between pest records. Coordinates from a global positioning system (GPS) can provide very precise information about the geographical origin; however, some pest records may just provide the state or region within a country where the pest was found. Having precise location data is especially important when an NPPO wants to determine pest status for an area within a country or state.

If pest records are associated with a region that has since split into two or more countries, it may complicate the process for determining pest status. In such situations, the NPPO may need to gather additional evidence or carry out surveillance activities in order to understand which of the new countries the pest record is most likely to have come from and to ensure that pest status is appropriately determined.

4.10 UNRELIABILITY OF INFORMATION SOURCES

Information may be gathered from many sources, but the reliability of the information may vary from source to source. Highly reliable and current sources should be used to determine pest status. However, when such sources are not available, lower reliability sources may be used. This may increase uncertainty but can also help to identify information gaps which can be addressed through surveillance (see ISPM 6) and pest diagnostics (see ISPM 27).

Table 2 categorizes information sources based on their potential reliability. It is important to recognize that this table is designed as a tool to help NPPOs evaluate the reliability of different information sources. These categories are for guidance purposes only and are neither rigid nor exhaustive. The first column in each row gives at least one example of a scenario which might be considered to have higher reliability, the second column indicates scenarios that might provide lower reliability and the third column suggests some factors to consider when evaluating the reliability of an information source.

Table 2: Reliability of information sources

Information sources		
Examples of higher reliability sources	Examples of lower reliability sources	Factors to consider when evaluating the reliability of information sources
Surveillance data or results		
Specific surveillance carried out by the NPPO, or by entities authorized by the NPPO, as described in ISPM 6 (*Surveillance*)	Surveillance carried out by other entities that are not authorized by the NPPO (e.g. surveillance carried out by regional governments, researchers, industry or pest-management consultants, independent of the NPPO)	Type of surveillance (detection, delimitation, monitoring) Survey method or protocol used Scope, timing and intensity (e.g. number of locations surveyed) of surveillance Availability of comprehensive surveillance data, including historical data The period (season) of the survey and frequency of field visits Confidence in the identification and diagnostic methods used Availability of voucher specimens
Reference collections		
Nationally and internationally recognized reference collections	Reference collections held by institutions or individuals that are not nationally or internationally recognized	Number of specimens of the pest in the collection Quality of the individual specimen or specimens Completeness of the specimen record or records Credentials of the collector or identifier Confidence in the diagnostic method used
Peer-reviewed journals, books and other scientific literature		
Recent or multiple, independent pest records and pest reports published in relevant, internationally recognized, peer-reviewed journals	Old publications, particularly if taxonomy has changed in the intervening time and voucher specimens are not available Multiple publications that reference a single pest record or pest report in an old publication	Number of independent pest records Age of pest records Whether the pest is recorded in other countries in the region (e.g. adjacent countries) Confidence in the identification and diagnostic methods used Availability of voucher specimens
Unpublished sources and published sources that are not peer-reviewed		
Pest reports and other official documents authored by NPPOs, other national government authorities, or regional plant protection organizations, including information on the International Phytosanitary Portal (IPP) Expert opinions	Extension-service reports, articles, bulletins, alerts, trade journals, personal communications, etc., that are authored by regional governments, researchers, subject-matter experts, producers, consultants, the general public, etc.	Number of independent pest records Age of pest records Whether the pest is recorded in other countries in the region (e.g. adjacent countries) Confidence in the identification and diagnostic methods used Availability of voucher specimens Ease of pest diagnosis (detection and identification)
Databases, websites and other online information sources		
Databases and websites maintained by the IPPC Secretariat, NPPOs, regional plant protection organizations and relevant national government authorities	Databases, websites and other online information sources maintained by other organizations (e.g. CABI, FAO, universities, regional governments) Producer websites, passive-surveillance networks (e.g. citizen-science websites), news websites, blogs	Number of independent pest records Age of pest reports Whether the pest is recorded in other countries in the region (e.g. adjacent countries) Whether the information was validated prior to publication Whether the records are referenced to authoritative sources Availability of voucher specimens or ability to validate pest reports Whether there is a mechanism for reviewing and updating pest records Date when information on the website was last updated

STEP 5.
Determine whether the pest is present or absent in the area

The decision as to whether a pest is present or absent should be based on a careful review of all the available information that has been gathered, including current and historical pest records and other scientific evidence. The NPPO should use expert judgement in evaluating uncertainty and determining whether there is sufficient relevant and reliable information to make the pest status determination.

It may not be possible to complete the pest status decision if the only pest records available are historic or unreliable or if a pest has been recently introduced into the area. If there is insufficient relevant and reliable information available to determine whether the pest is present or absent in an area, then the NPPO will need to gather additional information before the pest status determination can be completed. In these situations, the NPPO may need to carry out specific surveillance to obtain additional pest records to support the completion of the pest status determination.

A number of additional factors can be taken into consideration in order to determine the appropriate next steps and help define the scope and protocols for this surveillance. Examples of relevant questions include the following:

- Are there pest records from adjacent countries that have a shared land border with the area? (If a pest is present in a neighbouring country, this increases the likelihood that it could be present in the area being assessed.)
- What is the natural capacity of the pest to spread? (Pests with a high natural capacity to spread (e.g. fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)) are more likely to be able to expand their distribution from nearby areas into the area being assessed.)
- Has the pest been found to be moving in trade? (Pests that have been intercepted in association with trade are more likely to be introduced into an area.)
- Have there been any changes in the distribution of host plants since the last record of the pest in the area? (If favoured hosts are no longer being grown in an area, this will reduce the risk of a pest being present.)
- Have there been changes in the variety of hosts grown, the production systems or pest-management regimes that might have changed the pest status of an area? (A shift to producing resistant varieties or a change in production or pest-management methods there may result in a change in the prevalence of the pest.)
- Have there been reports of the pest expanding its host range or moving into new bioclimatic zones? (This should be taken into consideration when designing surveillance programmes.)
- Is the pest itself, or the damage or symptoms that it causes in host plants, likely to be noticed? (Pests that do not cause economic or visible damage are less likely to be reported.)

Depending on the circumstances, the NPPO may determine that it is appropriate to gather additional scientific evidence to support completion of the pest status determination. For example, additional scientific evidence may be needed to support the conclusion that a pest is not expected to establish in the area under consideration. If, after considering all the available information, the pest status is still uncertain, it may be necessary to carry out additional specific surveillance in order to gather all the evidence needed to complete the pest status determination.

5.1 PEST RECORDS AND DETERMINATION OF PRESENCE OR ABSENCE

Pest records are the basis for NPPOs to determine the status of a pest in their country or an area within a country. Pest records should be used in conjunction with

other information about the presence, distribution, hosts and biology of the pest to determine the pest status.

Pest records can be used both to demonstrate that a pest is present in an area, and to support the conclusion that a pest is absent. Confirming that a pest is present may be a simple decision if there are recent reliable records of the pest in the area under consideration. However, proving pest absence is often much more challenging. It may be difficult to gather sufficient evidence to demonstrate that a pest is not present anywhere across an area and, since pest records are specific to a specific point in time, ongoing or regular surveillance may be required to demonstrate that the pest has not been recently introduced. While it is possible to prove presence with 100 percent confidence, absence can only be demonstrated with a degree of certainty.

Declaring pest absence, with a view to international accountability, generally requires more extensive supporting data than declaring pest presence. Whenever possible, the NPPO should base declarations of pest absence on the results of specific surveillance or other scientific evidence. A lack of information due to inadequate or insufficient surveillance activities is generally not sufficient for determining pest absence.

If a pest is known to be present in an area or country, or there are reliable pest reports that indicate that the pest is likely to be present in at least part of the area or country, then the NPPO should consider the pest to be present. Situations where the pest is present and widespread, limited to part of a country, or present except in PFAs or areas of low pest prevalence, or where there is a transient population, are all types of pest presence and are described in STEP 6.

Established populations are often reflected in multiple pest records over time, particularly if they are of economically important species. If only one or very few pest records exist, it may be an indication that there are only individual detections and that the pest may not be established or has a naturally low prevalence. However, a lack of pest records, particularly if not supported by the negative results of specific surveillance, is insufficient for declaring absence and may simply reflect the fact that the pest is not having an impact on crops in the area.

In some cases, it may be necessary or desirable to provide additional information about pest presence, for example:

- the extent of a localized outbreak;
- the prevalence of the pest;
- official control measures that have been applied;
- if the pest has only been reported under specific conditions, such as:
  - on specific hosts,
  - in enclosed structures (e.g. in a greenhouse),
  - in botanical gardens,
  - in the environment but not on a plant host (e.g. in soil or water),
  - in urban areas,
  - at certain times of the year.

5.2 CIRCUMSTANCES OF PEST DETECTION

Pest records can relate to a wide variety of circumstances and the exact circumstances of the pest detection can be important in understanding the pest record.

When determining pest status, it is important to define whether the records represent an established population of the pest in the location of the record. Some pest presence records may relate to detections of pests on imported products or migrant pests that are not expected to establish. Pests that are held under quarantine conditions for diagnostic or research purposes (as described in ISPM 34 (*Design and operation of post-entry quarantine stations for plants*)), and are thus under the official control of the NPPO, do not change the pest status of an area or country. Pest interceptions on imported consignments at points of entry also do not affect the pest status in the country of import, provided relevant phytosanitary measures are taken to prevent the introduction and spread of the pest within the country.

ISPM 34: *Design and operation of post-entry quarantine stations for plants*

This standard describes general guidelines for the design and operation of post-entry quarantine stations for holding imported consignments of plants, mainly plants for planting, in confinement in order to verify whether or not they are infested with quarantine pests.

Determination of pest status in an area requires evidence and expert judgement on the current distribution of a pest in the area. This judgement should be based on a synthesis of available information from various sources, also taking into account historical pest records, where available. Detection of a pest in an area, confirmed by surveillance not to represent an established population, should not affect the pest status in the area.

The location of pest detections can be an important indication of the risk of establishment. In most cases, a pest that is found outdoors is more likely to become established than a pest that is only found in protected cultivation. A tropical pest that is found in a glasshouse in a temperate country would not be expected to establish if it is unable to survive outdoors all year round. A pest that is detected on fresh fruit at a processing facility may be unlikely to establish if the procedures that are used for processing will kill or remove the pest. A pest that is detected at a port of entry is unlikely to establish if the consignment is treated, destroyed or refused entry.

Another consideration, when evaluating the risk of establishment, is the proximity of hosts. If pests are discovered on recently imported goods in an area a long way from favoured hosts, this will decrease the probability that establishment will occur. Conversely, if pests are detected in an area with many suitable hosts then this will increase the probability of establishment. If a pest is found in association with recently imported goods that have already been divided and distributed by the time a pest is discovered, there may be opportunities for the pest to spread to multiple areas with suitable hosts and establish. In this case, the risk of the pest establishing will depend upon the biology of the pest, the opportunities for tracing and recalling the infested consignment, the availability of hosts and the suitability of environmental conditions. A PRA can provide valuable data on the level of risk for pest introduction and spread.

Table 3 provides some additional examples of possible circumstances associated with pest records and factors to consider when interpreting this information.

Table 3: Interpreting the circumstances of a pest detection

Circumstances of pest detection	Factors to consider when interpreting the circumstances
Pest recorded one year, but not in subsequent years despite carrying out specific surveillance	There are many possible explanations for this situation, including any of the following: the pest may not have been established; the population may have been successfully eradicated; the pest may occur but may have naturally low prevalence; pest-management procedures may have kept the population below detectable levels; or the pest population may be below the detectable level using available tools.
Pest record from a glasshouse in a country with a temperate climate	The pest may not be expected to establish in the environment; the pest may be eradicated between crop cycles, particularly if the crop is cleared out and replanted, depending on other circumstances.
Detecting a non-mobile pest or life stage in association with a recently imported host	Some organisms depend on vectors to move them between hosts, while for other organisms only certain life stages are capable of dispersal. If pests are detected but there is no possibility of natural dispersal taking place, the risk of establishment may be low, depending on other circumstances.
Adult moths (Lepidoptera) caught in light traps or in pheromone traps	Moths may migrate long distances and detections may not accurately represent an established population in the area where the trap has been positioned. However, this information may still be highly significant depending on the size of the area under consideration and other circumstances.
An invasive plant species is listed for sale on a garden centre or nursery website	Although a plant may be listed for sale, it may not be established in the environment. If the plant is a regulated pest, the NPPO should launch an investigation to gather information about the sales volume and time frame and perhaps even where the plants may have been planted. The NPPO could use this information to determine whether to conduct specific surveillance to determine if the plant is established in the environment and, if so, where.
Photographs of pests taken by members of the public	There are a variety of reasons why photographs may not be representative of an established population in an area. Even if the quality of the photograph is good enough to identify the organism, it is often difficult to verify where and when the photograph was taken or what the pest was found in association with (e.g. the photograph could have been taken in another country or a long time ago or the pest might have been detected on imported products from a grocery store). If there is a possibility that the pest is a regulated pest, the NPPO should launch an investigation. This might involve contacting the photographer to gather additional information about the circumstances and reliability of the detection and could lead to specific surveillance to gather additional information.
Detecting a pest within a warehouse, distribution centre or food-processing facility	The pest may have been associated with imported plant products, including wood packaging, or it may have moved internationally as a hitch-hiker with consignments or shipping containers. These detections may be highly significant depending on the pest and other circumstances surrounding the pest detection.
Highly sensitive molecular techniques may detect the presence of an organism's RNA or DNA, even on non-host materials	Further investigation or surveillance may be required to determine whether the pest is present. Finding a pest's RNA or DNA but no evidence of living pests or signs or symptoms of the pest is generally not sufficient evidence to make a pest status determination.
Spores found in a spore trap	Spores may have originated from outside the area being assessed and may not be indicative of a local pest population. However, this may still be highly significant depending on other circumstances.
Viruses detected on the surface of seeds	The viruses may have contaminated seed during processing in the country of origin. However, this may still be highly significant depending on other circumstances.
Pests detected on imported plants or plant products at locations other than the point of entry	The consignment may have been split and sent to a number of locations by the time the pest has been discovered, thereby increasing the risk of establishment. Further investigation or surveillance may be required to determine whether the pest is present in any of these locations.

STEP 6.
Select the appropriate pest status category

The NPPO should decide upon the most appropriate description of the pest status in an area, based on the available information and as per the requirements of ISPM 8. Pest status determination should be based on an evaluation of the information gathered from various sources, including the results from surveillance (see ISPM 6), as described in STEP 3. If there is insufficient relevant and reliable information available to determine the pest status category, then the NPPO will need to gather additional information before the pest status determination can be completed.

If a pest is present in the area under consideration and sufficient reliable information is available, the pest status should be characterized using the categories described in section 6.1. The process of identifying the correct category is also summarized in Figure 2.

If a pest is absent from the area under consideration and sufficient reliable information is available, the pest status should be characterized using the categories described in section 6.2. The process of identifying the correct category is also summarized in Figure 3.

6.1 PRESENCE CATEGORIES

When the NPPO determines that there is sufficient reliable information to determine that a pest is present in the area under consideration, the NPPO should use the appropriate presence category provided in ISPM 8 to more accurately describe the status of the pest. These categories of pest presence, which are described in more detail below, provide further characterization of the current pest status based on the ability of the pest to establish, its distribution within the specified area, and whether it is subject to official control.

6.1.1 Present: widely distributed

This category should be used in situations where the pest is established and distributed throughout the area, wherever environmental conditions are suitable and hosts are available, and is not under official control.

When a pest is considered to be widely distributed, it means that it is found throughout the area where hosts are available and environmental conditions are suitable for the development of the pest. When a pest is considered to be not widely distributed, this means that the pest is limited to only some parts of its potential distribution and there are areas where environmental conditions are suitable for the development of the pest and hosts are available but which are free from the pest.

For example, the area for which pest status is being defined could be an entire country, but the zone of potential distribution (the potential range) may extend to only a part or parts of the country where hosts are available and conditions are suitable for the development of the pest. If the pest is present throughout the area where it would be expected to establish (its potential range), the pest is widespread or widely distributed. If the pest is only present in some parts of its potential range, it is not widely distributed. In order to justify the statement of a pest being not widely distributed, a description and delimitation of the pest's distribution should be made available if requested.

"widely distributed" vs "not widely distributed"

widely distributed – the pest is present throughout its potential range

not widely distributed – the pest is only present in a part or parts of its potential range

Additional guidance may be found in Supplement 1 (Guidelines on the interpretation and application of the concepts of "official control" and "not widely distributed") to ISPM 5 (*Glossary of phytosanitary terms*).

Many of the organisms in this category are common economic pests that are managed at the farm level by producers. This category includes pests with a worldwide distribution, such as dandelion (*Taraxacum officinale* F.H. Wigg. (Asterales: Asteraceae)), western flower thrips (*Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae)), and the fungus *Alternaria alternata* (Fr.) Keissl. (Ascomycota: Pleosporales) that causes many leaf spot, rot and blight diseases. It may also include pests that are indigenous to the area under consideration, such as maize stalk borer (*Busseola fusca* (Fuller) (Lepidoptera: Noctuidae)) in Africa.

If a pest is present in an area and there is no evidence to suggest that the pest is "not widely distributed", then it should be assumed, in the regulatory context, to be widely distributed through its potential range.

6.1.2 Present: not widely distributed and not under official control

In this case, the pest is established, but its distribution is currently limited to a part or parts of its potential range within the area. Because there are no official control measures in place, the distribution of the pest may change over time.

This category may apply to new pest incursions, or to recently detected, localized outbreaks where the NPPO has made a decision not to regulate the pest or implement official controls, or in situations where an eradication programme has failed. In these situations, the pest will not yet have had time to distribute across its entire potential range, but eventually it probably will do. Regular surveillance (general or specific, as described in ISPM 6) should be carried out to monitor changes in the distribution of the pest. If no surveillance is carried out, it should be assumed that the pest will eventually become widely distributed and this status category would therefore no longer be appropriate.

ISPM 5: *Glossary of phytosanitary terms*

This reference standard is a listing of terms and definitions with specific meaning for phytosanitary systems worldwide. It has been developed to provide a harmonized, internationally agreed vocabulary associated with the implementation of the International Plant Protection Convention (IPPC) and International Standards for Phytosanitary Measures (ISPMs). Within the context of the IPPC and its ISPMs, all references to plants should be understood to continue to include algae and fungi, consistent with the International Code of Nomenclature for Algae, Fungi, and Plants.

ISPM 5: Glossary of phytosanitary terms – Supplement 1: Guidelines on the interpretation and application of the concepts of "official control" and "not widely distributed"

This supplement provides additional guidance on:

- official control of quarantine pests that are present in an area, and corresponding guidance on regulated non-quarantine pests; and
- determination of when a pest is considered to be present but not widely distributed, for the decision on whether a pest qualifies as a quarantine pest.

6.1.3 Present: not widely distributed and under official control

This category may be applied to a pest that is established in just a portion of its potential range and which is under "official control" in accordance with Supplement 1 to ISPM 5 (*Glossary of phytosanitary terms*).

Official control is defined as "the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests" (ISPM 5). The term "official control" therefore applies only to quarantine

Pest status example

***Phyllosticta vaccinii* in Argentina**

In Argentina, *Phyllosticta vaccinii* Earle (Botryosphaeriales: Phyllostictaceae) – a fungus that causes root rot in blueberry plants – is an example of a pest that is **present: not widely distributed and not under official control.** It is currently restricted to a single, isolated production area in the province of Tucuman. The pest has not been reported in any of the other blueberry production areas in Argentina, which are located in other provinces. However, no official control measures are being applied. The blueberry production areas are not contiguous and general surveillance is used to verify that the pest is not present in other provinces where blueberries are produced.

pests and regulated non-quarantine pests, and indeed the words "present but not widely distributed and under official control" express an essential concept in the definition of "quarantine pest". In order to be considered a quarantine pest, the pest must either meet the criterion of being absent from the area or it must meet the combined criteria of being (i) present but not widely distributed and (ii) subject to official control. Please refer to section 7 for additional guidance on quarantine pests and regulated non-quarantine pests.

Official control includes:

- suppression, eradication or containment in the infested area or areas;
- surveillance in the endangered area or areas;
- restrictions related to the movement into and within the regulated area or areas, including phytosanitary measures applied at import.

The purpose of the official control should be stated alongside the pest status determination. For quarantine pests, eradication and containment may have an element of suppression. For regulated non-quarantine pests, suppression may be used to avoid unacceptable economic impact as it applies to the intended use of plants for planting. (See ISPM 5, Supplement 1.)

It may also be helpful for NPPOs to distinguish between official controls designed to stop pests from moving out of an infested area (such as where there has been a localized incursion that is being contained or eradicated) and official controls designed to stop a pest from moving into an uninfested area. The latter often includes official controls implemented to protect a geographically isolated production area.

Official control

If pest risk analysis results indicate that official control of a pest is technically justified and the pest meets the criteria to be considered a regulated pest (see section 7), then the NPPO may choose whether or not to officially control the pest and place it on the list of regulated pests. Factors to consider when choosing whether or not to apply official control include:

- costs and benefits of regulating specific pests;
- technical and logistical ability to control a pest within a defined area.

As well as being technically justified, official control programmes should also meet other specific requirements related to non-discrimination, transparency, enforcement, the mandatory nature of official control, the area of application, and NPPO authority and involvement in official control.

For further guidance on quarantine pests, regulated non-quarantine pests and regulated pest lists, see sections 7.1, 7.2 and 8.2, respectively.

Case study 5 describes the steps taken by Argentina's NPPO to establish official control measures for a pest that is present but not widely distributed

Pest status example

Japanese beetle (*Popillia japonica*) in Portugal

Japanese beetle (*Popillia japonica* Newman (Coleoptera: Rutelidae)) is included on the European and Mediterranean Plant Protection Organization (EPPO) "A2 list of pests recommended for regulation as quarantine pests". In February 2019, the NPPO of Portugal reported the first detection of Japanese beetle on the Island of Graciosa (Azores). The insect was already known to occur on other islands of the archipelago (Terceira, Faial, Flores, Pico, Sao Jorge, and Sao Miguel) but is considered to be absent from the mainland. As part of an official survey, 41 pheromone traps were placed throughout the Island of Graciosa and 902 visual inspections were carried out. A total of nine adults were captured in five of the traps (in the municipalities of Luz and São Mateus), but no damage was detected on plants. Official control measures were put in place to prevent further spread and efforts are underway to eradicate the pest. Japanese beetle is present in some parts of Portugal; the current pest status is **present: not widely distributed and under official control**. Additional information about the distribution of this insect is available at: https://gd.eppo.int/taxon/POPIJA/distribution.

6.1.4 Present: at low prevalence

This category may be used to describe the status of a pest that is present in an area but its prevalence is low and the area is established and maintained as an area of low pest prevalence for that pest in accordance with ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*).

The NPPO may establish an area of low pest prevalence for a pest in order to maintain or reduce the pest population below a specified level in that area. An area of low pest prevalence may be used to facilitate the movement of commodities out of areas where the pest is present, such as for domestic movement or for exports. Areas of low pest prevalence may also be established in areas that are under an eradication or suppression programme; areas acting as buffer zones around a PFA; areas within a PFA which are under a corrective action plan; and areas under official control in relation to regulated non-quarantine pests.

The area of low pest prevalence should be described along with the pest status determination, indicating the boundaries of the area, supported by maps, and the natural barriers or buffer zones which may isolate the area.

ISPM 22: *Requirements for the establishment of areas of low pest prevalence*

This standard describes the requirements and procedures for the establishment of areas of low pest prevalence for regulated pests in an area and, to facilitate export, for pests regulated only by an importing country. This includes the identification, verification, maintenance and use of those areas of low pest prevalence.

Additional guidance about areas of low pest prevalence can be found in the IPPC Guide for Establishing and Maintaining Pest Free Areas.

6.1.5 Present: except in specified pest free areas

In this case, the pest is present and established in a country, except in specified areas that are free from the pest in accordance with ISPM 4 (*Requirements for the establishment of pest free areas*). This category of presence may refer either to (i) a country that is generally uninfested, except for a limited infested area and official controls are applied to the infested area to contain or to eradicate the pest population based on cost-benefit analysis, or (ii) a country that is generally infested, except for an uninfested area where official controls have been applied to eradicate the pest or are being applied to maintain the pest free status. In both cases, the PFA may include the entire uninfested area or a portion of it.

ISPM 4: *Requirements for the establishment of pest free areas*

This standard describes the requirements for the establishment and use of pest free areas (PFAs) as a pest risk management option for phytosanitary certification of plants and plant products and other regulated articles exported from the PFA or to support the scientific justification for phytosanitary measures taken by an importing country for protection of an endangered PFA.

Additional guidance about establishing and maintaining a PFA can be found in the IPPC Guide for Establishing and Maintaining Pest Free Areas.

Pest free areas should be described alongside the pest status determination, clearly indicating the boundaries of the PFA and the buffer zone. Pest free areas are generally delimited by readily recognizable boundaries, considered to coincide acceptably with the pest's biological limits. These may be administrative (e.g. province or commune borders), physical features (e.g. rivers, seas, mountain ranges, roads) or property boundaries which are clear to all parties. The buffer zone protecting the PFA normally consists of an area of low pest prevalence, the size of which depends on the mobility of the pest.

The establishment and maintenance of a PFA is the responsibility of the NPPO and should be adequately documented and periodically reviewed, as per ISPM 4. Further guidance is provided in the Guide for Establishing and Maintaining Pest Free Areas.

If an outbreak occurs within a PFA, official control measures should be put in place according to procedures agreed between the importing and exporting country. Temporary suspensions of PFA status for portions of the PFA or the whole PFA may be required, depending on the circumstances and the agreed procedures. If eradication efforts fail within the PFA or portions of the PFA then the NPPO may need to consider changes to the boundaries of the PFA or re-evaluate the status of the pest.

6.1.6 Present: transient

A transient pest is one that is present in an area, but for which there is evidence to support the conclusion that it will not become established. This category

should only be used to describe pest incursions where the pest is not expected to establish and its presence is considered to be temporary.

Some reasons why a pest might not be expected to establish and spread include the following:

- Climatic or other environmental conditions are not suitable for the pest's survival.
- Suitable hosts are not available, so the pest cannot complete its life cycle.
- Vectors to spread the pest are not present.
- Appropriate phytosanitary measures have been applied.
- Other evidence indicates that the pest is only temporarily present in the area and is unable to establish or spread.

Transient pests may occur where human activities result in a pest incursion and situations where a pest migrates into an area where the pest is not normally present, such as during outbreaks in adjacent countries or in the region. In both scenarios, the pest may be sporadically detected in the area, at irregular intervals and even in different locations, but it does not survive the immediate future or establish. For example, a tropical insect pest that is found in a country with a temperate climate may be unable to establish in the environment because it cannot survive the winter or find hosts to complete its life cycle.

Pest transience generally depends on the biology of the pest, the presence of natural enemies, the interaction of the pest with the climate and the availability of host plants that are required for the pest to complete its life cycle. Climate modelling tools may also be used to support the conclusion that the pest is unable to survive in an area. Other factors that may prevent the survival or spread of the pest include the absence of vectors to spread the pest, the absence of alternate hosts that are required for the pest to complete its life cycle, or even the prompt application of control measures to destroy the pest before it establishes.

If requested, additional biological information, information about the phytosanitary measures applied, or climatic modelling should be provided to support the conclusion that the pest is transient in an area.

Even if a pest is unable to establish in an area, it may still cause economic losses during the periods of time when it is present, and phytosanitary measures may be applied.

Pests that are "present: transient" in exporting countries may still be of concern to importing countries that regulate the pest and import commodities from the affected areas. Contracting parties may choose to apply phytosanitary measures targeting pests that are not capable of establishment in their territories, but which could cause economic damage if they gained entry, provided that these measures are technically justified.

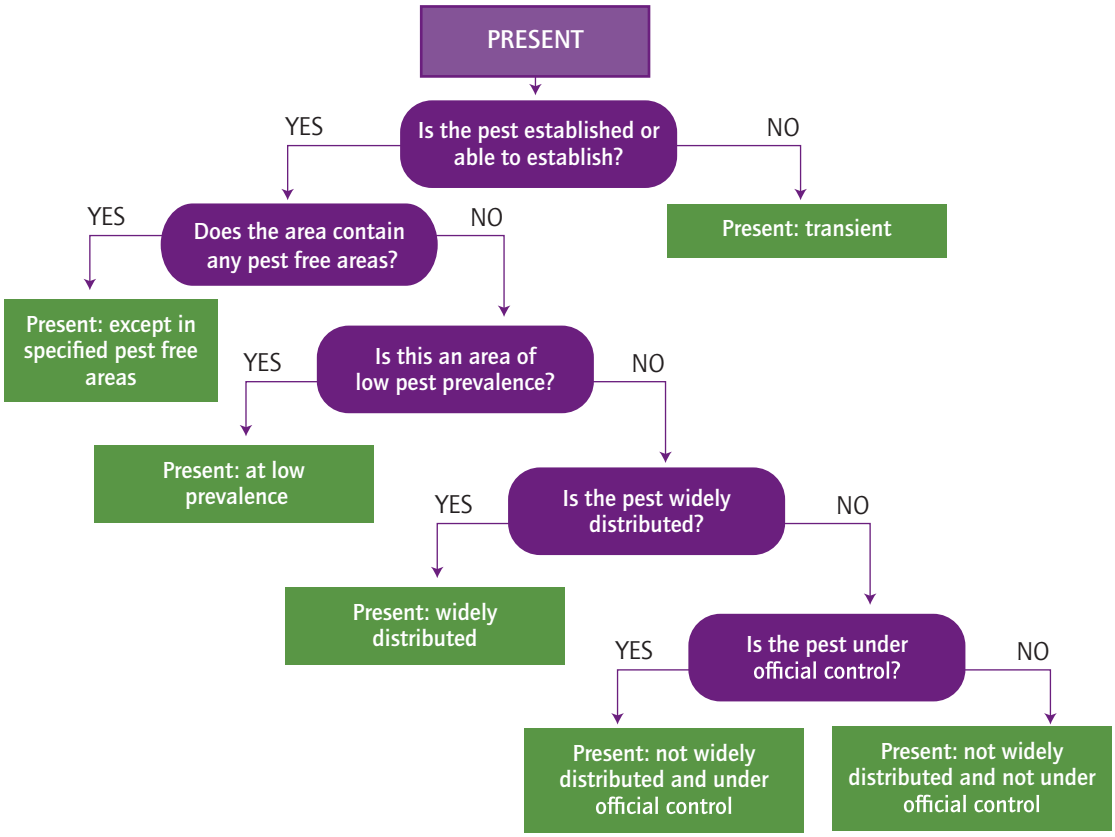
Transience should not be confused with the situation where a pest is established but cannot be detected during certain periods of the year. For example, insects that go into long diapause periods or pathogens that are present in the environment but only affect plants when conditions are favourable for development should not be considered transient.

Pest status example

Pepper weevil (*Anthonomus eugenii*) in Canada

Pepper weevil (*Anthonomus eugenii* Cano y Alcacio (Coleoptera: Curculionidae)) is a serious pest of pepper (*Capsicum* spp. L.) production in Central America, Mexico and the southern United States of America. This insect was detected in Canada for the first time in a single pepper greenhouse in 1992 and was subsequently eradicated. A pest categorization was carried out and, although pepper weevil has many of the characteristics of a quarantine pest, it was determined that pepper weevil is not able to establish in Canada. Pepper weevil could not survive a Canadian winter and is also extremely unlikely to be present in pepper greenhouses in Canada for more than one crop cycle, because of standard industry production practices. Pepper weevil is not considered a regulated pest by Canada and there are no phytosanitary measures in place to specifically prevent the entry and spread of pepper weevil. In the autumn of 2009, pepper weevil was detected again, in several greenhouses. The affected producers applied control measures targeting this economic pest and it was eradicated. Although the current status of pepper weevil in Canada is **absent: pest no longer present,** whenever the pest is detected in Canada, it is considered **present: transient.**

Figure 2: Process for identifying the correct pest presence category



Note: This flow chart illustrates the process that the NPPO may follow and the questions they may ask in order to identify the appropriate presence category for the pest under evaluation in the area under consideration. The assumption is that there is sufficient reliable information to support the determination that the pest is present in the area under consideration.

6.2 ABSENCE CATEGORIES

When the NPPO determines that a pest is absent from an area or country, the NPPO should identify the appropriate absence category to accurately describe the status of the pest in the area or country. In order to determine that a pest is absent, there needs to be sufficient information to support this status. A lack of information due to inadequate or insufficient surveillance activities does not constitute a basis for determining pest absence.

The absence categories incorporate additional information, including whether the pest has been recorded, whether the entire country is a PFA, whether there have been outbreaks that have been eradicated, whether the pest is no longer considered to be present and whether records of the pest are considered invalid.

6.2.1 Absent: pest not recorded

This absence category may be applied in situations where surveillance supports the conclusion that the pest is absent and has not been recorded (see ISPM 6).

The NPPO should be prepared to provide information to support the use of this category, since the lack of pest presence records alone may be insufficient grounds for concluding that a pest is absent from an area. Nonetheless, the lack of documented pest detections may contribute to a declaration of pest absence, especially if other information is available that supports the declaration, such as:

- if there are pest absence records from specific surveillance (e.g. detection surveys that are designed to maximize the chance of finding the pest, if it is present);
- if there are pest absence records from other surveillance carried out in the area under consideration;

- if general surveillance reveals no pest presence records or other evidence suggesting that the pest is present in the area (or perhaps even in the region or adjacent countries);
- if evidence suggests that the pest is not indigenous to the region and has never been introduced;
- if scientific evidence (e.g. peer-reviewed journal articles, species-distribution modelling, climate modelling, PRA) indicates that the pest is not able to establish in the area due to unfavourable conditions (e.g. climate, availability of hosts, presence of vectors);
- if the country is geographically isolated and has effective quarantine systems and phytosanitary measures in place on import pathways to prevent the introduction of the pest;
- if national reference collections are well established and comprehensive and do not include any specimens of the pest from the area under consideration.

The detection of a single specimen of a regulated pest should trigger official surveillance. However, if the delimiting survey does not result in the detection of a population, the single specimen should not affect the pest status in the area, since the pest is not considered established. One or a few pest records in an area do not necessarily justify the conclusion that the pest is present in the area, unless a properly conducted evaluation of pest status is provided.

6.2.2 Absent: the entire country is pest free

This status category may be used in situations where the entire country is established and maintained as a PFA in accordance with ISPM 4.

More detailed information about PFAs can be found in the IPPC Guide for Establishing and Maintaining Pest Free Areas.

6.2.3 Absent: pest records invalid

This category may be used in situations where pest records indicate the presence of a pest, but the NPPO considers that the records are invalid or no longer valid.

The following are examples of situations where a pest record might be considered invalid or no longer valid:

- Changes in taxonomy have occurred (e.g. the original species may have been subdivided into different species and therefore the original pest record is incorrect).
- Misidentification has occurred (e.g. voucher specimens are re-examined by a recognized authority who determines that the original identification was

Correcting a pest record

If the NPPO considers that a published pest record is invalid, the following actions may be carried out to correct it:

1. Verify whether the pest record is supported by a voucher specimen and, if it is, ask a recognized authority on the pest to re-examine it to confirm the identification.
2. Gather other details related to the initial pest record – try to verify the location where the sample was collected; review the competency of the identifier (if a specimen is not available); determine whether the specimen was an interception at the border or on a recent import, or if it was found in the environment. Contact the author, collector or identifier, if possible.
3. Confirm whether the taxonomy of the species has changed since the specimen was identified.
4. Verify whether the diagnostic methods and equipment that were used for identification are still considered to be appropriate.
5. Check whether an investigation or official surveillance was carried out as a result of the initial pest detection. Document the results of the investigation and identify any additional pest presence or absence records.
6. Gather additional information through general surveillance and document whether there are additional pest records in the scientific literature.
7. Carry out specific surveillance.
8. Post a correction to the pest status report on the International Phytosanitary Portal (IPP).
9. Publish a paper in a peer-reviewed journal.
10. Make a submission to CABI, the European and Mediterranean Plant Protection Organization (EPPO) and other pest databases, including the scientific justification, asking that the entries for the pest be corrected.

incorrect, or the diagnostic method used to identify the specimens is outdated or inappropriate).
- The record or records have not been confirmed (e.g. there may be a single pest record, but surveillance fails to confirm the presence of the pest).
- There are errors in the record or records, or the record is missing key information such as the location where the specimen was collected (e.g. the pest record may be associated with a pest interception at the point of entry in association with a recently imported article, or there may be reason to believe that the specimen was collected in another country).
- Changes in national borders have occurred, such that the area where the pest was recorded is no longer in the country.

Case study 3 provides a good example of the pest status being determined as "absent: pest records invalid"

6.2.4 Absent: pest no longer present

This category may apply to situations where pest records indicate that the pest was present in the past, but general and specific surveillance indicates that the pest is no longer present. The reason or reasons may include:
- climate or other natural limitation to pest perpetuation;
- changes in cultivated host species or cultivars;
- changes in production practices.

If a single record or very few outdated records show irregular temporary detections of the pest in the past, there is no indication that the pest record or records are invalid, and recent general surveillance reveals no evidence of pest presence, it can be concluded that the pest was not able to establish. If a "transient" pest is not present in the area at the time when the pest status determination is being made, then it could be considered "absent: pest no longer present".

The following actions may be conducted to corroborate the conclusion that a pest is no longer present:
1. Carry out general surveillance to seek any additional information that is relevant to the status of the pest in the area and perhaps even in the region (e.g. the pest may not have been reported from adjacent countries either).
2. Gather evidence or complete a PRA to support the conclusion that the pest is not able to establish because conditions are not suitable (e.g. climate, hosts, vectors).
3. Consult experts, including researchers, crop-extension specialists, pest managers and producers.
4. Carry out specific surveillance to demonstrate that the pest is no longer present.

6.2.5 Absent: pest eradicated

This status category may be used in situations where a pest has been successfully eradicated from an area. Records show that the pest was present; however, eradication measures have been applied and official surveys have confirmed that the eradication has been successful. Additional guidance on pest eradication programmes can be found in ISPM 9 (*Guidelines for pest eradication programmes*).

In most instances, the pests considered for eradication have newly entered the area under consideration, and the NPPO determines that emergency

Pest status example

Desert locust (*Schistocerca gregaria*) in Dominica

The first report of desert locust (*Schistocerca gregaria* (Forskål) (Orthopetera: Acrididae)) in Dominica was in October 1988. It was reported as causing some damage to banana, plantain, coconut, sugarcane and sweet potato, but not at economically significant levels. The insect was heavily predated upon by local bird species, including guives (*Nargaropo funcus*), chupits (*Quixalus lugutris*) and grey king birds (*Tyrannus dominiensis*). Surveillance carried out in the following year failed to find any locusts; however, it has been detected periodically since. Desert locust is not a regulated pest in Dominica and there are no phytosanitary measures in place to prevent its introduction and establishment. Desert locust has, so far, been unsuccessful in establishing on the island. Unpublished work by Collin Bully in 1995 attributed tropical weather conditions, unfavourable host range and fierce predation from local bird species as having repeatedly discouraged the establishment of this pest in Dominica. The current status of this pest in Dominica is **absent: pest no longer present**, but in some years it has been **present: transient**.

Pest status example

Cactus moth (*Cactoblastis cactorum*)

The invasive cactus moth (*Cactoblastis cactorum* Berg (Lepidoptera: Pyralidae)) was first detected in 2006 on the islands of Isla Mujeres and Isla Contoy in the State of Quintana Roo, Mexico. The cactus moth outbreak on the islands was eradicated using an integrated approach which included host stripping and disposal, limited insecticide use, public information and outreach and the sterile insect technique.
The use of a range of methods and levels of surveillance was fundamental in preventing establishment of this invasive pest in Quintana Roo and the Yucatan Peninsula. The current pest status of cactus moth in Mexico is **absent: pest eradicated**.

eradication measures are needed. However, eradication programmes may also be directed towards established pests or indigenous pests in the area. The eradication process involves three main activities: surveillance, containment (in the case of quarantine pests that have recently entered the area), and treatment or control measures. Official surveys should be carried out to delimit the incursion and assess the effectiveness of the eradication programme. Monitoring surveys should continue for a period of time to confirm that the pest has been eradicated. The length of this period of negative survey results will vary according to the biology of the pest, taking into consideration factors such as the sensitivity of the detection technology, the ease of detection, the life cycle of the pest, climatic effects and the efficacy of the treatment.

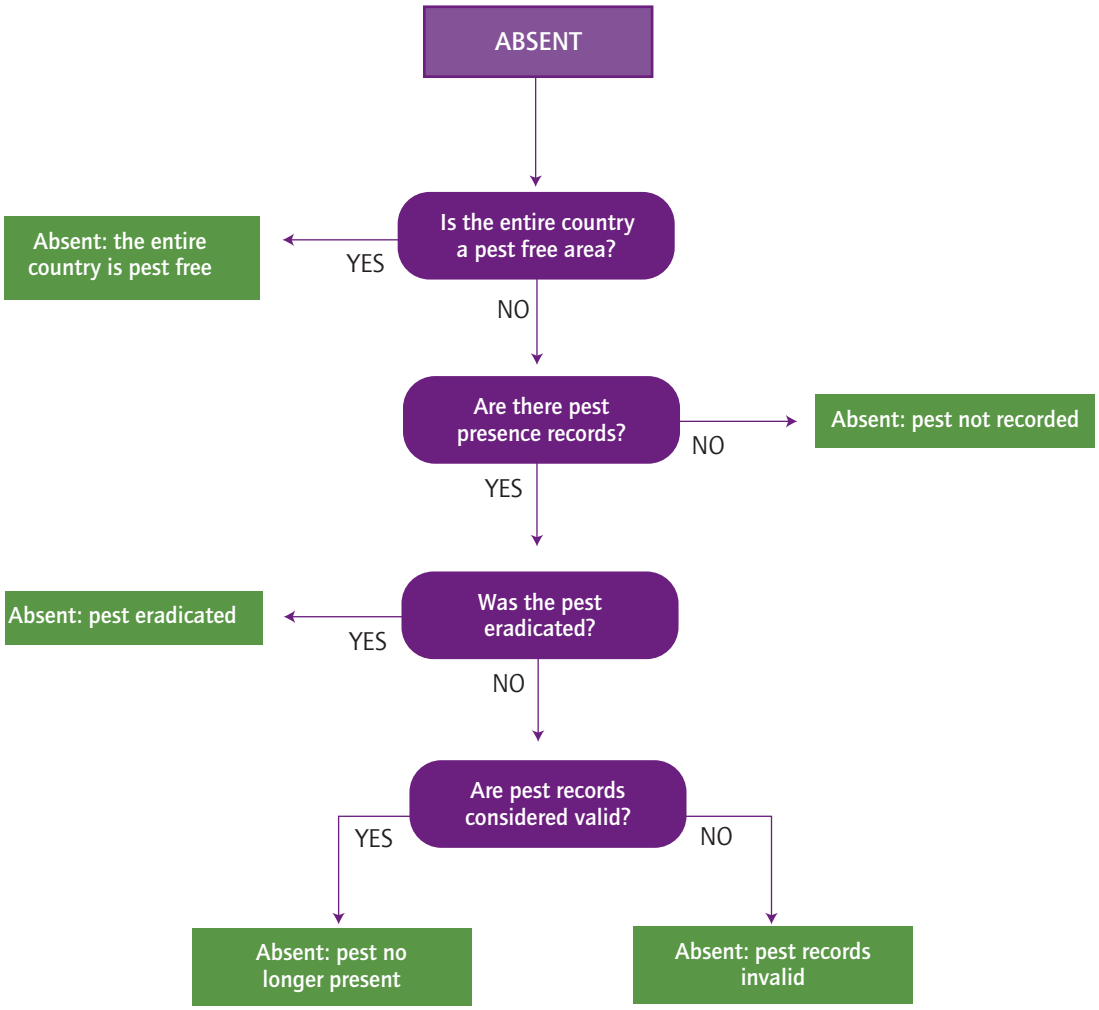
This category is less stringent than the pest status categories that include the establishment of a PFA. The NPPO should be able to demonstrate that the pest has been successfully eradicated and is no longer present, but the NPPO is not required to put measures in place to maintain pest freedom provided that a decision is not made to establish a PFA.

Successful eradication of a pest should be communicated to trading partners and the change in pest status should be reported on the International Phytosanitary Portal (IPP). It is recommended that a scientific paper documenting the eradication be published in a peer-reviewed journal. The published paper or other documented evidence of the eradication may then be submitted to international databases such as those of CABI and the European and Mediterranean Plant Protection Organization (EPPO).

ISPM 9: *Guidelines for pest eradication programmes*

This standard provides guidance on the development of a pest eradication programme and for reviewing the procedures of an existing eradication programme.

Figure 3: Process for identifying the correct pest absence category



Note: This flow chart illustrates the process that the NPPO may follow and the questions they may ask in order to identify the appropriate absence category for the pest under consideration in the area under consideration. The assumption is that there is sufficient reliable information to support the determination that the pest is absent from the area under consideration.

ONCE THE PEST PRESENCE OR ABSENCE CATEGORY HAS BEEN SELECTED (STEP 6 OF THE PROCESS), THIS COMPLETES THE DETERMINATION OF PEST STATUS. THE POSSIBLE NEXT STEPS ARE DESCRIBED IN SECTIONS 7 TO 9.

STEP 7.
Determine whether the pest should be regulated

After determining the status of a particular pest, the NPPO may decide to carry out a further evaluation to assess whether the organism meets the criteria to be considered a regulated pest. If the NPPO does decide, as a result of this evaluation, to change whether the pest is regulated or not, the pest status should be reviewed to check whether it is still valid. If the pest status is no longer appropriate (e.g. if the pest was formerly not under official control but now is), the pest status should be revised.

National governments have the sovereign right to regulate imports to achieve their appropriate level of protection, taking into account their international obligations, as described in ISPM 20 (*Guidelines for a phytosanitary import regulatory system*). Imported commodities that may be regulated include articles that may be infested or contaminated with regulated pests. If a pest is regulated by an importing country, then phytosanitary measures may be taken on imported goods in order to prevent the entry and spread of the regulated pest. The NPPO is also responsible for distributing information within its territory regarding regulated pests and the means of their prevention and control.

Regulated pests are either quarantine pests or regulated non-quarantine pests. All commodities can be regulated for quarantine pests. However, regulated non-quarantine pests can only be regulated with respect to plants for planting. Even if a pest does not meet the criteria to be considered a regulated pest, the NPPO may develop pest risk management options to control the pest and minimize economic losses or to minimize the risk of the pest being associated with exported commodities.

ISPM 20: *Guidelines for a phytosanitary import regulatory system*

The objective of a phytosanitary import regulatory system is to prevent the introduction of quarantine pests or limit the entry of regulated non-quarantine pests with imported commodities and other regulated articles. This standard describes the structure and operation of a phytosanitary import regulatory system and the rights, obligations and responsibilities that should be considered in establishing, operating and revising the system.

7.1 QUARANTINE PESTS

The first step in determining whether a pest can be regulated is to ask whether the pest meets the definition of a quarantine pest. 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" (ISPM 5).

ISPM 11 (*Pest risk analysis for quarantine pests*) contains detailed guidance on how to determine whether a pest can be considered a quarantine pest. The key elements include:

- identity of the pest (STEP 1 of this guide);
- the status of the pest in the area (STEPS 5 and 6 of this guide);
- potential for establishment and spread in the area;
- potential for economic consequences in the area.

The designation of "quarantine pest" may only be applied if the NPPO has determined that the pest is either "absent" from the area or "present: not widely distributed and under official control" and if PRA indicates that the pest has the potential to establish and spread and the potential for economic consequences in the area.

The first two elements required in order to determine a pest as a quarantine pest are covered by the pest status determination process.

The third element that is required to determine a pest as a quarantine pest is an evaluation of the potential for establishment and spread. This may be supported by activities considered in STEPS 5 and 6 of this guide, especially where pest records have indicated the presence of the pest. However, it may not have been fully considered, especially for pests that are absent. It is important to ensure that this element is fully considered. Relevant information may include:

- the presence of suitable hosts in the endangered area;
- the availability of environmental conditions suitable for establishment and spread in the endangered area;
- the availability of vectors, where relevant, in the endangered area;
- other evidence demonstrating that the pest is likely to have the potential for establishment and spread in the endangered area, including considerations related to uncertainty.

The fourth element that is required in order to determine a pest as a quarantine pest is an evaluation of its potential for economic consequences in the area. Evidence must be available to support the decision that it is "a pest of potential economic importance to the area endangered thereby". This information may include:

- information demonstrating economic importance in areas where the pest is currently established;
- other evidence demonstrating that the pest is likely to have the potential for economic consequences (including environmental consequences) in the endangered area, taking into account considerations related to uncertainty.

A transient pest (see section 6.1.6) may still meet the definition of a quarantine pest if it has the potential to cause economic damage in the area.

Phytosanitary measures may only be applied on imported goods if they are both technically justified, based on a PRA as per ISPM 11, and their purpose is to prevent the introduction and spread of quarantine pests in the importing country (although phytosanitary measures may also be applied in relation to regulated non-quarantine pests: see section 7.2).

ISPM 11: *Pest risk analysis for quarantine pests*

This standard provides details for the conduct of pest risk analysis to determine if pests are quarantine pests. It describes the integrated processes to be used for pest risk assessment as well as the selection of pest risk management options.

7.2 REGULATED NON-QUARANTINE PESTS

If a pest is present in an area but does not meet the definition of a quarantine pest, it may still be considered for import regulation as a regulated non-quarantine pest (RNQP).

The concept of RNQPs only applies to pests whose presence in plants for planting has an economically unacceptable impact on the intended use of the plants. In this case, a PRA and official controls are also required and a "tolerance" level must be set in imported plants for planting. The tolerance level would usually be something other than zero in order to be least trade restrictive, unless a level of zero can be technically justified.

The application of concepts relevant to RNQPs is detailed in ISPM 16 (*Regulated non-quarantine pests: concept and application*). The NPPO should undertake a PRA according to the guidelines detailed in ISPM 21 (*Pest risk analysis for regulated non-quarantine pests*) before a pest can be regulated as an RNQP.

ISPM 16: *Regulated non-quarantine pests: concept and application*

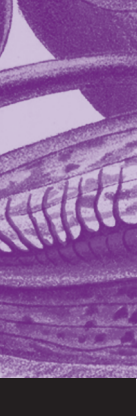
This standard describes the concept of regulated non-quarantine pests and identifies their characteristics. It describes the application of the concept in practice and the relevant elements for regulatory systems.

ISPM 21: *Pest risk analysis for regulated non-quarantine pests*

This standard provides guidelines for conducting pest risk analysis for regulated non-quarantine pests. It describes the integrated processes to be used for pest risk assessment and the selection of pest risk management options to achieve a pest tolerance level.

7.3 JUSTIFICATION OF EMERGENCY ACTIONS

National plant protection organizations may take emergency action on an imported consignment if a regulated pest that is not listed as being associated with the commodity from the exporting country is detected or if an organism posing a potential phytosanitary threat is detected. Depending on the urgency of the situation, expert judgement may be required to make a pest status determination based on available information. National plant protection organizations must be prepared to provide a justification for emergency actions on request from affected countries and to seek to obtain relevant additional information and evidence to review the pest status determination as appropriate within reasonable time periods.



STEP 8.
Exchange pest status information with other NPPOs

It is the responsibility of an NPPO to provide pest records and other supporting evidence on pest status upon request from another NPPO. In order to promote harmonization and transparency, NPPOs should use the pest status categories outlined in ISPM 8 when making pest reports and exchanging pest status information with other NPPOs. Detailed guidance pertaining to how pest status determination contributes to pest reports may be found in ISPM 17 (*Pest reporting*).

ISPM 17: *Pest reporting*

This standard describes the responsibilities of, and requirements for, contracting parties in reporting the occurrence, outbreak and spread of pests in areas for which they are responsible. It also provides guidance on reporting successful eradication of pests and establishment of pest free areas.

There may be some cases where a pest status declared by an NPPO is questioned (e.g. when there are repeated interceptions by importing countries or contradictory pest records). In these situations, the NPPOs should engage in bilateral exchanges to clarify the situation and, if needed, the pest status may be reviewed.

It should also be noted that any pest interceptions should be communicated by the NPPO of the importing country to the NPPO of the exporting country as per the provisions provided in ISPM 13 (*Guidelines for the notification of non-compliance and emergency action*). The NPPO of an importing country may intercept, on imported goods or conveyances, pests that have not been recorded as present in the exporting country. Repeated detections of a pest by a trading partner should trigger an investigation in the exporting country. However, pest interception reports alone do not provide evidence to confirm the presence or absence of a pest in the exporting country. For example, interceptions may indicate that the goods originated in a third country or they may indicate that the status of the pest in the exporting country needs to be re-evaluated.

ISPM 13: *Guidelines for the notification of non-compliance and emergency action*

This standard describes the actions to be taken by countries regarding the notification of:

- a significant instance of failure of a consignment to comply with specified phytosanitary import requirements, including the detection of specified regulated pests;
- a significant instance of failure of an imported consignment to comply with documentary requirements for phytosanitary certification;
- an emergency action taken on the detection in an imported consignment of a regulated pest not listed as being associated with the commodity from the exporting country;
- an emergency action taken on the detection in an imported consignment of organisms posing a potential phytosanitary threat.

National plant protection organizations should:

- use the categories of pest status set out in ISPM 8 when exchanging pest status information, to promote harmonization and transparency;
- inform other NPPOs and their RPPO of relevant changes in pest status according to ISPM 17 in a timely manner. This information should also be posted on the IPP.

The following sections outline recommendations for good reporting practices related to pest status, including regulated pest lists, pest reports, pest lists to support market access, and other bilateral exchanges of information.

8.1 RECOMMENDATIONS FOR GOOD REPORTING PRACTICES RELATED TO PEST STATUS

National plant protection organizations should develop and maintain adequate information on pest status and, on request, make such information available. Information on pest status and supporting technical and biological information should be communicated directly between contracting parties. When countries do not satisfy national reporting obligations related to pests or phytosanitary measures, or when they provide information that is inaccurate, unclear or incomplete, it may be difficult, and even impossible, to agree on the measures required for safe trade or protecting food security and the environment.

A lack of information on pest status or regulated pests could lead to unwarranted protective phytosanitary measures. Unwarranted protective measures or a lack of technical justification could lead to lengthy trade negotiations, limited market access or potential disputes.

Inaccurate or unclear information about pest status or regulated pests may also result in ineffective phytosanitary measures and could result in the spread of pests with negative consequences for agricultural and environmental resources.

The Guide to National Reporting Obligations provides additional guidance on creating and updating national reporting obligation (NRO) reports and offers assistance on how to upload them to the IPP.

8.2 REGULATED PEST LISTS

Lists of regulated pests are established and maintained by the importing contracting party. The pests listed are those that have been determined by the NPPO to be regulated pests; that is, either quarantine pests or regulated non-quarantine pests. Providing regulated pest lists is a basic reporting obligation. National plant protection organizations should make their regulated pest lists available on the IPP (https://www.ippc.int/).

Guidance on lists of regulated pests, including the information that should be provided for each organism as a regulated pest, is provided in ISPM 19 (*Guidelines on lists of regulated pests*).

Lists of regulated pests should be reviewed and updated as soon as the need for modification is identified. One of the common reasons for updating regulated pest lists is to reflect a change in pest status: pests should be removed from the list if their status is changed from quarantine to non-quarantine because they can no longer be considered as being "absent" or "present: not widely distributed and under official control".

A list of regulated pests should not be confused with a list of pests occurring within a country or a list of pests associated with a commodity. These types of pest lists are often prepared to support the completion of a PRA and to support market access (section 9).

ISPM 19: *Guidelines on lists of regulated pests*

This standard provides guidance to NPPOs on how to prepare and maintain lists of regulated pests and make these lists available to the IPPC Secretariat, to regional plant protection organizations of which the contracting party is a member and, on request, to other NPPOs and contracting parties.

8.3 PEST REPORTS

Where there is an immediate or potential threat arising from the occurrence, outbreak or spread of a pest (normally a quarantine pest) in the country in which it is detected, the pest status should be communicated to other contracting parties by means of a pest report. The pest report should contain information that allows neighbouring countries or trading partners to adjust their phytosanitary import requirements and to take actions as a result of any changes in pest risk. Guidance on the information that should be provided in a pest report is provided in ISPM 17.

"pest record" vs "pest report" vs "pest status report"

pest record – documents a single pest observation at a particular place and time

pest report – indicates the status of a pest in an area and is an obligation under the IPPC (and is what is entered onto the International Phytosanitary Portal by NPPOs, for their national reporting obligations)

pest status report – documents the information used to make a pest status determination

Pest reports are triggered by a change in the status of a pest and should be posted on the IPP (https://www.ippc.int). Changes in the status of quarantine pests should be reported promptly. More detailed information about creating a pest report can be found in ISPM 17. In addition, The Guide to National Reporting Obligations provides a detailed example of creating and updating a pest report.

For example, if the pest status changes in the exporting country and the pest can no longer be considered absent, the country of export must notify its trading partners. If the pest is a regulated pest for an importing country, then importing countries may require additional phytosanitary measures on goods that were previously exported without additional measures.

If the change in pest status in the importing country means that the pest will no longer be regulated, then exporting countries should be notified that phytosanitary measures will no longer apply to that pest on their exported goods.

Changes in categories of presence and absence also need to be communicated, particularly where those changes are likely to impact trade.

STEP 9.
Consider the implications for market access

Market-access negotiations follow a process agreed between trading partners, with the aim of initiating international trade with the least hindrance to trade but, at the same time, preventing the introduction of pests into new areas and their subsequent spread. The IPPC guide on Market Access provides detailed information about how to prepare market-access submissions or dossiers for commodities that are proposed for export.

Exporting countries are commonly asked to provide detailed information on the status of pests in their countries or a list of pests occurring within the country and associated with the commodity that is proposed for export. Commodity-specific pest lists should not be confused with lists of regulated pests (section 8.2).

These commodity-specific pest lists may include information such as:

- scientific names of each pest that is present in the country and associated with the commodity, including the describing authority and synonyms (STEP 1 of this guide);
- common name for the relevant taxonomic group (e.g. insect, mollusc, nematode, plant, fungus, virus) (STEP 1 of this guide);
- pest status in the country (STEP 6 of this guide);
- hosts and plant parts affected (supported by STEP 3 of this guide);
- symptoms or damage to the hosts;
- distribution (supported by STEPS 3 and 6 of this guide);
- prevalence (supported by STEP 3 and 6 of this guide);
- control measures (supported by STEP 3 and 6 of this guide).

The status of a pest in a country may have a significant impact on market access. These impacts should be carefully considered by NPPOs wishing to export new commodities to other countries or maintain existing exports in the case of significant changes in pest status. Where the pest is present, there are often numerous options available to manage the pest risk posed by exported commodities and further guidance on these options is available in the ISPMs detailed at the end of this section.

When a pest is considered to be "absent" then no additional phytosanitary measures should be required by the importing country. The NPPO of the exporting country should be prepared to provide evidence to support the claim of absence; the absence of pest records alone may be insufficient grounds for concluding that a pest is absent.

When a pest is "present" in an area, there are numerous options available to manage the pest risk and minimize economic losses. Some of these options may be used to minimize the risk of the pest being associated with exported commodities and to support access to export markets despite the fact that the pest is present. These options may include:[2]

- pest free places of production and pest free production sites (ISPM 10 (*Requirements for the establishment of pest free places of production and pest free production sites*));
- systems approaches (ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*) and ISPM 35 (*Systems approach for pest risk management of fruit flies (Tephritidae)*));

[2] Note: There are other ISPMs, in addition to those mentioned in this list, that support the identification and application of relevant phytosanitary measures.

- phytosanitary treatments (ISPM 18 (*Guidelines for the use of irradiation as a phytosanitary measure*), ISPM 28 (*Phytosanitary treatments*), ISPM 42 (*Requirements for the use of temperature treatments as phytosanitary measures*) and ISPM 43 (*Requirements for the use of fumigation as a phytosanitary measure*));
- pest free areas (ISPM 4 and ISPM 26 (*Establishment of pest free areas for fruit flies*));
- areas of low pest prevalence (ISPM 22).

See case study 6 for an example showing how a systems approach helped maintain market access

Case studies

Case study 1, Use of culture collections

Establishing the presence/absence of bacterial plant pathogens in the United Kingdom

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Location and timeline:

York Biotech Campus, York, United Kingdom of Great Britain and Northern Ireland, 15–25 May 2018

Content of case study:

Diagnostic and research laboratories require authentic strains, with the properties the laboratories require, so that they can perform their tasks. Storage of these materials in the short to medium term is inevitable. During storage, however, the more sensitive materials, through selective propagation, lack of interaction with their host, or poor maintenance, can change, attenuate or become contaminated.

Culture collections specialize in the long-term preservation of organisms, and the staff responsible for their upkeep are also responsible for ensuring that all the organisms they house are correctly identified and appropriately named. Use of culture collections reduces the incidence of non-authentic reference materials being used in diagnostic and research laboratories. These laboratories find pests on new hosts and in new locations and they are encouraged to publish such findings – as a new disease record, for example. Although it is not a requirement for organisms cited in new disease records to be submitted to culture collections, it is in the interests of collections to seek out and add such organisms to their collection.

In the United Kingdom of Great Britain and Northern Ireland (hereafter referred to as the "United Kingdom"), the National Collection of Plant Pathogenic Bacteria (NCPPB) is managed within the Plant Bacteriology Diagnosis team of Fera Science Ltd, which is the diagnostic laboratory for the national plant protection organization (NPPO) – the Department for Environment, Food and Rural Affairs. The NCPPB is funded through a Memorandum of Understanding between Fera and the NPPO. One of the aims of the NCPPB is to preserve and maintain cultures of the world's bacterial plant pathogens and the bacteria closely associated with them; it is intended that sufficient cultures shall be kept of each species to be representative of its geographical and host range, and of the variation within it. Hence it is the aim of the NCPPB to have historical and up-to-date information about the status of the pests in which it specializes.

As an international, public-service collection, there are minimum requirements for the accession data (the data that accompanies cultures that are added to the NCPPB), including country of origin and date of isolation. And as the collection is managed from within the NPPO's diagnostics team, all new or interesting finds are normally added to the collection. Both the accession data and the in-house diagnosis database (a database of all the diagnostic records of Fera) can be invaluable in helping to determine pest status.

One such example occurred in May 2018, when a request was received by the curator of the NCPPB from the government's Invasive Non-Native Species Secretariat, to determine which species, from a list that was supplied, had become established in the United Kingdom in the last 20 years. The list comprised the following organisms (with the pest status, as recorded on the United Kingdom plant health risk register, given in parentheses):

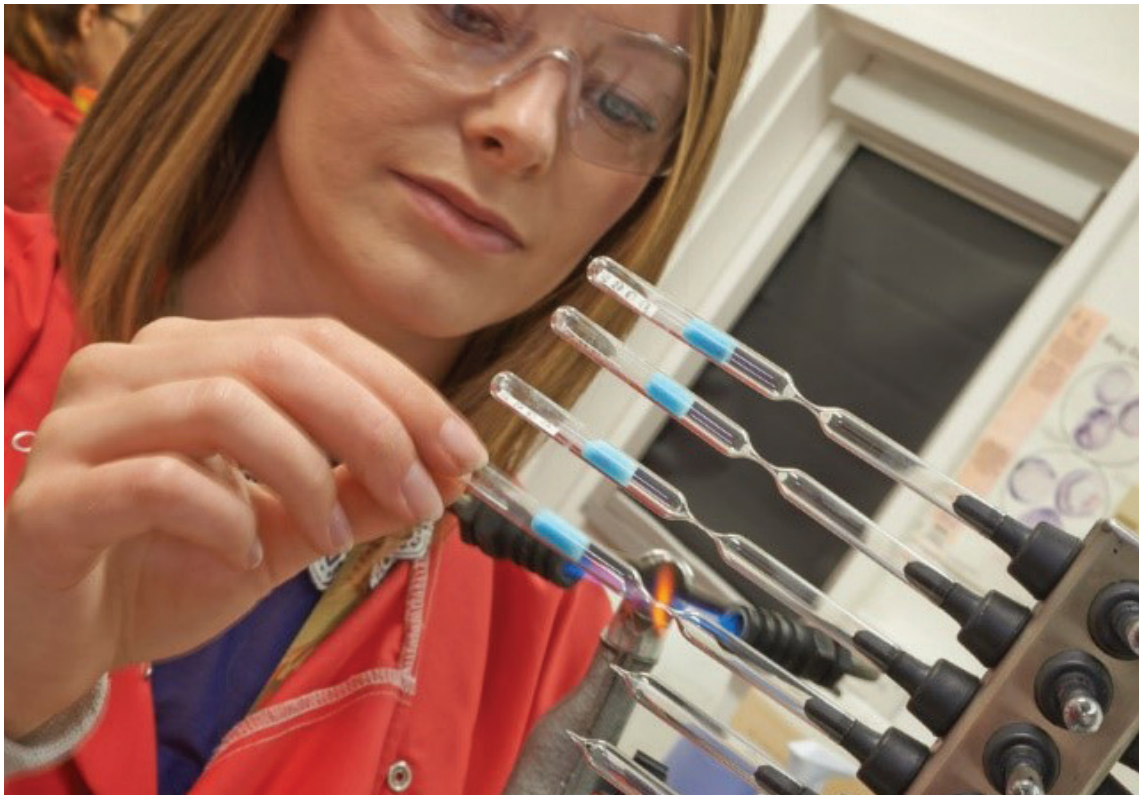
- *Clavibacter michiganensis* subsp. *insidiosus* (Insufficient data to determine status)
- *Dickeya dianthicola* (Present – Limited)
- *Erwinia amylovora* (Present – Widespread)
- *Ralstonia solanacearum* (Present – Limited)
- *Xanthomonas fragariae* (Insufficient data to determine status).

Clavibacter michiganensis subsp. *insidiosus* (McCulloch) Davis *et al.* (Micrococcales: Microbacteriaceae) causes blight, root rot and wilt diseases in lucerne. The last strain of it to be added to the NCPPB was in 1976. This is a regulated organism, so the lack of a new strain in the collection since 1976 indicated that it had not been a problem in the United Kingdom for some time, and it certainly hadn't been isolated by the Bacteriology diagnosis team. In addition to checking the NCPPB, Fera also checked the diagnosis database, which confirmed that there had be no diagnoses of this pest in the United Kingdom since 1976. However, it is possible that the use of resistant varieties of lucerne could have reduced the probability of damage and hence detection. Therefore, there were insufficient data to determine the current pest status.

Dickeya dianthicola Samson *et al.* (Enterobacterales: Pectobacteriaceae) causes stunt and wilt diseases in ornamental flowers such as carnations and dahlia, and blackleg of potato. Twenty years before the enquiry, *D. dianthicola* was known as *Erwinia chrysanthemi* pv. *dianthicola* and *Erwinia chrysanthemi*, but not all strains of *E. chrysanthemi* were transferred to *D. dianthicola*. One of the key activities of a public-service collection is to ensure that its strains are correctly named. Fera was able to establish whether the *E. chrysanthemi* strains that had been isolated in the United Kingdom were part of the renamed *D. dianthicola*. Fera was able to confirm that *D. dianthocola* was present as it had been found on potato (*Solanum tuberosum*) in 2000 and *Sedum* in 2002; therefore, the status was **present: not widely distributed and under official control**.

Erwinia amylovora (Burrill) Winslow *et al.* (Enterobacterales: Erwiniaceae), the causative agent of fireblight, was first isolated in England in 1958 and the NCPPB has United Kingdom isolates from every decade until the 1990s. The status is **present: widely distributed**.

Ralstonia solanacearum (Smith) Yabuuchi *et al.* (Burkholderiales: Burkholderiaceae) causes bacterial



Freeze-drying ampoules in the National Collection of Plant Pathogenic Bacteria

wilt of potato. In 1992, *R. solanacearum* (then called *Pseudomonas solanacearum*, before becoming *Burkholderia solanacearum* and subsequently *R. solanacearum*) was first isolated from *S. tuberosum* in the United Kingdom and, as a result of other findings in Europe, became more strictly regulated. Annual surveys of potatoes and watercourses have monitored its presence in the United Kingdom; currently, it is only found in a limited number of watercourses and so the status is **present: not widely distributed and under official control**.

Xanthomonas fragariae Kennedy & King (Lysobacterales: Lysobacteraceae) causes angular leaf spot, leaf blight and vascular collapse of strawberry. There are no isolates of *X. fragariae* from the United Kingdom in the NCPPB, but a check of the diagnosis database showed that there had been outbreaks limited to one geographical location from 2010 to 2015. Fera were able to say that *X. fragariae* had been found in the United Kingdom but had since been eradicated from one location. However, this species is extremely difficult to isolate, it has only been detected by molecular and microscopic techniques in the United Kingdom and has never been isolated in the United Kingdom. As *X. fragariae* is difficult to detect, it is not considered possible to confidently determine the status of this pest.

These examples demonstrate how the NCPPB has been used to verify the status of pests within the United Kingdom by referring to historic records and, where necessary, reanalysing them.

The following ISPM was successfully implemented:

- ISPM 8 (*Determination of pest status in an area*).

Further reading:

https://www.fera.co.uk/ncppb

Case study 2, Use of citizen science

A citizen-science approach to determine the status of the box tree moth (*Cydalima perspectalis*) in Ontario, Canada

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Location and timeline:

Ontario, Canada, October 2018 to September 2019

Content of case study:

Box tree moth (*Cydalima perspectalis* (Walker) (Lepidoptera: Crambidae)) is native to Asian countries such as China, Japan and the Republic of Korea (Wan *et al.*, 2014). The larvae feed mainly on the leaves, and occasionally on the bark, of boxwood, and can cause tree mortality through extreme defoliation (Nacambo *et al.*, 2014). Box tree moth was first detected in Europe in 2007 (Billen, 2007; van der Straten and Muus, 2010). Since then, it has spread to multiple other European countries and is considered invasive in most of them (Nacambo *et al.*, 2014).

Despite the rapid spread of box tree moth in Europe and to parts of Asia where it is not indigenous, this insect was considered to be absent from the Americas until very recently. Although the boxwood plant is not native to North America, it is widely distributed in North American nurseries, gardens and parks and is considered an important ornamental shrub. Thus, the introduction and spread of box tree moth in North America would pose a risk to boxwood in urban green spaces, which gives rise to concern in the landscape and nursery industries.

Box tree moth was first detected in Toronto, Canada in August 2018 by a citizen scientist, as reported in an online publication (iNaturalist, 2020; Iwane, 2018). The observations were brought to the attention of the Canadian Food Inspection Agency (CFIA) in October 2018. The Agency worked in collaboration with provincial experts in the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) to investigate the report and to assess boxwood plants in key areas in the vicinity of the reported sightings. Boxwood plants with signs of infestation were noted at three residential properties in an urban neighbourhood in Toronto. Pupae and cocoons were collected and submitted to the CFIA entomology laboratory for identification and, in November 2018, CFIA confirmed the presence of box tree moth in the city of Toronto. This is the first confirmed report of this pest in North America. In accordance with IPSM 17 (*Pest reporting*), the confirmed presence of box tree moth was reported by means of a North American Plant Protection Organization (NAPPO) Pest Alert in February 2020 (NAPPO, 2020).

The confirmed detections of box tree moth prompted CFIA and OMAFRA to establish a monitoring and outreach research project to collect surveillance data that could be used to determine the status of this pest in Ontario (e.g. to determine if the presence is transient or if box tree moth is more widely established). It also led to the creation of a Box Tree Moth Technical Advisory Committee, which provided input into survey design and implementation, recommended outreach and education strategies, liaised with experts, advisory bodies and other agencies dealing with box tree moth, and maintained a comprehensive communications strategy to support all elements of the project.

A CFIA-led research project was established in spring 2019 to assess the capacity of citizen-based monitoring for gathering data that could be used to determine pest status and to inform regulatory decisions. Citizen scientists were provided with

monitoring kits including a detailed survey protocol (CFIA, 2019a), traps with sticky liners, sufficient box tree moth lures for the season, gloves, pest detection cards and survey data sheets. Citizen scientists were asked to follow the survery protocol that was developed using guidelines from ISPM 6 (*Surveillance*), to photograph any potential findings of box tree moth and to send specimens to CFIA or OMAFRA for identification. Fifty-four traps were distributed as part of this collaborative, citizen-based monitoring campaign, 25 of which were placed beyond the core infested area that was identified in 2018, also by citizen scientists, to delimit the population. The remaining 29 traps, which were located in the core area, were monitored by the OMAFRA–CFIA field technician with support from citizen scientists and City of Toronto staff. All traps were checked weekly for the presence of moths and pheromone lures were changed monthly. The only positive trap captures of adult box tree moth were found within the core area.

A monitoring survey was also delivered to further determine the box tree moth pest status. Residences and parks throughout Toronto were scouted from the ground by trained university students. Scouting began in the Etobicoke neighbourhood where box tree moth was first detected and continued outward in all directions to establish a known boundary to the infestation. These scouting efforts took place from May to September of 2019. A total of 1 311 homes and parks with boxwood plants were scouted for evidence of box tree moth. Of these, 361 locations were found to be positive for the pest, spanning 21 km east to west and 15 km north to south. A programme of spraying biological insecticide on the boxwood plants of consenting homeowners was conducted to control pest populations.

All these monitoring and treatment efforts have been supported by an extensive, multi-partner, public-outreach campaign. Pest alerts, social-media messaging, temporary tattoos and a pest card have been developed to raise public awareness about box tree moth and enhance citizen participation and reporting (e.g. CFIA, 2019b; Invasive Species Centre, 2020).

With all the above information in hand, CFIA has been able to determine quickly, and with the use of minimal CFIA resources, that box tree moth is **present and not widely distributed** in Ontario. The pest risk assessment for box tree moth is being revised with this new information. The Canadian Food Inspection Agency will then determine if the pest meets the definition of a quarantine pest.

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Citizen scientists receiving instructions on how to use the box tree moth monitoring kits

To limit export restrictions and ensure phytosanitary requirements are justified and commensurate with risk, CFIA, as the national plant protection organization of the exporting country, has provided the United States Department of Agriculture with additional technical information on the pest status of box tree moth in Ontario through bilateral exchanges. The United States Department of Agriculture has since set its phytosanitary import requirements for boxwood based on an analysis of the pest status in Canada.

The success of this project relies on the collaborative approach taken with multiple partners and on a targeted outreach and communication campaign. The Canadian Food Inspection Agency continues to work with stakeholders and partners in establishing risk mitigation measures to maintain trade; it also supports industry in developing best-management practices to prepare for pest spread and potential changes to the United States of America's phytosanitary import requirements. Annual surveillance for box tree moth, delimiting the infested area, is planned to continue.

The following ISPMs were successfully implemented:

- ISPM 6 (*Surveillance*)
- ISPM 8 (*Determination of pest status in an area*)
- ISPM 17 (*Pest reporting*).

Further reading:

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A box tree moth trap deployed over boxwood

A box tree moth trap with adult moth catches

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Case study 3, Taxonomic revisions

Status of apple leafhopper (*Edwardsiana crataegi*) in Argentina

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Location and timeline:

Argentina, 2020

Content of case study:

Apple leaf hopper (*Edwardsiana crataegi* (Douglas) (Hemiptera: Cicadellidae)) was considered to be present in fruit crops in Argentina for several years, until the identification was reviewed by national specialists and corrected to *Edwardsiana froggatti* (Baker).

Edwardsiana froggatti (Baker, 1925) is a widely distributed species that causes severe damage in fruit-growing areas. Over the years, it has been registered worldwide with different generic and specific names, some of them being the same as already used for other organisms. This situation and the disparity in the interpretation of diagnostic morphological characteristics by different authors has led to many misidentifications.

The original name for *Edwardsiana froggatti* was *Typhlocyba crataegi* Dominique, 1902. However, this name, *T. crataegi*, had also been attributed to another organism by Douglas, in 1876. In 1918, Froggatt replaced *T. crataegi* Dominique with *Empoasca australis* Froggatt and in 1921 he transferred it again to the genus *Typhlocyba*. But this nomination, *Typhlocyba australis*, was also considered invalid, as it had already been used by Walsh in 1862 for another organism. Then, in 1925, Baker changed the name to *Typhlocyba froggatti*. Later, China (1950) included it in the *Edwardsiana* genus. *Typhlocyba crataegi* Dominique (now *Edwardsiana froggatti*) is a different organism to *Typhlocyba crataegi* Douglas (now *Edwardsiana crataegi*).

Adding further confusion, different authors had proposed synonymy between *Edwardsiana crataegi* and *E. froggatti*, considering their capacity to fertilize each other under laboratory conditions. However, this synonymy was refuted, based on the artificial nature of the laboratory assays and differences in the genetic components of the two species. Additionally, although these two species are visually very similar, it is possible to distinguish them through several distinct male and female morphological characteristics.

Male adult Edwardsiana froggatti *(Baker)*

Nevertheless, some international databases still show the two species as synonyms. Even national bibliographies in Argentina published prior to 2014 include references to *E. crataegi*, despite the fact that national specialists working with this taxonomic group had reviewed the identity of this species in Argentina in 2009. Specimens studied for this review were collected in the main fruit areas of the country and deposited in the entomological reference collection of La Plata Museum.

In 2018, through the implementation of general surveillance and enquiries to taxonomic specialists and reference entomologists in fruit crops, the situation was finally clarified. As a result, *Edwardsiana froggatti* is recognized as being **present: widespread and not under official control** in Argentina, while *Edwardsiana crataegi* is currently considered **absent: pest records invalid**.

The following ISPMs were successfully implemented:

- ISPM 6 (*Surveillance*)
- ISPM 8 (*Determination of pest status in an area*).

Further reading:

Catalano, M.I., Paradell, S.L. & de Remes-Lenicov, A.M.M. 2009. Biological and taxonomic considerations on *Edwardsiana froggatti* (Baker), the apple yellow leafhopper (Hemiptera-Auchenorrhyncha-Cicadellidae). *Interciencia*, 34(6): 424–427.

Metcalf, Z.P. 1968. *General catalogue of the Homoptera. Fascicle VI. Cicadelloidea. Part 17. Cicadellidae.* Washington, DC, United States Department of Agriculture. vii+1513 pp.

Sistema Nacional Argentino de Vigilancia y Monitoreo de Plagas. 2020. Sistema Nacional Argentino de Vigilancia y Monitoreo de Plagas [Argentine National Pest Surveillance and Monitoring System] [online]. Buenos Aires. [Cited 26 April 2020]. https://www.sinavimo.gov.ar

Case study 4, Official control

Regional official control in Western Australia

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Location and timeline:

Australia, 2007–ongoing

Content of case study:

The national context: the Australian biosecurity system and official control

Australia is a federated country comprising five mainland states, two mainland territories and one island state (see map). Under the federal system, government powers are divided between a central government (the Commonwealth Government, which is also the national plant protection organization of Australia) and regional governments (states and territories and their respective plant protection agencies). Responsibility for biosecurity is shared between all Australian governments in order to maintain Australia's favourable national pest status. The Commonwealth Government of Australia is responsible for managing biosecurity at Australia's international border while state and territory governments are responsible for managing domestic biosecurity within the country and between state or territory borders.

Each Australian state and territory maintains its own biosecurity system, including establishing biosecurity legislation and domestic trade regulations. This may include movement controls applied to import pathways and points of entry within Australia. In this way, individual state and territory governments may apply official controls to prevent the movement of a pest into their state or territory, within their borders, or both.

As an island nation, Australia is geographically isolated and protected from the natural introduction of many pests. Across Australia, there are significant climatic variations, from a tropical north to a cool temperate south, and from snow-covered mountains to a large arid desert centre. Similarly, Australia has significant regional differences in pest status, particularly in areas geographically isolated by arid desert (Western Australia and South Australia) or sea (Tasmania).

Official control and ISPMs

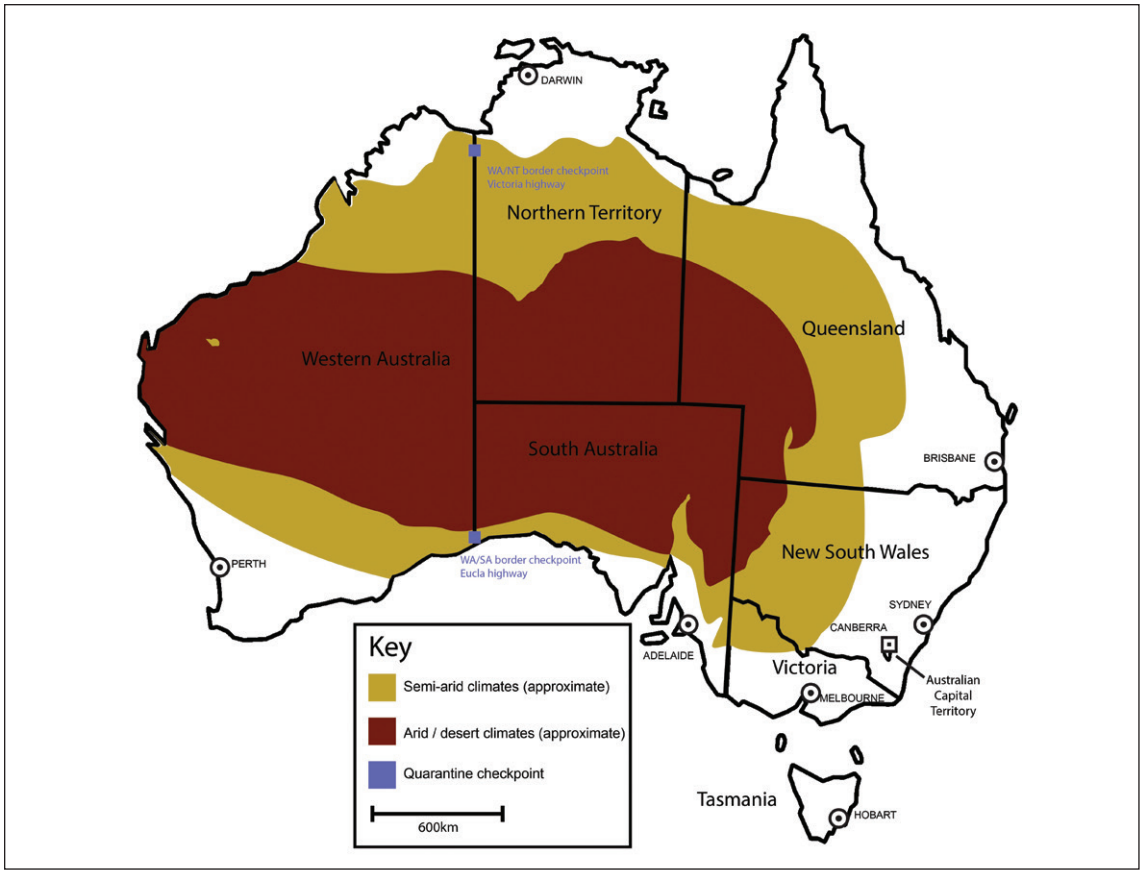
Australia's unique climate, geography and federal system means individual states and territories can implement regional official control programmes and regulate regional quarantine pests. Regional quarantine pests may in turn be regulated by the Commonwealth Government on imports at international points of entry in the states and territories where the pest is under official control.

Australia's national pest status is determined by the Commonwealth Government, based on information provided by the individual states and territories.

Official control in Australia is underpinned by a national policy that Commonwealth, state and territory governments follow. Australia's national official control policy complies with definitions, requirements and guidelines provided in the following ISPMs:

- ISPM 5 (*Glossary of phytosanitary terms*)
- ISPM 8 (*Determination of pest status in an area*)
- ISPM 9 (*Guidelines for pest eradication programmes*).

Regional quarantine pests that a state or territory regulates via official control must comply with



Map of Western Australia's geographical isolation

Australia's national official control policy before the Commonwealth Government will consider regulating the pest at the international border.

Western Australia's natural protection

Western Australia, while part of mainland Australia, is geographically isolated by a large arid desert (see map). At some points, this arid centre can extend more than 1 500 km before it reaches the Western Australian border. The large size and the harsh conditions of the "desert barrier" prevents the natural spread of pests into Western Australia.

Protection through legislation

Western Australia's Biosecurity and Agriculture Management Act 2007 (the Act) underpins the state's biosecurity system and is consistent with the principles of the ISPMs. Under the Act, the Western Australian government administers general and specific legislative requirements which support plant biosecurity. This includes regulating the movement of prescribed potential carriers such as plant material, machinery and seeds into and within the state. The Act also provides Western Australia with the authority to declare an organism as a quarantine pest (according to the criteria defined by the IPPC) and categorizes organisms as (1) a declared pest for the whole of the state (prohibited organism), (2) a declared pest for part of the state that is assigned a control category to exclude (prevent entry) from other areas, eradicate if considered feasible or manage in order to minimize any adverse effect (declared pest), or (3) a permitted organism. An organism not declared as one of the three categories is referred to as an unlisted organism. Prohibited organisms and unlisted organisms are prohibited entry into Western Australia except in accordance with an import permit and appropriate regulations. Movement of an organism that is a declared pest, a thing infested with a declared pest, or a potential carrier of an organism that is a declared pest into an area of the state that is free from that pest is restricted by the regulations.

Border controls

Due to Western Australia's geographical isolation, there are a limited number of points of entry into the state. Each point of entry is regulated, for example:

- Airports: At Western Australia's largest airport, Perth, detector dogs are used in surveillance of passengers. General passenger surveillance is also carried out at airports in Kununurra, Broome and Kalgoorlie.
- Road: There are only two main roads (highways) that connect Western Australia to eastern Australia: the Eyre Highway at the South Australian–Western Australian border, and the Victoria Highway at the Northern Territory–Western Australian border. The Western Australian government operates 24-hour-a-day border checkpoints at both these points of entry. Both private and commercial traffic is stopped and inspected, with goods declared or destroyed.
- Sea and rail: Goods that arrive at Fremantle Port and at Kalgoorlie and Kewdale freight terminals are inspected.

All commercial consignments carrying commodities that pose a biosecurity risk are inspected upon arrival using standard inspection practices. Western Australia maintains a series of import conditions for goods arriving from eastern Australia that are specific to the details of the pest–commodity combination. Common measures to reduce pest risk may include, but are not limited to: fumigation, cold treatment, irradiation, area freedom (including pest free places of production, and pest free areas), washing or other suitable treatments.

Examples of Western Australia's regional official controls and Australia's import conditions

The Commonwealth Government regulates kanzawa spider mite (*Tetranychus kanzawai* Kishida (Prostigmata: Tetranychidae)) at Australia's international border in Western Australia, but not at international points of entry across eastern Australia. Kanzawi spider mite is considered to be present in Queensland and New South Wales but not in Western Australia. It is considered to be under official control and is regulated as a prohibited organism by the Western Australia government. As a result, the Commonwealth Government (Department of Agriculture, Water and the Environment, 2020) considers kanzawi spider mite to be a regional quarantine pest. The national pest status for kanzawi spider mite is **present: not widely distributed and under official control (Western Australia)**. Phytosanitary measures, such as preexport inspection and, if the pest is found, remedial action, are recommended to manage the risk of kanzawi spider mite arriving in Western Australia on imports of strawberries from Japan.

Similarly, Pacific mealybug (*Planococcus minor* (Maskell) (Hemiptera: Pseudococcidae)) is regulated at Australia's international border in Western

Quarantine detector dog

Victoria highway roadstop

Eucla highway roadstop

Australia, but not at international borders in eastern Australia. Pacific mealybug is present in the Australian Capital Territory, New South Wales, Queensland, South Australia and Victoria, and is regulated as a prohibited organism by Western Australia. Because of this, the Commonwealth Government (Australian Government Department of Agriculture, 2019) considers Pacific mealybug to be a regional quarantine pest. The national pest status for Pacific mealybug is **present: not widely distributed and under official control (Western Australia)**. Phytosanitary measures, such as pre-export inspection and, if the pest is found, remedial action, are recommended to manage the risk of Pacific mealybug arriving in Western Australia on imports of breadfruit from Fiji, Samoa or Tonga.

Lessons learned, future plans

Australia will continue to review and refine its official control policy and procedures to ensure harmonization across the state and territory governments. It is hoped that this process will reduce regulatory burden, improve clarity and further strengthen Australia's biosecurity controls.

Further reading:

Australian Government Department of Agriculture. 2019. *Final report for the review of biosecurity import requirements for fresh breadfruit from Fiji, Samoa and Tonga*. Canberra, Department of Agriculture. vi + 82 pp.

Department of Agriculture, Water and the Environment.
2020. *Final report for the review of biosecurity import requirements for fresh strawberry fruit from Japan*. Canberra, Department of Agriculture, Water and the Environment. vii + 216 pp.

Official control in Australia:
https://www.outbreak.gov.au/prevent-and-prepare-for-outbreaks/official-control-quarantine-plant-pests-diseases

Australia's official control policy:
https://www.outbreak.gov.au/media/46

Western Australia's border checkpoints:
https://www.agric.wa.gov.au/importing-animals/quarantine-wa-border-checkpoints?page=0%2C0

Western Australia's organism list:
https://www.agric.wa.gov.au/organisms

Case study 5, Official control

European grapevine moth (*Lobesia botrana*) in Argentina

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Location and timeline:

Argentina, 2009–2019

Content of case study:

The preferred hosts of the European grapevine moth (*Lobesia botrana* (Denis & Schiffermüller) (Lepidoptera: Tortricidae)) are grapes. However, this insect may occasionally feed on several other plants, including blackberries, blueberries, currants, gooseberries, pomegranates, raspberries and stone fruits. The larvae cause damage by boring into flower buds and fruits.

The European grapevine moth was recorded for the first time in South America in 2008, when it was detected in Chile. This situation represented a high risk to Argentina, due to Chile's proximity, the similarity of the agro-ecosystems in the two countries, and the intense commercial and touristic exchange between them. Furthermore, Argentina is an important wine producer, with more than 235 000 hectares of grape production, most of which is located in provinces bordering Chile. The introduction and spread of this pest to the whole host production area of Argentina could cause a significant economic impact and the European grapevine moth is considered by Argentina to be a quarantine pest, based on the outcome of pest risk analysis.

In 2009, Argentina implemented an early detection programme for European grapevine moth. This included surveillance (general surveillance and detection surveys) according to ISPM 6 (*Surveillance*), training of inspectors and diagnostic laboratory personnel from the national plant protection organization (NPPO) and authorized institutions, public awareness campaigns, and mandatory reporting. In addition, the NPPO strengthened national border controls, put phytosanitary measures in place for used machinery and prepared a pest-response programme, including containment and eradication activities and control of used machinery before entry to the country. Based on the species-distribution model, 350 species-specific, pheromone-baited traps were installed from Jujuy province in the north of the country to Río Negro province in the Patagonia region.

As a result, European grapevine moth was confirmed in 2010 at two vineyards in Mendoza province. Argentina's NPPO declared an emergency and specific surveillance was intensified to delimit the population and define the area under official control.

Argentina's NPPO continues to carry out annual surveillance for European grapevine moth: ten years later, more than 9 000 pheromone traps are deployed across the country targeting both grapes and alternative hosts. Outbreaks have been detected in vineyards in the provinces of Mendoza, San Juan, Salta (Cafayate) and Entre Ríos, and in blueberry production in Entre Ríos. Official control measures have been established in all areas where the pest has been detected, with the purpose of containment or eradication of the pest, depending on the situation. Movement restrictions have been put in place to mitigate the risk of further spread of the pest.

At the time of writing, the European grapevine moth is considered to be present in the province of Mendoza and in part of San Juan. Outbreaks in other

Survey for European grapevine moth

Damage caused by European grapevine moth

Species-specific, pheromone-baited trap for European grapevine moth in vineyards

provinces are still under eradication, although no specimens have been captured in the last three years. In Argentina, the European grapevine moth is currently considered to be a quarantine pest that is **present: not widely distributed and under official control.**

The following ISPMs were successfully implemented:

- ISPM 6 (*Surveillance*)
- ISPM 8 (*Determination of pest status in an area*)
- ISPM 9 (*Guidelines for pest eradication programmes*).

Case study 6, Market-access considerations

Application of systems approaches for the export of chilli pepper (*Capsicum* spp.) from Ghana to the European Union market: mitigating the risk of false codling moth (*Thaumatotibia leucotreta*)

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Location and timeline:

Ghana, 2016–2017

Content of case study:

Chilli pepper (*Capsicum* spp.) is currently one of the leading vegetable exports from Ghana, with the main markets being the European Union member states. There are many producer–exporters with expertise in the production and marketing of chilli pepper who have access to a large pool of outgrowers, from whom they buy quality chilli pepper for export.

The foreign exchange derived from chilli-pepper export rose from USD 576 in 2013 to USD 56 524 and USD 132 835 in 2014 and 2015, respectively. Concurrent with this rise, however, was an upward trend in the number of chilli-pepper consignments from Ghana that were intercepted with false codling moth (*Thaumatotibia leucotreta* (Meyrick) (Lepidoptera: Tortricidae)) in European Union member states. An audit carried out in Ghana by the DG Health and Food Safety of the European Commission, which covered various stages of the chilli-pepper export value chain, revealed shortcomings in the phytosanitary export certification system. As a consequence, the European Union placed a temporary ban on chilli pepper from Ghana for one year ending on 31 December 2016, later extended to December 2017, to avoid the risk of introduction of false codling moth into the Union.

False codling moth has been a regulated quarantine pest in the European Union since 1 October 2014, following a risk assessment by the European and Mediterranean Plant Protection Organization (EPPO) in 2013, which indicated that it could establish in European Union member states with economic consequences, thus requiring intervention. It is categorized as an A2 pest (a quarantine pest present in the EPPO region, but not widely distributed there and being officially controlled), thus qualifying for inclusion as a harmful organism.

To provide import security for European Union member states and Switzerland importing chilli pepper from Ghana, the national plant protection organization (NPPO) of Ghana initiated a programme of systems approaches to manage false codling moth. The relevant stakeholders that provided logistical and technical support to implement these systems approaches included:

- The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) / Market Oriented Agriculture Programme;
- CABI;
- HortiFresh (GhanaVeg) Programme;
- European Commission's Trade Related Assistance and Quality Enabling (TRAQUE) Programme;
- Ghana Association of Vegetable Exporters (GAVEX);
- Soil and Irrigation Research Centre (SIREC), University of Ghana, Kpong;
- School of Agriculture, College of Basic and Applied Sciences of the University of Ghana;
- National Agricultural Research Organization, National Agricultural Research Laboratories, Uganda.

In terms of phytosanitary measures, a holistic approach to crop health, known as integrated crop management, was employed, of which integrated pest

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Officer inspecting false codling moth pheromone trap

© NPPO Ghana

Laboratory technician at the Plant Health Diagnostic Laboratory checking for exit holes, larvae and pupae of false codling moth

management is an integral part. During the 2016 and 2017 cropping seasons, this approach was tested through participatory, on-farm trials conducted by the NPPO in collaboration with exporters, their outgrowers, and donor partners, with technical assistance from research scientists (entomologists). After the participatory on-farm trials, the research team developed guidelines and protocols for the production of chilli pepper for the local market and consignments destined for the European Union market. These phytosanitary measures included important agronomic practices (nutrient management, mulching, irrigation, weed control, etc.) and specific interventions for the management of false codling moth (prevent, monitor and control). The combination of phytosanitary measures currently being implemented by the NPPO in Ghana to improve its performance in achieving zero interception of false codling moth includes the following:

- Chilli-production sites are inspected for the purposes of mapping (geolocation and taking of coordinates) and coding before production is included in the traceability system.
- Only those exporters and their outgrower production sites that fully comply with the production protocols are allowed to export chillies to the European Union market.
- A sample box of first chilli fruits (average 5 kg) picked from the production site is sent to the Plant Health Diagnostic Laboratory for inspection and incubated in cages for five to ten days to examine for exit holes, larvae and pupae of false codling moth.
- If the data from sampled first chilli fruits shows that the fruits are free from false codling moth, the coded production site is approved for export for that production season and the information is sent to the plant quarantine inspectors at the exit point.
- Approved and coded pack houses are used for sorting, cleaning, packaging and labelling, before chilli peppers are transported to the exit point.
- Plant quarantine inspectors conduct risk-based inspection and phytosanitary certification at the exit point prior to dispatch.
- NPPO officers are trained in the inspection and detection of all developmental stages of false codling moth in the field to increase the probability of detecting the target pest.
- Exporters and their outgrowers are trained in the various pest-management measures to manage false codling moth in chilli-production sites.
- Additional inspection facilities and appropriate equipment (computers, inspection tables, microscope, fridges, digital camera, etc.) have been provided to ensure effective inspection and export certification.
- Records on agronomic practices and pest-management strategies of exporters and their outgrower farms are documented and monitored at all production sites.

© NPPO Ghana

Chillies harvested from the field to the approved and coded pack house for value addition

© NPPO Ghana

Plant quarantine officer conducting risk-based inspection at Kotoka International Airport, Accra

With the application of these systems approaches, the number of detections at the exit point (Kotoka International Airport, Ghana) of chilli-pepper consignments infested with false codling moth was reduced, and the number of interceptions in European Union member states decreased from 70 in 2014 and 66 in 2015 to 12 in 2018 and zero in 2019 (European Commission, 2020). The ban on chilli peppers imported from Ghana into the European Union was lifted in 2018, with the European Commission providing new guidelines and options that took effect from 1 January 2018 (Commission Implementing Directive (EU) 2017/1279) and the current Directive 2019/523 which commenced on 1 September 2019. Following the lifting of the ban, export earnings recovered, the chilli-pepper crop yielding approximately USD 111 634 in 2018.

Given the proven effectiveness of the systems approaches employed by the NPPO of Ghana, such approaches could be expanded to cover other insect pests on other crops, such as sponge gourd / ridged luffa, bottle gourd, aubergine and bitter melon, which would increase market access for these Ghanaian vegetable products.

The following ISPMs were successfully implemented:

- ISPM 6 (*Surveillance*)
- ISPM 7 (*Phytosanitary certification system*)
- ISPM 12 (*Phytosanitary certificates*)
- ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*)
- ISPM 23 (*Guidelines for inspection*)
- ISPM 31 (*Methodologies for sampling of consignments*).

Further reading:

EPPO (European and Mediterranean Plant Protection Organization). 2013. *Pest risk analysis for* Thaumatotibia leucotreta [online]. Paris, EPPO. 126 pp. [Cited 16 April 2020]. http://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm

European Commission. 2020. Interceptions of harmful organisms in imported plants and other objects [annual interceptions for 2014, 2015 and 2018]. In: *European Union Notification System for Plant Health Interceptions* [online]. [Cited 16 April 2020]. https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/interceptions_en

Fening, K.O. & Billah, M.K. 2017. *Roadmap by Ghana's NPPO to address important amendment to EU plant health regulations affecting export of chillies and peppers (*Capsicum*) – to ensure produce is free from the false codling moth,* Thaumatotibia leucotreta *(Meyrick) (Lepidoptera: Tortricidae)*. Accra, National Plant Protection Organization (NPPO), Plant Protection and Regulatory Services Directorate (PPRSD) of Ministry of Food and Agriculture. 14 pp.

Fening, K.O. & Billah, M.K. 2019. *Phytosanitary measures by NPPO of Ghana to address important amendment to EU plant health regulations, implementing Directive 2019/523, affecting export of chillies and peppers (*Capsicum*) – to ensure produce is free from the false codling moth (*Thaumatotibia leucotreta*) (Meyrick) (Lepidoptera: Tortricidae)*. Accra, National Plant Protection Organization (NPPO), Plant Protection and Regulatory Services Directorate (PPRSD) of Ministry of Food and Agriculture. 14 pp.

Fening, K.O., Billah, M.K. & Kukiriza, C.N. 2016. *Protocol for evaluating the efficacy of six products against the false codling moth, fruit flies, thrips and whiteflies on chillies, garden egg and ridged gourd in Ghana*. Accra, GhanaVeg. 35 pp.

Fening, K.O., Billah, M.K. & Kukiriza C.N.M., eds. 2017. *Roadmap for pest reduction in Ghana's export vegetable sector*. GhanaVeg Sector Reports [online]. Accra, GhanaVeg. 28 pp. [Cited 16 April 2020]. http://docplayer.net/80364213-Ghana-sector-reports-roadmap-for-pest-reduction-in-ghana-s-export-vegetable-sector.html

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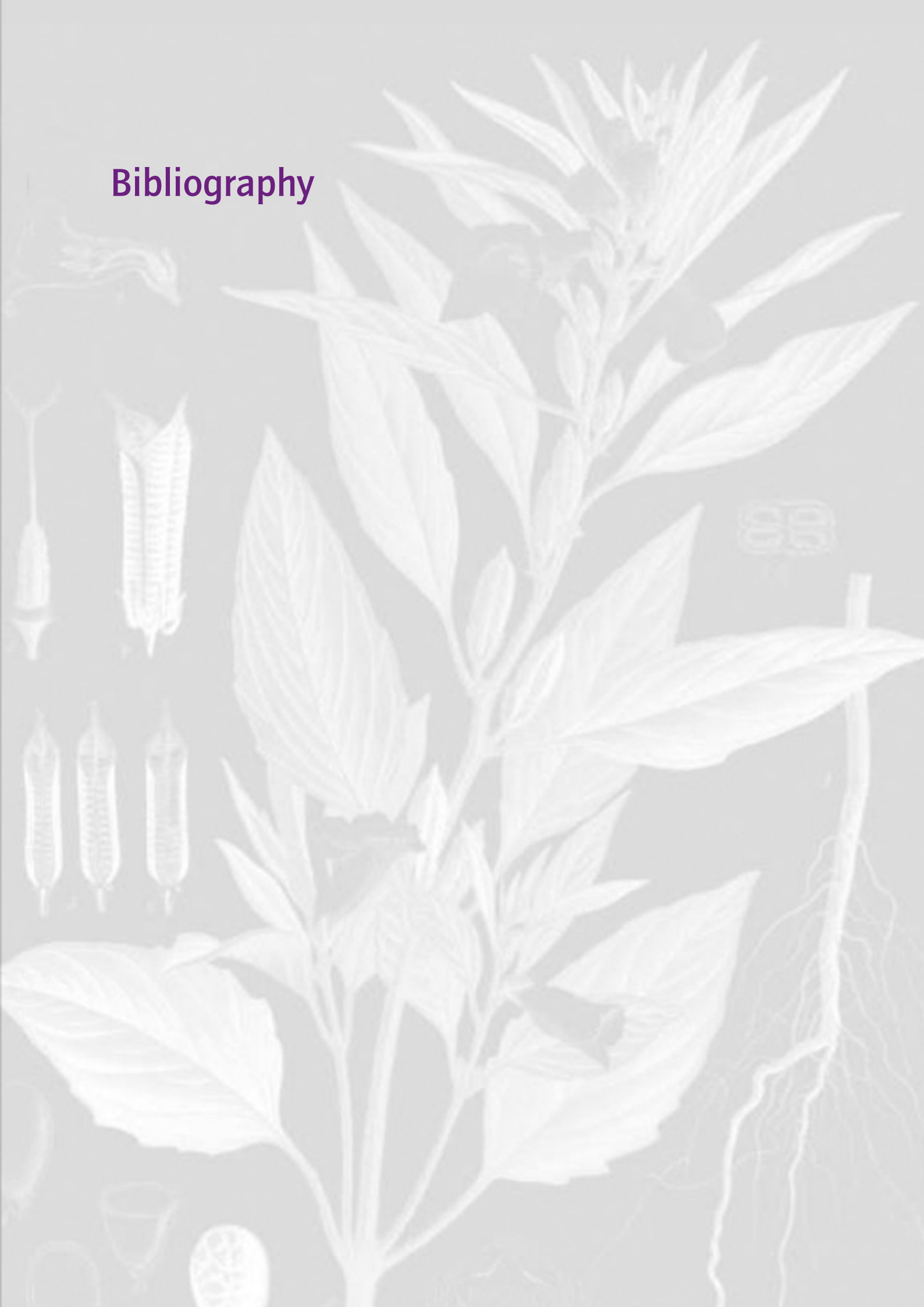
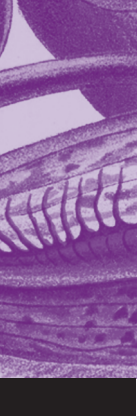




Examples of online information sources and information-exchange platforms

INTERNATIONAL PHYTOSANITARY PORTAL (IPP): https://www.ippc.int/en/

- Regulated pest lists, pest reports and other country information: https://www.ippc.int/en/countries/
- Contributed resources: https://www.ippc.int/en/core-activities/capacity-development/guides-and-training-materials/contributed-resource-list/

OTHER GLOBAL INFORMATION SOURCES:

- CABI Invasive Species Compendium: https://www.cabi.org/isc/
- CABI Crop Protection Compendium: https://www.cabi.org/cpc
- CABI Forestry Compendium: https://www.cabi.org/fc
- CABI Plantwise Knowledge Bank: https://www.plantwise.org/knowledgebank/
- eFloras.org: http://www.eFloras.org
- Global Biodiversity Information Facility (GBIF): https://www.gbif.org/
- Global Invasive Species Database (GISD): http://www.iucngisd.org/gisd
- Global Register of Introduced and Invasive Species (GRIIS): http://www.griis.org/
- Lucid identification or diagnostic keys: https://www.lucidcentral.org/key-search/
- Pest Information Wiki: https://wiki.pestinfo.org/
- Plants of the World Online: http://plantsoftheworldonline.org/
- ScaleNet: http://scalenet.info
- ThripsWiki: https://thrips.info
- United States Department of Agriculture Germplasm Resources Information Network (USDA GRIN) Taxonomy: https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx
- World Flora Online: http://www.worldfloraonline.org

REGIONAL INFORMATION SOURCES:

- European Alien Species Information Network (EASIN): https://easin.jrc.ec.europa.eu/easin/CitizenScience/Projects
- European and Mediterranean Plant Protection Organization (EPPO) Global Database: https://gd.eppo.int/
- North American Plant Protection Organization (NAPPO) Phytosanitary Alert System: https://www.pestalerts.org/
- Pacific Islands Ecosystems at Risk (PIER): http://www.hear.org/pier/

International Standards for Phytosanitary Measures (ISPMs) directly related to pest status determination

ISPM 1. *Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*. Rome, IPPC Secretariat, FAO.

ISPM 4. *Requirements for the establishment of pest free areas*. Rome, IPPC Secretariat, FAO.

ISPM 5. *Glossary of phytosanitary terms*. Rome, IPPC Secretariat, FAO. (Including Supplement 1: Guidelines on the interpretation and application of the concepts of "official control" and "not widely distributed".)

ISPM 6. *Surveillance*. Rome, IPPC Secretariat, FAO.

ISPM 8. *Determination of pest status in an area*. Rome, IPPC Secretariat, FAO.

ISPM 9. *Guidelines for pest eradication programmes*. Rome, IPPC Secretariat, FAO.

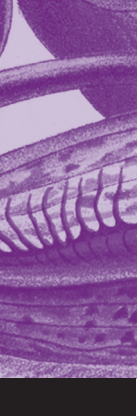
ISPM 17. *Pest reporting*. Rome, IPPC Secretariat, FAO.

ISPM 19. *Guidelines on lists of regulated pests*. Rome, IPPC Secretariat, FAO.

ISPM 22. *Requirements for the establishment of areas of low pest prevalence*. Rome, IPPC Secretariat, FAO.

ISPM 26. *Establishment of pest free areas for fruit flies (Tephritidae)*. Rome, IPPC Secretariat, FAO.

- The above ISPMs, together with the other ISPMs cited in this guide, may be found on the IPP at: https://www.ippc.int/en/core-activities/standards-setting/ispms/.



Other IPPC implementation and capacity development resources

Establishing and Maintaining Pest Free Areas A guide to understanding the principal requirements for pest free areas, pest free places of production, pest free production sites and areas of low pest prevalence

Market Access A practical guide for achieving market access and maintaining trade

National Reporting Obligations This guide offers assistance on how to upload and update national reporting obligation (NRO) reports on the IPP and includes NRO procedures and nomination forms for the IPPC Official Contact Point and IPP editor, as approved by the Commission on Phytosanitary Measures (CPM)

Operation of an NPPO A guide to understanding the principal requirements for operating an organization to protect national plant resources from pests

Plant Diagnostics A guide to support the establishment, operation and maintenance of diagnostic laboratories and services in order to support national phytosanitary systems

Plant Pest Surveillance A guide to understanding the principal requirements of surveillance programmes for national plant protection organizations

Pest Risk Analysis (PRA) Training Materials A portal to presentations, videos and training materials about pest risk analysis

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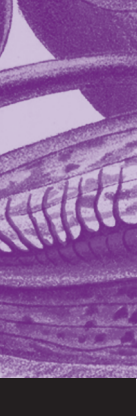
Appendices



Appendix 1.
Checklist for pest status reports

This checklist contains the information that should be considered in making a pest status determination. The information used to make the determination should be documented in a pest status report. References should be noted for all items of information. It is important to note information gaps and record this information.

1. Identify the pest under consideration

Record all of the following information:

- scientific name of the pest (genus and species);
- describing authority (name of the scientist who first published this scientific name);
- synonyms;
- taxonomic position (order and family);
- common name for the relevant taxonomic group (e.g. insect, mite, mollusc, nematode, plant, fungus, virus);
- regulatory status of the pest (e.g. regulated, unregulated, under evaluation).

2. Describe the area under consideration

- Give the name of the country and say whether the area under consideration is the entire country or a portion of the country.
- If it is a portion of the country, provide a precise description using legal boundaries, distinct geographical features or biogeographical regions.
- Include a map, if appropriate.

3. Global distribution of pest

- Identify where the pest is considered indigenous.
- List countries where the pest is reported as being present.

4. Pest presence/absence

- Document the evidence used to determine presence/absence in the area under consideration.
- Identify information gaps and sources of uncertainty and steps that will be taken to resolve these.
- Record whether the pest is present or absent in the area under consideration, or whether there is insufficient information to make a determination.

5. If the pest is present, is it widely distributed?

- Describe the pest distribution.
- Document the evidence used to make this determination.
- Record whether the pest has only been reported under specific conditions, such as in association with specific hosts, in enclosed structures, in botanical gardens, in the environment but not on a plant host (e.g. in soil or water), in urban areas, or at certain times of the year.
- Identify information gaps and sources of uncertainty.

6. If present, is the pest under official control?

- Record whether there are any parts of the area under consideration that are currently under official control (e.g. containment, surveillance, eradication, pest free areas, area of low pest prevalence).
- Describe the part or parts of the area that are under official control and include maps, if appropriate.

7. Is the pest expected to establish in the area under consideration?

- If the pest is present, is it considered established?
- Is the pest expected to establish?
- List any factors that are likely to limit or prevent establishment and document the supporting evidence, including maps and models, where appropriate. For example:
  - climate
  - availability of hosts.

8. Pest status determination

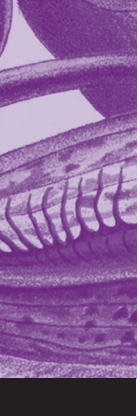
- Determine and record the appropriate pest status category from ISPM 8 (*Determination of pest status in an area*).
- Record the name of the expert making the pest status determination and preparing the report, the date the determination is made, and the date of the report.

9. Pest status review

- Record any changes to pest status.
- Document the evidence used to revise the pest status determination.
- Record the name of the expert reviewing or revising the pest status determination, and the date that the review or revision was concluded.

10. References

- List all references used.
- Include any relevant fact sheets or pest risk assessments.



Appendix 2.
How to interpret terms and phrases used to describe pest prevalence and distribution in the scientific literature, historical pest reports and pest data sheets

APPENDIX 2.1: COMMONLY USED PHRASES

The following phrases have commonly been used to describe pest detections and populations in many written sources of information, from NPPO reports and published scientific literature to pest databases and crop-production information. These phrases lack clarity and are open to interpretation. **It is recommended that NPPOs avoid using these terms and only use the pest status categories described in ISPM 8 (*Determination of pest status in an area*).**

"*finding of a pest*" is a general term that suggests that a pest has been detected and may be present, but it may also imply that just a single specimen was found. Additional information is needed in order to determine pest status, and the "finding of a pest", particularly a regulated pest, should trigger an investigation and perhaps specific surveillance, as described in ISPM 6 (*Surveillance*).

"*pest is not known to occur*" is a general term that indicates that the NPPO may not have completed surveillance or a pest status determination. Additional justification may be required in order to declare "absence".

"*pest is known not to occur*" is a general term that suggests that a pest is absent. This term also implies that absence has been confirmed by general or specific surveillance. However, it is vague and open to interpretation. The NPPO should describe the pest status using one of the "absence" categories in ISPM 8.

"*worldwide distribution*" and **"*cosmopolitan*"** are terms that suggest that a pest is "present: widely distributed and not under official control", not only within the country but also globally. The NPPO should describe the pest status in the area under consideration using one of the "presence" categories in ISPM 8.

"*natural low prevalence*" is a term that suggests that a pest is present in the area but specific surveys indicate that it is at low population levels and this is not as a result of official control measures. It is important to note that the pest status category "present: at low prevalence" should only be used when the pest's prevalence is low in accordance with ISPM 22. The NPPO should use the appropriate "presence" category in ISPM 8 to describe the status of the pest in the area, but may wish to provide additional information about its prevalence.

"*rare*" and **"*occasional*"** are terms that suggest that a pest may be present in the area but that it is uncommon. However, these terms may simply mean that the pest does not cause economic damage every year. Although the NPPO may wish to note that a pest is rare or occasional, its pest status should be described using one of the "presence" categories in ISPM 8.

"*endemic*", "*indigenous*" and **"*native*"** are terms that suggest that a pest is either "present: widely distributed and not under official control" or "present: not widely distributed and not under official control" within the area. The NPPO may continue to indicate that the pest is endemic, indigenous or native, but they should also describe its pest status in the area using the appropriate "presence" category from ISPM 8.

APPENDIX 2.2: PEST PRESENCE AND ABSENCE TERMS

This table is intended to be a tool to help national plant protection organizations (NPPOs) interpret and evaluate information gathered from general surveillance and historic pest reports. The left-hand column in the table below lists terms and phrases that have been commonly used to describe pest prevalence and pest distribution in the scientific literature, historical pest reports, pest data sheets and other documents. The right-hand column suggests a possible equivalent pest status category from ISPM 8. **NOTE:** It is recommended that NPPOs avoid using the terms in the left-hand column to describe pest status.

Terms and phrases that are found in scientific literature, historical pest reports, pest data sheets (e.g. CABI Crop Protection Compendium, EPPO Global Database), etc.	IPPC pest status categories, as per ISPM 8
Present, in all parts of the area Present, in all parts of the area where host crop or crops are grown Present, only in areas where host crop or crops are grown Present, widespread Worldwide distribution, cosmopolitan	**Present:** widely distributed
Present, few occurrences Present, only in captivity / cultivation / protected cultivation / under cover / indoors Present, only in some areas Present, only in some of the areas where host crops are grown Present, restricted distribution	**Present:** not widely distributed and not under official control
Present, under quarantine Present, under regulatory control Present, subject to official control Present, under eradication Transient: actionable, under eradication Transient: actionable, under surveillance	**Present:** not widely distributed and under official control
Present, area of low pest prevalence	**Present:** at low prevalence
Present, except in pest free areas	**Present:** except in specified pest free areas
Transient: non-actionable Present, seasonal / seasonally Present, casual / ephemeral / adventive	**Present:** transient
Absent, confirmed by survey Absent, never occurred Absent, no pest records Absent, reported but not confirmed Intercepted only	**Absent:** pest not recorded
Pest free area	**Absent:** the entire country is pest free
Absent, invalid record Absent, unreliable record	**Absent:** pest records invalid
Absent, formerly present No longer present	**Absent:** pest no longer present
Eradicated	**Absent:** pest eradicated

EPPO: European and Mediterranean Plant Protection Organization.

IPPC

The International Plant Protection Convention (IPPC) is an international plant health agreement that aims to protect global plant resources and facilitate safe trade. The IPPC vision is that all countries have the capacity to implement harmonized measures to prevent pest introductions and spread, and minimize the impacts of pests on food security, trade, economic growth, and the environment.

Organization

- There are over 180 IPPC contracting parties.
- Each contracting party has a national plant protection organization (NPPO) and an official IPPC contact point.
- 10 regional plant protection organizations (RPPOs) have been established to coordinate NPPOs in various regions of the world.
- The IPPC Secretariat liaises with relevant international organizations to help build regional and national capacities.
- The Secretariat is provided by the Food and Agriculture Organization of the United Nations (FAO).

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