Food and Agriculture Organization of the United Nations

International Plant Protection Convention
Protecting the world's plant resources from pests

INTERNATIONAL STANDARD FOR PHYTOSANITARY MEASURES 39

ISPM 39

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International movement of wood

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INTERNATIONAL STANDARDS FOR
PHYTOSANITARY MEASURES

ISPM 39

International movement of wood

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CONTENTS

Adoption

This standard was adopted by the Twelfth Session of the Commission on Phytosanitary Measures in April 2017.

INTRODUCTION

Scope

This standard provides guidance for the assessment of the pest risk of wood and describes phytosanitary measures that may be used to reduce the risk of introduction and spread of quarantine pests associated with the international movement of wood, in particular those that infest trees.

This standard covers only raw wood commodities and material resulting from the mechanical processing of wood: (1) round wood and sawn wood (with or without bark); and (2) materials resulting from the mechanical processing of wood such as wood chips, sawdust, wood wool and wood residue (all with or without bark). This standard covers wood of gymnosperms and angiosperms (i.e. dicotyledons and some monocotyledons, such as palms), but not bamboo and rattan.

Wood packaging material is covered within the scope of ISPM 15 (*Regulation of wood packaging material in international trade*) and therefore is not covered in this standard.

Products manufactured from wood (such as furniture), processed wood material (e.g. pressure treated, glued or heated wood) and wooden handicrafts are not covered in this standard.

Wood may also carry contaminating pests; however, they are not covered in this standard.

References

The present standard refers to International Standards for Phytosanitary Measures (ISPMs). ISPMs are available on the International Phytosanitary Portal (IPP) at https://www.ippc.int/core-activities/standards-setting/ispms.

FAO. 2009. *Global review of forest pests and diseases.* FAO Forestry Paper 156. Rome, FAO. 222 pp.

FAO. 2011. *Guide to the implementation of phytosanitary standards in forestry*. FAO Forestry Paper 164. Rome, FAO. 101 pp.

Definitions

Definitions of phytosanitary terms can be found in ISPM 5 (*Glossary of phytosanitary terms*).

Outline of Requirements

Pest risk varies among wood commodities such as round wood, sawn wood and wood material resulting from mechanical processing, depending on the level of processing that the wood has undergone.

National plant protection organizations (NPPOs) should use the pest risk analysis (PRA) to provide the technical justification for phytosanitary import requirements for quarantine pests associated with the international movement of wood.

Proportionate to the pest risk identified, phytosanitary measures for managing the pest risk related to wood, including bark removal, treatment, chipping and inspection, should be applied.

The NPPO of the importing country may require as a phytosanitary import requirement an individual phytosanitary measure or a combination of phytosanitary measures under a systems approach.

BACKGROUND

Wood produced from infested trees or woody plants may carry pests. These pests may then infest trees in the PRA area. This is the pest risk primarily dealt with in this standard.

Wood may also become infested by some pests after harvesting. The risk of such infestation is closely tied to the condition of the wood (e.g. the size, presence or absence of bark, moisture content) and exposure to pests after harvest.

Pests that have been shown historically to move with wood in international trade and establish in new areas include: insects that oviposit on bark, bark beetles, wood wasps, wood borers, wood-inhabiting nematodes, and certain fungi with dispersal stages that can be transported with wood. Therefore, wood (with or without bark) moved in international trade is a potential pathway for the introduction and spread of quarantine pests.

Wood is commonly moved as round wood, sawn wood and mechanically processed wood. The pest risk presented by a wood commodity depends on a range of characteristics, such as the commodity's type, the level of processing and the presence or absence of bark, and on factors such as the wood's origin, age, species and intended use and any treatment applied to the wood.

Wood is usually moved internationally to a specific destination and for a specific intended use. Given the frequency of association between key pest groups and key wood commodities, it is important to provide guidance on phytosanitary measures. This standard provides guidance for effectively assessing the risk of quarantine pests and for harmonizing the use of appropriate phytosanitary measures.

The FAO publication *Global review of forest pests and diseases* (2009) provides information on some of the major forest pests of the world. The FAO *Guide to the implementation of phytosanitary standards in forestry* (2011) provides information on best management practices that reduce pest risk during growing, harvesting and shipping of wood.

To differentiate wood from bark as used in this standard, a drawing and photographs of a cross-section of round wood and sawn wood are provided in Appendix 1.

IMPACT ON BIODIVERSITY AND THE ENVIRONMENT

Implementation of this standard is considered to reduce significantly the likelihood of introduction and spread of quarantine pests, thereby contributing to tree health and the protection of forest biodiversity. Certain treatments may have a negative impact on the environment and countries are encouraged to promote the use of phytosanitary measures that have a minimal negative impact on the environment.

REQUIREMENTS

1. Pest Risk Related to Wood Commodities

The pest risk of the commodities addressed in this standard varies depending on: the wood's origin and species; characteristics such as the level of processing and the treatment the wood has undergone and the presence or absence of bark; and the intended use.

This standard describes the general pest risk related to each wood commodity by indicating major pest groups associated with it. In addition to the risk factors listed above, the pest risk associated with a wood commodity may also depend on factors such as age, size, moisture content, pest status at origin and destination, and duration and mode of transport.

Phytosanitary measures should not be required without appropriate technical justification based on PRA (as described in ISPM 2 (*Framework for pest risk analysis*) and ISPM 11 (*Pest risk analysis for quarantine pests*)), taking into account:

- the pest status where the wood originated

- the degree of processing before export
- the ability of a pest to survive on or in the wood
- the intended use of the wood
- the likelihood of establishment of a pest in the PRA area, including the presence of a vector if needed for the dispersal of the pest.

Wood may be infested by pests present in the area of origin at the time of growing or harvesting. Several factors can influence a pest's ability to infest trees or wood. These factors can also affect pest survival on or in the harvested wood, and in turn impact the risk of pest association with the wood. Such factors are: outbreaks of pests in the area of origin, forestry management practices, conditions during transportation, storage time, place and conditions, and treatments applied to the harvested wood. These factors should be considered when evaluating the probability of introduction and spread of quarantine pests.

In general, the greater the level of processing or treatment of the wood after harvest, the greater the reduction in the pest risk. However, it should be noted that processing may change the nature of the pest risk. For example, the physical process of wood chipping is in itself lethal to some insect pests, particularly when a small chip size is produced, but the increase in surface area of the wood may facilitate its colonization by fungi. Chip size varies according to industry specifications and is usually related to the intended use of the chips. Pests that are associated with specific wood tissues (e.g. bark, outer sapwood) pose virtually no pest risk when the tissues that they inhabit are removed during processing. The pest risk associated with the removed material should be assessed separately if it is to be moved in trade as another commodity (e.g. cork, biofuel, bark mulch).

The pest groups identified in Table 1 are known to move with wood commodities and have shown the potential to establish in new areas.

Table 1. Pest groups that may be associated with the international movement of wood

Pest group	Examples within the pest group
Aphids and adelgids	Adelgidae, Aphididae
Bark beetles	Molytinae, Scolytinae
Non-wood-boring moths and wasps	Diprionidae, Lasiocampidae, Lymantriinae, Saturniidae, Tenthredinidae
Scales	Diaspididae
Termites and carpenter ants	Formicidae, Kalotermitidae, Rhinotermitidae, Termitidae
Wood-boring beetles	Anobiidae, Bostrichidae, Buprestidae, Cerambycidae, Curculionidae, Lyctidae, Oedemeridae, Platypodinae
Wood-boring moths	Cossidae, Hepialidae, Sesiidae
Wood flies	Pantophthalmidae
Wood wasps	Siricidae
Canker fungi	Cryphonectriaceae, Nectriaceae
Pathogenic decay fungi	*Heterobasidion* spp.
Pathogenic stain fungi	Ophiostomataceae
Rust fungi	Cronartiaceae, Pucciniaceae
Vascular wilt fungi	Ceratocystidaceae, Ophiostomataceae
Nematodes	*Bursaphelenchus cocophilus*, *B. xylophilus*

There are some pest groups among water moulds, bacteria, viruses and phytoplasmas that, even if known to be associated with wood, are unlikely to establish in new areas by transfer from imported wood to hosts.

1.1 Round wood

Most round wood, with or without bark, is moved internationally for subsequent processing at destination. The wood may be sawn for use as construction material (e.g. as timber framing) or it may be used to produce wood materials (e.g. wood chips, wood wool, bark chips, pulp, firewood, biofuels, manufactured wood products).

Removing bark from round wood reduces the probability of introduction and spread of some quarantine pests. The level of reduction depends on the degree to which the bark and underlying wood have been removed and on the pest group. For example, complete bark removal will greatly reduce the risk of infestation of most bark beetles in the wood. However, bark removal is unlikely to influence the incidence of deep wood borers, some species of fungi and wood-inhabiting nematodes.

The pest risk of round wood is greatly influenced by the total amount of remaining bark on the debarked wood, which in turn is greatly influenced by the shape of the round wood, the machinery used to remove the bark and, to a lesser extent, by the species of tree. In particular, the widened areas at the base of a tree, especially where large root buttresses are present, and around branch nodes are the preferred locations for beetle infestation and oviposition.

The pest groups likely to be associated with round wood are listed in Table 2.

Table 2. Likelihood of pest groups to be associated with round wood

Commodity	Likely	Less likely
Round wood with bark	Aphids and adelgids, bark beetles, non-wood-boring moths, scales, termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi, pathogenic stain fungi, rust fungi, vascular wilt fungi; nematodes	
Round wood without bark	Termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi, pathogenic stain fungi, vascular wilt fungi; nematodes	Aphids and adelgids, bark beetles†, non-wood-boring moths, scales; rust fungi

† Some bark beetles have life stages that are found in the wood below the surface of the bark and cambium and, therefore, may be present after debarking or complete bark removal.

1.2 Sawn wood

Most sawn wood, with or without bark, is moved internationally for use in building construction and furniture manufacturing and for the production of wood packaging material, wood lathing, wood stickers, wood spacers, railway sleepers (ties) and other constructed wood products. Sawn wood may include fully squared pieces of wood without bark or partially squared wood with one or more curved edges that may or may not include bark. The thickness of the piece of sawn wood may affect the pest risk.

Sawn wood from which some or all bark has been removed presents a much lower pest risk than sawn wood with bark. Reducing the size of pieces of bark remaining on wood reduces the pest risk.

The pest risk of bark-related organisms is also dependent on the moisture content of the wood. Wood from freshly harvested living trees has a high moisture content that decreases over time to ambient moisture conditions, which are less likely to allow bark-related organisms to survive. Further information on addressing pest risk through a combination of treatment and moisture reduction is provided in Appendix 2.

The pest groups likely to be associated with sawn wood are listed in Table 3.

Table 3. Likelihood of pest groups to be associated with sawn wood

Commodity	Likely	Less likely
Sawn wood with bark	Bark beetles, termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, rust fungi, vascular wilt fungi; nematodes	Aphids and adelgids, non-wood-boring moths, scales‡
Sawn wood without bark	Termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, vascular wilt fungi; nematodes	Aphids and adelgids, bark beetles, non-wood-boring moths, scales‡; rust fungi

† Although pathogenic decay fungi may be present in sawn wood, most present a low risk of establishment because of the intended use of the wood and the limited potential for the fungi to produce spores on the wood.

‡ Many scale species are removed during the squaring of wood, but remaining bark may present sufficient surface area for some species to survive after sawing.

1.3 Wood materials produced from mechanical processing of wood (excluding sawing)

Mechanical processes that reduce the size of wood pieces reduce the pest risk of some pests. However, for other pests, alternative pest risk management measures are necessary.

1.3.1 Wood chips

In addition to the pest risk factors mentioned in section 1 pertaining to wood in general, the pest risk of wood chips varies with their size and uniformity, and also with their storage conditions. The pest risk is reduced when bark is removed and the chip size is less than 3 cm in at least two dimensions (as described in Table 4 and section 2.3). The physical process of wood chipping is in itself lethal to some insect pests, particularly when a small chip size is produced. Chip size varies according to industry specifications and is usually related to the intended use of the chips (e.g. biofuel, paper production, horticulture, animal bedding). Some wood chips are produced in accordance with strict quality standards to minimize bark and fines (very small particles).

Depending on their size, insect pests normally found under the bark may be present in wood chips with bark. Many species of pathogenic decay fungi, canker fungi and nematodes may also be present in wood chips with or without bark. Spore dispersal of wood-inhabiting rust fungi would be very unlikely after the production of chips.

1.3.2 Wood residue

Wood residue is normally considered to present a high pest risk because it varies greatly in size and may or may not include bark. Wood residue is generally a waste by-product of wood being mechanically processed during production of a desired article; nevertheless, wood residue may be moved as a commodity.

The pest groups likely to be associated with wood chips and wood residue are listed in Table 4.

Table 4. Pest groups likely to be associated with wood chips and wood residue

Commodity	Likely	Less likely
Wood chips with bark and greater than 3 cm in at least two dimensions	Bark beetles, termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi pathogenic decay fungi†, pathogenic stain fungi, rust fungi†, vascular wilt fungi; nematodes	Aphids and adelgids, non-wood-boring moths, scales
Wood chips without bark and greater than 3 cm in at least two dimensions	Termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, vascular wilt fungi; nematodes	Aphids and adelgids, bark beetles, non-wood-boring moths, scales; rust fungi†
Wood chips with bark and less than 3 cm in at least two dimensions	Bark beetles, termites and carpenter ants; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, rust fungi†, vascular wilt fungi; nematodes	Aphids and adelgids, non-wood-boring moths, scales, wood-boring beetles, wood-boring moths, wood flies, wood wasps
Wood chips without bark and less than 3 cm in at least two dimensions	Termites and carpenter ants; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, vascular wilt fungi; nematodes	Aphids and adelgids, bark beetles, non-wood-boring moths, scales, wood-boring beetles, wood-boring moths, wood flies, wood wasps; rust fungi†
Wood residue with or without bark	Aphids and adelgids, bark beetles, non-wood-boring moths, scales, termites and carpenter ants, wood-boring beetles, wood-boring moths, wood flies, wood wasps; canker fungi, pathogenic decay fungi†, pathogenic stain fungi, rust fungi†, vascular wilt fungi; nematodes	

† Rust and pathogenic decay fungi may be present in consignments of wood chips or wood residue but are unlikely to establish or spread.

1.3.3 Sawdust and wood wool

Sawdust and wood wool present a lower pest risk than the commodities above. In certain cases, fungi and nematodes may be associated with sawdust. Wood wool is considered to present a similar pest risk as sawdust.

2. Phytosanitary Measures

The phytosanitary measures described in this standard should be required only if technically justified, based on PRA. A specific element to consider through PRA is how pest risk may be mitigated by the intended use of the commodity. Certain phytosanitary measures may be implemented to protect wood that has been produced in pest free areas but that may be at risk of infestation (e.g. during storage and transportation). Various methods to safeguard against infestation after the application of a phytosanitary measure should be considered; for example, covering wood with tarpaulin for storage or using an enclosed conveyance.

The NPPO of the importing country may require limitations on the time frame for import. The pest risk associated with wood moved in trade may be managed by the NPPO of the importing country specifying a certain time in which dispatch or import of a consignment may occur (e.g. during a time when a pest is inactive).

The NPPO of the importing country may require the application of specific methods of processing, handling and appropriate disposal of waste after import.

If necessary to comply with the phytosanitary import requirements, the NPPO of the exporting country should verify the application and the effectiveness of phytosanitary measures before export in accordance with ISPM 23 (*Guidelines for inspection*) and ISPM 31 (*Methodologies for sampling of consignments*).

Many pests associated with wood are specific to particular tree genera or species, and hence phytosanitary import requirements for wood are often genus or species specific. Therefore, the NPPO of the exporting country should verify that the genus or species of the wood in the consignment complies with phytosanitary import requirements, where such genus or species requirements exist.

The following sections describe commonly used options for phytosanitary measures.

2.1 Removal of bark

Some quarantine pests are commonly found in or just beneath the bark. To reduce the pest risk, the NPPO of the importing country may require the removal of bark (to produce bark-free or debarked wood) as a phytosanitary import requirement and, in the case of debarked wood, the NPPO may set tolerance levels for remaining bark. Where bark remains with wood, treatments may be used to reduce the pest risk associated with bark.

2.1.1 Bark-free wood

The complete removal of bark from round wood and other wood commodities physically removes a layer of material in which a large number of pests may develop, and eliminates large areas of uneven surface that provide concealment for other pests.

Bark removal eliminates pests found mostly on the surface of bark such as aphids, adelgids, scale insects, and non-wood-boring moths in some life stages. Moreover, bark removal eliminates most bark beetles and also prevents post-harvest infestation by other wood pests such as wood wasps and large wood borers (e.g. *Monochamus* spp.).

Where the NPPO of the importing country requires that the wood be bark-free, the commodity should meet the definition of bark-free wood stated in ISPM 5 (see Appendix 1 for illustration of ingrown bark and bark pockets). Bark completely surrounded by cambium presents a much lower pest risk as compared with that of surface bark. In many cases, the wood may have evidence of cambium, which may appear as a brown discoloured tissue on the surface of the wood, but this should not be considered as the presence of bark and does not pose a pest risk for pests associated with bark. Verification of bark-free wood should simply confirm that there is no evidence of the layer of tissue above the cambium.

2.1.2 Debarked wood

The mechanical process used in the commercial removal of bark from wood may not completely remove all bark and some pieces of bark may remain. The number and size of any remaining pieces of bark determines to what extent the risk of pests associated with bark (e.g. bark beetles, aphids, adelgids, scales) is reduced.

Some countries specify the tolerance levels for bark in imported wood in their regulations. Debarking to the tolerances indicated below reduces the risk of pests completing their life cycle in untreated wood.

When technically justified and prescribed as a phytosanitary import requirement by the NPPO of the importing country, the NPPO of the exporting country should ensure that the following requirements for debarked wood have been met.

For example, to mitigate the risk of presence of bark beetles, any number of visually separate and clearly distinct small pieces of bark may remain if they are:

- less than 3 cm in width (regardless of the length) or
- greater than 3 cm in width, with the total surface area of an individual piece of bark less than 50 cm^2.

2.2 Treatments

Treatments accepted internationally, found as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*), may be used as phytosanitary import requirements for some wood commodities.

The efficacy of all chemical treatments is affected by the penetration depth, which varies by treatment schedule (e.g. dosage, temperature), the wood species and moisture content, and the presence of bark. The removal of bark often improves chemical treatment penetration and may reduce the incidence of infestation of treated wood.

Treatments should be applied under the supervision or with the authorization of the NPPO of the exporting country to meet the phytosanitary import requirements. The NPPO of the exporting country should make arrangements to ensure that treatments are applied as prescribed and, where appropriate, should verify that wood is free of target pests by inspection or testing prior to phytosanitary certification. Specific tools (e.g. electronic thermometers, gas chromatographs, moisture meters connected to recording equipment) may be used to verify treatment application.

The presence of live quarantine pests should be considered as non-compliance of the consignment, with the exception of wood treated by irradiation, which may result in live but sterile pests. In addition, findings of suitable indicator organisms (or fresh frass) indicates treatment failure or non-compliance, depending on the treatment type.

Some treatment types may not be effective against all pests. Further guidance on treatments that may be used to mitigate the pest risk of wood is provided in Appendix 2.

2.3 Chipping

The mechanical action of chipping or grinding wood can be effective in destroying most wood-dwelling pests. Reduction of the chip size to a maximum of 3 cm in at least two dimensions may mitigate the pest risk posed by most insects. However, fungi, nematodes and small insects such as some Scolytinae, or small Buprestidae, Bostrichidae or Anobiidae may continue to present a pest risk.

2.4 Inspection and testing

Inspection or testing may be used for the detection of specific pests associated with wood. Depending on the wood commodity, inspection may be used to identify specific signs or symptoms of pests. For example, inspection may be used to detect the presence of bark beetles, wood borers and decay fungi on round wood and sawn wood. Inspection may also be carried out at various points along the production process to determine if phytosanitary measures applied have been effective.

Where undertaken, inspection methods should enable the detection of any signs or symptoms of quarantine pests. The detection of certain other organisms may indicate treatment failure. Signs may include the fresh frass of insects, galleries or tunnels of wood borers, staining on the surface of the wood caused by fungi, and voids or signs of wood decay. Signs of wood decay include bleeding cankers, long discontinuous brown streaks on outer sapwood and outer sapwood discoloration, soft areas in the wood, unexplained swelling, resin flow on logs, and cracks, girdling and wounds in sawn wood. Where bark is present it may be peeled back to look for signs of insect feeding and galleries, and for staining or streaking of the wood underneath, which may indicate the presence of pests. Acoustic, sensory and other methods may also be used for detection. Further examination should be made to verify whether live quarantine pests or indicator organisms are present; for example, examination for living life stages of insects such as egg masses and pupae.

Testing may be used to verify the application or effect of other phytosanitary measures such as treatments. Testing is generally limited to the detection of fungi and nematodes. For example, determination of the presence of nematodes that are quarantine pests may be made using a combination of microscopy and molecular techniques on samples of wood taken from consignments.

Guidance on inspection and sampling is provided in ISPM 23 and ISPM 31.

2.5 Pest free areas, pest free places of production and areas of low pest prevalence

Pest free areas, pest free places of production and areas of low pest prevalence may be established to manage the pest risk associated with wood, where feasible. Relevant guidance is presented in ISPM 4 (*Requirements for the establishment of pest free areas*), ISPM 8 (*Determination of pest status in an area*), ISPM 10 (*Requirements for the establishment of pest free places of production and pest free production sites*), ISPM 22 (*Requirements for the establishment of areas of low pest prevalence*) and ISPM 29 (*Recognition of pest free areas and areas of low pest prevalence*). However, the use of pest free places of production or pest free production sites may be limited to specific situations such as forest plantations located within agricultural or suburban areas. Biological control may be used as an option for achieving the requirements for an area of low pest prevalence.

2.6 Systems approaches

The pest risk of the international movement of wood may be managed effectively by developing systems approaches that integrate measures for pest risk management as described in ISPM 14 (*The use of integrated measures in a systems approach for pest risk management*). Existing forest management systems, both pre- and post-harvest, including processing, storage and transportation, may include activities such as site selection in pest free areas, inspection to ensure the wood is free from pests, treatments, physical barriers (e.g. wrapping wood), and other measures which when integrated in a systems approach are effective in pest risk management.

Some of the pest risk associated with round wood (in particular that of deep wood borers and certain nematodes) is difficult to manage through the application of a single phytosanitary measure. In these situations, a combination of phytosanitary measures in a systems approach may be applied.

In accordance with ISPM 14, the NPPO of the importing country may implement additional measures within its territory for transporting, storing or processing wood after import. For example, round wood with bark that may harbour bark beetles that are quarantine pests may be permitted to enter the importing country only during a period when the bark beetles are not active. In this case, processing in the importing country to remove the pest risk may be required to occur before organisms develop to the active stage. Requirements that the wood be debarked and the bark or wood residue be used as a biofuel or otherwise destroyed before the active period of the beetles commences may be used to sufficiently prevent the risk of introduction and spread of the bark beetles that are quarantine pests.

The pest risk associated with fungi may be managed effectively through selection of wood from pest free areas or pest free places of production, application of appropriate harvesting (e.g. visual selection of wood free from signs of infestation) and processing measures and treatments (e.g. surface fungicide).

3. Intended Use

The intended use of wood may affect its pest risk, because some intended uses (e.g. round wood as firewood, wood chips as biofuel or for horticultural purposes) may affect the probability of introduction and spread of quarantine pests (ISPM 32 (*Categorization of commodities according to their pest risk*)). Therefore, intended use should be taken into account when assessing or managing the pest risk associated with the international movement of wood.

4. Non-compliance

Relevant information on non-compliance notification and emergency action is provided in ISPM 13 (*Guidelines for the notification of non-compliance and emergency action*) and ISPM 20 (*Guidelines for phytosanitary import regulatory system*).

This appendix is for reference purposes only and is not a prescriptive part of the standard.

APPENDIX 1: Illustrations of bark and wood

Illustrations are provided below to assist in better differentiating wood and cambium from bark.

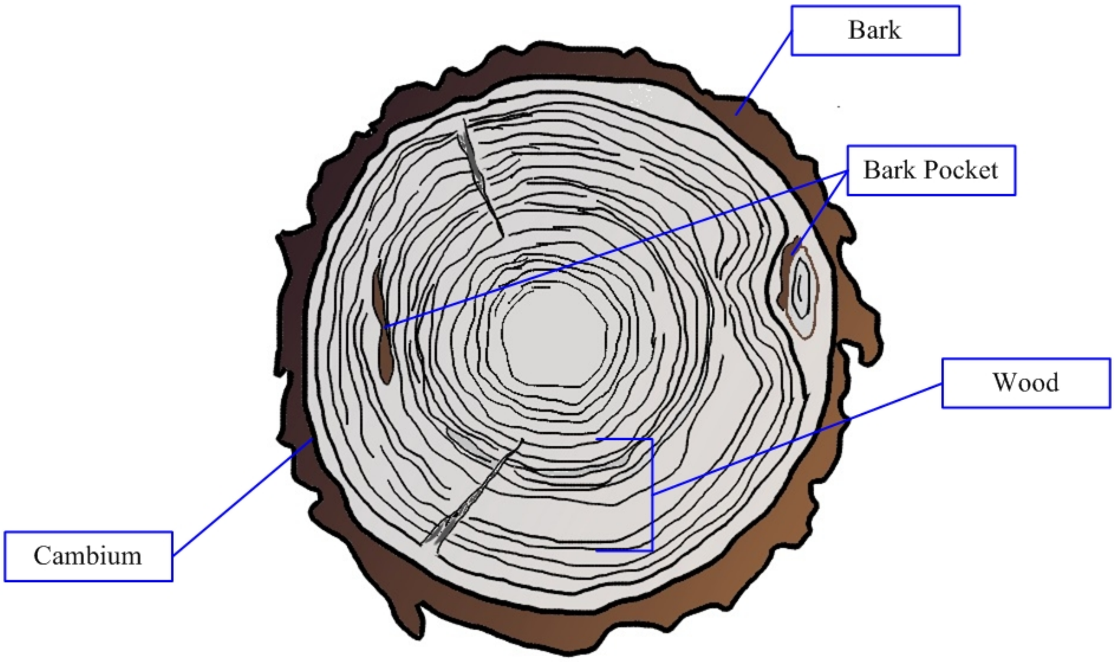


Figure 1. Cross-section of round wood.
Drawing courtesy S. Sela, Canadian Food Inspection Agency.

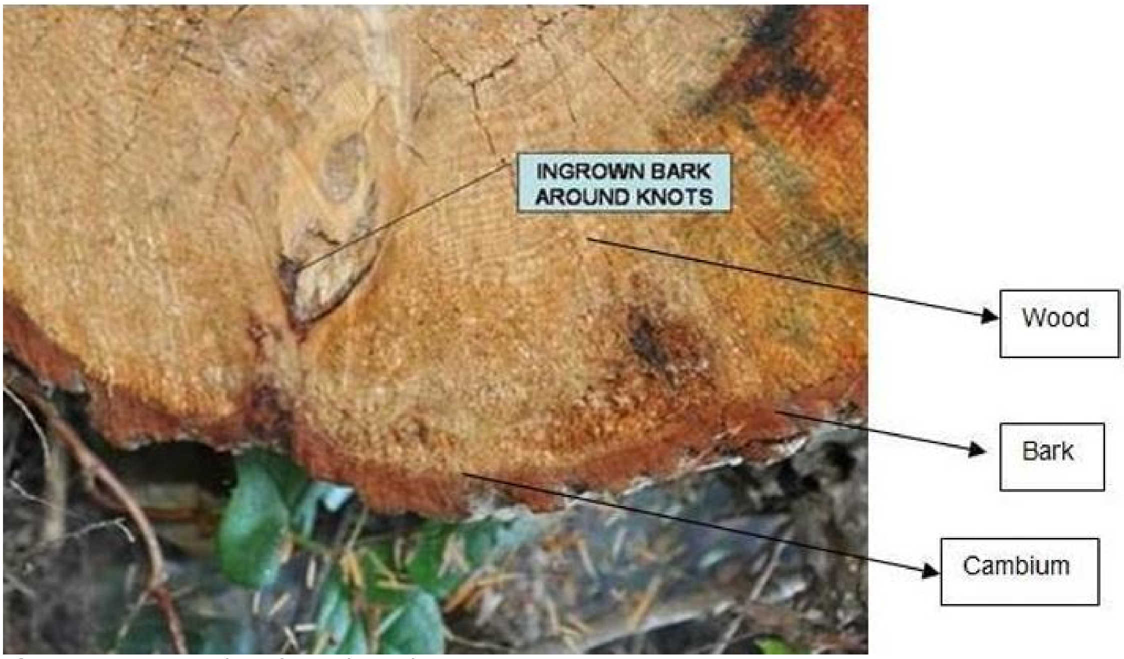


Figure 2. Cross-section of round wood.
Photo courtesy S. Sela, Canadian Food Inspection Agency.

Figure 3. Sawn wood.
Photo courtesy C. Dentelbeck, Canadian Lumber Standards Accreditation Board, Ottawa.

APPENDIX 2: Treatments that may be used to mitigate the pest risk of wood

1. Fumigation

Fumigation may be used to control pests associated with wood.

Despite the proven effectiveness of some fumigants against certain pests, there are limitations to their use to reduce pest risk. Fumigants vary in their ability to penetrate the wood and some are therefore effective only against pests in, on or just beneath the bark. The penetration depth for some fumigants may be limited to about 10 cm from the wood surface. Penetration is greater in dry than in fresh-cut wood.

For some fumigants, the removal of bark before fumigation may improve the efficacy of the treatment.

Before selecting fumigation as a phytosanitary measure, NPPOs should take into account the CPM Recommendation, *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (CPM, 2008).

2. Spraying or Dipping

Spraying with or dipping in chemicals may be used to control pests associated with wood, excluding wood chips, sawdust, wood wool, bark and wood residue.

In the process of spraying or dipping, liquid or dissolved chemicals are applied to wood at ambient pressure. This treatment results in limited penetration into the sapwood. Penetration depends on the species of the wood, the kind of wood (sapwood or heartwood), and the properties of the chemical product. Both removal of bark and application of heat increase the depth of penetration into the sapwood. The active ingredient of the chemical product may not prevent the emergence of pests already infesting the wood. Protection of the treated wood from subsequent pest infestation depends on the protective layer of chemical product remaining intact. Post-treatment infestation by some pests (e.g. dry wood borers) may take place if the wood is sawn after treatment and a portion of the cross-section has not been penetrated by the chemical product.

3. Chemical Pressure Impregnation

Chemical pressure impregnation may be used to control pests associated with wood, excluding wood chips, sawdust, wood wool, bark and wood residue.

The application of a preservative using vacuum, pressure or thermal processes results in a chemical product applied to the surface of the wood being forced deep into that wood.

Chemical pressure impregnation is commonly used to protect wood from infestation by pests after other treatments. It may also have some effect in preventing the emergence to the wood surface of pests that have survived treatment. The penetration of the chemical product into the wood is much greater than with spraying or dipping, but depends on the wood species and the properties of the chemical product. Penetration is generally throughout the sapwood and through a limited portion of the heartwood. Debarking or mechanical perforation of the wood may improve penetration of the chemical product. Penetration also depends on the moisture content of the wood, so drying wood before chemical pressure impregnation may improve penetration. Chemical pressure impregnation is effective against some wood-boring insects. In some impregnation processes, the chemical is applied at a temperature sufficiently high to be equivalent to a heat treatment. The protection of the treated wood from subsequent infestation depends on the protective layer of the chemical product remaining intact. Post-treatment infestation by some pests (e.g. dry wood borers) may take place if the wood is sawn after treatment and a portion of the cross-section has not been penetrated by the chemical product.

4. Heat Treatment

Heat treatment may be used to control pests associated with all wood commodities. The presence or absence of bark has no effect on the efficacy of heat treatment but should be taken into account if a heat treatment schedule specifies the maximum dimensions of the wood being treated.

The process of heat treatment involves heating wood to a temperature for a period of time (with or without moisture control) that is specific to the target pest. The minimum treatment time in the heat chamber necessary to reach the required temperature throughout the profile of the wood depends on the wood's dimensions, species, density and moisture content as well as on the capacity of the chamber and other factors. The heat may be produced in a conventional heat treatment chamber or by dielectric, solar or other means of heating.

The temperature required to kill pests associated with wood varies because heat tolerance varies across species. Heat-treated wood may still be susceptible to saprophytic moulds, particularly if moisture content remains high; however, mould should not be considered a phytosanitary concern.

5. Kiln-drying

Kiln-drying may be used for sawn wood and many other wood commodities.

Kiln-drying is an industrial process in which the moisture content in wood is reduced, by the application of heat, to achieve the prescribed moisture content for the intended use of the wood. Kiln-drying may be considered a heat treatment if carried out at sufficient temperatures and for sufficient durations. If lethal temperatures are not achieved throughout the relevant wood layers, kiln-drying on its own should not be considered a phytosanitary treatment.

Some species in the pest groups associated with wood commodities are dependent on moisture and therefore may be inactivated during kiln-drying. Kiln-drying also permanently alters the physical structure of the wood, which prevents subsequent resorption of sufficient moisture to sustain existing pests and reduces the incidence of post-harvest infestation. However, individuals of some species may be capable of completing their life cycle in the new environment of reduced moisture content. If favourable moisture conditions are re-established, many fungi and nematodes and some insect species may be capable of continuing their life cycle or infesting the wood after treatment.

6. Air-drying

Compared with kiln-drying, air-drying reduces wood moisture content only to ambient moisture levels and is therefore less effective against a broad range of pests. The pest risk remaining after treatment depends on the duration of drying and the moisture content and on the intended use of the wood. Moisture reduction through air-drying alone should not be considered a phytosanitary measure.

Although moisture reduction through air-drying or kiln-drying alone may not be a phytosanitary measure, wood dried to below the fibre saturation point may be unsuitable for infestation by many pests. Therefore, the likelihood of infestation of dried wood is very low for many pests.

7. Irradiation

The exposure of wood to ionizing radiation (e.g. accelerated electrons, x-rays, gamma rays) may be sufficient to kill, sterilize or inactivate pests (ISPM 18 (*Guidelines for the use of irradiation as a phytosanitary measure*)).

8. Modified Atmosphere Treatment

Modified atmosphere treatments may be applied to round wood, sawn wood, wood chips and bark.

In such treatments, wood is exposed to modified atmospheres (e.g. low oxygen, high carbon dioxide) for extended periods of time to kill or inactivate pests. Modified atmospheres can be artificially generated in gas chambers or allowed to occur naturally, for instance during water storage or when the wood is wrapped in airtight plastic.

9. References

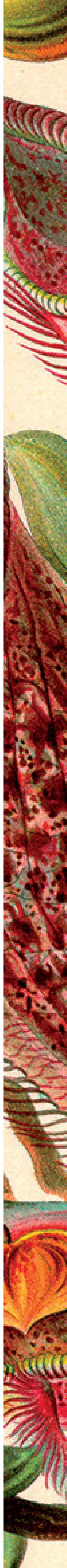
CPM. 2008. *Replacement or reduction of the use of methyl bromide as a phytosanitary measure*. CPM Recommendation. In: *Report of the Third Session of the Commission on Phytosanitary Measures.* Rome, 7–11 April 2008, Appendix 6. Rome, IPPC, FAO. Available at https://www.ippc.int/publications/500/ (last accessed 21 November 2016).

IPPC

The International Plant Protection Convention (IPPC) is an international plant health agreement that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. International travel and trade are greater than ever before. As people and commodities move around the world, organisms that present risks to plants travel with them.

Organization

- There are over 180 contracting parties to the IPPC.
- Each contracting party has a national plant protection organization (NPPO) and an Official IPPC contact point.
- Nine regional plant protection organizations (RPPOs) work to facilitate the implementation of the IPPC in countries.
- IPPC 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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