Biosecurity Plan for the Plantation Forests Industry

A shared responsibility between government and industry

Version 3.1 April 2022

Plant Health AUSTRALIA

Australian Forest Products Association

Forest & Wood Products Australia

Location: Level 1
1 Phipps Close
DEAKIN ACT 2600
Phone: +61 2 6215 7700
Email: biosecurity@phau.com.au
Visit our website planthealthaustralia.com.au

An electronic copy of this plan is available through the email address listed above.

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Acknowledgements

The *Plantation Forests Biosecurity Plan* was funded by Forest Wood Products Australia and developed by Plant Health Australia (PHA) through consultation with the plantation forests Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG). These groups were coordinated by PHA and were made up of forest health and biosecurity experts from AFPA's Forest Health and Biosecurity subcommittee. This group contains representatives of State/Territory and Commonwealth government, PHA's National Forest Biosecurity Coordinator, industry representatives, university researchers and the CSIRO.

The following organisations and agencies were involved in the development and finalisation of the plan:

Endorsement

The *Plantation Forests Biosecurity Plan (Version 3.0)* was formally endorsed by the plantation forests sector (through the Australian Forest Products Association) in August 2021, and all state and territory governments (through the Plant Health Committee) in September 2021.

The Australian Government endorses the document without prejudice for the purposes of industry's planning needs and meeting the Department's obligations under Clause 13 of the Emergency Plant Pest Response Deed (EPPRD). In providing this endorsement the Department notes the section *Pest risk assessments* of the Plan which states: *"This Document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling)"*. This is a broader view of potential risk than the Biosecurity Import Risk Assessment (BIRA) conducted by the Department of Agriculture, Water and Environment which focus only on specific regulated import pathways."

Version History

VERSION	DATE	DESCRIPTION	APPROVED
1.0	2007	Identification of plantation forests biosecurity threats and general description of biosecurity system.	AFPA & PHC
2.0	2013	Review of plantation forests biosecurity threats, general description of biosecurity system and suggested actions and activities for plantation forest sector to drive improvements in biosecurity.	AFPA & PHC
3.0	2021	Review of plantation forests biosecurity threats, increased focus on recommendations, actions and activities for plantation forest sector to drive improvements in biosecurity.	AFPA & PHC
3.1	2022	Annual review process to monitor emerging 'pest' threats, document industry achievements and drive preparedness actions.	

Reporting suspect pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication.

EXECUTIVE SUMMARY

Preservation of Australia's enviable biosecurity pest status is a shared responsibility, with biosecurity stakeholders working in partnership across the biosecurity continuum; pre-border, at the border and post-border (*Figure E1*). It is important that the Australian plantation forests sector, represented by Australian Forest Products Association (AFPA), minimises the risks posed by exotic pests and responds effectively to plant pest threats. This is best achieved by identifying and addressing biosecurity risks and capacity or capability gaps that prevent the plantation sector, working with governments, from addressing biosecurity threats.

Aimed at decision makers, this third edition of the Plantation Forests Biosecurity Plan *provides the plantation forests sector and governments with a framework to guide actions and investments over 5 years, designed to mitigate biosecurity risks and protect Australia's plantation forests.*

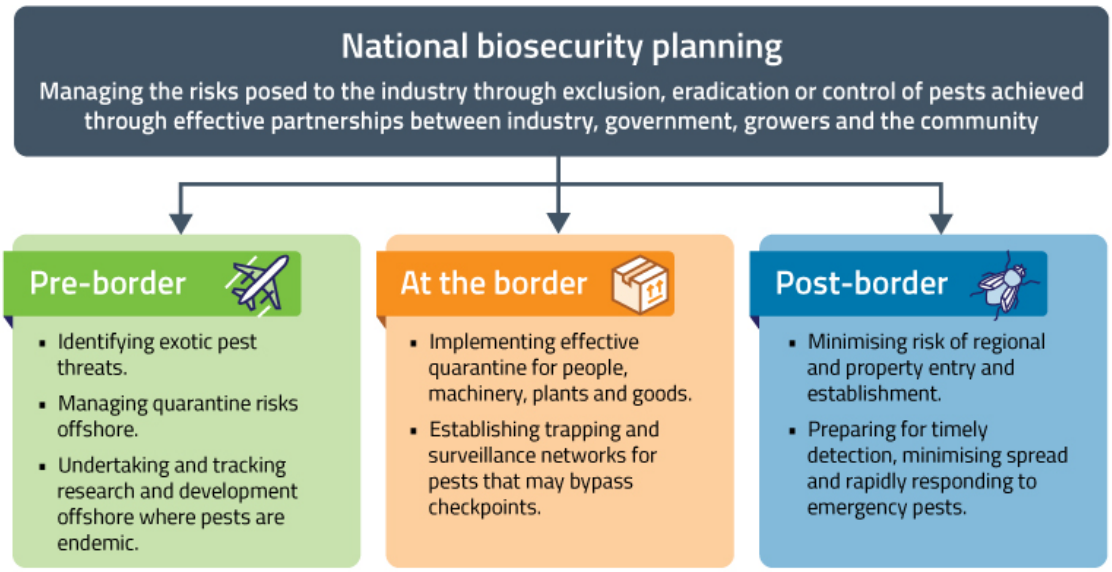

Figure E1: *National biosecurity is a shared responsibility.*

Coordinated by Plant Health Australia, a Technical Expert Group and a Biosecurity Implementation Group were formed to undertake different aspects of the Plantation Forests Biosecurity Plan review. Both groups were made up from members of AFPA's Forest Health and Biosecurity (FHaB) subcommittee (*Table 1*). The Technical Expert Group made up of forest/tree health experts, focused on reviewing and updating the Threat Summary Table (*Appendix 2*). The Biosecurity Implementation Group, made up of forest health and forest management experts, reviewed the plan itself with particular focus on the Biosecurity Implementation Table (*Table 4*). To ensure currency and relevance, and to monitor progress with implementation of the recommendations in this Biosecurity Plan, a Biosecurity Reference Panel (BRP) will review it on an annual basis *Table 1*.

AFPA's FHaB subcommittee has committed itself to consider the Biosecurity Plan as a standing item on its agenda. It will prioritise the actions within this Biosecurity Plan (*Table 4*) and recommend them for industry implementation through AFPA or Forest Wood Products Australia, as appropriate.

Five key areas of biosecurity are reviewed, updated or described in this Plantation Forest Biosecurity Plan:

Pests of biosecurity significance

Potential exotic pest threats to Australian Plantation forests were identified and their potential risk assessed

(*Threat identification and pest risk assessments*). Those exotic pests deemed to pose a high overall risk to the plantation forests sector are deemed High Priority Pests (HPP). Pest Information, contingency planning, diagnostic and surveillance protocols available for each HPP are summarised in *Table E1*.

As biosecurity planning is beneficial for the management and surveillance of established pests of biosecurity significance, these pests are also tabled. (*Table 3*),

Established weeds of biosecurity significance were initially considered. However, separate National and State strategies or arrangements were identified that are already in place to deal with both established and exotic pest weeds. To avoid duplication, no further consideration of weeds biosecurity was undertaken in this biosecurity plan. It should be noted that as responsible land managers, control of weeds by the plantation sector is already undertaken as necessary or, as legally required.

Biosecurity Implementation (2020-2025)

A Biosecurity Implementation Table (*Table 4*) was compiled to provide strategic direction for improvements to plantation forests biosecurity over the life of this Biosecurity Plan (2020 to 2025). The table summarises the status of biosecurity activities and arrangements. It also provides specific actions and recommendations identified by both industry and government, to strengthen biosecurity to protect plantation forests. The biosecurity implementation table will be revisited regularly over the next five years by the BRP and AFPA's FHaB to review progress made on improvements to plantation forest biosecurity (see above).

Threat identification and pest risk assessments

Identification and ranking of exotic pest threats through a process of qualitative risk assessment was undertaken (*Threat identification*; *Pest risk assessments*). Threat Summary Tables (TST) were compiled, with 51 exotic plant pests that could constitute a potential biosecurity threat to the Australian plantation forests identified (*Appendix 2*). Exotic pests on the list were given an overall risk rating based on four criteria; entry, establishment and spread potential, and economic impact. Details of the ranking process for high priority pests is summarised in *Ranking pest threats*.

Established pests of biosecurity significance were also determined using qualitative criteria (see *Established pests of biosecurity significance*; *Table 3*).

Risk mitigation and preparedness

A summary of current arrangements, suggested actions for improvement or RD&E necessary to mitigate pest risks to Australian plantation forests and be prepared to respond in the case of a biosecurity incident, are described for all operational levels from Australia's border to the plantation gate (*Risk mitigation and Preparedness*).

The status of pest-specific information and preparedness documents such as fact sheets, contingency plans and nationally agreed diagnostic or surveillance protocols, is provided to highlight areas for improvement (*Table 13*).

Response management

A summary is provided of the processes in place to respond to emergency plant pest (EPP)[1] incursions that would affect the Australian plantation forests industry. Areas covered in this section include the Emergency Plant Pest Response Deed (*EPPRD*), PLANTPLAN (the generic response plan under the EPPRD), categorisation of pests under the EPPRD and industry specific response procedures and industry communication.

In summary, this Plantation Forests Biosecurity Plan aims to mitigate biosecurity risks specific to plantations forests and, build capacity and capability to effectively respond to biosecurity threats. It outlines the shared commitment by, the plantation forests sector (through AFPA) and governments (through Plant Health Committee), to work in partnership to implement the recommendations within the plan. While this Biosecurity Plan is industry specific, it is related to a broader set of biosecurity collaborations and partnerships between AFPA, PHA, Forest Wood Products Australia (FWPA) and Commonwealth and State governments to improve biosecurity for forest/tree pests (*Figure E2*).

[1] Refer to the PHA website for details planthealthaustralia.com.au/biosecurity/emergency-plant-pests

Table E1: *Pest information, surveillance protocols, diagnostic protocols and contingency planning available for plantation forest HPPs.*

SCIENTIFIC NAME / **COMMON NAME**	**FACT SHEET**	**SURVEILLANCE PROTOCOL**	**DIAGNOSTIC PROTOCOL**	**CONTINGENCY PLAN**
Arhopalus ferus Burnt pine longicorn	DAWE, NSW	No	No	No
Dendroctonus valens Red turpentine beetle	PHA, NSW	No	Yes	No
Monochamus alternatus, M. galloprovincialis, M. titillator, M. saltuarius, M. scutellatus and *Monochamus* spp. with associated nematodes including *Bursaphelenchus xylophilus.* Japanese pine sawyer, Pine sawyer, Southern pine sawyer, White-spotted sawyer	DAWE, PHA, NSW	Draft	No	No
Tomicus piniperda Pine shoot beetle	NZ	No	No	No
Lymantria dispar complex Gypsy moth complex, Spongy moth complex	PHA, NSW, QLD, SA	Review	Yes	PHA (2009)
Austropuccinia psidii (exotic strains) Myrtle Rust (including *Eucalyptus* strain)	DAWE, QLD, NSW, VIC, TAS, SA	No	Draft	PHA (2009)
Fusarium circinatum Pitch canker	DAWE, PHA, NZ	No	IPPC[2]	No
Teratosphaeria destructans Eucalypt leaf blight	No	No	No	No
Phytophthora pinifolia Daño Foliar del Pino	PHA, NSW, NZ	No	EPPO[3]	No
Phytophthora pluvialis Red needle cast	PHA, NSW	No	No	No
Phytophthora ramorum Sudden oak death	PHA, NSW, NZ	No	Yes	QLD (2019)
Bursaphelenchus spp. with insect vectors Pinewood nematodes (PWN)	DAWE, PHA, NSW	Draft	IPPC	No
Coptotermes formosanus Formosan subterranean termite	DAWE	No	No	No
Coptotermes gestroi Asian subterranean termite	DAWE	No	No	No

[2] International Plant Protection Convention
[3] European Plant Protection Organisation

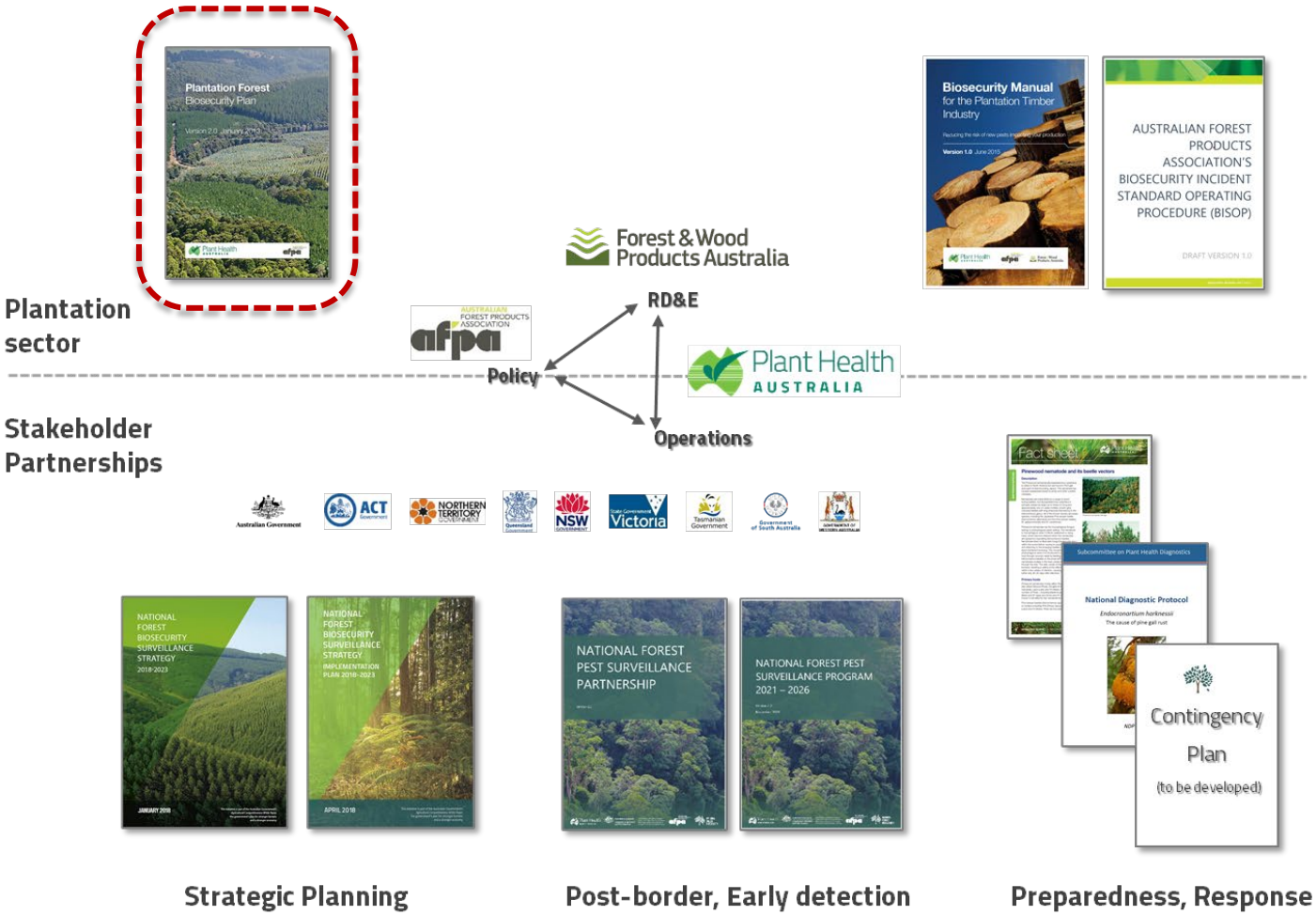

Figure E2: *AFPA, FWPA, PHA and governments work together on policy, RD&E and operational activities to improve biosecurity for the plantation forests sector specifically (TOP). To improve biosecurity outcomes for forests and urban trees more broadly, strategic stakeholder partnerships and post-border activities are in development (BOTTOM). Guiding documents,* ***TOP****; this Biosecurity Plan (red highlight), Biosecurity Manual, AFPA Biosecurity Incident Standard Operating Procedure,* ***BOTTOM****; Forest Strategy & Implementation, Surveillance Partnership & Program, Factsheets, Protocols, and Contingency Plans (depending on the pests these can be specific to the plantation forest sector or cross-sectoral).*

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ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACIAR	Australian Centre for International Agricultural Research
ACPPO	Australian Chief Plant Protection Office
AFPA	Australian Forest Products Association
AFS	Australian Forestry Standards
APPS	Australian Plant Production Standards
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
ASFR	Australia's State of the Forests Report
BICON	Australian Biosecurity Import Conditions Database
BIG	Biosecurity Implementation Group
BIRA	Biosecurity Import Risk Analysis
BISOP	Biosecurity Incident Standard Operating Procedure
BOLT	Biosecurity On-Line Training
BP	Biosecurity Plan
BRP	Biosecurity Reference Panel
CABI	Centre for Agriculture and Bioscience International
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	State Chief Plant Health Manager
CSIRO	Commonwealth Scientific and Industrial Research Organisation
QDAF	Department of Agriculture and Fisheries, Queensland
DAWE	Department of Agriculture, Water and Environment
DJPR	Department of Jobs, Precincts and Regions, Victoria
NSW DPI	Department of Primary Industries, New South Wales
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
DPIR NT	Department of Primary Industry and Resources, Northern Territory
DPIRD	Department of Primary Industries and Regional Development, Western Australia
EFSA	European Food Safety Authority
EPP	Emergency Plant Pest
EPPO	European and Mediterranean Plant Protection Organization
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
FBS	Forest Biosecurity Surveillance
FHaB	Forest Health and Biosecurity subcommittee (of AFPA)
FHS	Forest Health Surveillance

FSC	Forest Stewardship Council
FWPA	Forest Wood Products Australia
GRAC	Growers Research Advisory Committee (of FWPA)
HACCP	Hazard Analysis Critical Control Point (BioSecure HACCP)
HPP	High Priority Pest
ICA	Interstate Certification Assurance
IGAB	Intergovernmental Agreement on Biosecurity
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
NAQS	Northern Australian Quarantine Strategy
NDP	National Diagnostic Protocol
NFBC	National Forest Biosecurity Coordinator
NFBSS	National Forest Biosecurity Surveillance Strategy 2018-2023
NFPSP	National Forest Pest Surveillance Program
NIASA	Nursery Industry Accreditation Scheme Australia
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBRDES IC	National Plant Biosecurity Research, Development and Extension Strategy Implementation Committee
NPBS	National Plant Biosecurity Strategy
NPSHP	National Plant Health Surveillance Program
NPI	National Plantation Inventory
NSW	New South Wales
NT	Northern Territory
ORC	Owner Reimbursement Costs
PaDIL	Pest and Disease Image Library
PBRI	Plant Biosecurity Research Initiative
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
QLD	Queensland
R&D	Research and Development
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute

SDQMA	Subcommittee for Domestic Quarantine and Market Access (of PHC)
SNPHS	Subcommittee for Plant Health Surveillance (of PHC)
SPHD	Subcommittee on Plant Health Diagnostics (of PHC)
SPS	Sanitary and Phytosanitary Standards
T2M	Transition to Management
TBA	To be announced
TEG	Technical Expert Group
TST	Threat Summary Table
VIC	Victoria
WA	Western Australia
WTO	World Trade Organization

DEFINITIONS

The definition of a plant pest used in this document includes insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. Endemic pests are those established within Australia. Exotic pests are those not currently present in Australia.

Emergency Plant Pest (EPP) – for a pest to be classified as an emergency plant pest (EPP), it must either be listed in Schedule 13 of the EPPRD, or be determined by the Categorisation Group or National Management Group (NMG) to be of potential national significance and meet at least one of the criteria below:

- a known exotic pest
- a variant form of an established plant pest
- a previously unknown pest
- a confined or contained pest.

High Priority Pest (HPP) – an exotic plant pest identified as one of the greatest pest threats to one or more plant production industries. A HPP must have a High or Extreme overall rating through the Biosecurity Planning process. For more information on risk ratings please refer to *Pest risk assessments*.

INTRODUCTION

This document is the result of the third industry biosecurity planning process undertaken for the Australian plantation forests sector.

The *Plantation Forests Biosecurity Plan* was funded by Forest Wood Products Australia and developed by Plant Health Australia (PHA) through consultation with the plantation forests Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG). These groups included a mix of forest health and plantation management experts from AFPA's Forest Health and Biosecurity subcommittee, State and Commonwealth government agencies, Universities, CSIRO and PHA (*Table 1*).

The biosecurity plan not only details exotic pest threats of the Australian plantation forests sector but also contains information on the current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the sector.

This biosecurity plan is also a framework to coordinate biosecurity activities and investment for Australia's plantation forests sector that address the strengths and weaknesses in relation to industry's current biosecurity position. The biosecurity planning process provides a mechanism for industry, governments, and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the Australian plantation forests sector.

BIOSECURITY PLANNING

Biosecurity planning provides a mechanism for the plantation forests sector, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and put in place practices and procedures that would rapidly detect an incursion, minimise the impact if a pest incursion occurs and/or reduce the chance of pests becoming established. Effective industry biosecurity planning relies on all stakeholders, including government agencies, industry, and the public (*Figure E1*, *Figure E2*).

Ensuring the plantation forests sector has the capacity to minimise the risks posed by pests, and to respond effectively to any pest threats is a vital step for the future sustainability and viability of the industry. Through this pre-emptive planning process, the industry will be better placed to maintain domestic and international trade and reduce the social and economic costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian plantation forests sector is free from specific pests and has systems in place to control and manage biosecurity risks, which assists the negotiation of access to new overseas markets.

Plan development

A Technical Expert Group (TEG) and a Biosecurity Implementation Group (BIG) were formed to work on the review of the *Plantation Forests Biosecurity Plan*. These groups were coordinated by Plant Health Australia (PHA) and included representatives from the AFPA's Forest Health and Biosecurity subcommittee, the University of Sunshine Coast, State/Territory and Commonwealth government agencies, CSIRO, PHA and industry representatives (*Table 1*).

Key roles of the Technical Expert Group to develop this biosecurity plan included:

- identifying and documenting key threats to the Australian plantation forests sector.
- confirming an agreed High Priority Pest (HPP) list.

Key roles of the Biosecurity Implementation Group for the biosecurity plan included:

- developing a biosecurity implementation table for future biosecurity related work to be conducted over the life of this biosecurity plan.

- documenting available pest-specific fact sheets, contingency plans, diagnostic protocols and surveillance programs for HPPs.
- documenting the roles and responsibilities of stakeholder groups.

Monitoring progress

Once developed the Biosecurity Plan will be revisited annually by a Biosecurity Reference Panel (BRP), established through PHA, that is comprised of industry, government and scientific experts (*Table 1*). The BRP process will ensure currency and relevance; monitor progress with implementation and suggest changes, including but not limited to:

- Threat Summary Tables
- pest risk assessments
- RD&E activities
- industry biosecurity processes
- relevant legislation
- stakeholders contact details and references.

Major changes or recommendations would need to include consultation and agreement of all stakeholders. For example, through AFPA's Growers Chamber[4] or through Plant Health Committee (PHC)[5].

AFPA's Forest Health and Biosecurity (FHaB) subcommittee has committed itself to consider the recommendations in the Biosecurity Implementation Table as a standing item on its agenda. This group composed of plantation sector managers and forest health and biosecurity experts meet regularly throughout the year and will work to progress the recommendations in the table.

Finally, with the support of the relevant industry bodies and PHA, this plan will be reviewed in its entirety on a 5-yearly basis by re-establishing a TEG and BIG to undertake the full plan development process once again.

Table 1. Membership of the technical, implementation and reference groups involved in biosecurity planning.

NAME	ORGANISATION	AREA OF EXPERTISE	TEG[6] MEMBER	BIG[7] MEMBER	BRP[8] MEMBER
Lucy Aukett	Plant Health Australia	Biosecurity		✓	
Angus Carnegie	NSW DPI	Forest Health	✓	✓	
Matthew Chifley	Plant Health Australia	Biosecurity		✓	
David Gale	Plant Health Australia	Biosecurity		✓	
Madaline Healey	University of the Sunshine Coast	Entomology	✓		
Natalie Heazlewood	AFPA	Plantation forest policy		✓	
Mike Hodda	CSIRO	Nematology	✓		
Martin Horwood	NSW Local Land Services	Entomology	✓		
Chris Howard	DAWE	Biosecurity	✓	✓	
Brendon Reading	DAWE	Preparedness and Response			✓
Phil Lacy	PF Olsen Limited	Plantation management		✓	✓

[4] AFPA's Growers Chamber – Is made up of senior executive representatives of major plantation and native forest growers.
[5] Plant Health Committee (PHC) – Is made up of senior members of all Government Biosecurity agencies.
[6] Technical Expert Group
[7] Biosecurity Implementation Group
[8] Biosecurity Reference Panel

NAME	ORGANISATION	AREA OF EXPERTISE	TEG[6] MEMBER	BIG[7] MEMBER	BRP[8] MEMBER
Simon Lawson	University of the Sunshine Coast	Entomology	✓	✓	✓
Ian Last	HQPlantations	Plantation management		✓	
Victoria Ludowici	Plant Health Australia	Biosecurity	✓	✓	
Jodie Mason	Forest & Wood Products Australia	Forest Research		✓	✓
Nicolas Meurisse	Scion (NZ)	Entomology	✓		
Helen Nahrung	University of the Sunshine Coast	Entomology	✓	✓	
Geoff Pegg	QDAF	Pathology	✓	✓	
Michael Ramsden	HQPlantations	Plantation Health	✓	✓	✓
Louise Shuey	QDAF	Pathology	✓		
David Smith	AgVIC	Forest Health	✓	✓	✓
Tim Hurst	AgVIC	Plant Surveillance Design and Analysis			✓
Brian Thistleton	NT DITT	Entomology	✓		
Thilini Ekanayake	NT DITT	Entomology			✓
Francisco Tovar	Plant Health Australia	Forest Biosecurity	✓	✓	✓
Andrew Vossen	Plant Health Australia	Biosecurity	✓	✓	✓
Danielle Wiseman	Plantation Industry Pest Management Group (IPMG)	Plantation management		✓	✓
Dianne Patzel	University of South Australia	Forest Health			✓
Sam Van Holsbeeck	University of the Sunshine Coast	Forest Pest Management Research Consortium			✓
Trevor Dunmall	Plant Health Australia	Biosecurity			✓

PESTS OF BIOSECURITY SIGNIFICANCE

One of the primary goals of this document is to coordinate the identification of the key exotic High Priority Pests (*Table 2*) and established pests of biosecurity significance (*Table 3*) to the Australian plantation forests sector. Pest lists were developed in consultation with industry and governments stakeholders and provide the information to aid prioritisation of resources for biosecurity risk management. Details of the process undertaken to assess the threat posed by each of the pests can be found in *Threat identification and pest risk assessments*.

Established weeds of biosecurity significance were initially considered as part of the threat identification process. However, separate National and State arrangements were identified that are already in place to deal with both established and exotic pest weeds. To avoid duplication, no further consideration of weeds biosecurity was undertaken in this biosecurity plan. For more information on weeds readers are referred to the following links:

- https://www.environment.gov.au/biodiversity/invasive-species/weeds
- https://weeds.org.au/

As responsible land managers, control of weeds by the plantation sector is already undertaken as necessary or, as legally required.

Exotic High Priority Pests

Table 2 provides an overview of the top ranked exotic pest threats to the Australian plantation forests industry. Further details on each pest along with the basis for the likelihood ratings are provided in *Threat Summary Tables*. Assessments may change due to increased understanding of pest biology, changes to forest products import arrangements, or production methods. The HPP list will be formally reviewed on an annual basis through the Biosecurity Reference Panel. An explanation of the method used for calculating the overall risk can be found on the PHA website[9].

Table 2. Plantation forests sector High Priority Pest list.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Arhopalus ferus	Burnt pine longicorn	*Pinus* spp. and less commonly, Norway spruce (*Picea abies*).	Often dead or dying *Pinus* and *Picea* trees injured by fire or other damage[13].	Intercepted 500 times internationally. This is the most highly intercepted Cerambycidae[14].	Europe, northern Asia (except Japan) and northern Africa, New Zealand.	HIGH	HIGH	HIGH	HIGH	HIGH
Dendroctonus valens	Red turpentine beetle	Attacks over 40 conifer species in the USA. Especially destructive to *Pinus radiata*.	Basal area of tree trunks.	A commonly intercepted Curculionidae (231 interceptions internationally).	North America, China, Guatemala, Honduras.	MEDIUM	HIGH	HIGH	HIGH	HIGH
Monochamus spp. (including *M. alternatus, M.*	Japanese pine sawyer, Pine sawyer,	Pines (*Pinus* spp.), Spruce (*Picea* spp.) and	Whole plant: fruits, pods, leaves and	11 species intercepted globally. *M.*	The genus *Monochamus* is comprised of around 150 known species	MEDIUM	HIGH	HIGH	HIGH	HIGH

[9] Available from planthealthaustralia.com.au/biosecurity/risk-mitigation
[10] Interceptions are based on data collected from nine world regions between 1995 to 2019 (Turner *et al.* 2021) - https://doi.org/10.1002/eap.2412
[11] Centre for Agriculture and Bioscience International (2020).
[12] Establishment potential.
[13] Occasionally, *A. ferus* will attack growing and healthy trees.
[14] Australian import conditions are still in place. The establishment of burnt pine longicorn in Australia could have market access ramifications.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
galloprovincialis, M. titillator, M. saltuarius and *M. scutellatus*) with associated plant parasitic nematodes (including *Bursaphelenchus xylophilus*)[15]	Southern pine sawyer, White-spotted sawyer	Fir (*Abies* spp.).	stems.	*alternatus* intercepted 68 times - one of the most frequently intercepted species[16]. Most likely pathway is wood packaging.	distributed across Asia, Africa, Europe and North America[17]. *M. alternatus* is present in China, Japan, Korea, Laos, Taiwan and Vietnam.					
Tomicus piniperda	Pine shoot beetle	*Pinus* spp. (including *P. sylvestris* and *P. radiata*), *Abies* spp., *Larix* spp., *Picea* spp. and *Pseudotsuga* spp.	Stems and shoots[18].	65 interceptions internationally. One of the most frequently intercepted Curculionidae.	China, Georgia, Israel, Japan, Korea, Turkey, Algeria, Morocco, Tunisia, Canada, USA, Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Russia,	MEDIUM	HIGH	HIGH	HIGH	HIGH

[15] A worldwide list of insects associated with *Bursaphelenchus xylophilus* identified species within Cerambycidae, Buprestidae and Curculionidae. The main vectors of *B. xylophilus* are within the genus *Monochamus* (Robertson *et al*. 2008).

[16] International interceptions of other *Monochamus* species are *Monochamus sutor* (52 times), *M. galloprovincialis* (38 instances), and *M. scutellatus* (6 occasions - mid-range for Cerambycidae). Interceptions of *M. titillator* and *M. saltuarius* have only occurred on once (Turner *et al*. 2021).

[17] The distribution of other *Monochamus* species are: *M. galloprovincialis*: Algeria, Morocco, Tunisia, China, Kazakhstan, Mongolia, Albania, Armenia, Austria, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Moldova, Montenegro, Netherlands, North Macedonia, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and Ukraine. *M. titillator*: Canada, USA and Cuba. *M. saltuarius*: China, Japan, Korea, Mongolia, Austria, Croatia, Czech Republic, Germany, Italy, Lithuania, Poland, Romania, Russian Federation, Slovakia, Switzerland and Ukraine. *M. scutellatus*: Canada, Mexico, and USA.

[18] *Tomicus piniperda* is considered a secondary pest, colonising tree trunks and thick branches of weakened trees. *Tomicus* spp. can be considered a primary pest when feeding on pine shoots as they mature (Bezos *et al*. 2015).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
					Slovenia, Spain, Sweden, Switzerland and the UK.					
Lymantria dispar complex[19]	Gypsy moth complex	Over 600 species of trees and shrubs (including eucalypts and pine).	Larvae feed on foliage. Can cause high tree mortality when forests are under stress from drought or other pests.	458 interceptions internationally. The most frequently intercepted Erebidae. Gypsy moths have a propensity to be transported on human-made objects, typically as egg masses. Potential pathways include clothing, footwear, wood packaging, containers, cars, vessels and plants.	Afghanistan, Armenia, Azerbaijan, China, India, Iran, Iraq, Israel, Japan, Kazakhstan, Korea, Kyrgyzstan, Lebanon, Mongolia, Syria, Taiwan, Tajikistan, Turkey, Turkmenistan, Uzbekistan, Algeria, Morocco, Tunisia, Canada, USA, Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Macedonia, Moldova, Netherlands, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK and Ukraine[20].	HIGH	HIGH	HIGH	HIGH	HIGH
Austropuccinia psidii[21] (exotic	Myrtle Rust	Myrtaceae (including	Leaves, shoots, young	*A. psidii* can spread rapidly	Numerous South and Central American	HIGH	HIGH	HIGH	HIGH	HIGH

[19] This pest is a National Priority Plant Pest.
[20] Eradicated in New Zealand.
[21] This pest is a National Priority Plant Pest.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
biotypes/strains[22]; syn. *Puccinia psidii* sensu lato)		eucalypts).	branches, epicormic shoots, coppice and stem blight. Severe infection and crown loss; dieback and tree mortality has been reported for certain Myrtaceous species[23], [24].	because it produces large numbers of small spores that can be dispersed over long distances by wind and animal vectors[23], [25].	countries as well as USA (Hawaii, Florida, California), Australia, New Caledonia, the Caribbean, South Africa, Indonesia, Japan, China (Hainan), Singapore and most recently New Zealand[21], [22], [23].					
Fusarium circinatum	Pitch canker	Pines and Douglas firs	Needles, branches (dieback), the bole and exposed roots. Natural infections are	Spores disseminated by the air and insects as well as birds and mammals (occasionally)[27].	Japan, Korea, South Africa, Mexico, USA, Haiti, Chile, Uruguay, Portugal and Spain.	MEDIUM	HIGH	HIGH	HIGH[30]	HIGH

[22] The *Austropuccinia psidii* 'complex' contains multiple biotypes or strains which display unique host associations and climatic niches. Locations with a specific biotype may be at risk from the introduction of other biotypes. Genetic clustering has revealed nine distinct genetic clusters [C1–C9]. C1: diverse hosts from Costa Rica, Jamaica, Mexico, Puerto Rico, and USA-Hawaii, and USA-California; C2: Eucalypts in Brazil/Uruguay and rose apple (*Syzygium jambos*) in Brazil; C3: Eucalypts in Brazil; C4: Diverse hosts in USA-Florida; C5: Java plum (*Syzygium cumini*) in Brazil; C6: Guava and Brazilian guava (*Psidium guineense*) in Brazil; C7: Pitanga (*Eugenia uniflora*) in Brazil; C8: Allspice (*Pimenta dioica*) in Jamaica and sweet flower (*Myrrhinium atropurpureum*) in Uruguay and C9: Jabuticaba (*Myrciaria cauliflora*) in Brazil. The C1 cluster and the closely related C4 cluster are considered a "pandemic biotype," associated with myrtle rust emergence in Central America, the Caribbean, USA-Florida, USA-Hawaii, Australia, China-Hainan, New Caledonia, Indonesia and Colombia (Stewart *et al.* 2017).

[23] Pegg *et al.* (2017)

[24] Fernandez Winzer *et al.* (2017)

[25] Human mediated pathways of *A. psidii* include (i) infected or contaminated planting material, nursery stock, plant cuttings, flowers and germplasm; (ii) contaminated plant waste, timber, wood packaging and dunnage; (iii) contaminated equipment and tools used on or around plants (e.g. chainsaws, secateurs etc.) or (iv) contaminated clothing, shoes and other personal possessions (Stewart *et al.* 2017).

[27] Forestry Commission UK (2016). Contingency Plan for Pitch Canker of Pine (Fusarium circinatum), Retrieved from: https://www.forestresearch.gov.uk/documents/7299/Contingency-plan-Pitch-canker-of-pine-published-_Sept-05-2016.pdf

[30] This disease affects plantations and nurseries in several countries worldwide and is a serious threat to pine forests wherever it occurs (especially on *Pinus radiata*). *Fusarium circinatum* entry and establishment in Australia may cause movement restrictions and high impact to forestry sub-sectors.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			often associated with wounds[26].	Human-mediated dispersal of seed[28], soil and plant materials can facilitate long distance dispersal[29].						
Teratosphaeria destructans (syn. *Kirramyces destructans* and *Phaeophleospora destructans*)	Eucalypt leaf blight	*Eucalyptus* spp.	Serious leaf, bud and shoot blight, premature defoliation and in some instances tree mortality[31].	Wind dispersed spores over long distances. A possible long-distance pathway is plants for planting and seeds[32].	China, East Timor, Indonesia, Laos, Thailand, Vietnam, South Africa[33].	HIGH	HIGH	MEDIUM	HIGH	HIGH[34]
Bursaphelenchus spp. with insect vectors[35]	Pinewood nematode (PWN)	*Pinus* spp. but also other conifers.	Roots, bark, wood and buds but not leaves,	Insect vectors (regional and international	The genus *Bursaphelenchus* includes more than 100	MEDIUM	HIGH[37]	HIGH	HIGH	HIGH

[26] Characteristic sunken cankers produce abundant resin in branches and the main stem. Above the infection point, needles are brown and necrotic which cause partial discoloration and the defoliation of branches (dieback). Multiple infection points may cause severe defoliation. Severe infections result in extensive tree mortality, reduced tree growth and poor timber quality (Dvorák *et al.* 2017; Vettraino *et al.* 2018).

[28] Externally and internally seed borne.

[29] *Fusarium circinatum* spreads via spores which are disseminated by the air and insect vectors. Spores are produced throughout the year. The pathogen can be brought to new areas by seeds, seedlings, soil and plant materials. Pine seeds and seedlings are considered the major pathways of introduction into new countries (Dvorák *et al.* 2017; Vettraino *et al.* 2018).

[31] Andjic *et al.* (2011; 2019)

[32] *Teratosphaeria nubilosa* spores can be ejected from ascomata. This allows the spores to be wind dispersed over considerable distances. The dispersal of *Teratosphaeria* spp. is likely to be further dependent on climatic factors, such as temperature and moisture (relative humidity and rainfall) (Hunter *et al.* 2009; Andjic *et al.* 2011, 2019).

[33] *Teratosphaeria destructans* is thought to be absent from Australia, whereas *T. novaehollandiae* and *T. tiwiana* spp. nov. have been identified and described within Australia (Andjic *et al.* 2016).

[34] Risk ratings were assigned for tropical and subtropical environments. The epidemiology of *T. destructans* in temperate zones is unknown.

[35] *Bursaphelenchus* is vectored by beetles, particularly *Monochamus* species. *B. xylophilus* is particularly damaging to pines and is included in this entry. *B. xylophilus* is a National Priority Plant Pest.

[37] The establishment of pinewood nematode requires complex interactions between a pathogenic agent (Pine wood nematode), the insect vector (typically *Monochamus* species), a susceptible tree host (often pine) with associated microbiota (bacteria and Ophiostomatoid fungi).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
	complex		cones or fruit.	dispersal). Movement in wood and wood packaging materials (particularly with blue stain fungi) is another an important pathway[36],	species worldwide[33]. *B. xylophilus* is found in China, Japan, Korea, Taiwan, South Africa, Canada, Mexico, USA, Portugal and Spain.					
Phytophthora pinifolia	Daño Foliar del Pino	*Pinus radiata*. It is highly likely the Pinus host list will be wider than just *P. radiata*.	Needle necrosis and defoliation. Repeated defoliation can cause tree death. Branch and stem lesions can coalesce to form cankers, girdling and death of young trees[38], [39].	Sporangia spread via wind and rain splash onto healthy needles[40]. Potential pathways include plants for planting, cut branches, cones, soil or travellers (*e.g.* footwear).	Chile	MEDIUM	HIGH	HIGH	HIGH	HIGH
Phytophthora pluvialis	Red needle cast	*Pinus radiata*	Needle	Rain splash and air movement are the likely	USA and New Zealand[44]	MEDIUM	HIGH	HIGH	HIGH	HIGH

[36] Insect vectors are mainly beetles from a range of families, such as the Cerambycidae, Curculionidae (including subfamily Scolytinae) and Buprestidae. Movement of insect vectors in the international trade of wood and host plants is considered a main pathway for *Bursaphelenchus* spp. dispersal (d'Errico *et al.* 2015). PWN movement in wood, particularly with blue stain fungi is another an important pathway.
[38] Duran *et al.* (2008).
[39] Jung *et al.* (2018)
[40] After the onset of humid conditions, the pathogen infects needles on lower branches via sporangia formed on infected needles. Sporangia spread via wind and rain splash onto healthy needles and adjacent hosts. If humid conditions persist, *P. pinifolia* produces new sporangia causing multi-cyclic infections which gradually move up in each canopy (Duran *et al.* 2008; Jung *et al.* 2018).
[44] North-western USA - Oregon and New Zealand (initial detection - 2008).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			defoliation[41]. Death of fine roots and root tips.	drivers of pathogen movement[42]. Potential pathways include plants for planting, cut branches, cones, soil[43] or travellers (*e.g.* footwear).						
Phytophthora ramorum[45, 46]	Sudden oak death	Numerous trees and shrubs species (including eucalypts).	*P. ramorum* causes at least three types of disease (lethal cankers, leaf and branch dieback, leaf blotches or spots) on different	Wind-blown rain and/or rain splash are the likely mechanism for movement[48]. Baited from rivers and streams downstream of infested areas[49].	Canada, USA, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and UK[51].	MEDIUM	HIGH	HIGH	HIGH	HIGH

[41] *Phytophthora pluvialis* has caused substantial losses of pine needles in New Zealand since its introduction. Severe disease can almost completely defoliate affected trees, but recovery is common. In the following year, the one-year foliage is unaffected. Growth losses are not always significant unless repeated defoliation occurs. *P. pluvialis* infection can also cause the death of fine roots and root tips (Dick *et al*. 2014; Ganley *et al*. 2014; Scott *et al*. 2019).

[42] Occurrence of *Phytophthora pluvialis* is likely to be dependent on climatic factors, such as temperature, moisture and leaf wetness.

[43] The potential for subsequent spread of the pathogen through the trade of export logs has been demonstrated to be negligible (Dick *et al*. 2014; Ganley *et al*. 2014).

[45] This pest is a National Priority Plant Pest.

[46] https://www.agriculture.gov.au/biosecurity/risk-analysis/plant/importation-phytophthora-ramorum

[48] *P. ramorum* has been recovered from plants, rain, soil, litter and stream water from forests with suitable host taxa. Infectious airborne sporangia were not produced in significant numbers on the bole lesions responsible for oak and tanoak mortality but were extremely abundant on foliar lesions of other hosts (Davidson *et al*. 2002; Garbelotto and Hayden 2012).

[49] Grünwald *et al*. (2008).

[51] A wide host range and the ability to reproduce from chlamydospores for persistence through adverse environmental conditions suggests that *P. ramorum* may have a wide potential distribution without strict controls and regulations (Garbelotto and Hayden 2012). EPPO lists 68 countries that mention *P. ramorum* in their regulations.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			hosts[47].	Potential pathways: Plants for planting, plant materials, wood, solid wood packaging materials (particularly untreated wood products) or contaminated soil/water[50].						
Coptotermes formosanus[52]	Formosan subterranean termite	Living and dead trees, timber in service or any material containing cellulose[53].	Wood of standing trees and timber in service.	41 interceptions internationally. This is the most highly intercepted Rhinotermitidae[54].	China, Taiwan, South Africa, USA, United States Virgin Islands, Marshall Islands and US Minor Outlying Islands.	MEDIUM	HIGH[55]	HIGH	HIGH	HIGH
Coptotermes gestroi[56]	Asian subterranean termite	Living and dead trees, timber in service or any material containing	Living trees, standing dead wood and timber in	27 interceptions internationally. This is the second most intercepted	*Coptotermes gestroi* is endemic to southeast Asia. *C. gestroi* was introduced to other geographic areas	MEDIUM	HIGH[59]	HIGH	HIGH	HIGH

[47] Garbelotto and Hayden (2012).
[50] Tubajika K.M., Singh R. & Shelly J.R. (2008).
[52] This pest is a National Priority Plant Pest.
[53] *Coptotermes formosanus* usually nest in the ground and need contact with soil or some other constant source of moisture for persistence.
[54] Human transportation is the primary means of migration for termite pests with shipboard infestations as a likely means of human dispersal. All substantial objects containing cellulose and adequate moisture may maintain small colonies. These may include large wooden articles, such as crates, pallets or shipping containers, lumbers, railway sleepers, wooden posts and planting containers holding soil. Alates are often found swarming out of infested boats (CABI, 2021).
[55] The establishment potential of *Coptotermes* spp. may be dependent on colony status. There are instances of *Coptotermes* spp. being intercepted in nests with a queen.
[56] This pest is a National Priority Plant Pest.
[59] The establishment potential of *Coptotermes* spp. may be dependent on colony status. There are instances of *Coptotermes* spp. being intercepted in nests with a queen.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[10]	DISTRIBUTION[11]	ENTRY POTENTIAL	EST.[12] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
		cellulose[57].	service.	Rhinotermitidae [54].	including North America and Pacific, Caribbean, South American and Indian Ocean islands[58].					

[57] *Coptotermes gestroi* usually nest in the ground and need contact with soil or some other constant source of moisture for persistence.
[58] Li H.F., Fujisaki I. & Su N.Y. (2013).

Established pests of biosecurity significance

This section identifies established pests of biosecurity significance for the Australian plantation forests sector (*Table 3*). By identifying pests which producers already manage, appropriate mechanisms can be put in place to better align industry and government resources and provide a stronger base for biosecurity risk management for the plantation forests sector.

Identification of established pests of biosecurity significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, surveillance coordinators, diagnosticians and development of pest-specific mitigation activities.

Information on the pests described in this section came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

To be considered as an established pest of biosecurity significance, the pests included in *Table 3* should be economically important to the plantation forests sector and at least one of the following:

- restricted to regions within Australia
- notifiable by law
- have market access implications
- able to be prevented from entering a plantation through good biosecurity practices.

These pests were considered to prioritise investment but did not undergo a formal pest risk assessment.

Table 3. Established pests of biosecurity significance

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS OR MARKETS IMPACT BY PESTS	FACTSHEETS	COMMENTS
Eucalyptus weevil (*Gonipterus* spp. including. *G. scutellatus* complex – particularly G. sp. 2 and *G. platensis*)	*Eucalyptus* spp.	Leaves (defoliation)	Eastern Australia (G. scutellatus complex) and TAS, WA (G. platensis)[60]	No formal movement restrictions	Not developed	*Gonipterus* spp. can be significant defoliators outside their native range.
European house borer (*Hylotrupes bajulus*)	*Abies* (firs), *Larix* (larches), *Picea* (spruces) and *Pinus* spp. (pines). *Pseudotsuga menziesii* (Douglas-fir) and other softwood timbers.	Softwood timber in service, dead branches and boles	WA	Market access conditions and controls on host materials.	Developed - WA[61], SA[62]	The movement of undetected larvae in seasoned pinewood is the likely entry pathway of European house borer into other Australian states and territories.
Five spined engraver; Five spined bark beetle (*Ips grandicollis*)	*Pinus* spp.	Bark and phloem	QLD, NSW, VIC, SA, WA	No formal movement restrictions	Developed - QLD[63]	*I. grandicollis* spreads blue stain fungi (e.g. *Ophiostoma* spp.) which can severely affect the value, quality, and presentation of milled timber.
Asian ambrosia beetle; granulate ambrosia beetle (*Xylosandrus crassiusculus*)	Polyphagous including *Eucalyptus* spp.	Seedlings, saplings	QLD, NSW	No formal movement restrictions	Not developed	

[60] Mapondera *et al.* (2012).
[61] agric.wa.gov.au/sites/gateway/files/EHB%20factsheet%20Aug%202017.pdf
[62] pir.sa.gov.au/__data/assets/pdf_file/0003/295815/europeanhouseborer_factsheet19.pdf
[63] business.qld.gov.au/industries/farms-fishing-forestry/forests-wood/pests-diseases/trees-timber/five-spined-bark-beetle

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS OR MARKETS IMPACT BY PESTS	FACTSHEETS	COMMENTS
Giant pine scale (*Marchalina hellenica*)	*Pinus* spp., *Abies* (firs) and *Picea* (spruces)	Giant pine scale prefers lower parts of a tree and occurs on the trunk but may also inhabit branches and exposed roots. Needles wilt and drop which causes dieback that can eventually kill the tree.	VIC	Market access conditions and controls on host materials and equipment.	Developed - ACT[64], NSW[65], QLD[66], SA[67], VIC[68]	Trees of all ages are susceptible. Affected trees also become weakened and susceptible to secondary attack by other organisms.
Sirex wood wasp (*Sirex noctilio*)	*Pinus* spp.	Bole	ACT, NSW, QLD, VIC, SA, TAS	No formal movement restrictions	Developed - QLD[69]	Not present in WA. WA undertakes log border inspections & trapping program (13 sites, 98 inspections).
Myrtle rust (*Austropuccinia psidii*)	Myrtaceae	Flowers, fruits, leaves, shoots, young branches, epicormic shoots, coppice and stem(s) can develop blight. Severe infection and crown loss; dieback and tree	NSW, QLD, TAS, VIC, and NT[70]	Market access restrictions, conditions and controls on host materials and equipment are in place.	Developed- NSW[71], TAS[72], SA[73]	The C1 cluster and the closely related C4 cluster are considered as a "pandemic biotype," associated with myrtle rust emergence in Central America, the

[64] environment.act.gov.au/parks-conservation/plants-and-animals/Biosecurity/current-biosecurity-alerts/giant-pine-scale
[65] dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/giant-pine-scale
[66] business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/giant-pine-scale
[67] pir.sa.gov.au/biosecurity/plant_health/emergency_and_significant_plant_pests/giant_pine_scale
[68] agriculture.vic.gov.au/biosecurity/pest-insects-and-mites/priority-pest-insects-and-mites/giant-pine-scale
[69] business.qld.gov.au/industries/farms-fishing-forestry/forests-wood/pests-diseases/trees-timber/sirex-wood-wasp
[70] Myrtle rust occurs in the Tiwi Islands in the NT.
[71] dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/myrtle-rust
[72] dpipwe.tas.gov.au/Documents/myrtle.pdf
[73] pir.sa.gov.au/__data/assets/pdf_file/0005/259709/Myrtle_Rust_Fact_Sheet_-_June_2019.pdf

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS OR MARKETS IMPACT BY PESTS	FACTSHEETS	COMMENTS
		mortality has been reported for certain Myrtaceous species.				Caribbean, USA-Florida, USA-Hawaii, California, Australia, China-Hainan, New Caledonia, Indonesia and Colombia[74].
Dothistroma needle blight (*Dothistroma septosporum* (syn. *Mycosphaerella pini*))	*Pinus* spp., Douglas fir and some spruce, cedar, fir and larch spp.	Needle blight (persistent 1-3 mm wide brick-red bands) which can cause the eventual death of the tree after successive infections.	NSW, QLD, TAS, VIC	No formal movement restrictions	Not developed	

[74] Stewart *et al.* (2017).

BIOSECURITY IMPLEMENTATION

Following the prioritisation and gap analysis through the Australian plantation forests Biosecurity Implementation Group (BIG) planning process, both industry and government have developed a Biosecurity Implementation Table (*Table 4*). This table has been developed in recognition that biosecurity is a shared responsibility between the Australian plantation forests sector and governments. The table sets out shared biosecurity preparedness goals, objectives and recommendations for biosecurity improvement activities for the Australian plantation forests sector, governments, and other stakeholders to consider throughout the formal review period (2020-2025). Activities and recommendations in this table may require additional funding to be sourced prior to commencement.

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[75] and the National Plant Biosecurity Strategy (NPBS)[76] by providing a clear line of sight between the development of *Plantation Forests Biosecurity Plan* and broader plant health policy and legislation. Implementing the specific actions listed in the Biosecurity Implementation Table will not only strengthen the Australian plantation forests biosecurity system, but also the broader plant biosecurity system.

[75] For more information visit agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity
[76] For more information visit planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 1 Legislative and Regulatory Issues

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
1. Adopt nationally consistent plant biosecurity legislation, regulations and approaches where possible within each state and territory government's overarching legislative framework	1.1. Review relevant legislation in all states/territories with regards to forest biosecurity and highlight issues to be resolved.	Review Report	AFPA, State and Commonwealth governments, PHA	PHA	Ongoing	Certified growers are aware of legislative responsibilities and industry regulations. Biosecurity practices are listed as operational goals within state or territory Codes of Practice for Timber Production.	N/A	N/A	Medium	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 2 Surveillance

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
2. Establish a nationally coordinated surveillance system R3. Facilitate the development of a nationally coordinated and targeted surveillance system that provides intelligence, supports the early detection of exotic plant pests, reports evidence of area freedom, enhances pest incursion responses and supports the effective management of established pests	2.1. Establish a National Forest Pest Surveillance Program with formal linkages between industry and government surveillance coordinators across biosecurity.	* Remain aware and informed of surveillance activities across the biosecurity continuum (e.g. offshore/pre-border surveillance, national border surveillance program). * Agreed shared surveillance priorities	AFPA, PHA, Commonwealth, States & other stakeholders	PHA	2022-2027	National Forest Pest Surveillance Program (NFPSP) is establishing in July 2022. NFPSP Includes formal arrangements through: * National Forest Biosecurity Steering Group - Strategic leadership. * Operations Team - Operational planning and reporting.	N/A	1.1	High	Short
	2.2. Facilitate capture and collation of data from industry surveillance activities.	* Industry surveillance data collection tool. * Industry surveillance data standard. * Industry surveillance agreed collation platform.	AFPA, FWPA, PHA, Commonwealth, States & other stakeholders	PHA	2022-2027	Biosecurity data collation is a component of NFPSP, including: * A mobile-based diagnostic and reporting tool 'MyPestGuideTREES' to capture information for the differentiation of exotic and established forest pests. * AUSPestCheck online data collation tool being used to collate NFPSP generated data. FWPA funded iMapPESTS project aims to detect and monitor airborne pests and diseases using a sentinel surveillance approach - potentially integrating into the NFPSP.	3.4	3.4	High	N/A

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
	2.3. Develop national forest pest surveillance protocols, including consideration of industry needs.	* National surveillance protocols for HPPs. * National surveillance protocols for major established pests or, FHS more generally (e.g. FHS manual).	AFPA, FWPA, PHA, Commonwealth, States & other stakeholders	PHA	TBD	* FHS data is not being collated nationally. * Requires development of: - agreed data standard and, - agreed national data collation platform. * Could be integrated into the NFPSP activities.	3.4	3.4	High	N/A

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 3 Preparedness and Response

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
3. Build Australia's ability to prepare for, and respond to, pest incursions R4. Continue to review and improve emergency response efficiency and effectiveness through improved processes, decision making, education, training and accreditation of personnel R5. Develop contingency plans or business continuity plans covering all High Priority Pests	3.1. Develop and update an industry specific Biosecurity Incident Standard Operating Procedures (BISOP - designed to guide industries in an incursion).	* BISOP developed * List of EPPRD trained staff * List of ILO trained staff	AFPA, PHA, FHaB	FHaB	TBD	* A new BISOP framework is being developed by PHA. * FHaB has formed a working group to progress BISOP. * A simulation exercise could contextualise and inform BISOP development and/or review. * PHA has delivered industry liaison training in all States between 2021-2022.	No	No	High	Short
	3.2. Simulation exercise for a HPP incursion – particularly to test the ability to reach out/communicate to all parts of the plantation forests supply chain, governments and stakeholders.	* Run an exercise - discuss with PHA and feed into BISOP development (3.1)	AFPA, FWPA, State and Commonwealth governments, PHA	FHaB	TBD	* The possibility of a simulation exercise (during BISOP development and/or after finalisation) will be considered and reviewed at FHaB.	No	No	High	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
R6. Develop a national risk-based decision making and investment framework that guides the efficient allocation of plant biosecurity resources, maximising return on investment and establishing a transparent and objective decision-making process	3.3. Obtain shelf/emergency chemical use permits, if necessary, for control of HPPs from the APVMA.	* Table of HPPs vs chemical control options * Develop necessary trials * Could include as part of any contingency planning work	AFPA, FWPA, Commonwealth, States & other stakeholders, IPMG, Consortium, PBRI, PHA	FHaB	TBD	* Trials to be channelled through Forest Pest Research Consortium (University of the Sunshine Coast)	No	No	High	Medium
	3.4. Engage with initiatives to improve preparedness and response to cross-sectoral tree pests and where possible include Plantation Forest HPPs.	* National Forest and Timber Pests ACTION PLAN 2023-2033	AFPA, FWPA, State and Commonwealth Governments, PHA, PBRI, relevant industries	PHA	2022-2023	* In 2017/18 the development of the National Forest Biosecurity Surveillance Strategy & its Implementation Plan (2018-2023) examined cross-sector benefits for joint forest pest surveillance, leading to establishment of the NFPSP. * From 2022, the Commonwealth is investing in a Forest and TImber Pests ACTION PLAN. This seeks to improve preparedness more generally (not just surveillance) with a particular focus on National Priority Plant Pests and Environmental Pests. * PHA is undertaking this work and will look to include ongoing collaboration and inclusion, where sensible of Industry Forest Pests in proposed initiatives of the ACTION PLAN. All stakeholders will be consulted.	No	2.1	High	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
	3.5. Develop and update contingency plans for HPPs.	* Table of HPPs vs Priority rank, including potential partners for collaboration	AFPA, FWPA, State and Commonwealth Governments, PHA, PBRI, relevant industries	FHaB	TBD	Agriculture Victoria are developing an online portal with a compartmentalised structure that organises contingency plans in general and specific sections. Pest and industry specific contingency plans have been flagged as an area for further consideration and review at the annual Biosecurity Reference Panel (BRP) meetings.	Suggested	4.3	High	Medium
	3.6. Resolve the categorisation of Forest HPPs in the EPPRD	* Clarify if EPPRD categorisation can be done as a batch process. * Set yearly number to categorise	AFPA, FHaB, State Government, Commonwealth, PHA	FHaB	TBD	Prioritisation of pests are scheduled for the next BRP meeting.	No	No	Low	Medium
	3.7. Review adoption of biosecurity schemes for nurseries supplying plantation forests.	* Table of forest nurseries vs accreditations	AFPA, State and Commonwealth Governments, PHA	FHaB	TBD	Consult with AFPA to review industry adoption. APPS are in place to acquire the following certifications through Greenlife: NIASA – demonstrates maintenance of high health benchmark standards for plant materials and continuous improvement systems. EcoHort – nursery industry Environmental Management System (EMS) for production nurseries, growing media manufacturers and markets. BioSecure HACCP– demonstrates management of biosecurity risks for both imported and exported material.	No	No	Low	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 4 Capacity and Capability

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
4. Expand Australia's plant biosecurity training, capacity and capability R7. Maintain and enhance Australia's plant biosecurity training capability and capacity to underpin the ongoing needs of the national plant biosecurity system.	4.1. Develop a TRAINING FRAMEWORK identifying and prioritising industry biosecurity training and extension needs at three levels: * Leadership level - Deed Training * Management Level - Industry Liaison Training * Field level - supply chain = foresters, contractors, nursery	* Deed workshop for AFPA Board and Growers Chamber. * ILA training provided and attended by at least one main grower in each State. * Plantation field worker training workshop or webinar developed.	PHA, AFPA	PHA	ASAP; then bi-annually.		No	1.1	Medium	Medium
	4.2 Develop and implement training of biosecurity expertise and community/tree stakeholders in areas of high risk for entry of exotic forest pest.	* NFPSP	AFPA, State and Commonwealth governments, PHA	PHA	2022-2027	Implemented through NFPSP.	No	-	Medium	Medium
	4.3 Develop and implement FHS training program	* Agreed FHS standard methodology * National Training package developed	AFPA, PHA	FHaB	TBD	Pest recognition and surveillance training is undertaken in some jurisdictions. Nationally there is an ad-hoc approach.	No	-	Medium	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 5 Diagnostics

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
5. Create a nationally integrated diagnostic network R8. Develop a nationally integrated plant biosecurity diagnostic network that underpins Australia's plant biosecurity system. R9. Implement, maintain and manage appropriate quality management systems in plant biosecurity laboratories undertaking diagnostic testing. R10. Endorsed National Diagnostic Protocols for all High Priority Pests be developed and maintained.	5.1. Implement improvements in diagnostic standards, methods and tools for Plantation Forest HPPs including: * Field diagnostics methods * Laboratory National Diagnostic Protocols * Diagnostic sample processing protocols * Improved trap diagnostic triaging.	* List of HPPs vs field and lab diagnostics available. * Develop recommended RD&E, as necessary.	AFPA, FWPA, SPHD, PHA, State and Commonwealth governments, other relevant industries.	FHaB	Ongoing	* Assessment and prioritisation of the identified HPPs without a NDP will be considered as FHaB works through implementation. * An internationally collaborative research project to identify and circumscribe rust biotypes is proposed. This project will underpin the review and development of some NDPs. * A QDAF project "Development of National Forest Biosecurity Diagnostic SOP's" will establish a nationally standardised and co-ordinated procedure. * Assessment of bulk trap samples has been undertaken and will be operationalised over time (i.e. AgriBlo - Conrad).	3.2.1	3.2	Medium	Ongoing
	5.2. Develop diagnostic capacity that can meet industry FHS diagnostic requirements.	* List of private/alternative plant diagnostic laboratories and providers.	AFPA, State Government, SPHD.	FHaB	TBD	* Government laboratories already approaching, or at full capacity were identified as an industry risk. Contingencies and alternative options are being explored.	3.2.1	No	Medium	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 6 Established Pests

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
6. Enhance national management systems for established pests R11. Enhance the national management system for established pests.	6.1. Raise industry awareness of established pests of biosecurity significance, and demonstrate how best biosecurity practice has direct relevance to day-to-day operations for pests already within Australia (e.g. giant pine scale).	* Look to develop case study (e.g. EHB, GPS).	AFPA, PHA	PHA	TBD	* Certified plantation growers are highly aware of and follow local and state regulations and codes of practice to: - declare and control 'pests', and - manage weeds.	Suggested	2.1	Medium	Medium
	6.2. Include established pests of significance in biosecurity materials and tools	Include established pests of significance in: * The Plantation Timber Biosecurity Manual * MyPestGuide TREES	AFPA, State governments	PHA	TBD	Established pest awareness materials will be included in the mobile application being developed with funding from DAWE/FWPA.	Suggested	2.1	Low	Medium
	6.3. As necessary, develop research and/or programs to manage established 'pests' or weeds.	* FWPA's "Damage Agents" Investment Plan	AFPA, FWPA, Consortium, PHA, State and Commonwealth governments, other relevant industries	Consortium	TBD	* FWPA's "Damage Agents" Investment Plan includes RDE for established pests. *A Forest Pest Research Consortium has been established at University of the Sunshine Coast to undertake collaborative research on established pests.	1.1.2	N/A	Low	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
	6.4 Engagement with National Established Weed Priorities (NEWP) framework	* Select Forestry representatives to engage with NEWP framework development * Identify priority weeds of significance for Plantation Forests	AFPA	FHaB	TBD	* FHaB members have had initial discussions with NEWP development team.	1.1.2	N/A	Low	Medium
	6.5 Develop "state-of-knowledge" guidelines for FHS	* FHS Guideline	AFPA, FWPA, Consortium, PHA, State and Commonwealth governments, other relevant industries	FHaB	TBD	-	N/A	N/A	Low	Medium
	6.6 Develop "state-of-knowledge" guidelines for significant pests affecting plantations, e.g. Teratosphaeria (similar to contingency plan but for established pest).	* FHS Guideline	AFPA, FWPA, Consortium, PHA, State and Commonwealth governments, other relevant industries	FHaB, Consortium	TBD	-	N/A	N/A	Low	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 7 Education and Awareness

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
7. Establish an integrated national approach to plant biosecurity education and awareness R12. Develop an integrated national approach to plant biosecurity communication between all key stakeholders. R13. Processes need to be defined that identify, engage, evaluate and sustain community engagement and capture plant biosecurity information.	7.1. Promote, disseminate and demonstrate benefits of biosecurity to industry within and across each component of the supply chain (e.g. nurseries, growers, contractors, processors etc.).	* National Forest Biosecurity Training Package * BOLT course * Updated Plantation Timber Biosecurity Manual	AFPA, FWPA, PHA, State governments	PHA	Ongoing	The development and implementation of specific extension activities will be reviewed on an ongoing basis. Surveillance aspects of biosecurity will be implemented and maintained across jurisdictions through the NFPSP.	Suggest inclusion	2.1	Medium	Ongoing
	7.2. Develop and raise awareness of forest pest biosecurity to encourage community engagement and reporting of tree pests.	* National Forest Biosecurity Training Package * Annual urban tree pest training workshops	AFPA, FWPA, PHA, State governments	PHA	TBH	A national training package is being developed for forest pests. A modular approach that will complement and strengthen existing biosecurity training. It will be implemented and maintained across jurisdictions through the NFPSP with PHA assistance.	Suggest inclusion	2.1	Medium	Medium

Table 4. Biosecurity Implementation Table for the Australian Plantation Forests Sector (2020-2025).

Strategy 8 Biosecurity Research, Development and Extension

NATIONAL PLANT BIOSECURITY PLAN STRATEGY (STRATEGY [**IN BOLD**], RECOMMENDATION [NOT IN BOLD])	BIOSECURITY PLAN ACTION	OUTCOME / OUTPUT / KEY PERFORMANCE INDICATOR	POTENTIAL PARTNERS	LEAD	PERIOD	CURRENT ACTIVITIES	RD&E INVESTMENT PLAN	FOREST STRATEGY	PRIORITY	IMPLEMENTATION TIMEFRAME
8. Develop a national framework for plant biosecurity research R14. Establish a national framework for plant biosecurity research.	8.1. Review and prioritise biosecurity RD&E annually and identify opportunities for collaboration and cross-sectoral investment.	Bi-annual review of RD&E investment and opportunities.	AFPA, FHaB, FWPA, GRAC	PHA	Annually	A five-year investment plan (with periodic review) has been completed by FWPA for RD&E activities. * FWPA and PHA to collaborate to organise a review. * FHaB, PHA and invited RD&E providers to undertake review & provide recommendations on priority projects via report. * FWPA Growers Research Advisory Committee (GRAC) reviews research proposals and Review Report teams providing recommendation to FWPA Board. * FWPA Board approves projects	Investment Plan 3.2.1, 3.3.1	1.1, 3.3, 3.4	Medium	Ongoing

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

This section presents the framework utilised for assessing the potential economic, social, and environmental impacts associated with each identified pest threat (*Table 2*). This part of the biosecurity plan uses a nationally consistent and coordinated approach to threat identification and risk assessment to provide a strong base for future risk management in the Australian plantation forests sector.

By identifying key threats, a pre-emptive approach may be taken to risk management. Under this approach, mechanisms can be put into place to increase our response effectiveness if pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA's government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions, and assists in the response to EPP incursions, particularly those identified as key threats.

Identification of exotic High Priority Pests will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and diagnosticians, and development of pest-specific incursion response plans.

Established pests of biosecurity significance have also been considered in this plan (*Table 3*). It is well understood that good biosecurity practice is beneficial for the ongoing management of established pests, as well as for surveillance and early detection of exotic pests. Established pests cause ongoing hardships for growers and have been listed with the support of industry and government in recognition that they need a strategic, consistent, scientific and risk-based approach to better manage these pests for the plantation forests sector.

Threat identification

Information on exotic pest threats to the Australian plantation forests sector described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment

At this time, only invertebrate pests (insects, mites and molluscs), nematodes and pathogens (disease causing organisms) have been identified for risk assessment, as these pests are covered under national agreed arrangements, under the EPPRD. If exotic weeds were to be included in the EPPRD, then this would be revisited through future reviews of the plan.

Pest risk assessments

The assessment process used in this biosecurity plan was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this biosecurity plan is shown in *Table 5* and the complete protocol used for pest risk analysis can be found on the PHA website - Risk assessment.

While there are similarities in the ranking system used in this document and the Biosecurity Import Risk Analysis (BIRA) process followed by the Department of Agriculture, Water and Environment (DAWE), there are differences in the underlying methodology and scope of consideration that may result in different outcomes

between the two assessment systems. This includes different guidance to assignment of qualitative probabilities.

This document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the BIRA conducted by the Department of Agriculture, Water and Environment, which focuses only on specific regulated import pathways.

Modifications of the DAWE protocol (Department of Agriculture Fisheries and Forestry, 2011) have been made to suit the analysis required in the biosecurity plan development process, including, but not limited to:

- Entry potential: The determination of entry potential in this biosecurity plan considers multiple pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore, the scope is wider than that used by the DAWE in the BIRA process, which only considers legal importation of plants or plant commodities.
- Potential economic impact of pest establishment in this document only considers the impacts on the Australian plantation forests sector. The DAWE BIRA process has a wider scope, including the impacts on all of Australia's plant industries, trade, the environment, social amenity and public health.
- Risk potential and impacts: The categories used in this biosecurity plan for describing the entry, establishment, spread, and potential economic impact (see *Description of terms used in pest risk tables*) differs in comparison to that used in the DAWE BIRA process.

Table 5. Summary of pest risk assessment process used in biosecurity plans.

Step 1	Clearly identify the pest	Pests defined to species level Alternatively, a group (e.g. family, genus level) can be used Sub-species level (e.g. race, pathovar, etc.) may be required
Step 2	Assess entry establishment and spread likelihoods	Assessment based on current system and factors Negligible, low, medium, high or unknown ratings
Step 3	Assess the consequences	Primarily based on economic impact to industry based on current factors Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risks	Entry, establishment and spread likelihoods are combined to generate an overall likelihood score Likelihood score combined with the likely economic impact to generate an overall risk score
Step 5	Review the risks	Risk ratings should be reviewed with the biosecurity plan

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and mitigation of these risks. Risk assessment involves consideration of the sources of risk, their consequences, and the likelihood that those consequences may occur. Factors that affect the consequences and likelihood may be identified and addressed via risk mitigation strategies.

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative, or a combination of these. The complexity and cost of assessment increases with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment, and if

necessary, undertake more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS) ISO 31000, 2018].

Ranking pest threats

Key questions required for ranking the importance of pests include the following:

- What are the probabilities of entry into Australia, establishment and spread, for each pest?
- What are the impacts of the pest on cost of production, overall productivity and market access?
- How difficult is each pest to identify and control and/or eradicate?

The Threat Summary Tables (TST) (*Threat Summary Tables*) present a list of potential plant pest threats to the Australian plantation forests sector and provide summarised information on entry, establishment and spread potential, the economic consequences of establishment and eradication potential (where available). The most serious threats from the TST were identified through a process of qualitative risk assessment and are detailed in the HPP list (*Table 2*).

When a pest that threatens multiple industries is assessed, the entry, establishment and spread potential considers all known factors across all host industries. This accurately reflects the ability of a pest to enter, establish and spread across Australia and results in different industries, and their biosecurity plans, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (*i.e.* only for the Australian plantation forests sector), and therefore this rating may differ between biosecurity plans.

Description of terms used in pest risk tables

The descriptions below relate to terms in *Table 2* and elsewhere in the document.

Entry potential

Negligible	The probability of entry is extremely low given the combination of all known factors including the geographic distribution of the pest, quarantine practices applied, probability of pest survival in transit and pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely and potentially frequent given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Establishment potential

Negligible	The pest has limited potential to survive and become established within Australia given the combination of all known factors.
Low	The pest has the potential to survive and become established in approximately one-third or less of the range of hosts. The pest could have a low probability of contact with susceptible hosts.
Medium	The pest has the potential to survive and become established in between approximately one-third and two-thirds of the range of hosts.
High	The pest has potential to survive and become established throughout most or all the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival, it is likely to survive in Australia wherever major hosts are grown.
Unknown	The establishment potential of the pest is unknown or very little of value is known.

Spread potential

Negligible	The pest has very limited potential for spread in Australia given the combination of dispersal mechanisms, availability of hosts, vector presence, industry practices and geographic and climatic barriers.
Low	The pest has the potential for natural or assisted spread to susceptible hosts within Australia yet is hindered by several of the above factors
Medium	The pest has an increased likelihood of spread due to the above factors
High	The natural spread of the pest to most production areas is unhindered and assisted spread within Australia is also difficult to manage
Unknown	The spread potential is unknown or very little of value is known.

Economic impact

Negligible	There are very minor, often undetectable, impacts on production with insignificant changes to host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Very low	There are minor, yet measurable, impacts on production including either host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Low	There are measurable impacts to production including either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or minimal impacts on market access.
Medium	There are significant impacts on production with either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or moderate impacts on market access.
High	There are severe impacts on production including host mortality and significant impacts on either crop quality or storage losses, and/or severe impacts on market access.
Extreme	There is extreme impact on standing crop at all stages of maturity, with high host mortality or unmanageable impacts to crop production and quality, and /or extreme, long term, impacts on market access.
Unknown	The economic potential of the pest is unknown or very little of value is known.

References

AS/NZS ISO 31000:2018 Risk management - Principles and guidelines. Standards Australia, Sydney, and Standards New Zealand, Wellington.

DAFF (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

FAO (2004) Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms. International Standards for Phytosanitary Measures No. 11. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

FAO (2007) Framework for pest risk analysis. International Standards for Phytosanitary Measures No. 2. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

RISK MITIGATION AND PREPAREDNESS

There are several strategies that can be adopted to help protect and minimise the risks of Emergency Plant Pests under International Plant Protection Convention (IPPC) standards (ippc.int/standards) and Commonwealth and State/Territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the Australian plantation forests sector (*Figure 1*). Such risk mitigation and preparedness practises are the responsibility of governments, industry and the community.

Several key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and plantation forests sector members. This section is to be used as a guide outlining activities that may be adopted by industry and growers to mitigate the risk and prepare for an incursion response. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 1. Examples of biosecurity risk mitigation activities considered Best Management Practices.

Barrier quarantine

Barrier quarantine refers to the biosecurity measures implemented at all levels of the plantation forests sector including national, state, regional and farm/plantation levels.

National level – importation restrictions

The Department of Agriculture, Water and Environment (DAWE) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry and food industries. DAWE achieves this through:

- establishment of scientifically-based quarantine policies
- provision of effective technical advice and export certification services
- negotiations with key trading partners
- participation in multilateral forums and international sanitary and phytosanitary (SPS) standard-setting organisations
- collaboration with portfolio industries and exporters.

DAWE is responsible for developing biosecurity risk management policy and reviewing existing quarantine measures (i.e. SPS) for the importation of live animals and plants, and animal and plant products. DAWE undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAWE also consults with industry and the community, conducting research and developing policy and procedures to protect Australia's animal and plant health status and natural environment. In addition, DAWE assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at agriculture.gov.au.

The administrative authority for national quarantine is vested in DAWE under the Australian Government *Biosecurity Act 2015*. Quarantine policies are developed through the Biosecurity Import Risk Analysis (BIRA) process. This process is outlined in the BIRA Guidelines 2016 (Department of Agriculture and Water Resources, 2016). DAWE maintains barrier quarantine services at all Australian international sea and airports, and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, is the responsibility of DAWE.

The Australian Biosecurity Import Conditions Database (BICON) contains the current Australian import conditions for more than 20,000 foreign plants, animal, mineral and human products and is the first point of access to information about Australian import requirements for a range of commodities. It can be used to determine if a commodity intended for import to Australia requires a quarantine import permit and/or treatment or if there are any other quarantine prerequisites. The cases listed on BICON for plantation forests are included below (*Table 6*). BICON can be accessed at agriculture.gov.au/import/bicon. For export conditions see the Manual of Importing Country Requirements (MICoR) database at agriculture.gov.au/micor/plants.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact DAWE on (02) 6272 3933 or 1800 020 504, or visit the website at agriculture.gov.au/biosecurity/import.

The World Trade Organization (WTO) SPS Agreement facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures put in place must minimise negative effects on trade while meeting an importing country's appropriate level of protection. For plant products, these measures are delivered through the IPPC standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit ippc.int.

Table 6. Product types for which import conditions are listed in BICON (June 2020)[77]

CROP	PRODUCT TYPE
***Agathis* spp.**	*Agathis* spp. (kauri, dammar) for use as nursery stock
***Araucaria* spp.**	*Araucaria* spp. for use as nursery stock

[77] Please note, this is a summary only. Conditions change overtime and BICON (agriculture.gov.au/import/bicon), or the Department of Agriculture, Water and Environment will need to be consulted to confirm the specific conditions that apply to a given situation.

CROP	PRODUCT TYPE
***Pinus* spp.**	*Pinus* spp. and *Pseudotsuga* spp. for use as nursery stock *Pinus* spp. seed for sowing Conifer (excluding *Pinus* spp. and *Pseudotsuga* spp.) seed for sowing Pine cones Shelled pine nuts for human consumption Vacuum sealed nuts for human consumption Dried herb products not for human consumption Dried herbs for human consumption
***Acacia* spp.**	Frozen fruit, vegetables and herbs for human consumption Gum products Dried fruit Dried herb products not for human consumption Dried herbs for human consumption
Myrtaceae	Timber and timber products Myrtaceae seed for sowing
***Eucalyptus* spp.**	Timber and timber products
General products	Timber and timber products Timber and bamboo packaging Burnt pine longicorn affected timber from New Zealand Logs, log cabins and oversize timber Seed for sowing products Sawdust and woodchips Wooden manufactured articles containing bark Packing materials and packaging of plants Forestry or amenity species that are hosts of *Xylella fastidiosa*, sudden oak death and *Ceratocystis* Machinery and equipment

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread plantation forest pests is of high importance. Each state/territory has quarantine legislation in place to control the importation of forest materials interstate and intrastate, and to manage agreed pests if an incursion occurs (). Further regulations have been put in place in response to specific pest threats and these are regularly reviewed and updated by state/territory authorities and the Subcommittee for Domestic Quarantine and Market Access (Subcommittee for Domestic Quarantine and Market Access: SDQMA).

Moving plant material between states/territories requires permits from the appropriate authority, depending on the plant species and which territory/state the material is being transferred to/from. Moving plant material intrastate may also require a permit from the appropriate authority. Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of timber materials and related commodities can be obtained by contacting your local state or territory agriculture department directly (*Table 7*), or through the SDQMA website domesticquarantine.org.au which lists relevant contacts in each state/territory as well as Interstate Certification Assurance (ICA) documents relating to each state/territory.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state/territory has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Further information can be obtained by contacting your local state/territory agriculture department (*Table 7*).

Table 7. Interstate and interregional movement of plant products legislation, manuals, and contacts.

STATE	ADMINISTERING AUTHORITY	LEGISLATION	LINKS TO QUARANTINE MANUAL	PHONE
ACT	Environment ACT environment.act.gov.au	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	13 22 81
NSW	Department of Primary Industries dpi.nsw.gov.au	*Biosecurity Act 2015* Biosecurity Regulation 2017 *Biosecurity Order (Permitted Activities) 2017* and other supporting legislation such as Control Orders	dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases	(02) 6391 3384
NT	Department of Primary Industry and Fisheries dpir.nt.gov.au/	*Plant Health Act 2008* Plant Health Regulations 2011	nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/plants-and-quarantine	(08) 8999 2118
QLD	Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland daf.qld.gov.au/business-priorities/biosecurity	*Biosecurity Act 2014* Biosecurity Regulation 2016	daf.qld.gov.au/plants/moving-plants-and-plant-products	13 25 23[78] (07) 3404 6999[79]
SA	Primary Industries and Regions SA pir.sa.gov.au	*Plant Health Act 2009* Plant Health Regulations 2009	pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia	(08) 8207 7820
TAS	Department of Primary Industries, Parks, Water and Environment dpipwe.tas.gov.au	*Plant Quarantine Act 1997* Weed Management Act 1999	dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manual	1300 368 550
VIC	Department of Jobs, Precincts and Regions djpr.vic.gov.au	*Plant Biosecurity Act 2010* Plant Biosecurity Regulations 2016	agriculture.vic.gov.au/psb	13 61 86
WA	Department of Primary Industries and Regional Development agric.wa.gov.au/	*Biosecurity and Agricultural Management Act 2007*		(08) 9334 1800

[78] Within QLD.
[79] Interstate.

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from NSW DPI Regulatory Services by phone 02 6391 3384 or by visiting the NSW Department of Primary Industries website dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Resources (DPIR) under the Plant Health Act 2008 and Plant Health Regulations 2011. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for pests, plants or plant related materials are identified in the Regulations. Further information on NT import requirements and treatments can be obtained by contacting NT Quarantine on (08) 8999 5511 or email quarantine@nt.gov.au.

For more information refer to the DPIR website (dpir.nt.gov.au/).

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the QDAF website (business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/moving-plant-soil).

Further details can be obtained from the QDAF Customer Service Centre (13 25 23 within Queensland, or phone 07 3404 6999 or fax 07 3404 6900 interstate).

South Australia

Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material in South Australia (SA) may be obtained from Biosecurity SA - Plant Health by phone (08) 8207 7820 or fax (08) 8207 7844 or visiting pir.sa.gov.au/biosecurity/plant_health.

Primary Industries and Regions South Australia (PIRSA) have strict regulations and requirements regarding the entry of plant material (fruit, vegetables, flowers, plants, soil and seeds) into the State. For further information on import conditions consult SA Import Conditions.

Tasmania

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Tasmania may be obtained from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) Biosecurity website (dpipwe.tas.gov.au/biosecurity) or by phoning 1300 368 550.

General and specific import conditions apply to the importation of plant material into Tasmania to prevent the introduction of pests and diseases into the State. Plants and plant products must not be imported into Tasmania unless State import requirements are met and a Notice of Intention to import has been provided to a Biosecurity Tasmania inspector not less than 24 hours prior to the importation.

For further information on import conditions consult the Plant Quarantine Manual (dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manual).

Victoria

The movement into Victoria of plants and plant products may be subject to a prohibition, or to one or more conditions which may include chemical treatments. These prohibitions and conditions are described on the Department of Jobs, Precincts and Regions (DJPR) website (see link in *Table 7*). Some items may need to be presented to a DJPR inspector or an accredited business, for checking of details such as correct certification, labelling or treatment.

Further information on pre-importation inspection, certification and treatments and/or certification

requirements for movement of fruit or plant material into or within Victoria may be obtained from DJPR on the web at agriculture.vic.gov.au/psb or by phone 136 186.

Western Australia

The lead agency for agricultural biosecurity in Western Australia is the Department of Primary Industries and Regional Development (DPIRD). Western Australia is naturally free from many pests and diseases that are present in many other parts of the world. WA's geographical isolation in conjunction with a robust plant biosecurity system including border and intrastate regulations, industry and public awareness campaigns and surveillance programs maintains this status.

There are general and specific legislative requirements which underpin Western Australian plant biosecurity. Amongst other things the legislation regulates movement of potential carriers (such as plant material, honey, machinery, seeds etc.) into and within the state.

General conditions include (but are not limited to the following):

- The requirement for all potential carriers to be presented to an inspector for inspection upon arrival in WA
- Soil is prohibited entry and imported goods, including containers, must be free from soil
- Freedom from pests and diseases of quarantine concern to WA

In addition to the general requirements, specific requirements are also in place for movement into and within the state.

For further information on requirements contact Quarantine WA on (08) 9334 1800 or fax (08) 9334 1880.

Plantation level exclusion activities

A significant risk of spreading pests onto plantations arises when propagation material, people, machinery and equipment move from property to property and from region to region. It is the responsibility of the industry and the owner/manager of each property to ensure these risks are minimised.

The Australian plantation forests sector is already a strong supporter of plantation biosecurity; but should continue to further extend this message of promoting good plantation hygiene in a wide range of ways. One major way this can be achieved is through management of industry biosecurity at the plantation level using exclusion practices. It is in the interests of industry to encourage and monitor the management of risk at the plantation level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

For further detail of other potential strategies see *Plantation forests biosecurity*.

Surveillance

International standards

Surveys enhance prospects for early detection, minimising costs of eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia's states, territories and regions.

The SPS Agreement gives WTO members the right to impose SPS measures to protect human, animal and plant health provided such measures do not serve as technical barriers to trade. In other words, for countries (such as Australia) that have signed the SPS Agreement, imports of food, including fresh fruit and plantation forests, can only be restricted on proper, science-based quarantine grounds. Where quarantine conditions are imposed, these will be the least trade restrictive measures available that meet Australia's appropriate level of quarantine protection. The SPS Agreement also stipulates that claims of area freedom must be supported by appropriate information, including evidence from surveillance and monitoring activities. This is termed

"evidence of absence" data and is used to provide support that we have actively looked-for pests and not found them. ISPM 6 provides international guidelines for structured pest surveys. Structured pest survey planning, and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

Types of surveillance

Surveillance can be either targeted toward specific pests, or general in nature. Provided individuals are trained, made aware of what to look for and that reporting procedures are in place, both types of surveillance can be useful for early detection of exotic pests or, for establishing whether specific pests are present in a particular state or region, and if so, where these occur.

Targeted surveillance, as the name suggests, involves actively surveying for specific pests. It is commonly undertaken by specialist or trained staff (though not necessarily). It can involve assessment of susceptible hosts for unusual symptoms, through a variety of methods such as aerial, drive-by or walk through surveys. Where applicable trapping for pests is undertaken. An example of this type of surveillance would be, high-risk site surveillance (HRSS) involving trapping and, host-based health assessments and sampling, at or near first-points-of entry such as "Approved Arrangement" facilities (i.e. Quarantine) at airports and ports.

General non-targeted surveillance is commonly based on observation of potential host trees and distinguishing between a normal healthy trees and abnormal trees or plant material (i.e. suspect) which may indicate the presence of a pest or disease. For example, industry personnel (i.e. foresters, consultants or contractors), as frequent visitors to plantations, are familiar with what a healthy tree should look like and can report information of new or unusual symptoms. This type of surveillance wherein a stakeholder is simply undertaking their normal management practices but reporting unusual symptoms is also known as passive surveillance.

A variety of general and targeted surveillance activities are undertaken by the Commonwealth, States and forest sector for the purposes of early exotic pest detection, collection of pest presence data and pest management. These are outlined below and in *Table 8* and *Table 9*.

National surveillance

Northern Australia Quarantine Strategy

The Department of Agriculture, Water and Environment (DAWE) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAWE also surveys the northern coast of Australia, offshore islands and neighbouring countries for exotic pests that may have reached the country through other channels (e.g. illegal vessel landings in remote areas, bird migrations, wind currents) as part of the Northern Australia Quarantine Strategy (NAQS). The pests that NAQS survey for that may impact forest tree species are listed in *Table 8*.

National Border Surveillance

DAWE has recently established a National Border Surveillance (NBS) program for the early detection of plant pests at first-points-of entry such as "Approved Arrangement" facilities (i.e. Quarantine) at airports and ports. Target pests for this program are the National Priority Plant Pests (NPPPs) and those of environmental biosecurity importance. Several exotic pests of significance to the plantation forest sector are included in this program (*Table 8*).

National Plant Health Surveillance Program

A National Plant Health Surveillance Program (NPHSP) is managed by the DAWE but delivered through state/territory agriculture departments. Pests of concern to the plantation forests sector (exotic or those under official control in a region or state/territory) targeted under this program are shown in *Table 8*.

State surveillance

State level surveillance depends on the participation of all stakeholder groups, particularly state/territory agriculture departments working with industry representative groups, agri-business or growers. The state/territory agriculture departments can provide:

- planning and auditing of surveillance systems
- coordination of surveillance activities between industry and interstate groups
- diagnostic services
- field diagnosticians for special field surveillance
- surveillance on non-commercial sites
- liaison services with industry members
- communication, training, and extension strategies with industry
- biosecurity training
- reporting services to all interested parties (DAWE, national bodies, trading partners and industry).

State/territory agencies also have active general surveillance reporting channels wherein any concerned stakeholder can report a suspect pest or send samples of diseased or dying plants for diagnosis of potentially exotic pests, free of charge (*Table 12*).

Industry surveillance

Plantation monitoring and/or surveillance involves the participation and interaction of plantation managers, agribusinesses and industry representative groups. Conducting regular surveys of plantation and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses. Generalised examples of the surveillance activities that can be carried out by each of these groups are outlined in *Figure 2*. A description of specific activities undertaken or funded by plantation growers are provided in the following sections and *Table 9*.

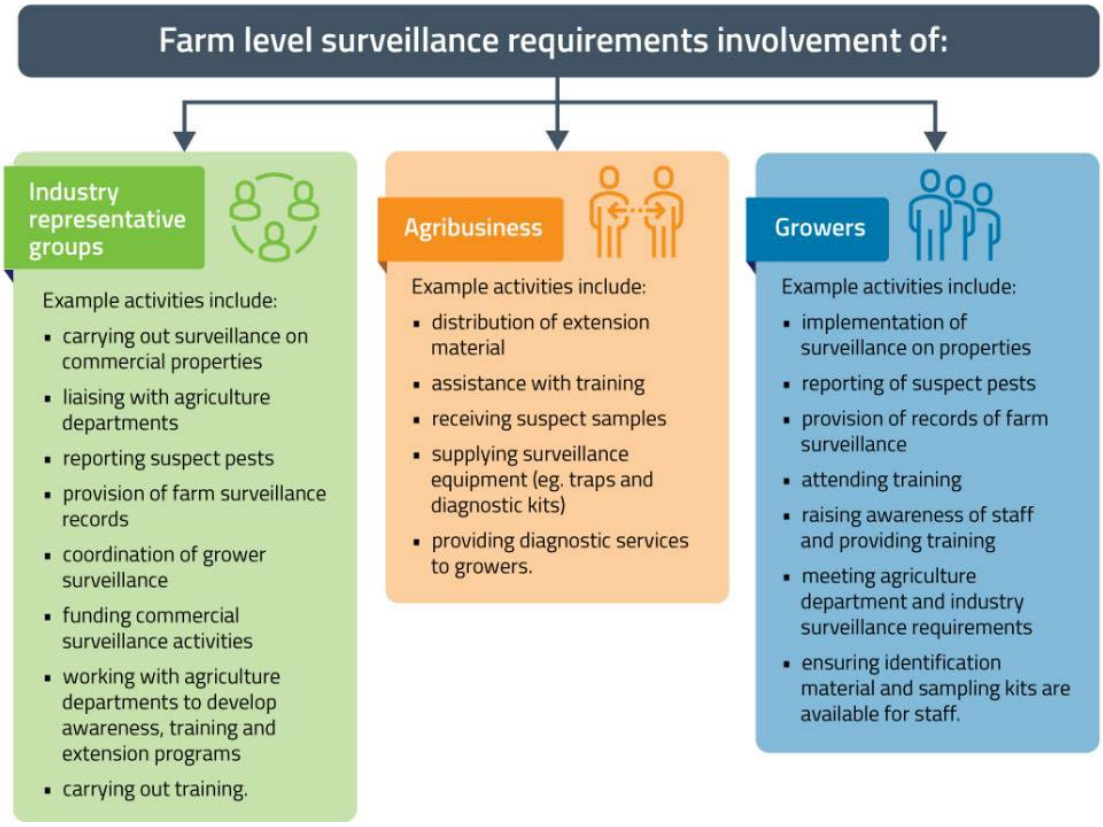


Figure 2. Examples of plantation/farm level surveillance activities.

Forest Health Surveillance

Some plantation forest growers Forest Health Surveillance (FHS) to inform the management of pests and weeds and minimize their deleterious impacts on tree growth or mortality. The level of surveillance effort and monitoring and the quality of the data collected varies between plantation companies and across growing regions. Surveillance may be undertaken directly by plantation company personnel or is contracted to third parties, including State agencies. Increasingly, plantation companies are working collaboratively to undertake FHS, pest management RD&E or, operational control activities (e.g. Industry Pest Management Group, Green Triangle NIFPI project).

Forest Biosecurity Surveillance

Some plantation forest growers are conducting Forest Biosecurity Surveillance (FBS) targeting detection of exotic pests of trees. This may consist of:

1. identifying unusual insect by-catch[80] collected from FHS traps to ensure they are not an exotic pest species,
2. sampling and diagnosing trees during FHS surveys that have unusual symptoms indicative of a possible exotic species or,
3. undertaking structured surveys or sentinel tree monitoring in areas of their plantation estate closest to high-risk areas for establishment of exotic pests, commonly in the peri-urban fringes of large cities.

Again, the methods and levels of effort are variable across the plantation sector.

High-risk site surveillance

In NSW, the softwood sector funds high-risk site surveillance (HRSS) involving trapping and host-based health assessments and sampling at or near first-points-of entry such as "Approved Arrangement" facilities (i.e. Quarantine) at airports and ports. Target pests are currently softwood plantation HPPs, though Plane trees (*Platanus* spp.) are being assessed to detect potential hardwood exotics. The same suite of target pests are surveyed for in HRSS activities in Victoria, though these are supported through in-kind extension work based off projects funded by the Commonwealth, State government and the plantation softwood sector.

Ongoing collaboration between the Commonwealth, States and DAWE is aiming to deliver an expanded HRSS program at all potential entry points across Australia, through the collaborative establishment of a National Forest Pest Surveillance Program.

Current industry supported FHS, FBS and HRSS activities are highlighted in *Table 9*.

[80] By-catch – refers to insects caught in a trap that were not the intended target of the trap.

Table 8. Government surveillance programs that target pests of forests (as of June 2020)[81]

SURVEILLANCE	PESTS	HOSTS
Australian Government		
Northern Australia Quarantine Strategy (NAQS) Surveillance	*Chrysoporthe cubensis, Austropuccinia psidii* (exotic strains), *Ralstonia pseudosolanacearum* (exotic strains), *Ralstonia syzygii* subsp. *syzygii* *Amblypelta cocophaga*, *Helopeltis* spp., *Paracoccus marginatus*, *Xylosandrus compactus* *Lissachatina fulica*	Multiple including *Eucalyptus* spp., *Syzygium* spp., *Melaleuca* spp., *Callistemon* spp., *Psidium* spp. Multiple including *Eucalyptus* spp., *Acacia* spp. Multiple, *Eucalyptus* spp., *Acacia* spp.
National Border Surveillance Program	Awaiting information	Multiple
Australian Capital Territory		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha*	Multiple
ACT Tree Managers Network	Discussion of general tree health issues and reporting of *Marchalina hellenica*	Urban pine plantings, other urban trees
New South Wales		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha*	Multiple
Northern Territory		
National Plant Health Surveillance Program	*Austropuccinia psidii* (exotic biotypes/strains)	Multiple
Queensland[82]		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha, Anoplophora* *spp., Monochamus* spp., *Stromatium barbatum, Ips* spp., *Dendroctonus* spp., *Urocerus gigas*	Multiple
West Indian drywood termite surveys	*Cryptotermes brevis*	Timber structures
South Australia		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha*	*Eucalyptus* spp., ornamental trees
Tasmania		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha*	Multiple, including forest and amenity trees
Victoria		
National Plant Health Surveillance Program	*Monochamus alternatus, Urocerus fantoma, Tetropium castaneum, Tetropium fuscum, Bursaphelenchus* spp. (including *B.*	Plants and weed hosts around Melbourne ports

[81] Information presented has been taken from the National Plant Biosecurity Status Report 2019 and confirmed or updated by the Subcommittee on National Plant Health Surveillance (subcommittee of the Plant Health Committee).
[82] As of July 2021, QLD's NPHSP targets relevant to plantation forests only include *Lymantria dispar* complex, *Lymantria monacha.*

SURVEILLANCE	PESTS	HOSTS
	xylophilus), Monochamus spp. (e.g. *Monochamus alternatus*), *Lymantria* spp. (e.g. *Lymantria dispar* complex)	
Western Australia		
National Plant Health Surveillance Program	*Lymantria dispar* complex, *Lymantria monacha*	Multiple forest, orchard, ornamental and native tree species

Table 9. Surveillance activities undertaken by or funded by the plantation forest sector.

SURVEILLANCE	DESCRIPTION	PESTS	HOSTS
Australian Capital Territory			
FHS[83]	• Aerial surveys • Trap tree plots to monitor *Sirex* Woodwasp populations and introduce biocontrol (nematode)	• Map unusual symptoms. • Identify stands affected by *Essigella californica*, *Sphaeropsis sapinea*, and drought. • *Sirex noctilio* and monitoring of *Ips grandicollis.*	Softwood Plantations (*Pinus radiata*)
New South Wales			
HRSS[84]	Trapping and host-tree surveillance	*Arhopalus ferus, Anoplophora* spp.*, Dendroctonus* spp. (e.g. *Dendroctonus valens), Monochamus* spp. (e.g. *Monochamus alternatus), Tomicus piniperda, Lymantra* spp. (e.g. *Lymantra dispar* complex), *Fusarium circinatum, Bursaphelenchus* spp.*, Phytophthora pinifolia, P. pluvialis, P. ramorum.*	*Pinus* and *Platanus* species
FHS	Drive-through and ground surveys	Surveys for general tree health, symptom mapping, exotic and native pests and pathogens.	Hardwood plantations (*Eucalyptus*, *Corymbia*), native forest regeneration (*Eucalyptus*, *Corymbia*)
FBS[85]	Targeted sampling and diagnosis for High Priority Pests during FHS.	*Teratosphaeria destructans*	Hardwood plantations (*Eucalyptus*, *Corymbia*), native forest regeneration (*Eucalyptus*, *Corymbia*)
FHS	• Aerial, drive-through and ground surveys • Trap tree plots to monitor *Sirex* Woodwasp populations and introduce biocontrol (nematode)	• Surveys for general tree health, symptom mapping, exotic and native pests and pathogens. • *Marchalina hellenica* monitoring • *Sirex noctilio*	Softwood plantations (*Pinus* spp.)
FBS	• Targeted sampling and	• *Fusarium*	Softwood plantations (*Pinus*

[83] FHS – Forest Health Surveillance
[84] HRSS – High-Risk Site Surveillance
[85] FBS – Forest Biosecurity Surveillance

SURVEILLANCE	DESCRIPTION	PESTS	HOSTS
	diagnosis for High Priority Pests during FHS. • Screening *Sirex* traps for exotic pests	*circinatum, Phytophthora pinifolia, P. pluvialis, Bursaphelenchus* spp., *Dendroctonus valens,* • *Arhopalus ferus, Dendroctonus valens, Monochamus* spp.	spp.)
Northern Territory			
FHS	Details to be received	• *Mastotermes darwiniensis* • *Microcerotermes* spp.	• Sandalwood, *Acacia* spp., Mahogany • Sandalwood, *Acacia* spp.
Queensland[86]			
FHS/FBS	Details to be received		
Tasmania			
FHS	• Drive through surveys • Chrysomelid IPM program • Transect visual surveys	• General tree health, symptom mapping, exotic and native pests and pathogens. • Monitoring of *Paropsiterna* spp. populations • *Austropuccinia psidii*	Harwood Plantations (*Eucalyptus globulus*, *E. nitens*), native forest informal reserves, native forest regeneration
FHS	• Aerial and drive through surveys • Trap tree plots to monitor *Sirex* Woodwasp populations and introduce biocontrol (nematode)	• General tree health, symptom mapping, exotic and native pests and pathogens. • *Sirex noctilio*	Softwood Plantations (*Pinus radiata*)
FBS	• Ground spot checks for symptoms /targeted sampling and diagnosis for High Priority Pests during FHS. • Screening Sirex traps for exotic pests	• *Fusarium circinatum*, *Endocronartium harknessii*, *Marchalina hellenica, Rhyacionia buoliana*. • *Ips grandicollis*, *Ips typographicus*, *Dendroctonus valens*, *Dendroctonus ponderosae*	Softwood Plantations (*Pinus radiata*)
Victoria			
HRSS*[87]	• Trapping and host-tree surveillance targeting High Priority Pests • Water monitoring	• *Arhopalus ferus, Anoplophora* spp., *Dendroctonus* spp. (e.g. *Dendroctonus valens), Monochamus* spp. (e.g. *Monochamus alternatus*), *Tomicus piniperda, Lymantra* spp. (e.g. *Lymantra dispar* complex), *Fusarium*	Multiple

[86] As part of RD&E activities QLD undertook HRSS activities in 2019-20 like those undertaken in NSW and Victoria. In 2020-21 limited HRSS activities are being undertaken as part of the RD&E project "Developing exotic forest/tree pest surveillance capacity in high risk areas"

[87] HRSS activities in Victoria targeting plantation forest pests and urban and amenity pests are supported through in-kind extension work based off projects funded by the Commonwealth, State government and the plantation softwood sector.

SURVEILLANCE	DESCRIPTION	PESTS	HOSTS
		circinatum, Bursaphelenchus spp. • *Phytophthora pinifolia, P. pluvialis, P. ramorum.*	
FHS	• Aerial, drive-through and ground surveys • Sentinel Myrtle Rust plots	• General tree health, symptom mapping, pests and pathogens • Monitoring of Autumn Gum Moth, *Mnesampela privata* • *Austropuccinia psidii*	• Hardwood plantations (*E. globulus*, *E. nitens*), native forest regeneration (*Eucalyptus*, *Corymbia*)
FBS	• Targeted sampling and diagnosis for High Priority Pests during FHS.	• *Teratosphaeria destructans*	• Hardwood plantations (*Eucalyptus*, *Corymbia*), native forest regeneration (*Eucalyptus*, *Corymbia*)
FHS	• Aerial, drive-through and ground surveys • Trap tree plots to monitor *Sirex* Woodwasp populations and introduce biocontrol (nematode) • Sentinel Giant Pine Scale plots	• Surveys for general tree health, symptom mapping, exotic and native pests and pathogens. • *Dothistroma* needle blight monitoring • *Sirex noctilio* • *Marchalina hellenica*	• Softwood plantations (*Pinus* spp.)
FBS	• Targeted sampling and diagnosis for High Priority Pests during FHS. • Screening Sirex traps for exotic pests	• *Fusarium circinatum, Phytophthora pinifolia, P. pluvialis, Bursaphelenchus* spp., *Dendroctonus valens,* • *Arhopalus ferus, Dendroctonus valens, Monochamus* spp.	Softwood plantations (*Pinus* spp.)
South Australia			
FHS	Aerial, drive through surveys, and permanent plots	• General tree health, symptom mapping, pests and pathogens. • Specific monitoring of Autumn Gum Moth	Hardwood plantations (*E. globulus*)
FBS	• Targeted sampling and diagnosis for High Priority Pests during FHS	• *Austropuccinia psidii*	Hardwood plantations (*E. globulus*)
FHS	• Aerial, drive through surveys, and permanent plots • Trap tree plots to monitor *Sirex* Woodwasp populations and introduce biocontrol (nematode)	• General tree health, symptom mapping, exotic and native pests and pathogens. • *Dothistroma* needle blight monitoring • *Sirex noctilio*	Softwood plantations (*P. radiata*)
FBS	• Targeted sampling and	*Arhopalus ferus, Anoplophora*	Softwood plantations (*P.*

SURVEILLANCE	DESCRIPTION	PESTS	HOSTS
	diagnosis for High Priority Pests during FHS	spp., *Dendroctonus valens, Monochamus* spp., *Tomicus piniperda, Lymantra dispar complex, Fusarium circinatum, Bursaphelenchus* spp., *Phytopht hora pinifolia, P. pluvialis, P. ramorum.*	*radiata*)
Western Australia			
FHS	• Drive through surveys • Ground surveys	• General tree health, symptom mapping, pests and pathogens. • Monitoring damage caused by *Teratosphaeria* spp. • *Gonipterus* spp. population monitoring	Hardwood plantations (*E. globulus*)
FHS	• Drive through surveys	• General tree health, symptom mapping, pests and pathogens.	Softwood plantations (*P. radiata*)
FBS	• Trap tree plots to monitor for Sirex Woodwasp detection	• *Sirex noctilio* (not present in WA)	Softwood plantations (*P. radiata*)

Training

A key component of biosecurity preparedness is ensuring personnel engaged are suitably and effectively trained for their designated roles in a response. Biosecurity preparedness training is the responsibility of all governments and industries, involved in the biosecurity system.

National EPP Training Program

PHA supports members in training personnel through the delivery of the National EPP Training Program. This program is focussed on ensuring personnel from the governments and peak industry bodies who will be involved in responses to EPPs have the skills and knowledge to effectively fulfil the roles and responsibilities of their parties, as signatories to the EPPRD. This covers a range of areas, from representatives on the national decision-making committees (i.e. the Consultative Committee on Emergency Plant Pests and the National Management Group) through to industry liaison personnel in the State Coordination or Local Control Centres.

In addition to face to face training delivered to members and the provision of simulation exercises, PHA also offers biosecurity training through the Biosecurity OnLine Training (BOLT) platform which houses a variety of eLearning courses relevant to plant biosecurity. Access to BOLT is free and open to any stakeholder interested in biosecurity and is available through planthealthaustralia.com.au/bolt.

For more information on the National EPP Training program, refer to planthealthaustralia.com.au/training.

Biosecurity Incident Standard Operating Procedures

An industry Biosecurity Incident Standard Operating Procedure (BISOP) is focussed on documenting the critical processes, functions, contact and authorisations information regarding how a specific organisation fulfils its roles and responsibilities during biosecurity incidents managed under the Emergency Plant Pest

Response Deed (EPPRD). The completion of an organisation(s) BISOP involves:

- A detailed look at key decision points in a response put into the context of basic incursion scenarios and documentation of how the industry body will determine their view on those decision points (e.g. technical feasibility, approval to fund a Response Plan, input into communications).
- Documentation of the peak industry body record keeping processes and other internal processes to meet responsibilities under the EPPRD.

AFPA is currently working with PHA to develop a BISOP that clearly defines the plantation forest sectors' arrangements during an emergency plant pest response.

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities raise the profile of biosecurity and exotic pest threats to the Australian plantation forests sector, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as appropriate.

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the **Exotic Plant Pest Hotline (1800 084 881)**.

High priority plant pest threat-related documents

Pests listed in *Table 2* have been identified as high priority threats to the plantation forests sector by members of the TEG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

The websites listed below (*Table 10*; *Table 11*) contain information on biosecurity or pests of concern across most plant industries, including the plantation forests sector.

Table 10. Sources of information on High Priority Pests for plantation forests.

SOURCE	WEBSITE
CABI – Crop Protection Compendium	cabi.org/cpc/
QDAF	business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease
Department of Agriculture, Water and Environment	agriculture.gov.au
European and Mediterranean Plant Protection Organization (EPPO)	eppo.int/DATABASES/pqr/pqr.htm
Plant Health Australia (PHA)	planthealthaustralia.com.au/
Pest and Disease Image Library (PaDIL)	padil.gov.au/
University of California State-wide Integrated Pest Management (IPM) Program	ipm.ucanr.edu/

Further information/relevant websites

A range of government and grower organisation details and websites for persons seeking further information on biosecurity for plantation forests (*Table 11*).

Table 11. Sources for information on biosecurity for plantation forests

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
National			
Australian Forest Products Association	ausfpa.com.au/ enquiries@ausfpa.com.au	(02) 6285 3833	PO Box 239 Deakin West, ACT 2600
Department of Agriculture, Water and Environment	agriculture.gov.au	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	planthealthaustralia.com.au biosecurity@phau.com.au	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	dpi.nsw.gov.au/biosecurity/plant	(02) 6391 3535	Locked Bag 21 Orange, NSW 2800
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland	daf.qld.gov.au info@daf.qld.gov.au	13 25 23[88] (07) 3404 6999[89]	41 George Street Brisbane, QLD 4000
Northern Territory			
Department of Primary Industry and Resources	dpir.nt.gov.au/about	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
South Australia			
Primary Industries and Regions SA	pir.sa.gov.au	(08) 8207 7820	GPO Box 1671, Adelaide, SA 5001
Biosecurity SA-Plant Health	pir.sa.gov.au/biosecuritysa/planthealth PIRSA.planthealth@sa.gov.au	(08) 8207 7820	33 Flemington Street Glenside, SA 5065
Biosecurity SA-Plant Health Market access and Interstate Certification Assurance	IRSA.planthealthmarketaccess@sa.gov.au	(08) 8207 7814	
Biosecurity SA-Plant Health Transport manifest lodgement	pirsa.planthealthmanifest@sa.gov.au	Fax: (08) 8124 1467	
South Australian Research and Development Institute (SARDI)	sardi.sa.gov.au sardi@sa.gov.au	(08) 8303 9400	2b Hartley Grove Urrbrae, SA 5064
Tasmania			
Department of Primary	dpipwe.tas.gov.au	1300 368 550	GPO Box 44,

[88] Within QLD.
[89] Interstate.

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
Industries, Parks, Water and Environment	BPI.Enquiries@dpipwe.tas.gov.au		Hobart, TAS 7001
Victoria			
Department of Jobs, Precincts and Regions	agriculture.vic.gov.au/	136 186	Chief Plant Health Officer Unit, Biosecurity and Agriculture Services Department of Jobs, Precinct and Regions 475 Mickleham Road, Attwood, Victoria 3047
Western Australia			
Department of Primary Industries and Regional Development	agric.wa.gov.au/	(08) 9368 3333	WA DPIRD PO Box 1143 West Perth WA 6872

Plantation forests biosecurity

Plant pests can have a major impact on production if not managed effectively. This includes pests already present in Australia and several serious pests of plantation forests that Australia does not have.

Plantation biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can increase the likelihood that they could be eradicated. This section of the document outlines plantation biosecurity and hygiene measures to help reduce the impact of pests on the industry.

The biosecurity and hygiene measures outlined here can be considered as options for each plantation's risk management. Many of these measures can be adopted in a way that suits a given plantation so that each can have an appropriate level of biosecurity.

Suggested plantation biosecurity reporting and hygiene procedures to reduce the risk of pest threats are:

- selection and preparation of appropriate planting material
- chemical control measures
- control of vectors
- control of alternative hosts
- neglected plantations and volunteer plants
- post-harvest handling and produce transport procedures
- use of warning and information signs
- managing the movement of vehicles and equipment
- managing the movement of people
- visiting overseas farms/plantations/forests – what to watch out for when you return.
- including plantation biosecurity in industry best management practice and quality assurance schemes
- plantation level biosecurity checklist.

Development of a plantation biosecurity plan tailored to the needs of an individual operation is a good way to integrate best practice biosecurity with day to day operations (farmbiosecurity.com.au/planner/).

Further information on farm/plantation biosecurity can be found at farmbiosecurity.com.au.

Reporting suspect emergency plant pests

Rapid reporting of exotic plant pests is critical as early detection gives Australia the best chance to effectively control and eradicate pests. If you find something you believe could be an exotic plant pest, call the Exotic Plant Pest Hotline immediately to report it to your local state or territory government.

The one phone number – **1800 084 881** – will connect to an automated system that allows the caller to choose the state or territory to which the report relates. The caller will then be connected to the relevant authority for that jurisdiction. Most lines are only monitored during business hours. Messages can be left outside of those hours and calls will be returned as soon as an officer is available. A summary of the opening hours for each state and territory is provided in *Table 12*. Each jurisdiction also has an alternative contact to ensure no report is missed. It does not matter which of these methods is used to report a suspect exotic plant pest. The important thing is to report it.

Calls to the Exotic Plant Pest Hotline will be answered by an experienced person, who will ask some questions

to help understand the situation, such as:

- What was seen (describe the pest or send a photo)?
- Where was it found?
- What was it found on?
- How many pests are present/how infected is the crop?
- How widely distributed it is?
- When was it first noticed?

It is important not to touch or move the suspect material as this may spread the exotic pest or render samples unsuitable for diagnostic purposes. A biosecurity officer may attend the location to inspect and collect a sample. In some cases, the biosecurity officer will explain how to send a sample for testing. In this circumstance they will explain how to do this without risk of spreading the pest and ensuring it arrives at the laboratory in a suitable condition for identification.

Every report will be taken seriously, followed up and treated confidentially.

Table 12. Exotic Plant Pest Hotline and alternate contact information for reporting per jurisdiction.

STATE/TERRITORY	HOTLINE HOURS	ALTERNATIVE CONTACT
NSW	Operates 08:30 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	biosecurity@dpi.nsw.gov.au
NT	Operates 08:00 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	quarantine.NT@nt.gov.au
QLD	Operates 08:00 – 17:00 Monday to Friday (09:00 – 17:00 Thursday). Calls outside these hours are answered by a third party who will take the message and depending on the urgency of the report, organise a response from a biosecurity officer as soon as possible.	Biosecurity Queensland 13 25 23
SA	Operates 24 hrs/7 days	Online plant pest report form
TAS	Operates 24 hrs/7 days	Biosecurity Tasmania (03) 6165 3777
VIC	Operates 08:00 – 18:00 Monday to Friday. After hours answering machine service with messages followed up the next business day. Option also to forward to the 24 hr Emergency Animal Disease Watch Hotline.	plant.protection@ecodev.vic.gov.au
WA	Operates 08:30 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	info@agric.wa.gov.au

Recent changes to legislation in some states includes timeframes for reporting and have implications for those who do not report. It is important that individuals know the obligations for their jurisdiction.

Some plantation forest pests are notifiable under each state or territory's quarantine legislation. Each state or territory's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural agency (*Table 12*) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture agency of the presence of those pests within a defined timeframe (*Table 13*).

Preparedness

Pest-specific preparedness and response information documents

To help prepare for an incursion response a list of pest-specific preparedness and response information documents is provided in *Table 13*. It has been populated with the High Priority Pests (HPP) of the plantation forests sector. The aim of this table is to document the current preparedness documents and activities which are available and are currently being undertaken. This will allow industry, governments and RD&E agencies to better prepare for these HPP and align future activities as listed in the Biosecurity Implementation Table (*Table 4*). Over time, as more resources are produced for individual pests of the plantations forests sector they will be included in this document and made available through the PHA website. Resources include the development of pest-specific information and emergency response documents, such as fact sheets, contingency plans, diagnostic protocols (see planthealthaustralia.com.au/pidd) and, a summary of surveillance programs currently in operation for these High Priority Pests (*Table 8*). Documents and programs should be developed over time for all medium to high-risk pests listed in the TST (*Threat Summary Tables*).

Fact sheets

Fact sheets or information sheets are a key activity of biosecurity extension and education with growers. Fact sheets provide summary information about the pest, its biology, what it looks like and what symptoms it may cause. They also contain detailed images. Refer to *Table 13* for a list of current fact sheets available for plantation forest producers.

Contingency Plans

Contingency Plans provide background information on the pest biology and available control measures to assist with preparedness for incursions of a specific pest into Australia (*Table 13*). The contingency plan provides guidelines for steps to be undertaken and considered when developing a response plan for the eradication of that pest. Any response plan developed using information in whole or in part from a contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

As a part of contingency planning, biological and chemical control options are considered, as are options for breeding for pest resistance. Through the planning process, it may be discovered that there are gaps in knowledge. Such gaps should be identified and consequently be considered as RD&E needs to be met within the implementation table (*Table 4*). For a list of current contingency plans see planthealthaustralia.com.au/pidd.

National Diagnostic Protocols

Diagnostic protocols are documents that contain information about a specific plant pest, or related group of pests, relevant to its diagnosis. National Diagnostic Protocols (NDP) are diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDP include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification. Australia has a coherent and effective system for the development of NDP for plant pests managed by the Subcommittee on Plant Health Diagnostics (SPHD). NDP are peer reviewed and verified before being endorsed by Plant Health Committee (PHC).

Endorsed NDP are available on the National Plant Biosecurity Diagnostic Network (NPBDN) website (plantbiosecuritydiagnostics.net.au), together with additional information regarding their development and endorsement.

Diagnostic information for some plantation forest pests (*Table 13*) is available through the PHA website planthealthaustralia.com.au/pidd.

Table 13. Documents and information currently available for High Priority Pests of plantation forests[90]

COMMON NAME (SCIENTIFIC NAME)	FACT SHEETS[91]	NATIONAL DIAGNOSTIC PROTOCOL[92]	NATIONAL SURVEILLANCE PROTOCOL	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	POTENTIAL COLLABORATORS[93]
Burnt pine longicorn (*Arhopalus ferus*)	Yes - NSW DPI[94], DAWE[95]	Not developed	Not developed	Not developed	Not categorised	Not listed	-
Red turpentine beetle (*Dendroctonus valens*)	Yes - PHA[96], NSW DPI[97]	NDP 24	Not developed	Not developed	Not categorised	Not listed	-
Sawyer beetles (*Monochamus* spp.) with associated plant parasitic nematodes (including *Bursaphelenchus xylophilus*)	Yes - DAWE[98], PHA, NSW DPI[99]	Not developed	Draft	Not developed	Not categorised	Yes - 33	Pest: Nursery and Garden
Pine shoot beetle (*Tomicus piniperda*)	NZ (Scion)[100]	Not developed	Not developed	Not developed	Not categorised	Not listed	-

90 Information presented has been taken from the National Plant Biosecurity Status Report 2018 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostics, the Subcommittee on National Plant Health Surveillance or other stakeholders.
91 Copies of these PHA documents are available from planthealthaustralia.com.au/pidd
92 Copies of these PHA documents are available from planthealthaustralia.com.au/pidd
93 Industries listed in this column identify these pests within their biosecurity plans. Pests listed as a High Priority Pest are indicated by HPP.
94 dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/burnt-pine
95 https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/longicorn.pdf
96 planthealthaustralia.com.au/wp-content/uploads/2015/07/Red-turpentine-beetle-FS.pdf
97 https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/red-turpentine-beetle
98 https://www.awe.gov.au/biosecurity-trade/import/arrival/pests/japanese-sawyer-beetle
99 dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/sawyer-beetles
100 https://www.scionresearch.com/__data/assets/pdf_file/0018/78210/CommonPineShootBeetleFactsheet.pdf

COMMON NAME (SCIENTIFIC NAME)	FACT SHEETS[91]	NATIONAL DIAGNOSTIC PROTOCOL[92]	NATIONAL SURVEILLANCE PROTOCOL	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	POTENTIAL COLLABORATORS[93]
Gypsy moth complex (*Lymantria dispar* complex)	Yes - DAWE[101], PHA, NSW DPI[102], PIRSA[103], QLD[104]	NDP 42[105]	In review	Yes- Nursery and Garden (2009)[106]	Not categorised	Yes - 8	HPP: Apple and Pear, Nursery and Garden, Nut, Summer fruit. Pest: Blueberry, Grains, Lychee, Rubus, Truffle.
Myrtle Rust (*Austropuccinia psidii* (exotic biotypes/strains; syn. *Puccinia psidii* sensu lato))	Yes - DAWE[107], NSW DPI[108], QLD[109], VIC[110], TAS[111], PIRSA[112]	Draft	Not developed	Yes- Nursery and Garden (2009)[113]	Category 1	Yes - 11	HPP: Cut flower, Nursery and Garden, Tea Tree.
Pitch canker (*Fusarium circinatum*)	Yes - DAWE[114], PHA[115], NZ[116]	IPPC[117]	Not developed	Not developed	Not categorised	Yes - 38	-

101 https://www.awe.gov.au/biosecurity-trade/pests-diseases-weeds/plant/exotic-gypsy-moth
102 https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/asian-gypsy-moth
103 https://www.pir.sa.gov.au/__data/assets/pdf_file/0006/296178/Gypsy_Moths_Fact_Sheet_-_July_2019.pdf
104 https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/exotic-gypsy-moth
105 Gypsy moths - focussing on *L. dispar asiatica*.
106 Gypsy moth (Asian and European strains) *Lymantria dispar*. planthealthaustralia.com.au/pests/gypsy-moth/
107 https://www.awe.gov.au/biosecurity-trade/invasive-species/diseases-fungi-and-parasites/myrtle-rust
108 https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/myrtle-rust
109 https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/myrtle-rust
110 https://agriculture.vic.gov.au/biosecurity/plant-diseases/shrub-and-tree-diseases/myrtle-rust
111 https://nre.tas.gov.au/biosecurity-tasmania/plant-biosecurity/pests-and-diseases/myrtle-rust
112 pir.sa.gov.au/__data/assets/pdf_file/0005/259709/Myrtle_Rust_Fact_Sheet_-_June_2019.pdf
113 planthealthaustralia.com.au/pests/myrtle-rust/
114 https://www.awe.gov.au/biosecurity-trade/pests-diseases-weeds/plant/quarantine/pine-pitch-canker
115 planthealthaustralia.com.au/wp-content/uploads/2015/07/Pine-pitch-canker-FS.pdf
116 https://www.scionresearch.com/__data/assets/pdf_file/0020/78212/PinePitchCankerFactsheet.pdf
117 https://www.ippc.int/static/media/files/publication/en/2017/04/DP_22_2017_En_2017-04-12.pdf

COMMON NAME (SCIENTIFIC NAME)	FACT SHEETS[91]	NATIONAL DIAGNOSTIC PROTOCOL[92]	NATIONAL SURVEILLANCE PROTOCOL	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	POTENTIAL COLLABORATORS[93]
Eucalypt leaf blight (*Teratosphaeria destructans* (syn. *Kirramyces destructans, Phaeophleospora destructans*)).	Not developed	Not developed	Not developed	Not developed	Not categorised	Not listed	-
Pinewood nematode complex (*Bursaphelenchus* spp. (including *B. xylophilus*) with insect vectors (particularly *Monochamus* spp.))	Yes - DAWE[118], PHA, NSW DPI[119]	IPPC[120]	Draft	Not developed	Not categorised	Yes - 33	-
Daño Foliar del Pino (*Phytophthora pinifolia*)	Yes - PHA[121], NZ[122]	Not developed	Not developed	Not developed	Not categorised	Not listed	-
Red needle cast (*Phytophthora pluvialis*)	Yes - PHA[123]	Not developed	Not developed	Not developed	Not categorised	Not listed	-

118 https://www.awe.gov.au/biosecurity-trade/import/arrival/pests/pine-wilt-nematode
119 planthealthaustralia.com.au/wp-content/uploads/2015/07/Pinewood-nematode-and-vectors-FS.pdf
nswgcsa.com.au/wp-content/uploads/2016/04/2016-Primefact-Pine-nematodes.pdf
120 https://www.ippc.int/static/media/files/publication/en/2016/04/DP_10_2016_En_2016-04-14.pdf
121 planthealthaustralia.com.au/wp-content/uploads/2015/07/Dano-foliar-de-pino-FS.pdf
122 https://www.scionresearch.com/__data/assets/pdf_file/0019/78211/DanoFoliardelPinoFactsheet.pdf
123 planthealthaustralia.com.au/wp-content/uploads/2015/07/Red-needle-cast-FS.pdf

COMMON NAME (SCIENTIFIC NAME)	FACT SHEETS[91]	NATIONAL DIAGNOSTIC PROTOCOL[92]	NATIONAL SURVEILLANCE PROTOCOL	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	POTENTIAL COLLABORATORS[93]
Sudden oak death (*Phytophthora ramorum*)	Yes – DAWE[124], PHA, NSW DPI[125], NZ[126]	NDP 5	Not developed	Yes - QDAF and Nursery and Garden (2019)[127]	Category 1	Yes - 14	HPP: Avocado, Blueberry, Cut flowers, Nursery and Garden, Nut, Rubus, Truffle, Tea Tree.
Formosan subterranean termite (*Coptotermes formosanus*)	DAWE[128]	Not developed	Not developed	Not developed	Not categorised	Yes - 29	Pest: Pineapple
Asian subterranean termite (*Coptotermes gestroi*)	DAWE[129]	Not developed	Not developed	Not developed	Not categorised	Yes - 29	

124 https://www.awe.gov.au/biosecurity-trade/pests-diseases-weeds/plant/sudden-oak-death
125 dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/sudden-oak-death
126 https://www.scionresearch.com/__data/assets/pdf_file/0007/78892/SuddenOakDeathFactsheet.pdf
127 planthealthaustralia.com.au/pests/sudden-oak-death/
128 https://www.awe.gov.au/biosecurity-trade/import/arrival/pests/formosan-termite
129 https://www.awe.gov.au/biosecurity-trade/pests-diseases-weeds/plant/subterranean-termites

Research, Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or extension of knowledge have been identified and documented in the Biosecurity Implementation Table (). Some of these gaps will require:

- further research and development (e.g. understanding risk pathways, developing surveillance programs or diagnostic protocols, developing tools to facilitate preparedness and response, developing IPM or resistance breeding strategies)
- other gaps will require communication or extension of that knowledge to various target audiences (i.e. developing awareness raising materials, undertaking training exercises, running workshops, consideration of broader target audiences).

It is important that the RD&E gaps identified through this plan feed directly into the normal annual RD&E priority setting and strategic planning activities that an industry undertakes. To ensure this, PHA's National Forest Biosecurity Coordinator works collaboratively with FWPA's research coordinator and AFPA's FHaB subcommittee to align RD&E priorities.

Market access

As an active trading nation, Australia has entered into several multilateral and bilateral trade agreements that influence its plant biosecurity system. On a multilateral level, Australia's rights and obligations in relation to plant biosecurity are set out under World Trade Organization (WTO) agreements, particularly the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), although others may apply in certain circumstances. The SPS Agreement provides WTO member countries with the right to use sanitary and phytosanitary measures to protect human, animal and plant life or health. Under this agreement, countries can specify consistent, science-based conditions aimed at providing sanitary and phytosanitary protection but not unnecessarily restricting trade.

The establishment of exotic pests in Australia may result in conditions on Australian exports that previously did not apply and in some cases, may result in the short or long-term loss of overseas markets, depending on the significance of the pest to the trading partner and the availability of options to reduce the risk to acceptable levels. These options could include measures such as designation of pest free areas or places of production or application of treatments (e.g. cold or fumigation). The time taken to regain access will depend on the availability and acceptance of measures to reduce risk and the appetite for risk of the receiving market.

RESPONSE MANAGEMENT

No matter how many preparedness activities are undertaken or how much surveillance is done at the border, a small number of plant pests will inevitably make their way into Australia. This section outlines the national agreements and processes in place to effectively respond to such incursions.

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing the procedures required and the roles and responsibilities of all Emergency Plant Pest Response Deed (EPPRD) signatories affected by an Emergency Plant Pest (EPP).

The following section includes key contact details and communication procedures that should be used in the event of an incursion relevant to the Australian plantation forests sector. Additionally, a listing of pest-specific emergency response and information documents are provided that may support a response. Over time, as more of these documents are produced for pests of the plantation forests sector they will be included in the list and made available through the PHA website.

The Emergency Plant Pest Response Deed (EPPRD)

A fundamental component of the Australian plant biosecurity system is the EPPRD, which is an agreement between the Australian government, the state/territory governments, 38 plant industries (including the Australian Forests Products Association) and PHA (collectively known as the signatories), that allows the rapid and efficient response to EPPs. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for EPP eradication responses.

The EPPRD provides:

- A national response management structure that enables all governments and plant industry signatories affected by the EPP to contribute to the decisions made about the response.
- An agreed structure for the sharing of costs to deliver eradication responses to EPPs detected in Australia. Costs are divided between signatories affected by the EPP in an equitable manner based on the relative potential impact of the EPP.
- A mechanism to encourage reporting of EPP detections and the implementation of risk mitigation activities.
- A mechanism to reimburse growers whose crops or property are directly damaged or destroyed because of implementing an EPP Response Plan.
- Rapid responses to EPPs (excluding weeds).
- A framework for decisions to eradicate are based on appropriate criteria (e.g. eradication must be technically feasible and cost beneficial).
- An industry commitment to biosecurity and risk mitigation and a government commitment to best management practice.
- Cost Sharing of eligible costs.
- An Agreed Limit for Cost Sharing.
- An effective industry/government decision-making process.

For further information on the EPPRD, including copies of the EPPRD, fact sheets or Frequently Asked Questions, visit planthealthaustralia.com.au/epprd and planthealthaustralia.com.au/epprd-qa.

PLANTPLAN

PLANTPLAN outlines the generic approach to response management under the EPPRD and introduces the key roles and positions held by industry and government during a response. The document is supported by several operating guidelines, job cards and standard operating procedures that provide further detail on specific topics. PLANTPLAN underpins the EPPRD and is endorsed by all EPPRD signatories.

The current version of PLANTPLAN and supporting documents are available on the PHA website (planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/).

For more information about PLANTPLAN and the supporting document, visit: planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/

How to respond to a suspect EPP

Following the detection of a suspect EPP, the relevant state agency will be notified either directly or through the Exotic Plant Pest Hotline. Within 24 hours of the state agency having a reasonable suspicion that they are dealing with an EPP, the Chief Plant Health Manager (CPHM) of the state or territory will inform the Australian Chief Plant Protection Officer (ACPPO). All signatories affected by the EPP (both government and industry) are then notified immediately, and a Consultative Committee on Emergency Plant Pests (CCEPP) meeting is convened (this process is outlined in *Figure 3. Reporting of suspect EPPs and notification process.*). Only the industry signatories affected by the EPP are engaged in the response process. These are determined based on the known hosts of the EPP. All positive detections of EPPs or suspect EPPs must undergo secondary identification from an independent laboratory. Confirmation of the identification should not delay

the reporting of the suspected EPP to the ACPPO or the CCEPP.

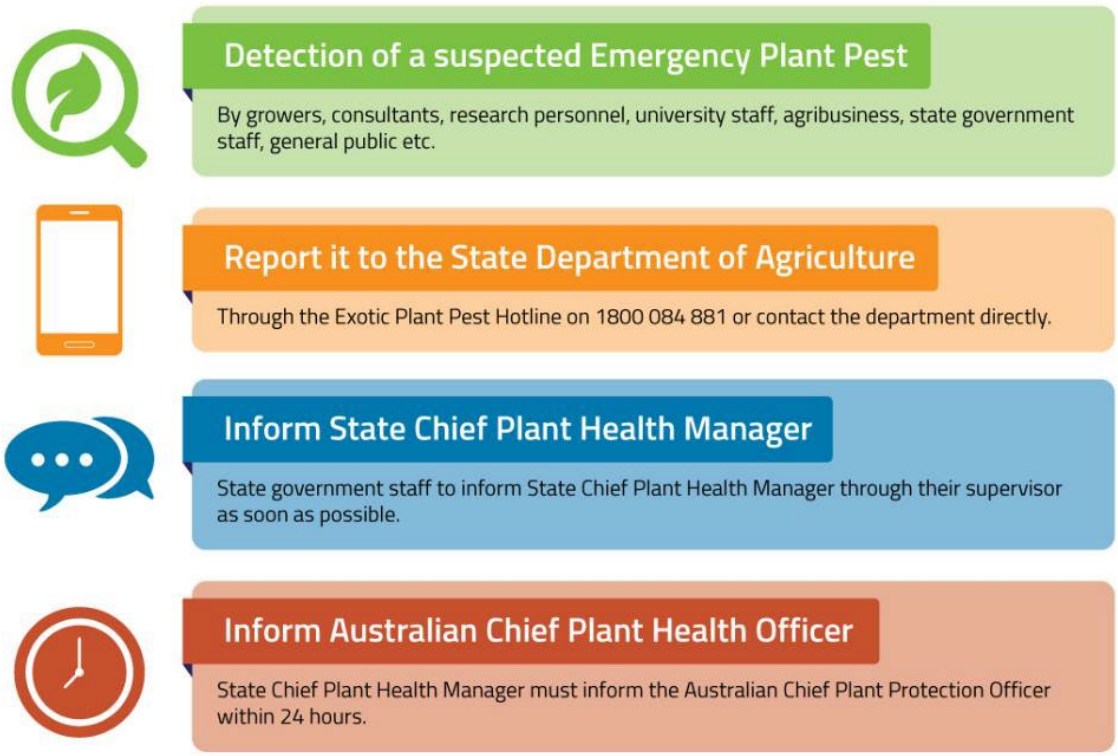


Figure 3. Reporting of suspect EPPs and notification process.

Once a pest is notified to the CCEPP, all EPPRD signatories that are affected by the EPP play a part in the national response. This is primarily through the two national decision-making committees, both of which contain a representative from the Australian Forest Products Association. The committees are:

- The Consultative Committee on Emergency Plant Pests (CCEPP), which provide technical expertise on the response, and
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses and funding.

If the EPP is deemed ineradicable, a decision is made on another course of action, namely containment or long-term management. In 2016, a Transition to Management (T2M) phase was incorporated into the EPPRD following approval by all EPPRD Parties. T2M may only be initiated if a response plan has been approved and started and it has been agreed that eradication is not possible. Its aim is to provide a formalised structure for transitioning a response under the EPPRD from the eradication of an EPP under an approved Response Plan to management of the EPP outside of the EPPRD processes. T2M is not an automatic process as the parties to the response must agree it is needed and what activities will be included. Its aims to provide a mechanism to enable the affected industry to transition to ongoing management of the pest.

The relevant state/territory agriculture department is responsible for the on-ground response to EPPs and will adopt precautionary emergency containment measures if appropriate. Depending on the nature of the EPP, measures could include:

- restriction of operations in the area
- disinfection and withdrawal of people, vehicles and machinery from the area
- restricted access to the area
- control or containment measures.

Each response to an EPP is applied differently due to the nature of the incursion, however, each follows the defined phases of a response as outlined at planthealthaustralia.com.au/biosecurity/incursion-

management/phases-of-an-emergency-plant-pest-response/.

Cost sharing a response

Affected industries and governments invest in the eradication of EPPs and share the costs of an agreed response plan, this is referred to as 'cost sharing'. Not all activities in a response are eligible to be cost shared, with some activities considered as normal commitments for signatories.

The cost shared costs of a response are divided between affected industries and governments in an equitable manner directly related to the benefit obtained from eradicating the EPP. These relative benefits are represented by the category of the pest, with the overall view that 'the higher the benefit, the greater the investment'.

There are four categories for EPPs (*Table 14*). The category indicates how the funding will be split between government and industries; with the government funding the share of public benefit and industry funding the share of private benefit. It does not indicate the likelihood of eradication or the overall importance of the pest i.e. an EPP listed as Category 1 is not deemed to be any more or less important than an EPP listed as Category 4.

Table 14. Response funding allocation between Government and Industry based on EPP category.

EPP CATEGORY	GOVERNMENT FUNDING	INDUSTRY FUNDING
Category 1	100%	0%
Category 2	80%	20%
Category 3	50%	50%
Category 4	20%	80%

Pest categorisation

The list of categorised EPPs can be found in Schedule 13 of the EPPRD. If a response plan is endorsed for an uncategorised EPP, cost sharing will commence using the default category (Category 3) and may be revised later.

Any signatory to the EPPRD can request for additional pests to be categorised and added to Schedule 13 of the EPPRD. Contact EPPRD@phau.com.au for more information and guidance on this process.

Once a substantiated request has been received by PHA a group of independent scientific technical experts (known as the categorisation group) will be convened to assess all known information about the EPP to identify the public and private benefits. Full details can be found in *Clauses 7* and *9* of the EPPRD.

Plantation forest EPPs categorised to date

EPPs relevant to the Australian plantation forests sector that are categorised and listed within Schedule 13 of the EPPRD are listed in *Table 15*.

Table 15. Categories for pests of the Australian plantation forests sector listed in the EPPRD (June 2020).

FORMAL CATEGORY	SCIENTIFIC NAME	COMMON NAME
1	*Phytophthora ramorum*	Sudden oak death
1	*Austropuccinia psidii* (formerly *Uredo rangelii*)	Myrtle rust

Owner reimbursement costs

Owner Reimbursement Costs (ORCs) are included in the shared costs of a response and are available to eligible growers to alleviate the financial impacts of crops or property that are directed to be destroyed under an agreed response plan.

ORCs were developed to encourage early reporting and increase the chance of successful eradication. ORCs are paid to the owner and cover direct costs associated with implementing a response plan, including:

- Value of crops destroyed,
- Replacement of lost capital items and
- Fallow periods

ORCs are only available when there is an approved response plan under the EPPRD, and only to industries that are signatories to the EPPRD, such as the plantation forests sector through AFPA.

The value of ORCs is directed by the ORC Evidence Frameworks and is based on an agreed valuation approach developed for each industry.

Further information about ORCs is available from planthealthaustralia.com.au/biosecurity/incursion-management/owner-reimbursement-costs/.

Industry specific response procedures

Levies

Commercial forest growers within Australia pay statutory national levies which are used for biosecurity and Research, Development and Extension (RD&E) and marketing activities (*Table 16*).

Table 16. The forest growers levy charge rates for RD&E and marketing, PHA and EPPR.

COMMODITY	RD&E AND MARKETING	PHA	EPPR	TOTAL
Plantation logs- exotic softwood (*Pinus* spp.)	5 cents per m^3	0.5 cents per m^3	$0.00	5.5 cents per m^3
Plantation logs- other	5 cents per m^3	0.5 cents per m^3	$0.00	5.5 cents per m^3
Other logs	5 cents per m^3	$0.00	$0.00	5 cents per m^3

Source: Department of Agriculture, 2017.

Forest and Wood Products Australia (FWPA) is responsible for the management of the RD&E and marketing levy. The Australian Government provides funding to FWPA via a Statutory Funding Agreement to match its spending on eligible RD&E activities up to a cap of 0.5 per cent of the forest industry's gross value of production. Formation of the Grower Research Advisory Committee has helped establish consensus on the research priorities of the major growers through the completion of research investment plans.

The PHA and EPPR levies are used to fund the membership to PHA and EPPR responses.

AFPA Biosecurity Statement

All EPPRD Parties are required under Clause 13 of the EPPRD to produce a Biosecurity Statement, the purpose of which is to provide acknowledgement of, and commitment to, risk mitigation measures and preparedness activities related to plant biosecurity. The Biosecurity Statement will inform all Parties of activities being undertaken by the Industry Party to meet this commitment. Parties are required to report to PHA each year any material changes to the content of, or the Party's commitment to, the Party's Biosecurity statement. Biosecurity Statements are included in Schedule 15 of the EPPRD, which can be found on the PHA

website at planthealthaustralia.com.au/emergency-plant-pest-response-deed/

Industry communication

The Australian Forest Products Association (AFPA) are the peak industry body for the Australian plantation forests sector, i.e. a signatory to the EPPRD, and will be the key industry contact point if a plant pest affecting the plantation forests sector is detected and responded to using the arrangements in the EPPRD.

AFPA will have responsibility for relevant industry communication and media relations (see PLANTPLAN for information on approved communications during an incursion). The contacts nominated for the CCEPP and the NMG by AFPA will be contacted regarding any meetings of the CCEPP or NMG (*Table 17*). It is important that all Parties to the EPPRD ensure their contacts for these committees are nominated to PHA and updated swiftly when personnel change. To ensure this, AFPA is working with PHA to develop a Plantation Forests Biosecurity Incident Standard Operating Procedure (BISOP) that includes relevant contacts and industry-specific actions that should be undertaken.

Close cooperation is required between relevant government and industry bodies to ensure the effective development and implementation of a response to an emergency plant pest, and the management of media/communication and trade issues.

Readers should refer to PLANTPLAN, undertake the relevant BOLT courses and/or refer to the Plantation Forest Biosecurity Incident Standard Operating Plan for further information.

Table 17. Contact details for the Australian Forest Products Association.

Website:	ausfpa.com.au/
Postal address:	PO Box 239, Deakin West ACT 2600, Australia
Email:	enquiries@ausfpa.com.au
Phone:	(02) 6285 3833
Fax:	-

References

PHA (In prep) Australian Forest Products Association's Biosecurity Incident Standard Operating Procedure

PLANTPLAN (2019) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 3.3. (planthealthaustralia.com.au/plantplan).

APPENDIX 1 THE NATIONAL BIOSECURITY SYSTEM & THE AUSTRALIAN PLANTATION FORESTS SECTOR

To develop an effective biosecurity plan, it is critical to understand the Australia's biosecurity system and the structural and operational contexts of the industry.

What is biosecurity and why is it important?

Plant biosecurity is a set of measures which protect the economy, environment and community from the negative impacts of plant pests. A fully functional and effective biosecurity system is a vital part of the future profitability, productivity and sustainability of Australia's plant production industries and is necessary to preserve the Australian environment and way of life.

Plant pests are insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. An exotic pest entering Australia can reduce crop yields, affect trade and market access, significantly increase costs to production and in the worst-case scenario, bring about the complete failure of a production system. Historical examples present us with an important reminder of the serious impact that exotic plant pests can have on plant production systems.

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic plant pest threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industries. However, there will always be some risk of an exotic pest entering Australia, whether through natural dispersal (such as wind) or assisted dispersal because of increases in international tourism, imports and exports, mail and changes to transport procedures (e.g. refrigeration and containerisation of produce).

The plant biosecurity system in Australia

Australia has a unique and internationally recognised biosecurity system to protect our plant production industries and the natural environment against new pests. The system is underpinned by a cooperative partnership between plant industries and all levels of government.

The framework for managing the cooperative partnership for delivering an effective plant biosecurity system is built on a range of strategies, policies and legislation, such as the Intergovernmental Agreement on Biosecurity (IGAB) and the National Plant Biosecurity Strategy (NPBS). These not only provide details about the current structure but provide a vision of how the future plant biosecurity system should operate.

Australia's biosecurity system has been subject to several reviews in recent times, with the recommendations recognising that a future-focused approach is vital for maintaining a strong and resilient biosecurity system that will protect Australia from new challenges. As a result, there is a continuous improvement from industry and governments to Australia's plant biosecurity system, with the key themes including:

- Targeting what matters most, including risk-based decision making and managing biosecurity risks across the biosecurity continuum (pre-border, border, and post-border)
- Good regulation, including reducing regulatory burden and having effective legislation in place
- Better processes, including service delivery modernisation with electronic, streamlined systems
- Sharing the responsibility, including maintaining productive relationships with all levels of government, primary industries, and the wider Australian public
- Maintaining a capable workforce.

Through these themes, a focus on the biosecurity continuum better supports consistent service delivery offshore, at the border, and onshore, and provides an effective biosecurity risk management underpinned by sound evidence and technical justification.

The benefits of the modern biosecurity system are realised by industry, government and the community with positive flow on effects to the economy more generally. This occurs through streamlined business processes, productivity improvements and reduced regulatory burden in a seamless and lower cost business environment by emphasising risk-based decision making and robust partnerships.

Plant Health Australia

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia.

PHA is a not-for-profit, subscription-funded public company based in Canberra. PHA's main activities are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 39 plant industry organisations are all members of PHA and each meet one third of the total annual membership subscription. This tri-partisan funding model ensures the independence of the company.

The company was formed to address priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. PHA's independence and impartiality allow the company to put the interests of the plant biosecurity system first and support a longer-term perspective.

For more information about PHA visit planthealthaustralia.com.au

Australian Forest Products Association

Australian Forest Products Association (AFPA) is the organisation representing the plantation forests sector in matters of biosecurity. AFPA coordinates industry policy and strategy at a national level. AFPA membership falls under three chambers (resources, processing, and pulp & paper) which represent the core focus of organisations at different points in the value chain. This extends from the growers and managers of plantations and native forest resources to the processors and manufacturers of a range of forestry related products. Overall, AFPA supports its affiliates and the Australians who work across production and manufacturing operations by delivering outcomes that improve forest industries.

AFPA are a signatory to the EPPRD and are the key industry contact point if a suspect emergency plant pest affecting the plantation forests sector is detected. For further information about the AFPA in relation to response procedures following the identification of a suspect exotic pest refer to *Response Management*. For background information on the Australian plantation sector industry, see below *Industry profile*.

Forest Wood Products Australia

Forest and Wood Products Australia limited (FWPA) is a not-for-profit company that provides national, integrated research, development and extension (RD&E) services to the Australian forest and wood products industry. FWPA funds projects by using the RD&E levy component of the Forest Wood Products levy and co-contributions from the Australian Government. FWPA's Growers Research Advisory Committee (GRAC) identifies and prioritises RD&E projects of interest to industry through a robust consultation process and the formulation of strategic investment plans.

In consultation with AFPA's FHaB subcommittee and PHA's National Forest Biosecurity Coordinator FWPA, through the GRAC, has endorsed a "*An investment plan for research, development and extension to minimise*

threats from forest damage agents" that aims to invest $3M over 5 years into forest health and biosecurity RD&E projects. Proposed projects align with this *Plantation Forests Biosecurity Plan*, the *National Forests Biosecurity Surveillance Strategy 2018-2023* and an emerging *National Forests Pest Surveillance Program*.

Industry profile

Australian plantations within a global context

Plantation forestry is the planting, intensive management and harvesting of trees to produce industrial wood and related products. Managed forests are becoming increasingly important components of global forest ecosystems which provide important economic, social and environmental values. Global trends in the forest area indicates a decrease in global forest cover by 1 per cent to 30.85 per cent between 1990 to 2015 (Payn *et al*. 2015). In contrast, the total forest area of planted forests increased by 2.9 per cent to 6.95 per cent which constitutes 2.14 per cent of the total land area (Payn *et al*. 2015). Most of this expansion was within temperate zones.

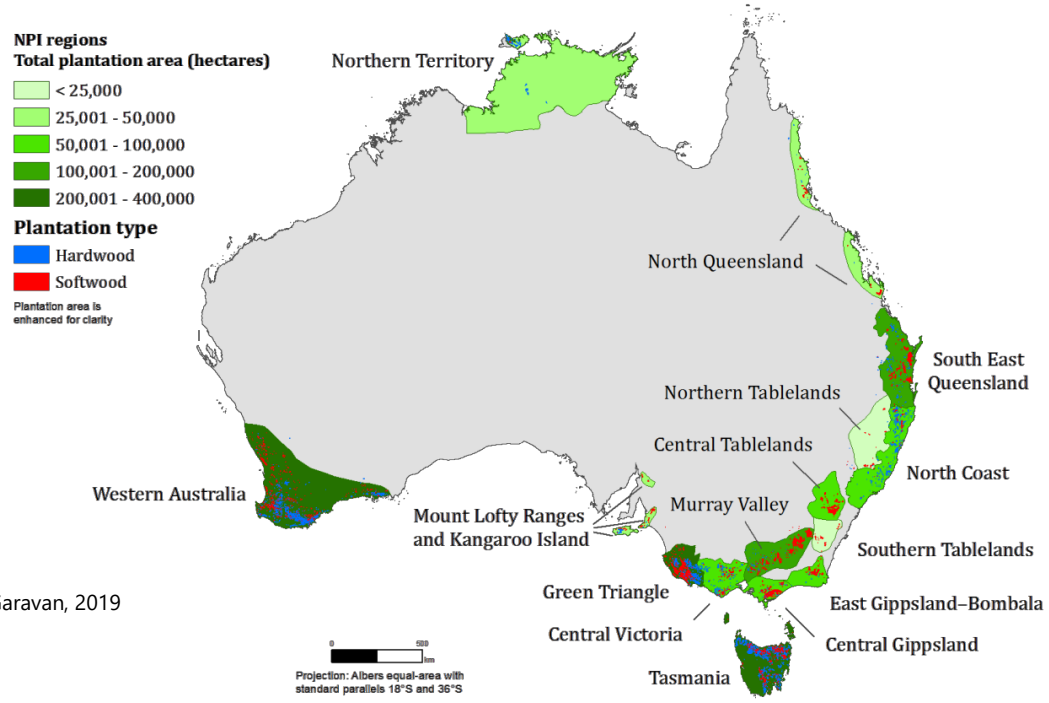
Most of the planted forest area around the world is located within the northern hemisphere. Country-specific data showed that 20 countries accounted for 85 per cent of the of planted forest area (Payn *et al*. 2015). China had the largest planted forest area (28.4 per cent) in 2015, followed by the United States of America (9.5 per cent), the Russian Federation (7.1 per cent), Canada (5.7 per cent) and Sweden (4.9 per cent; Payn *et al*. 2015). All 20 countries continued to increase their planted forest area, but a slowdown in the rate of expansion was found at global and regional scales. In summary, decreases in natural forest area is being offset by expansions in planted forest area to an increasing degree over time.

Planted forests throughout the world are largely comprised of native species. Only 19 per cent of the total forest area is attributed to introduced species (Payn *et al*. 2015). The use of introduced species is more prevalent in the southern hemisphere (South America, Oceania, and Africa) where industrial forestry represents a major component of planted forests. The use of *Pinus* spp. for softwood timber production and the planting of Eucalypts around the world (e.g. India, Brazil, China and South East Asia; Brockerhoff *et al*. 2013) increases the risk posed by exotic organisms to Australian plantation forests.

Australia's plantation estates

Australia is the seventh most forested country in the world with 134 million hectares of forest, covering 17 per cent of Australia's land area in 2016 (ASFR, 2018). Australia's total commercial plantation area in 2017-18 was 1.943 Mha which equates to 1.5 per cent of all forest resources (Downham & Garavan, 2019). The softwood plantation estate covers 1.037 Mha which represents 53 per cent of the commercial plantation area. The hardwood plantation estate spans an estimated 0.896 Mha and accounts for 46 per cent of commercial plantation area. These plantations are located within the 15 National Plantation Inventory (NPI) regions that also contain most processing facilities (

Figure 4). The NPI regions are in higher rainfall zones along the east coast and southwest corner of mainland Australia as well as Tasmania and the Northern Territory (Downham & Garavan, 2019).

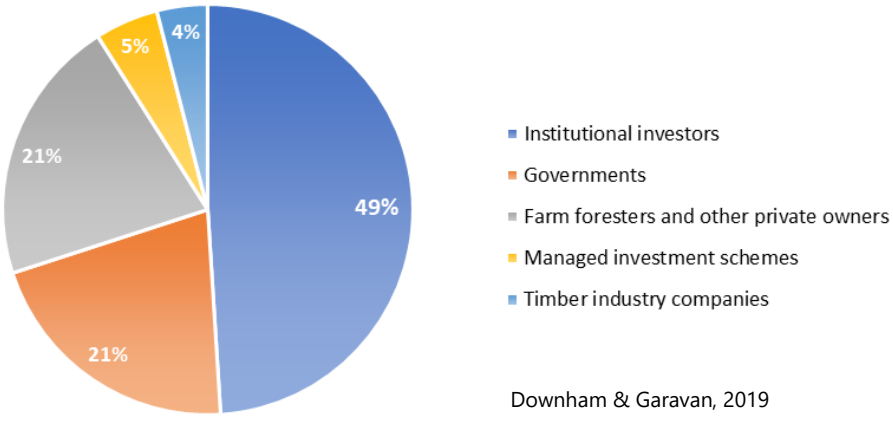


Downham & Garavan, 2019

Figure 4. National Plantation Inventory regions in Australia.

Plantation forest ownership

Commercial plantations account for 87 per cent of Australia's total log harvest and native production forests contribute 13 per cent. In 2017-18, 20.6 per cent of plantation resources were government owned. The remainder are under private or joint ownership with 49 per cent held by institutional investors and 21 per cent attributed to farm foresters and other private owners (*Figure 5*; Downham & Garavan, 2019).



Downham & Garavan, 2019

Figure 5. Plantation forest ownership during 2017-18. Note: Joint venture plantations are not included.

Growing plantation forests

The management of a plantation forest is termed silviculture. Initially, economic feasibility studies and site-specific planning is undertaken to consider a variety of abiotic and biotic factors that will influence establishment, production, and product pathways. Plants are often sourced from nurseries from seed or cuttings of known genetic lines. Seedlings are planted at specific densities and spatial arrangements with a

site to maximise resource quality and productivity. Over the length of their rotation, some plantations will be thinned (i.e. trees removed) to maximise the growth of the remaining trees. At the end of the rotation, trees are harvested and transported to processing facilities to produce a variety of products.

Plantation estate - sizes and uses

All states and territories have significant plantations estates (*Table 18*). The plantation estate currently consists of 53 per cent softwood species and 46 per cent hardwood species (*Table 18*; Downham & Garavan, 2019). The softwood plantation estate has remained stable at around 1 million hectares over the past decade (Downham & Garavan, 2019). Over the past five years, the plantation area of hardwood species has declined by 8.2 per cent (Downham & Garavan, 2019).

Table 18. Summary of plantation type and area (ha) by State.

STATE OR TERRITORY	HARDWOOD	SOFTWOOD	OTHER	TOTAL
Australian Capital Territory	0	7,400	0	7,400
New South Wales	87,100	306,000	100	393,200
Northern Territory	45,500	1,900	0	47,400
Queensland	34,800	195,600	100	230,500
South Australia	44,800	127,200	200	172,200
Tasmania	233,900	75,800	0	309,800
Victoria	196,300	223,400	800	420,600
Western Australia	253,500	99,700	8,500	361,700
Total	**896,000**	**1,037,000**	**9,700**	**1,942,700**

Adapted from Downham & Garavan, 2019.

The softwood plantation estate

Radiata pine (*Pinus radiata)* is the most planted species which comprises 74.5 per cent of the softwood estate (Downham & Garavan, 2019). The southern pines (*P. elliottii, P. caribaea* (including hybrids) and *P. taeda*) compose 15.1 per cent of Australia's softwood estate (ABARES, 2016). Only the hoop (*Araucaria cunninghamii*) and Kauri (*Agathis robusta*) pines are native to Australia.

Softwood plantations are grown in long rotation schedules to produce integrated products and are primarily managed for 25 to 40 years to produce solid wood products (97.7 per cent) and materials for the pulp industry (Downham & Garavan, 2019). Larger diameter logs from thinning operations and the final harvest are sold to sawmills to produce solid timber products (i.e. building and construction materials). Smaller diameter logs from thinning operations are sold as pulp for engineered wood products, landscaping and paper products.

The hardwood plantation estate

Native Eucalypt species dominate the Australian hardwood plantation estate. The major plantation species in 2017-18 were Tasmanian blue gum (*E. globulus*, 51.1 per cent), shining gum (26.1 per cent), other Eucalypts (7.8 per cent) [130] and brown salwood (*Acacia mangium,* 3.5 per cent).
Certain hardwood species (i.e. Tasmanian blue gum, shining gum and brown salwood) are often managed on

[130] Including lemon-scented gum (*Corymbia citriodora*), red Mahogany (*Eucalyptus pellita*), mountain ash (*E. regnans*), Sydney blue gum (*E. saligna*) and western white gum (*E. argophloia*).

short rotations (8-15 years) to produce pulp-logs for manufactured products (i.e. woodchips and paper). Longer rotations schedules (≥ 15 years) are employed to produce saw logs from blackbutt (*E. pilularis*), flooded gum (*E. grandis*), Dunn's white gum (*E. dunnii*), Acacia species (including *Acacia mangium*), spotted gums (*Corymbia maculata, C. variegata* and related species), mountain ash (*E. regnans*), Sydney blue gum (*E. saligna*), African mahogany (*Khaya senegalensis*), teak (*Tectona grandis*) and southern silky oak (*Grevillea robusta*) (ASFR, 2018).

Exotic (e.g. Teak and African mahogany) and native species (Southern silky oak) are planted at a much smaller scale to grow high value products. Sandal wood (S*antalum spicatum* (a native species) and *S. album* (an exotic species)) are grown in Western Australia and Queensland to produce fragrant timber and oils.

Processing Facilities

Harvested soft and hardwood materials are processed in mills around Australia. 300 mills were operating in 2016–17 (Downham *et al*, 2019). The number of sawmills in Australia has decreased significantly since 2006–07. Hardwood sawmills have decreased by 64 per cent, whereas softwood and cypress pine sawmills have declined by 31 per cent. The volume of hardwood (-38 per cent) and softwood sawlogs (-2 per cent) harvested for domestic processing has also decreased over the same period. The declines in operating mills has recently stabilised and total sawlog processing volumes have increased. An estimated $2.48 billion of revenue was generated in 2016–17 from the sale of sawn wood processed in Australia (Downham *et al.*, 2019).

Market Value

Wood and forestry products generate an annual economic contribution of around $23 billion with an added value (income minus costs) of $8.8 billion (ABARES, 2018a; Lawson *et al.*, 2018) in 2016-17. The industry directly employs over 76,400 people with many of these jobs based in rural and regional Australia (ABARES, 2018b).

The total log harvest (from native production forests and commercial plantations) in Australia reached a record high of 33.1 million cubic metres between 2016 and 2017 at an estimated gross value of $2.6 billion (ABARES, 2018c). Australia is a net importer of wood products in value terms and this is reflected in the types of products imported and exported. Total trade (imports plus exports) in wood products has increased 1 per cent to $8.7 billion in 2016–17 (ABARES, 2018c). Australia tends to import lower volumes of more processed and higher value wood products as well as secondary wood products. In contrast, the main wood products exported are woodchips, roundwood and higher value paper and paperboard.

References

ABARES: Australian Bureau of Agricultural and Resource Economics and Sciences (2016). Email: Downham R. (2019). A non-exhaustive list of plantation species within Australia captured from a spatial plantation study in 2016. *Australian Bureau of Agricultural and Resource Economics and Sciences*, Canberra.

ABARES: Australian Bureau of Agricultural and Resource Economics and Sciences (2018c) Australian forest and wood products statistics, September and December quarters 2018. *Australian Bureau of Agricultural and Resource Economics and Sciences*, Canberra: ABARES. CC BY 4.0. Retrieved from: agriculture.gov.au/SiteCollectionDocuments/abares/publications/afwps-overview-sep-dec-2018-v1.0.0.pdf

ABARES: Australian Bureau of Agricultural and Resource Economics and Sciences (2018b). Agricultural commodities and trade data: Agricultural commodity statistics 2018. *Australian Bureau of Agricultural and Resource Economics and Sciences*, Canberra: ABARES. CC BY 4.0. Retrieved from: agriculture.gov.au/abares/research-topics/agricultural-commodities/agricultural-commodities-trade-data#2018

ABARES: Australian Bureau of Agricultural and Resource Economics and Sciences (2018a). Australian forest and wood

products statistics, March and June quarters, 2018. *Australian Bureau of Agricultural and Resource Economics and Sciences*, Canberra: ABARES. CC BY 4.0.

AFPA: Australian Forest Products Association (2019). Forest industries proposals for the 2019-20 Federal Budget. *Refer to*: treasury.gov.au/sites/default/files/2019-03/360985-Australian-Forest-Products-Association.pdf

ASFR: Australia's State of the Forests Report (2018). Montreal Process Implementation Group for Australia and National Forest Inventory Steering Committee, 2018. ABARES, Canberra, December. CC BY 4.0. *Refer to*: apo.org.au/sites/default/files/resource-files/2019/02/apo-nid221681-1334346.pdf. ISBN 978-1-74323-407-5

Brockerhoff E.G., Jactel H., Parrotta J.A. & Ferraz S.F.B. (2013) Role of eucalypt and other planted forests in biodiversity conservation and the provision of biodiversity-related ecosystem services. *Forest Ecology and Management*, **301**, 43–50.

Department of Agriculture (2017). Levy and charge rates for forestry growers and industry products. *Retrieved from*: agriculture.gov.au/ag-farm-food/levies/rates#forestry

Downham R. & Garavan M. (2019). Australian plantation statistics 2019 update, ABARES technical report 19.2, Canberra, May. CC BY 4.0.

Downham R., Gavran M. & Frakes I. (2019). ABARES National Wood Processing Survey: 2016–17, ABARES technical report 19.3, Canberra, June. CC BY 4.0.

Ferguson I. (2014). Australian plantations: Mixed signals ahead. *International Forestry Review*, **16,** 160–171. agriculture.gov.au/SiteCollectionDocuments/abares/afwps-overview-mar-jun-2018.pdf

Lawson S.A., Carnegie A.J., Cameron N., Wardlaw T. & Venn T. (2018). Risk of exotic pests to the Australian forest industry. *Australian Forestry*, **81**, 3–13.

Payn T., Carnus J.M., Freer-Smith P., Kimberley M., Kollert W., Liu S., Orazio C. Rodriguez L., Silva L.N. & Wingfield M.J. (2015). Changes in planted forests and future global implications. *Forest Ecology Management,* **352**, 57–67.

Rhodes, D. & Stephens, M. (2014). Planted forest development in Australia and New Zealand: Comparative trends and future opportunities. *New Zealand Journal of Forestry Science*, **44**, S10.

Stephens M.L. & Grist P. (2014). Market failure for plantations: Past experiences and emerging trends for delivering wood production and ecosystem services in Australia. *International Forestry Review*, **16,** 205–215.

APPENDIX 2 THREAT SUMMARY TABLES

The information provided in the threat summary tables (TST) is an overview of exotic plant pest threats to the plantation forests sector. Many forests pests were identified and condensed into a summary table containing 51 exotic plant pests. Information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[131] or eradication may be included in these tables where appropriate. However, plantation forest pests that are established but regionalised within Australia are not covered by TST but may be assessed in state biosecurity plans. Assessments may change given more detailed research and will be reviewed with the biosecurity plan.

Full descriptions of the risk rating terms can be found in *Ranking pest threats*. An explanation of the method used for calculating the overall risk can be found on the PHA website[132]. Additional information on High Priority Pests listed in the TST can be found in pest-specific information documents (*Table 13*). Some plantation forests HPP are included in government surveillance programs (*Table 8*).

Invertebrates

Table 19. Invertebrate threat summary table for plantation forests.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Blattodea (cockroaches and termites)										
Coptotermes formosanus[136]	Formosan subterranean termite	Living and dead trees, timber in service or any material containing	Wood of standing trees and timber in service.	41 interceptions internationally. This is the most highly intercepted Rhinotermitidae	China, Taiwan, South Africa, USA, United States Virgin Islands, Marshall Islands and US Minor Outlying Islands.	MEDIUM	HIGH[139]	HIGH	HIGH	HIGH

[131] Official control defined in ISPM No. 5 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.
[132] Available from planthealthaustralia.com.au/biosecurity/risk-mitigation
[133] Specified interceptions are based on data collected from nine world regions between 1995 to 2019 (Turner et al. 2021) - https://doi.org/10.1002/eap.2412
[134] Centre for Agriculture and Bioscience International [CABI] (2020).
[135] Establishment potential.
[136] This pest is a National Priority Plant Pest.
[139] The establishment potential of *Coptotermes* spp. may be dependent on colony status. There are instances of *Coptotermes* spp. being intercepted in nests with a queen.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
		cellulose[137].		[138].						
Coptotermes gestroi[140]	Asian subterranean termite	Living and dead trees, timber in service or any material containing cellulose (i.e. paper etc.)[141].	Living trees, standing dead wood and timber in service.	27 interceptions internationally. This is the second most intercepted Rhinotermitidae [119].	*Coptotermes gestroi* is endemic to southeast Asia. *C. gestroi* was introduced to other geographic areas including North America and Pacific, Caribbean, South American and Indian Ocean islands[142].	MEDIUM	HIGH[143]	HIGH	HIGH	HIGH
Cryptotermes spp. (including *C. brevis*)[144]	Drywood termites	Living and dead trees, timber in service.	Nests in dead wood of standing trees and timber in service.	Detections in northern Australia. Any movement of seasoned wooden materials, from areas where *Cryptotermes* spp. occur could result in new introductions at their destination[119,]	Most *Cryptotermes* spp. are from the West Indies, Caribbean and central America. *C. brevis* is present in the Caribbean, United States, Central America, tropical South America, Peru, Chile, St Helena, tropical Africa, South Africa and Madagascar. It is also invasive in Australia, where it was first observed in 1966, as well as New	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM

[137] *Coptotermes formosanus* usually nest in the ground and need contact with soil or some other constant source of moisture for persistence.
[138] Human transportation is the primary means of migration for termite pests with shipboard infestations as a likely means of human dispersal. All substantial objects containing cellulose and adequate moisture may maintain small colonies. These may include large wooden articles, such as crates, pallets or shipping containers, lumbers, railway sleepers, wooden posts and planting containers holding soil. Alates are often found swarming out of infested boats (CABI, 2021).
[140] This pest is a National Priority Plant Pest.
[141] *Coptotermes gestroi* usually nest in the ground and need contact with soil or some other constant source of moisture for persistence.
[142] Li H.F., Fujisaki I. & Su N.Y. (2013).
[143] The establishment potential of *Coptotermes* spp. may be dependent on colony status. There are instances of *Coptotermes* spp. being intercepted in nests with a queen.
[144] This pest is a National Priority Plant Pest.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				[145]. 58 interceptions internationally of *Cryptotermes* spp.	Caledonia, NZ, French Polynesia and Fiji. *C. brevis* has also been reported in Egypt, Italy and Spain.					
Incisitermes minor[146]	Western drywood termite	Living and dead trees, timber in service.	Nests in dead wood of standing trees and timber in service.	Infestations of *I. minor* have been recorded on vessels in Florida and Australia[147]. Dispersal is largely due to the commercial transportation of wood products[119]. 19 international interceptions.	*I. minor* is a common structure-infesting drywood termite in the south-western United States and north-western Mexico. The termite has spread across the USA as far as Florida and internationally to Canada, China and Japan.	LOW	LOW	LOW	HIGH	LOW
Coleoptera (beetles and weevils)										
Agrilus spp. (including *A. maculiventris* and *A. sexsignatus*)[148]	Varicose borers	*Eucalyptus deglupta*	Larvae feed on the cambium of their living host. Adults feed on young foliage	Six international interceptions of different species in the genus (not *A. maculiventris* or *A. sexsignatus*). For comparison,	*Agrilus* spp. has a worldwide distribution. *A. maculiventris*: Papua New Guinea. *A. sexsignatus*: Philippines[149].	VERY LOW	LOW	LOW	LOW	NEGLIGIBLE

[145] Movements of boats and ships may also result in introductions to ports. Dispersing alates will be attracted to lights.
[146] This pest is a National Priority Plant Pest.
[147] Scheffrahn R.H. & Crowe B. (2011).
[148] Information is limited for species other than *Agrilus planipennis* (Emerald Ash Borer). It is unknown if *Agrilus* spp. will impact eucalypt taxa planted in Australia.
[149] Floyd R., Wylie R., Old K., Dudzinski M. & Kile G. (1998).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			of host tree.	the most highly intercepted Buprestidae was intercepted 36 times internationally.						
Arhopalus ferus	Burnt pine longicorn	*Pinus* spp. and less commonly, Norway spruce (*Picea abies*).	Often dead or dying *Pinus* and *Picea* trees injured by fire or other damage[150].	Intercepted 500 times internationally. This is the most highly intercepted Cerambycidae [151].	Europe, northern Asia (except Japan) and northern Africa, New Zealand.	HIGH	HIGH	HIGH	HIGH	HIGH
Dendroctonus frontalis	Southern pine beetle	*Pinus* spp. Slash pine is more resistant to attack than Loblolly pine. No information on the susceptibility of Radiata pine. Expanding host range[152].	Tree trunks	Two international interceptions. One of the least intercepted Curculionidae.	Mexico, USA, Belize, El Salvador, Guatemala, Honduras and Nicaragua.	LOW	HIGH	HIGH	HIGH	MEDIUM
Dendroctonus ponderosae	Mountain pine beetle	Pines (*Pinus* spp.), Spruce (*Picea* spp.).	Tree trunks; larvae feed on cambium under the	297 international interceptions. One of the most	Canada, Mexico, USA.	LOW	HIGH	HIGH	HIGH	MEDIUM

[150] Occasionally, *A. ferus* will attack growing and healthy trees.
[151] Australian import conditions are still in place. The establishment of burnt pine longicorn in Australia could have market access ramifications.
[152] Dodds K.J., Aoki C.F., Arango-Velez A., Cancelliere J., D'Amato A.W., DiGirolomo M.F. & Rabaglia R.J. (2018).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			bark.	highly intercepted Curculionidae.						
Dendroctonus valens	Red turpentine beetle	Attacks over 40 conifer spp. in USA. Especially destructive to Radiata pine.	Basal area of tree trunks.	231 international interceptions. A commonly intercepted Curculionidae.	North America, China, Guatemala, Honduras.	MEDIUM	HIGH	HIGH	HIGH	HIGH
Euwallacea spp. (including *E. fornicatus* and *E. kuroshio*)[153].	Polyphagous and kuroshio shot hole borers	Up to 58 different plant families, including *Acacia* and *Eucalyptus* spp.	Tree trunk and large branches primarily. Exposed roots, root collar and small branches occasionally [154].	56 interceptions of *Euwallacea* spp. internationally. Dispersal within a country may be through natural flight, movement of green waste from urban areas, movement of firewood and nursery stock and the availability and	China (Chongqing, Guizhou, Hong Kong, and Yunnan), India (Uttar Pradesh), Indonesia, Italy, Japan (Bonin Islands and Okinawa), Malaysia (Sabah), Samoa, Sri Lanka, Taiwan, Thailand and Vietnam. These species have been introduced into Israel, South Africa, Mexico and the United States of America.	MEDIUM[156]	HIGH	HIGH	LOW[157]	LOW

[153] Smith S.M., Gomez D.F., Beaver R.A., Hulcr J. & Cognato A.I. (2019).

[154]Entrance holes can be observed primarily along the main stem and larger branches of trees. Damage can extend from the root collar to small diameter (< 2.5 cm) branches. High levels of borer attacks on a tree can cause (i) severe branch and crown dieback; (ii) epicormic growth along the stem and at the base of the tree; (iii) stem or branch failure and (iv) eventual tree death (Coleman *et al.* 2019).

[156] A *Euwallacea* spp. was recovered from an empty shipping container in Australia which supports the entry potential of this genus (Coleman *et al.* 2019).

[157]*Fusarium euwallaceae* is a well-characterized fungal symbiont of the exotic ambrosia beetle *Euwallacea* spp. which can collectively incite Fusarium dieback on many host plants. *Euwallacea* spp. are associated with a dynamic assemblage of mycangial fungal associates (including *Graphium euwallaceae* and *Paracremonium pembeum*) that could pose additional risk to native and non-native hosts (Lynch *et al.* 2016).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				range of hosts[155].						
Hylobius abietis	European large pine weevil	*Pinus* spp. (including Radiata pine)	Seedlings	11 international interceptions. This is mid-range for Curculionidae interceptions along entry pathways.	Armenia, Azerbaijan, China, Georgia, Japan, Kazakhstan, Turkey, Austria, Belarus, Belgium, Bulgaria, Czech Rep., Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Moldova, Netherlands, Poland, Romania, Russia, Scandinavia, Slovakia, Slovenia, Spain, Switzerland, UK, Ukraine	NEGLIGIBLE	HIGH	HIGH	LOW	NEGLIGIBLE
Hylurdrectonus araucariae	Araucaria bark beetle	*Araucaria cunninghamii* (4-12 yr. old trees the most susceptible)	Branchlets and leaves	No interceptions. Unusual for Curculionidae.	Papua New Guinea	LOW	LOW	MEDIUM	MEDIUM[158]	VERY LOW
Ips spp. (including *I. calligraphus* and *I. avulsus*)	Ips bark beetles	Pines (*Pinus* spp.), Spruce (*Picea* spp.)	Inner layer of bark and sapwood[159].	24 different *Ips* species have been intercepted internationally with 5 species being intercepted at a	Different species throughout the northern hemisphere. In North America, there are ~25 Ips[160] spp. and a further 11 spp. in Europe and Asia. Some species have been introduced into	MEDIUM	MEDIUM	HIGH	MEDIUM	LOW

[155] Coleman *et al.* (2019).
[158] *Hylurdrectonus araucariae* could have an impact on native *Araucaria cunninghamii* (Hoop pine) which represents a small part of the industry.
[159] The beetles are called 'engravers' because of the long, grooved galleries they excavate in sapwood (youngest/outermost wood).
[160] Birgersson G., Dalusky M.J., Espelie K.E. & Berisford C.W. (2012).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				high frequency.	Australia and Africa[161].					
Ips typographus	Spruce bark beetle	Spruce (*Picea* spp.), recorded on Radiata pine[162].	Inner layer of bark and sapwood[163].	727 interceptions internationally. One of the most frequently intercepted Curculionidae. Australian interceptions are low.	China, Japan, Korea, Georgia, Tajikistan, Turkey, Austria, Baltics, Belarus, Belgium, Bosnia-Herz., Bulgaria, Croatia, Czech Rep., Finland, France, Germany, Greece, Hungary, Italy, Lux., Netherlands, Poland, Portugal, Romania, Russia, Scandinavia, Serbia, Slovakia, Slovenia, Switzerland Ukraine	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Monochamus spp. (including *M. alternatus, M. galloprovincialis, M. titillator, M. saltuarius* and *M. scutellatus*) with associated plant parasitic nematodes	Japanese pine sawyer, Pine sawyer, Southern pine sawyer, White-spotted sawyer	Pines (*Pinus* spp.), Spruce (*Picea* spp.) and Fir (*Abies* spp.)	Whole plant, fruits, pods, leaves and stems.	11 species intercepted globally. *M. alternatus* intercepted 68 times - one of the most frequently intercepted species[165]. Most	The genus *Monochamus* is comprised of around 150 known species distributed across Asia, Africa, Europe and North America[166]. *M. alternatus* is present in China, Japan, Korea, Laos, Taiwan and Vietnam.	MEDIUM	HIGH	HIGH	HIGH	HIGH

[161] Buhroo A.A. & Lakatos F. (2011).

[162] *Pinus radiata* recorded as host but *I. typographus* causes less damage on pine.

[163] The beetles are called 'engravers' because of the long, grooved galleries they excavate in sapwood (youngest - outermost wood).

[165]International interceptions for other *Monochamus* species are *Monochamus sutor* (52 times). *M. galloprovincialis* (38 instances), and *M. scutellatus* (6 occasions - mid-range for Cerambycidae). Interceptions of *M. titillator* and M. *saltuarius* have only occurred once.

[166]The distribution of other *Monochamus* species are: *M. galloprovincialis*: Algeria, Morocco, Tunisia, China, Kazakhstan, Mongolia, Albania, Armenia, Austria, Azerbaijan, Belarus, Bosnia and Herzegovina,

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
(including *Bursaphelenchus xylophilus*)[164]				likely pathway is wood packaging.						
Pissodes spp. (including *Pissodes castaneus*[167]).	Small banded pine weevil	*Pinus* spp.	Feeding damage to young *Pinus* by adult beetles is usually minimal[168].	Roundwood with bark. 15 international interceptions at genus level.	All members of *Pissodes* are native to the northern hemisphere but have been introduced into numerous countries and continents[169].	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Tomicus piniperda	Pine shoot beetle	*Pinus* spp. (including *P. sylvestris* and *P. radiata*), *Abies* spp., *Larix* spp., *Picea* spp. and *Pseudotsuga* spp.	Stems and shoots[170].	65 interceptions globally. One of the most frequently intercepted Curculionidae.	China, Georgia, Israel, Japan, Korea, Turkey, Algeria, Morocco, Tunisia, Canada, USA, Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania,	MEDIUM	HIGH	HIGH	HIGH	HIGH

Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Moldova, Montenegro, Netherlands, North Macedonia, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and Ukraine. *M. titillator*: Canada, USA and Cuba. *M. saltuarius*: China, Japan, Korea, Mongolia, Austria, Croatia, Czech Republic, Germany, Italy, Lithuania, Poland, Romania, Russian Federation, Slovakia, Switzerland and Ukraine. *M. scutellatus*: Canada, Mexico, and USA.

[164]A worldwide list of insects associated with *Bursaphelenchus xylophilus* identified species within Cerambycidae, Buprestidae and Curculionidae. The main vectors of *B. xylophilus* are within the genus *Monochamus* (Robertson *et al*. 2008).

[167]*Pissodes castaneus* represents a phytosanitary risk for temperate regions (other than Europe) where pine plantations occur. It is listed by COSAVE as a quarantine pest. Species including *Pissodes strobi*, *P. terminalis*, *P. piniphilus*, *P. yunnanensis*, *P. punctatus*, *P. nitidus*, *P. nemorensis* and *P. castaneus* can cause significant economic losses to coniferous plantations (Wondafrash et al. 2016).

[168]*Pissodes* spp. make small holes in the young bark of fine branches and stems. By reaching the inner bark, they produce resiniferous canals. *Pissodes* have been involved in the transmission of forest pathogenic fungi (Wondafrash *et al*. 2016).

[169]*Pissodes castaneus*: Turkey, Algeria, Morocco, Canary Islands, Brazil, Chile, Austria, Belarus, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Moldova, Netherlands, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Spain, Sweden, Switzerland, UK, Ukraine, Serbia and Montenegro.

[170]*Tomicus piniperda* is considered a secondary pest, colonising tree trunks and thick branches of weakened trees. *Tomicus* spp. can be considered a primary pest during maturation by feeding on pine shoots (Bezos *et al*. 2015).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
					Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovenia, Spain, Sweden, Switzerland and the UK.					
Vanapa oberthuri	PNG Hoop weevil	*Araucaria* spp. (including *A. cunninghamii* - Hoop pine)	Attack after pruning and thinning[171].	Species most likely to enter Australia from PNG via items carried by people for traditional trade or in timber from *Araucaria* species or souvenirs[172].	Papua New Guinea (PNG) and Indonesia (West Irian)	LOW	LOW	MEDIUM	LOW[173]	NEGLIGIBLE
Hymenoptera (ants, bees and wasps)										
Sirex juvencus	Steely-blue wood wasp	*Pinus* spp. (including *P. radiata*), *Picea*, *Abies* and *Larix* spp.	Wood of recently cut, fallen, weakened or dying trees and green timber.	84 interceptions internationally. Most frequently intercepted Siricidae.	China, Japan, Mongolia, Turkey, Canada, Mexico, USA, Austria, Belarus, Czech Republic, Estonia, Denmark, France, Germany, Hungary, Italy, Norway, Poland, Serbia, Portugal, Sweden, Russian Federation, Slovakia, Slovenia, Switzerland and the UK.	MEDIUIM	HIGH	HIGH	LOW	LOW
Urocerus gigas	Giant wood	*Pinus*, *Picea*,	Wood of	36 interceptions	This species of wood	MEDIUM	HIGH	HIGH	LOW	LOW

[171] Secondary pests in Curculionidae, Cerambycidae, Platypodidae and Scolytidae are attracted to *Vanapa* spp. damage.
[172] Agriculture, Fisheries and Forestry – Australia (2000).
[173] *Vanapa oberthuri* could have severe impact on native Araucaria forests which represents a relatively small part of the industry (i.e. Hoop pine)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
	wasp	*Abies*, *Pseudotsuga* and *Larix* spp.	recently cut, fallen, weakened or dying trees and green timber.	internationally. Second most frequently intercepted Siricidae.	wasp occurs widely in North America, Europe and Asia as well as in parts of South America, northern Africa and the Arabian Peninsula.					
Xeris spectrum	Wood wasp, Long horntail	All conifers, except Yew. Firs, European black pine and Scots pine	Wood of recently cut, fallen, weakened or dying trees & green timber.	19 interceptions internationally. 4th most frequently intercepted Siricidae.	North America, Europe, Asia, and North Africa[174].	MEDIUM	HIGH	HIGH	LOW	LOW
Lepidoptera (butterflies and moths)										
Chilecomadia valdiviana	Carpenter worm	Broad native host range. Attacks *Eucalyptus nitens* and occasionally *E. camaldulensis* and *E. gunnii*.	Infests living trees greater than 4 cm in diameter. Attacks occur in all parts of the bole. Tree stress is not a prerequisite for attack.	No international interceptions[175].	Argentina and Chile[176].	NEGLIGIBLE	MEDIUM	MEDIUM	LOW	NEGLIGIBLE
Coryphoderma tristis	South African cossid moth	Wide host range. *Eucalyptus nitens* is attacked in South Africa.	Tree trunks	No international interceptions [136].	South Africa.	NEGLIGIBLE	MEDIUM	MEDIUM	HIGH	VERY LOW

[174] Schiff N.M., Valley S.A., LaBonte J.R. & Smith D.R. (2006).
[175] Only 24 interceptions have been delineated to species rank for this family (Cossidae), so data is limited.
[176] Lanfranco D. & Dungey H.S. (2001).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Dendrolimus spp. (including *D. sibiricus* and *D. superans*)	Siberian silk moth	*Pinus* spp.	Whole plant (particularly leaves).	Live plants. One international interception of *Dendrolimus*.	*D. sibiricus*- China, Kazakhstan, Korea, Mongolia and Russia. *D. superans*- Japan, Korea and east Russia.	VERY LOW	MEDIUM	HIGH	HIGH	LOW
Hylesia nigricans	Burning moth	*Acacia*, *Eucalyptus* and other species	Leaves	Four interceptions globally. One of the most highly intercepted Saturniidae.	*Hylesia* contains 110 spp. with a distribution from Mexico to Argentina. *H. nigricans* is located throughout south-east Brazil, Uruguay and north-east Argentina.	LOW	HIGH	HIGH	MED	LOW
Lymantria dispar complex[177]	Gypsy moth complex	Over 600 species of trees and shrubs (including eucalypts and pine).	Larvae feed on foliage. Can cause high tree mortality when forests are under stress from drought or other pests.	458 interceptions internationally. The most frequently intercepted Erebidae. Gypsy moths are often transported on human-made objects, typically as egg masses. Potential pathways include clothing, footwear, wood packaging, containers, cars,	Afghanistan, Armenia, Azerbaijan, China, India, Iran, Iraq, Israel, Japan, Kazakhstan, Korea, Kyrgyzstan, Lebanon, Mongolia, Syria, Taiwan, Tajikistan, Turkey, Turkmenistan, Uzbekistan, Algeria, Morocco, Tunisia, Canada, USA, Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Macedonia,	HIGH	HIGH	HIGH	HIGH	HIGH

[177] This pest is a National Priority Plant Pest.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				vessels and plants.	Moldova, Netherlands, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK and Ukraine[178].					
Lymantria monacha	Nun moth	Wide range of hosts including fruit trees and confers, such as *Pinus*, *Picea*, *Abies* and *Larix* spp.	Leaves	No interceptions internationally. There have been many interceptions of other species in the same genus and a total of 54 species within Erebidae. Potential entry pathways are on unprocessed wood packaging, vehicles, ships and live plants.	Armenia, Azerbaijan, China, Georgia, Japan, Kazakhstan, Korea, Turkey, Vietnam, Austria, Belgium, Bosnia-Hercegovina, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Spain, Sweden, Switzerland, UK and Ukraine.	LOW	MEDIUM	HIGH	HIGH	MEDIUM
Orgyia thyellina	White spotted tussock moth	Larvae feed on the foliage of urban trees and plants, horticultural plants, and	Leaves	No interceptions of *Orgyia thyellina*. There have been 10 international	The white spotted tussock moth is found in China, Korea, Japan, far eastern Russia, and Taiwan.	LOW	MEDIUM	HIGH	MEDIUM[179]	LOW

[178] Eradicated in New Zealand.

[179] The absence of natural enemies could allow this species to become a serious pest of timber species and ornamentals.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL[133]	DISTRIBUTION[134]	ENTRY POTENTIAL	EST.[135] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
		forest trees.		interceptions of other species in the same genus and a total of 54 species within Erebidae.						
Rhyacionia spp. (including *R. buoliana*)	European pine shoot moth	*Pinus* spp.	Needles and terminal buds.	No interceptions internationally, compared to 97 within Tortricidae.	There are 35 known species of pine tip moths (*Rhyacionia* spp.) distributed throughout the palearctic and nearctic regions of the world[180, 181].	VERY LOW	MEDIUM	HIGH	HIGH	LOW
Thaumetopoea pityocampa (Thaumetopoea pityocampa/T. wilkinsoni complex: Notodontidae[182]).	Pine processionary moth	*Pinus* spp.	Feed on the needles close to their silken nests - defoliation	Live plants and soil. Pupae are not easily detected in soil and may be introduced by large trees/soil being transplanted or moved[183]. One genus-level interception.	Central Asia, North Africa and the countries of southern Europe[117].	LOW	HIGH	HIGH	MEDIUM	LOW

[180] Asaro C. (2008).

[181] *Rhyacionia buoliana*: Iran, Israel, Japan, Syria, Turkey, Algeria, Canada, USA, Argentina, Chile, Uruguay, Austria, Belgium, Bosnia-Hercegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK and Ukraine.

[182] Kerdelhué C., Zane L., Simonato M., Salvato P., Rousselet J., Roques A. & Battisti A. (2009).

[183] Pine processionary moth can enter an extended diapause at the pupal stage (Robinet *et al*. 2012).

Pathogens

Table 20. Pathogen threat summary table for plantation forests.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bacteria										
Erwinia psidii	Dieback and wilt disease	Myrtaceae (including *Eucalyptus*)	Necrotic lesions (central leaf veins and petioles), wilt and plant death[185],[186]. A red discolouration of young host tissue and blistering of young bark leads to rapid shoot death120. *E. psidii* colonises sclerenchyma, parenchyma and xylem vessels in the	Spread in eucalypts still unsure, but in guava it is transmitted through seed and pruning. Pathway not known. Pathogen dispersal in Brazil can occur from contaminated planting materials[188].	Brazil, Argentina, Uruguay[189] and Malaysia[190].	VERY LOW	LOW	MEDIUM	LOW[191]	NEGLIGIBLE

[184] Centre for Agriculture and Bioscience International [CABI] (2020).
[185] Arriel *et al.* (2014).
[186] Coutinho *et al.* (2011).
[188] Janse (2012).
[189] Hermenegildo *et al.* (2019).
[190] Chai *et al.* (2017).
[191]Dieback caused by *Erwinia psidii* is currently one of the most important emerging diseases in eucalypt plantations in Brazil, Argentina and Uruguay. Sources of resistance against *E. psidii* exist in *Eucalyptus* and *Corymbia* which could be used in developing resistant genotypes in species of economic importance (Caires *et al.* 2019). The genetic diversity of eucalypt plantations/forests in Australia may limit the economic impact of *E. psidii.*

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			host stem and leaves[187].							
Fungi										
Armillaria spp. (including *A. ostoyae* and *A. mellea*)	Armillaria root disease	Conifers (including *Pinus* spp.), all fruit trees, most natives, ornamental & horticultural crops.	Roots. Destruction of bark, sapwood and heart wood is caused by enzymatic activities[192].	Natural and human-mediated movement of suitable host materials (e.g. wood, live plants, root fragments and soil[193]).	*Armillaria* spp. are globally distributed and primarily occupy temperate and tropical regions of the world[166],[194].	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Austropuccinia psidii[195](exotic biotypes/strains [196]; syn. *Puccinia*	Myrtle Rust	Myrtaceae (including eucalypts)	Leaves, shoots, young branches, epicormic	*A. psidii* can spread rapidly because it produces large	Numerous South and Central American countries	HIGH	HIGH	HIGH	HIGH	HIGH

[187] Montoya-Estrada *et al*. (2018).

[192]*Armillaria* spp. can produce white mycelial sheets or black to reddish brown rhizomorphs under the bark and exudation of resin at the root collar. Armillaria infection can cause crown die-back and plant death (Williams *et al*. 1986).

[193]Armillaria can live for decades in suitable host materials (e.g. stumps and root fragments) and can disperse naturally through the spread of rhizomorphs in the soil. The movement of infected plants or soil can potentially spread the pathogen to new areas (Williams *et al*. 1986; FAO 2009)

[194]*Armillaria ostoyae*: China, India, Japan, Korea, Turkey, Canada, Greenland, Mexico, USA, Albania, Andorra, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and UK. A. mellea: China, Georgia , India, Iran, Japan, Korea, Syria, Turkey, Congo Democratic Republic, Kenya, Morocco, Nigeria, Réunion, Sao Tome and Principe, South Africa, Tanzania, Tunisia, Uganda, Canada, Mexico, USA, Colombia, Albania, Austria, Belarus, Bosnia-Hercegovina, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Macedonia, Netherlands, Poland, Portugal, Romania, Russian Federation, Serbia, Slovenia, Spain, Switzerland, UK and Ukraine.

[195] This pest is a National Priority Plant Pest.

[196]The *Austropuccinia psidii* 'complex' contains multiple biotypes or strains which display unique host associations and climatic niches. Locations with a specific biotype may be at risk from the introduction of other biotypes. Genetic clustering has revealed nine distinct genetic clusters [C1–C9]. C1: diverse hosts from Costa Rica, Jamaica, Mexico, Puerto Rico, and USA-Hawaii, and USA-California; C2: from eucalypts (*Eucalyptus* spp.) in Brazil/Uruguay and rose apple (*Syzygium jambos*) in Brazil; C3: from eucalypts in Brazil; C4: from diverse hosts in USA-Florida; C5: from Java plum (*Syzygium cumini*) in Brazil; C6: from guava and Brazilian guava (*Psidium guineense*) in Brazil; C7: from pitanga (*Eugenia uniflora*) in Brazil; C8: from allspice (*Pimenta dioica*) in Jamaica and sweet flower (*Myrrhinium atropurpureum*) in Uruguay and C9: from jabuticaba (*Myrciaria cauliflora*) in Brazil. The C1 cluster and the closely related C4 cluster are considered a "pandemic biotype," associated with myrtle rust emergence in Central America, the Caribbean, USA-Florida, USA-Hawaii, Australia, China-Hainan, New Caledonia, Indonesia and Colombia (Stewart *et al*. 2017).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
psidii sensu lato)			shoots, coppice & stem blight. Severe infection and crown loss; dieback and tree mortality has been reported for certain Myrtaceous species[197,198.]	numbers of small spores that can be dispersed over long distances by wind and animal vectors[170, 199].	as well as USA[200], Australia, New Caledonia, the Caribbean, South Africa, Indonesia, Japan, China (Hainan), Singapore and most recently NZ[169,170,171].					
Ceratocystis spp.[201] (including the '*C. fimbriata* complex' [exotic species, subspecies or strains/biotypes])	Wilt disease	Large and diverse host range on dicotyledons (including eucalypt spp., Acacia spp.)	*Ceratocystis* species are wound colonizers and include weak to highly virulent pathogens. Symptoms	Insect vectors (particularly bark & nitidulid beetles) & water assisted movement in soil for species that produce	*Ceratocystis* spp. (including *the C. fimbriata* complex[205] have a global distribution.	LOW	LOW	HIGH	LOW	NEGLIGIBLE

[197] Pegg *et al*. (2017)

[198] Fernandez Winzer *et al*. (2017)

[199]Human mediated pathways of *A. psidii* include (i) infected or contaminated planting material, nursery stock, plant cuttings, flowers and germplasm; (ii) contaminated plant waste, timber, wood packaging and dunnage; (iii) contaminated equipment and tools used on or around plants (e.g. chainsaws, secateurs etc.) or (iv) contaminated clothing, shoes and other personal possessions (Stewart *et al*. 2017).

[200] Hawaii, Florida, California

[201]Species in the Ceratocystidaceae occur on a wide range of hosts with a broad geographic distribution. The family encompasses 11 genera; *Ambrosiella*, *Berkeleyomyces*, *Bretziella*, *Ceratocystis*, *Chalaropsis*, *Davidsoniella*, *Endoconidiophora, Huntiella*, *Meredithiella*, *Phialophoropsis* and *Thielaviopsis* which include plant pathogens, insect associates and the causal agents of sap stain in wood (De Beer *et al*. 2014; Holland et al. 2019). Ceratocystis is the largest genus in the family including many important plant pathogens such as those of fruit and forest trees as well as tuber crops. Ceratocystis now comprises 39 delineated species in four geographic clades are believed to be centered in Latin America, North America, African and Asian-Australian regions (Liu *et al*. 2018; Holland et al. 2019). Within each geographic clade there are numerous lineages associated with certain hosts (Thorpe *et al*. 2005). Recent genetic, morphological and ecological studies have suggested that species concepts in *Ceratocystis* require re-evaluation and scientific consensus (Li *et al*. 2017). The Latin American clade includes *C. fimbriata* which is the pathogen that causes black rot of sweet potato. This pathogen is native to South and Central America and the Caribbean and causes wilt or cankers on coffee, *Eucalyptus* spp., rubber trees, and mango (Holland *et al*. 2019).

[205]*C. fimbriata* complex: Brunei Darussalam, Cambodia, China, India, Indonesia, Japan, Korea, DPR, Korea, Republic of, Malaysia, Myanmar, Oman, Pakistan, Philippines, Taiwan, Thailand, Vietnam, Congo, Congo Democratic Republic, Côte d'Ivoire, Seychelles, South Africa, Uganda, Canada, Mexico, USA, Costa Rica, Cuba, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Jamaica, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Uruguay, Venezuela, France, Italy, Poland, Portugal, Switzerland, American Samoa, Australia, Fiji, New Zealand, Papua New Guinea, Samoa and Solomon Islands.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			include discoloration of the xylem, wilting, cankers and rot of storage roots[202].	aleurioconidia. Movement by humans to new regions can occur on propagative material & solid wood packing materials[175,203,204].						
Chrysoporthe spp. (including *C. austroafricana*, *C. cubensis* and *C. deuterocubensis*)	Eucalyptus canker disease, Chrysoporthe canker	*Tibouchina* spp. (amenity plant), *Corymbia* spp., *Eucalyptus* spp., *Syzygium* spp.	The girdling of stems, wilting & eventual death of infected trees. *C. austroafricana* causes cankers at the base/root collar of Eucalypts. Cankers caused by *C. cubensis* & *C. deuterocubensis* are found at varying heights on the	*Chrysoporthe* spp. infect trees through wounds. Rain splash is thought to disperse asexual spores and wind may disseminate sexual spores. The movement of infected plant material or spores may facilitate long distance	*Chrysoporthe* spp. has been reported in South and Central America, Asia, Australia (Cairns and WA - no reports of the canker disease on eucalypts in Australia[180]), North America and Africa[209].	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM

[202] Holland *et al*. (2019).
[203] Thorpe *et al.* (2005).
[204] Kamgan et al. (2012).
[209]*Chyrsoporthe austroafricana* is not known outside of Africa whereas, C. cubensis is known from western Africa, the Americas and C. deuterocubensis has been identified in Asia, Australia, Hawaii and eastern Africa (van der Merwe *et al*. 2010; 2012)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
			bole[206],[207].	dispersal[208].						
Coniferiporia weirii (syn. *Phellinidium weirii*)	Laminated root rot	Douglas fir, western red cedar	Roots and butts	Primarily slow, vegetative, root-to-root spread. Host plants for planting, non-squared wood and isolated bark may be pathways[210].	China, Japan, Canada, USA, Turkey and Russian Federation (east).	MEDIUM	LOW	LOW	LOW	NEGLIGIBLE
Corinectria fuckeliana	Nectria canker	Fir (*Abies*), Larch (*Larix*), Spruce (*Picea*) species, Radiata pine.	Tree trunks. *C. fuckeliana* has been reported as a wound invader, requiring natural or artificial wounds[211] for infection.	*C. fuckeliana* is dispersed by rain and splashing water, rather than by wind. There is a possibility of insect-mediated dispersal. The movement of infected plant material or spores may facilitate long distance	Originates in the northern hemisphere (North America and Europe). Present on Radiata pine in New Zealand and Chile. In warmer regions, the amount of inoculum available to colonise new hosts may be less than that in cooler areas[213].	MEDIUM	MEDIUM	HIGH	LOW	VERY LOW

[206] Nakabonge *et al.* (2005).
[207] Burgess T.I. & Wingfield M.J. (2016).
[208] FAO (2009).
[210] It is presumed that spore infections must occur, at least infrequently. *Coniferiporia weirii* can persist for long periods as a saprobe in compatible environments (EFSA Panel on Plant Health, 2018).
[211] *Corinectria fuckeliana* is often associated with pruning practices which is uncommon in Australia.
[213] Crane *et al.* (2009).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				dispersal[212].						
Endocronatium harknessii	Western gall rust	Restricted to *Pinus* spp. (including *Pinus radiata*).	Branches, stems, seedlings.	Seeds, nursery stock, plants for planting (hosts) lumber and wood packaging[214].	Canada, USA and Mexico	NEGLIGIBLE	HIGH	HIGH	HIGH	VERY LOW
Fusarium circinatum	Pitch canker	Pines and Douglas fir	Needles, branches (dieback), the bole and exposed roots. Natural infections are often associated with wounds[215].	Spores disseminated by the air and insects as well as birds and animals (occasionally)[216] . Human-mediated dispersal of seed[217], soil and plant materials can facilitate long distance	Japan, Korea, South Africa, Mexico, USA, Haiti, Chile, Uruguay, Portugal and Spain	MEDIUM	HIGH	HIGH	HIGH[219]	HIGH

[212]Ascospores (sexual state) produced in red fruiting bodies (perithecia) are the most common mode of dispersal for *C. fuckeliana*. Conidial stages of this fungus are rarely found on standing trees. Both laboratory and field observations indicate that ascospores of *C. fuckeliana* are dispersed mainly by rain and splashing water, rather than by wind. There is a possibility of insect dispersal because both conidia and ascospores are sticky. The movement of infected plant material or spores may facilitate long distance dispersal (Crane *et al.* 2009).

[214]*Endocronartium harknessii* can be carried to new areas on plants for planting of the coniferous hosts, as has occurred in parts of the USA. Long incubation periods mean that latent infections easily go undetected unless post-entry quarantine is applied. There is no risk in the movement of *Pinus* seeds or pollen. EPPO considers *E. harknessii* a major quarantine pest for Australia.

[215]Characteristic sunken cankers produce abundant resin in branches and the main stem. Above the infection point, needles are brown and necrotic which cause partial discoloration and the defoliation of branches (dieback). Multiple infection points may cause severe defoliation. Severe infections result in extensive tree mortality, reduced tree growth and poor timber quality (Dvorák *et al.* 2017; Vettraino *et al.* 2018).

[216] Forestry Commission UK (2016). Contingency Plan for Pitch Canker of Pine (*Fusarium circinatum),* Retrieved from: https://www.forestresearch.gov.uk/documents/7299/Contingency-plan-Pitch-canker-of-pine-published-_Sept-05-2016.pdf

[217] Internally and externally seed borne.

[219]This disease affects plantations and nurseries in several countries worldwide and is a serious threat to pine forests wherever it occurs (especially on *Pinus radiata*). *Fusarium circinatum* entry and establishment in Australia may cause movement restrictions and high impact to forestry sub-sectors.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				dispersal[218].						
Heterobasidion annosum sensu lato (pathogenic forms)	Annosus root & butt rot	Primarily affects conifers (e.g. *Pinus*) and oaks.	Roots and butts. Spores infect stumps after harvesting or thinning. Mycelium colonises the stump and spreads into adjacent trees via root-to-root contacts[190].	Airborne spores and root-to-root contacts. Long distance dispersal may occur on bark, timber and wood packaging[220].	Predominantly distributed throughout the northern hemisphere[221].	LOW	VERY LOW	MEDIUM	LOW	NEGLIGIBLE
Inocutis spp. (including *I. jamaicensis* and *splitgerberi*)	White rot	Trees and woody shrubs (including *Eucalyptus globulus, E. grandis*), grapes.	Recorded on dead and living hardwoods.	Wood products and packaging, plant material and grapevine stocks from North and South America should be monitored.	*Inocutis jamaicensis*: Argentina, Brazil, Chile, USA (Arizona), Jamaica, Mexico, Uruguay[222].	LOW	MEDIUM	LOW	MEDIUM	VERY LOW
Lecanosticta acicola	Brown spot needle blight	*Pinus* spp.	Needle blight that can result in yield losses	Spores are dispersed via wind and rain. The main	China, Georgia, Japan, Korea, Malawi, Canada, Mexico, USA, Belize,	LOW[226]	LOW	MEDIUM	LOW	NEGLIGIBLE

[218] *Fusarium circinatum* spreads via spores which are disseminated by the air and insect vectors. Spores are produced throughout the year. The pathogen can be brought to new areas by seeds, seedlings, soil and plant materials. Pine seeds and seedlings are considered the major pathways of introduction into new countries (Dvorák *et al.* 2017; Vettraino *et al.* 2018).
[220] Oliva *et al.* (2011).
[221] Kazakhstan, Nepal, Canada, USA, Austria, Belarus, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Russian Federation, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine, Serbia and Montenegro and New Zealand. A non-pathogenic form is present in Australia.
[222] Martínez (2005).
[226] There are import restrictions on *L. acicola* in many countries. A latency period exists between initial infection and the first visible symptoms where infected plants appear healthy (van der Nest *et al.* 2019).

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			or tree death[223].	phytosanitary risk is the export and import of infected plant materials[224].	Costa Rica, Cuba, Guatemala, Honduras, Jamaica, Nicaragua, Chile, Colombia, Austria, Belarus, Croatia, Czech Republic, France, Germany, Greece, Italy, Latvia, Lithuania, Macedonia, Slovenia, Switzerland, Ireland, Russia, Portugal, Spain[225].					
Leptographium wageneri	Black stain root disease	Pine	Vascular wilt of mature trees	Natural spread: (i) root contact between adjacent trees, (ii) insect vectors (bark beetles and weevils)[227], and (iii) potentially by water. Trade of host plants or insect vectors in	Canada and USA	MEDIUM	HIGH	HIGH	LOW	LOW

[223]Small yellow irregular spots appear on infected pine needles that become brown over time. They can be surrounded by a yellow halo. The characteristic brown spots develop to form narrow brown bands that result in needle death from the tips down to the point of infection. Needles are prematurely shed, leaving bare branches with new needles at the tips of branches. Infection is usually most severe in the lower parts of the trees and progresses upwards into the canopies. Severe defoliation can lead to reduced or stunted growth that can result in yield losses or tree death (van der Nest *et al.* 2019).
[224]*Lecanosticta acicola* can occur in asexual or sexual states. The pathogen overwinters as acervuli (asexual), ascostromata (sexual) in tissues of either dead or living pine needles. It can also overwinter as vegetative mycelium in the infected needles that remain attached to the host. Conidia or ascospores develop when light, temperature and humidity are favourable (van der Nest *et al.* 2019).
[225] Mullett *et al.* (2018).
[227] Conidia of the fungus occur in a sticky droplet which adheres to an insect. Bark beetles (*Hylastes* spp.) and weevils (*Pissodes* spp. and *Steremnius* spp.) are the main insect vectors (EPPO n.d.).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				wood materials could facilitate international dispersal[228].						
Phakopsora myrtacearum		*Eucalyptus* spp.	Rust pustules are restricted to leaves, causing locally defined lesions (commonly necrotic). No defoliation or shoot dieback have been observed[229].	Wind dispersal of spores. Long distance dispersal most likely from distributed germplasm or plants[230].	Kenya, Mozambique and South Africa	VERY LOW	LOW	LOW	VERY LOW	NEGLIGIBLE
Teratosphaeria destructans (syn. *Kirramyces destructans* and *Phaeophleospora destructans*)	Eucalypt leaf blight	*Eucalyptus* spp.	Serious leaf, bud and shoot blight, leading to premature defoliation and in some instances tree mortality[231].	Wind dispersed spores over long distances. A possible long distance pathway is plants for planting and seeds[232].	China, East Timor, Indonesia, Laos, Thailand, Vietnam, South Africa and Australia (absent - novel taxa: *T. novaehollandiae* and *T. tiwiana* spp. nov.)[233].	HIGH	HIGH	MEDIUM	HIGH	HIGH[234]

[228] International spread would most readily occur by trade of living coniferous host plants. The fungus is not likely to be carried by wood unless it is infested by insect vectors (EPPO n.d.).
[229] Maier *et al.* (2015).
[230]Two possible explanations for the occurrence of *P. myrtacearum* in Africa is (i) a non-native species was introduced (e.g. on germplasm of *Eucalyptus*), or (ii) it is a native rust that has undergone a host shift to *Eucalyptus* (Maier *et al.* 2015).
[231] Andjic *et al.* (2011; 2019)
[232]*Teratosphaeria nubilosa* spores can be ejected from ascomata. This allows the spores to be wind dispersed over considerable distances. The dispersal of *Teratosphaeria* spp. is likely to be further dependent on climatic factors, such as temperature and moisture (relative humidity and rainfall) (Hunter *et al.* 2009; Andjic *et al.* 2011, 2019).
[233] Andjic *et al.* (2016).
[234] Risk ratings were assigned for tropical and subtropical environments. The epidemiology of *T. destructans* in temperate zones is unknown.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Teratosphaeria zuluensis and *T. gauchensis*	Coniothyrium eucalypt canker	*Eucalyptus* spp.	Tree stems, trunks and leaves. Often discrete sunken lesions can coalesce into large necrotic cankers on susceptible trees. Abundant kino exudation and kino in the xylem are caused by the disease. Lesions restrict bark peeling prior to pulping[235].	Asymptomatic infection of live plants and seed[236].	*T. zuluensis*: Africa (South Africa, Malawi, Uganda, Mozambique, Zambia), Asia (Thailand, Vietnam, China) and Mexico. *T. gauchensis*: Africa (Kenya, Ethiopia, Uganda, Zimbabwe), Hawaii, Portugal, South America (Argentina and Uruguay)[237].	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Nematodes										
Bursaphelenchus spp. with insect vectors[238]	Pinewood nematode (PWN) complex	*Pinus* spp. but also other conifers.	Roots, bark, wood and buds but not leaves, cones or fruit.	Insect vectors (regional and international dispersal). Movement in wood and wood packing materials	The genus *Bursaphelenchus* includes more than 100 species worldwide[209]. B. xylophilus- China, Japan, Korea, Taiwan, South	MEDIUM	HIGH[240]	HIGH	HIGH	HIGH

[235] Cortinas *et al.* (2011).
[236] Jimu *et al.* (2015).
[237] Aylward *et al.* (2019).
[238] *Bursaphelenchus* is vectored by beetles particularly *Monochamus* spp. *B. xylophilus* is particularly damaging to pines and is included in this entry. *B. xylophilus* is a National Priority Plant Pest.
[240]The establishment of pinewood nematode requires complex interactions between a pathogenic agent (Pine wood nematode), the insect vector (typically *Monochamus* species), a susceptible tree host (often pine) with associated microbiota (bacteria and Ophiostomatoid fungi).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
				(particularly with blue stain fungi) is another an important pathway[239].	Africa, Canada, Mexico, USA, Portugal and Spain					
Oomycetes										
Phytophthora kernoviae	Phytophthora blight	Wide range (30 species) of trees and shrubs (ornamentals)	Leaf blight, dieback and bleeding cankers. Infection may be latent.	Rain splash disperses zoospores[241]. Potential long-distance dispersal on logs/wood products [242], ornamental or nursery stock (incl. potting mix) and travellers (e.g. footwear).	Chile, Ireland, UK and New Zealand	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Phytophthora pinifolia	Daño Foliar del Pino	*Pinus radiata*. It is highly likely the *Pinus* host list will be wider than just *P.*	Needle necrosis and defoliation. Severe defoliation over years can cause tree death.	Sporangia spread via wind and rain splash onto healthy needles[245]. Potential	Chile	MEDIUM	HIGH	HIGH	HIGH	HIGH

[239]Insect vectors are mainly beetles from a range of families, such as the Cerambycidae, Curculionidae (including subfamily Scolytinae) and Buprestidae. Movement of insect vectors in the international trade of wood and host plants is considered a main pathway for *Bursaphelenchus* spp. dispersal (d'Errico *et al.* 2015). PWN movement in wood, particularly with blue stain fungi is another an important pathway.
[241] Chlamydospores have not been reported for this species.
[242]*P. kernoviae* on logs and wood products (even without bark) and ornamental or nursery stock (incl. potting mix and latent infections) should be of regulatory concern as a potential entry pathway (USDA ARS 2008).
[245]After onset of humid conditions, the pathogen infects needles on lower branches via sporangia formed on infected needles. Sporangia spread via wind and rain splash onto healthy needles and adjacent hosts. If humid conditions persist, *P. pinifolia* produces new sporangia on infected needles causing multi-cyclic infections which gradually move up in each canopy (Duran *et al.* 2008; Jung *et al.* 2018).

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		radiata.	Branch and stem lesions can coalesce to form cankers, girdling and death of young trees[243], [244].	pathways include plants for planting, cut branches, cones, soil or travellers (*e.g.* footwear).						
Phytophthora pluvialis	Red needle cast	*Pinus radiata*	Needle defoliation[246]. Death of fine roots and root tips.	Rain splash and air movement is the most likely drivers of pathogen movement[247]. Potential pathways include plants for planting, cut branches, cones, soil or travellers (*e.g.* footwear).[248].	USA and New Zealand[249].	MEDIUM	HIGH	HIGH	HIGH	HIGH
Phytophthora ramorum[250, 251]	Sudden oak death	Numerous trees and shrubs species	Causes at least three types of disease (lethal	Wind-blown rain and rain splash are the	Canada, USA, Belgium, Croatia, Denmark, Finland,	MEDIUM	HIGH	HIGH	HIGH	HIGH

[243] Duran *et al*. (2008).
[244] Jung *et al*. (2018).
[246] *Phytophthora pluvialis* has caused substantial losses of pine needles in New Zealand since its introduction. Severe disease can almost completely defoliate affected trees, but recovery is common. In the following year, the one-year foliage is unaffected. Growth losses are not always significant unless repeated defoliation occurs. *P. pluvialis* infection can also cause the death of fine roots and root tips (Dick *et al*. 2014; Ganley *et al*. 2014; Scott *et al*. 2019).
[247] Occurrence of *Phytophthora pluvialis* is likely to be dependent on climatic factors, such as temperature, moisture and leaf wetness.
[248] The potential for subsequent spread of the pathogen through the trade of export logs has been demonstrated to be negligible (Dick *et al*. 2014; Ganley *et al*. 2014).
[249] North-western USA - Oregon and New Zealand (initial detection - 2008).
[250] This pest is a National Priority Plant Pest.
[251] https://www.agriculture.gov.au/biosecurity/risk-analysis/plant/importation-phytophthora-ramorum

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION[184]	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
		(including Eucalypts)	cankers, leaf and branch dieback, leaf blotches or spots) on different hosts[252].	most likely mechanism for spread[253]. Baited from rivers and streams, downstream of infested areas[254]. Potential pathways: Plants for planting, plant materials, wood, solid wood packaging materials (particularly untreated wood products) or contaminated soil/water[255].	France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and UK[256].					

[252] Garbelotto & Hayden (2012).

[253] *P. ramorum* has been recovered from plants, rain, soil, litter and stream water from forests with suitable host taxa. Infectious airborne sporangia were not produced in significant numbers on the bole lesions responsible for oak and tanoak mortality but were extremely abundant on foliar lesions of other hosts (Davidson *et al*. 2002; Garbelotto & Hayden 2012).

[254] Grünwald *et al*. (2008).

[255] Tubajika K.M., Singh R. & Shelly J.R. (2008).

[256] A wide host range and the ability to reproduce from chlamydospores for persistence through adverse environmental conditions suggests that *P. ramorum* may have a wide potential distribution without strict controls and regulations (Garbelotto & Hayden 2012). EPPO lists 68 countries that mention *P. ramorum* in their regulations.

References

Agriculture, Fisheries and Forestry – Australia (2000). Forests and Timber: A Field Guide to Exotic Pests and Diseases. Australian Quarantine and Inspection Service, Commonwealth of Australia. Retrieved from: agriculture.gov.au/pests-diseases-weeds/forestry-timber

Andjic V., Carnegie A.J., Pegg G.S., Hardy G.E. St J., Maxwell A., Crous P.W., Pérez C., Wingfield M.J. & Burgess T.I. (2019). 23 years of research on *Teratosphaeria* leaf blight of *Eucalyptus*. *Forest Ecology and Management*, **443**, 19–27.

Andjic V., Dell B., Barber P., Hardy G. E. St. J., Wingfield M.J. & Burgess T.I. (2011). Plants for planting; indirect evidence for the movement of a serious forest pathogen, *Teratosphaeria destructans*, in Asia. *European Journal of Plant Pathology*, **131**, 49–58.

Andjic V., Maxwell A., Hardy G.E. St J. & Burgess T.I. (2016). New cryptic species of *Teratosphaeria* on *Eucalyptus* in Australia. *IMA Fungus*, **7**, 253–263.

Arriel D.A.A., Fonseca N.R., Guimarães L.M.S., Hermenegildo P.S., Mafia R.G., Borges Jr. N., de Souza H.P. & Alfenas A.C. (2014). Wilt and die-back of *Eucalyptus* spp. caused by *Erwinia psidii* in Brazil. *Forest Pathology*, **44**, 255–265.

Asaro C. (2008). Pine Tip Moths, *Rhyacionia* spp. (Lepidoptera: Tortricidae). In: Capinera J.L. (eds) Encyclopedia of Entomology. Springer, Dordrecht.

Aylward J., Roets F., Dreyer L.L. & Wingfield M.J. (2019). Teratosphaeria stem canker of *Eucalyptus*: Two pathogens, one devastating disease. *Molecular Plant Pathology*, **20**, 8–19.

Bezos D., Martínez-Álvarez P., Diez J.J. & Fernández M. (2015). The pine shoot beetle *Tomicus piniperda* as a plausible vector of *Fusarium circinatum* in northern Spain. *Annals of Forest Science*, **72**, 1079–1088.

Birgersson G., Dalusky M.J., Espelie K.E. & Berisford C.W. (2012). Pheromone production, attraction, and interspecific inhibition among four species of Ips bark beetles in the Southeastern USA. *Psyche*, Article ID 532652.

Buhroo A.A. & Lakatos F. (2011). Molecular and morphological diagnostic markers for the Himalayan Ips DeGeer species (Coleoptera: Curculionidae: Scolytinae). *Zootaxa*, **3128**, 47–57.

Burgess T.I. & Wingfield M.J. (2016). Pathogens on the move: A 100 year global experiment with planted eucalypts. *Bioscience*, **67**, 14–25.

Caires N.P., Hermenegildo P.S., Guimarães L.M.S., Mafia R.G., Zauza E.A.V., Borges N. Jr., Badel J.L. & Alfenas A.C. (2019). Host range of *Erwinia psidii* and genetic resistance of *Eucalyptus* and *Corymbia* species to this pathogen. *Forest Pathology*, e12527.

Centre for Agriculture and Bioscience International [CABI] (2020). Crop Protection Compendium - Datasheets. Online Version: cabi.org/cpc/ [accessed January 2020].

Centre for Agriculture and Bioscience International [CABI] (2021). Crop Protection Compendium - Datasheets. Online Version: cabi.org/cpc/ [accessed September 2021].

Chai W.T., Gansau J.A., Atong M., Kadir J., Poili E. & Chong K.P. (2017). First report of *Erwinia psidii* associated with papaya dieback disease in Malaysia. *Malaysian Journal of Microbiology*, **13**, 20–25.

Coleman T.W., Poloni A.L., Chen Y., Thu P.Q., Li Q., Sun J., Rabaglia R.J., Man G. & Seybold S.J. (2019). Hardwood injury and mortality associated with two shot hole borers, *Euwallacea* spp., in the invaded region of southern California, USA, and the native region of Southeast Asia. *Annals of Forest Science*, **76**, 61.

Cortinas M.N., Barnes B.D., Wingfield B.D. & Wingfield M.J. (2011). Unexpected genetic diversity revealed in the Eucalyptus canker pathogen *Teratosphaeria gauchensis*. *Australasian Plant Pathology*, **40**, 497–503.

Coutinho T.A., Brady C.L., van der Vaart M., Venter S.N., Telechea N., Rolfo M., Perez C. & Wingfield M.J. (2011). A new shoot and stem disease of Eucalyptus species caused by *Erwinia psidii*. *Australasian Plant Pathology*, **40**, 55–60.

Crane P.E., Hopkins A.J.M., Dick M.A. & Bulman L.S., (2009). Behaviour of *Neonectria fuckeliana* causing a pine canker disease in New Zealand. *Canadian Journal of Forest Research*, **39**, 2119–2128.

d'Errico G., Carletti B., Schröder T., Mota M., Vieira P. & Roversi P.F. (2015). An update on the occurrence of nematodes belonging to the genus *Bursaphelenchus* in the Mediterranean area. *Forestry*, **88**, 509–520.

Davidson J.M., Rizzo D.M. & Garbelotto M. (2002). *Phytophthora ramorum* and sudden oak death in California: II. Pathogen transmission and survival. USDA Forest Service, 741–749. Retrieved from: nature.berkeley.edu/garbelotto/downloads/davidson2002b.pdf

De Beer Z.W., Duong T.A., Barnes I., Wingfield B.D. & Wingfield M.J., (2014). Redefining *Ceratocystis* and allied genera. *Studies in Mycology*, **79**, 187–219.

Dick M., Williams N., Bader M., Gardner J. & Bulman, L. (2014). Pathogenicity of *Phytophthora pluvialis* to *Pinus radiata* and its relation with red needle cast disease in New Zealand. *New Zealand Journal of Forestry Science*, **44**, 1–12.

Dodds K.J., Aoki C.F., Arango-Velez A., Cancelliere J., D'Amato A.W., DiGirolomo M.F. & Rabaglia R.J. (2018). Expansion of southern pine beetle into northeastern forests: Management and impact of a primary bark beetle in a new region. *Journal of forestry*, **116**, 178–191.

Duran, A., Gryzenhout M., Slippers B., Ahumada R., Rotella A., Flores F., Wingfield B.D. & Wingfield M.J. (2008). *Phytophthora pinifolia* sp nov associated with a serious needle disease of *Pinus radiata* in Chile. *Plant Pathology*, **57**, 715–727.

Dvorák M., Janoš P., Botella L., Rotková G. & Zas R. (2017). Spore dispersal patterns of *Fusarium circinatum* on an Infested Monterey Pine forest in north-western Spain. *Forests*, **8**, 432.

EFSA Panel on Plant Health (2018) Pest categorisation of *Coniferiporia sulphurascens* and *Coniferiporia weirii*. EFSA Journal, **16**, e05302.

EPPO - European and Mediterranean Plant Protection Organization (n.d.) Data Sheets on Quarantine Pests: *Ophiostoma wageneri*. Retrieved from: gd.eppo.int/taxon/LEPGWA/documents

FAO - Food and Agriculture Organisation of the United Nations (2009). Global review of forest pests and diseases: Part II. Profiles of selected forest pests - Diseases; *Armillaria mellea*. Food and Agriculture Organisation of the United Nations - FAO Forestry paper, **156**, p. 123. Retrieved from: fao.org/3/a-i0640e.pdf

FAO - Food and Agriculture Organisation of the United Nations (2009). Global review of forest pests and diseases: Part II. Profiles of selected forest pests - Diseases; Chrysoporthe cubiensis. Food and Agriculture Organisation of the United Nations - FAO Forestry paper, **156**, p. 129. Retrieved from: fao.org/3/a-i0640e.pdf

Fernandez Winzer L., Carnegie A.J., Pegg G.S. & Leishman M.R. (2017). Impacts of the invasive fungus *Austropuccinia psidii* (myrtle rust) on three Australian Myrtaceae species of coastal swamp woodland. *Austral Ecology*, **43**, 56–68.

Floyd R., Wylie R., Old K., Dudzinski M. & Kile G. (1998). Pest Risk Analysis of *Eucalyptus* spp. at risk from incursions of plant pests and pathogens through Australia's northern border. CSIRO Entomology, Australia.

Forestry Commission UK (2016). Contingency Plan for Pitch Canker of Pine (*Fusarium circinatum*), Retrieved from: https://www.forestresearch.gov.uk/documents/7299/Contingency-plan-Pitch-canker-of-pine-published-_Sept-05-2016.pdf

Ganley R.J., Williams N.M., Rolando C.A., Hood I.A., Dungey H.S., Beets P.N. & Bulman L.S. (2014). Management of red needle cast, caused by *Phytophthora pluvialis*, a new disease of Radiata pine in New Zealand. *New Zealand Plant Protection - South East*, **67**, 48–53.

Garbelotto M. & Hayden K.J. (2012). Sudden oak death: Interactions of the exotic oomycete *Phytophthora ramorum* with naïve North American hosts. *Eukaryotic Cell*, **11**, 1313–1323.

Grünwald N.J., Goss E.M. & Press C.M. (2008). *Phytophthora ramorum*: A pathogen with a remarkably wide host range causing sudden oak death on oaks and ramorum blight on woody ornamentals. *Molecular Plant Pathology*, **9**, 729–740.

Hermenegildo P.S., Santos S.A., Guimarães L.M.S., Pereira I.C., Vidigal P.M.P., Badel J.L., Alfenas-Zerbini P., Mafia R.G., Ferreira M.A.S.V. & Alfenas A.C. (2019). Draft Genome Sequence of *Erwinia psidii*, Causal Agent of Bacterial Blight of Guava (*Psidium guava*) and Dieback of Eucalypt (*Eucalyptus* spp.). *Microbiology Resource Announcements*, **8**, e01598-18.

Holland L.A., Lawrence D.P., Nouri M.T., Travadon R., Harrington T.C. & Trouillas F.P. (2019). Taxonomic revision and multi-locus phylogeny of the North American clade of Ceratocystis. *Fungal Systematics and Evolution*, **3**, 135–156.

Hunter G.C., Crous P.W., Carnegie A.J. & Wingfield M.J. (2009). *Teratosphaeria nubilosa*, a serious leaf disease pathogen of *Eucalyptus* spp. in native and introduced areas. *Molecular Plant Pathology*, **10**, 1–14.

Janse J.D. (2012). Bacterial diseases that may or do emerge, with (possible) economic damage for Europe and the Mediterranean basin: Notes on epidemiology, risks, prevention and management on first occurrence. *Journal of Plant Pathology*, **94**, 5–29.

Jimu L., Kemler M., Wingfield M.J., Mwenje E. & Roux J. (2015). The Eucalyptus stem canker pathogen *Teratosphaeria zuluensis* detected in seed samples. *Forestry*, **89**, 316–324.

Jung T., Pérez-Sierra A., Durán A., Horta Jung M., Balci Y. & Scanu B. (2018). Canker and decline diseases caused by soil- and airborne *Phytophthora* species in forests and woodlands. *Persoonia*, **40**, 182–220.

Kamgan N.G., Wingfield M.J., Mohammed C., Carnegie A.J., Pegg G.S. & Roux J. (2012) *Ceratocystis* species, including two new species associated with nitidulid beetles, on eucalypts in Australia. *Anton Leeuw*, **101**, 217–241.

Kerdelhué C., Zane L., Simonato M., Salvato P., Rousselet J., Roques A. & Battisti A. (2009). Quaternary history and

contemporary patterns in a currently expanding species. *BMC Evolutionary Biology*, **9**, 220.

Lanfranco D. & Dungey H.S. (2001). Insect damage in *Eucalyptus*: A review of plantations in Chile. *Austral Ecology*, **26**, 477–481.

Li H.F., Fujisaki I. & Su N.Y. (2013). Predicting habitat suitability of *Coptotermes gestroi* (Isoptera: Rhinotermitidae) with species distribution models. *Journal of Economic Entomology*, **106**, 311–321.

Li Q., Harrington T.C., McNew D. & Li J. (2017). *Ceratocystis uchidae* sp. nov., a new species on Araceae in Hawaii and Fiji. *Mycoscience*, **58**, 398–412.

Liu F.F., Barnes I., Roux J., Wingfield M.J. & Chen S.F. (2018). Molecular phylogenetics and microsatellite analysis reveal a new pathogenic *Ceratocystis* species in the Asian-Australian clade. *Plant Pathology*.

Lynch S.C., Twizeyimana M., Mayorquin J.S., Wang D.H., Na F., Kayim M., Kasson M.T., Thu, P.Q., Bateman C., Rugman-Jones P., Hulcr J. Stouthamer S. & Eskalen A. (2016). Identification, pathogenicity and abundance of *Paracremonium pembeum* sp. nov. and *Graphium euwallaceae* sp. nov. —two newly discovered mycangial associates of the polyphagous shot hole borer (*Euwallacea* sp.) in California. *Mycologia*, **108**, 313–329.

Mapondera T.S., Burgess T., Matsuki M. & Oberprieler R.G. (2012). Identification and molecular phylogenetics of the cryptic species of the *Gonipterus scutellatus* complex (Coleoptera: Curculionidae: Gonipterini) *Australian Journal of Entomology*, **51**, 175–188.

Martínez S. (2005). *Inocutis jamaicensis*, the causal agent of eucalypt stem rot in Uruguay. *Mycotaxon*, **91**, 165–171.

Montoya-Estrada C.N., Costa C.R., Badel J.L., Guimarães L.M.S. & Alfenas A.C. (2018). Root infection and aerial colonization of eucalypt host plants by *Erwinia psidii*. *Tropical Plant Pathology*, **44**, 251–257.

Mullett M.S., Adamson K., Bragança H., Bulgakov T.S., Georgieva M., Henriques J., Jürisoo L., Laas M. & Drenkhan R. (2018). New country and regional records of the pine needle blight pathogens *Lecanosticta acicola, Dothistroma septosporum* and *Dothistroma pini*. *Forest Pathology*, **48**, e12440.

Nakabonge G., Roux J., Gryzenhout M. & Wingfield M.J. (2005). Distribution of Chrysoporthe canker pathogens on *Eucalyptus* and *Syzygium* species in eastern and southern Africa. *Plant Disease*, **90**, 734–740.

Oliva J., Bendz-Hellgren M. & Stenlid J. (2011). Spread of *Heterobasidion annosum* s.s. and *Heterobasidion parviporum* in *Picea abies* 15 years after stump inoculation. *FEMS Microbiology Ecology*, **75**, 414–429.

Pegg G., Taylor T., Entwistle P., Guymer G., Giblin F. & Carnegie A. (2017). Impact of *Austropuccinia psidii* (myrtle rust) on Myrtaceae-rich wet sclerophyll forests in south east Queensland. *PLoS ONE*, **12**, e0188058.

Robertson L., Garcia-Alvarez A., Arcos S.C., Diez-Rojo M.A., Mansilla J.P., Sanz R., Martinez C., Escuer M., Castresana L., Notario A., Bello A. & Arias M. (2008). Potential insect vectors of *Bursaphelenchus* spp. (Nematoda: Parasitaphelenchidae) in Spanish pine forests. In: Mota M.M. & Vieira, P. (Eds). Pine wilt disease: A worldwide threat to forest ecosystems. Dordrecht, The Netherlands, Springer, pp. 221–233.

Robinet C., Imbert C.E., Rousselet J., Sauvard D., Garcia J., Goussard F. & Roques A. (2012) Human-mediated long-distance jumps of the pine processionary moth in Europe. *Biological Invasions*, **14**, 1557–1569.

Scheffrahn R.H. & Crowe W. (2011). Ship-borne termite (Isoptera) border interceptions in Australia and onboard infestations in Florida, 1986–2009. *Florida Entomologist*, **94**, 57–63.

Schiff N.M., Valley S.A., LaBonte J.R. & Smith D.R. (2006) Guide to the Siricid wood wasps of North America. USDA Forest Service: Forest Health Technology Enterprise Team, pp. 91–95. Retrieved from: fs.fed.us/foresthealth/technology/pdfs/GuideSiricidWoodwasps.pdf

Scott P.M., Taylor P. & Williams N. (2019). Contrasting the infection and survival of *Phytophthora pluvialis* and *Phytophthora cinnamomi* in *Pinus radiata* roots. *Australasian Plant Pathology*, **48**, 193–199.

Smith S.M., Gomez D.F., Beaver R.A., Hulcr J. & Cognato A.I. (2019) Reassessment of the species in the *Euwallacea fornicatus* (Coleoptera: Curculionidae: Scolytinae) complex after the rediscovery of the "lost" type specimen. *Insects*, **10**, 261.

Stewart J.E., Ross-Davis A.L., Graça R.N., Alfenas A.C., Peever T.L., Hanna J.W., Uchida J.Y., Hauff R.D., Kadooka C.Y., Kim M.-S., Cannon P.G. Namba S., Simeto S., Pérez C.A., Rayamajhi M.B., Lodge D.J., Arguedas M., Medel-Ortiz R., López-Ramirez M.A., Tennant P., Glen M., Machado P.S., McTaggart A.R., Carnegie A.J. & Klopfenstein, N.B. (2017). Genetic diversity of the myrtle rust pathogen (*Austropuccinia psidii*) in the Americas and Hawaii: Global implications for invasive threat assessments. *Forest Pathology*, e12378.

Thorpe D.J., Harrington T.C. & Uchida J.Y. (2005). Pathogenicity, internal transcribed spacer-rDNA variation, and human dispersal of *Ceratocystis fimbriata* on the family Araceae. *Phytopathology*, **95**, 316–323.

Tubajika K.M., Singh R. & Shelly J.R. (2008). Preliminary observations of heat treatment to control *Phytophthora ramorum* in infected wood species: an extended abstract. Proceedings of the sudden oak death third science symposium. General

Technical Report PSW-GTR-214. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, pp. 275–279. Retrieved from: https://ucanr.edu/sites/WoodyBiomass/newsletters/Heat_Treatment_of_SOD_Infected_Wood31538.pdf

Turner R.M., Brockerhoff E.G., Bertelsmeier C., Blake R.E., Caton B., James A., MacLeod A., Nahrung H.F., Pawson S.M., Plank M.J., Pureswaran D.S., Seebens H., Yamanaka T. & Liebhold A.M. (2021). Worldwide border interceptions provide a window into human-mediated insect movements. *Ecological applications*, **31**, e02412. https://doi.org/10.1002/eap.2412

USDA ARS – United States Department of Agriculture, Agricultural Research Services (2008). Recovery Plan for *Phytophthora kernoviae*: Cause of Bleeding Trunk Cankers, Leaf Blight and Stem Dieback in Trees and Shrubs. U.S. Department of Agriculture. Retrieved from: ars.usda.gov/ARSUserFiles/00000000/opmp/P.%20kernoviae%2081100.pdf

van der Merwe N.A., Gryzenhout M., Steenkamp E.T., Wingfield B.D. & Wingfield M.J. (2010). Multigene phylogenetic and population differentiation data confirm the existence of a cryptic species within *Chrysoporthe cubensis*. *Fungal Biology*, **114**, 966–979.

van der Merwe N.A., Steenkamp E.T., Rodas C., Wingfield B.D. & Wingfield M.J. (2012) Host switching between native and non-native trees in a population of the canker pathogen *Chrysoporthe cubensis* from Colombia. *Plant Pathology*, **62**, 642–648.

van der Nest A., Wingfield M.J., Janoušek J. & Barnes I. (2019). *Lecanosticta acicola*: A growing threat to expanding global pine forests and plantations. *Molecular Plant Pathology*, **20**, 1327–1364.

Vettraino A.M., Potting R. & Raposo R. (2018). EU legislation on forest plant health: An overview with a focus on *Fusarium circinatum*. *Forests*, **9**, 568.

Williams R.E., Shaw C.G., Wargo P.M. & Sites W.H. (1986). Armillaria Root Disease. Forest Insect & Disease Leaflet 78. United States Department of Agriculture Forest Service, Washington, DC.

Wondafrash M., Slippers B., Garnas J., Roux G., Foit J., Langor D.W. & Hurley B.P. (2016). Identification and genetic diversity of two invasive *Pissodes* spp. Germar (Coleoptera: Curculionidae) in their introduced range in the southern hemisphere. *Biological Invasions*, **18**, 2283–2297.

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Plant Health Australia
ABN 97 092 607 997
Level 1, 1 Phipps Close
Deakin ACT 2600

Phone 02 6215 7700
Email biosecurity@phau.com.au
planthealthaustralia.com.au

Plant Health AUSTRALIA

EXOTIC PLANT PEST HOTLINE
1800 084 881

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