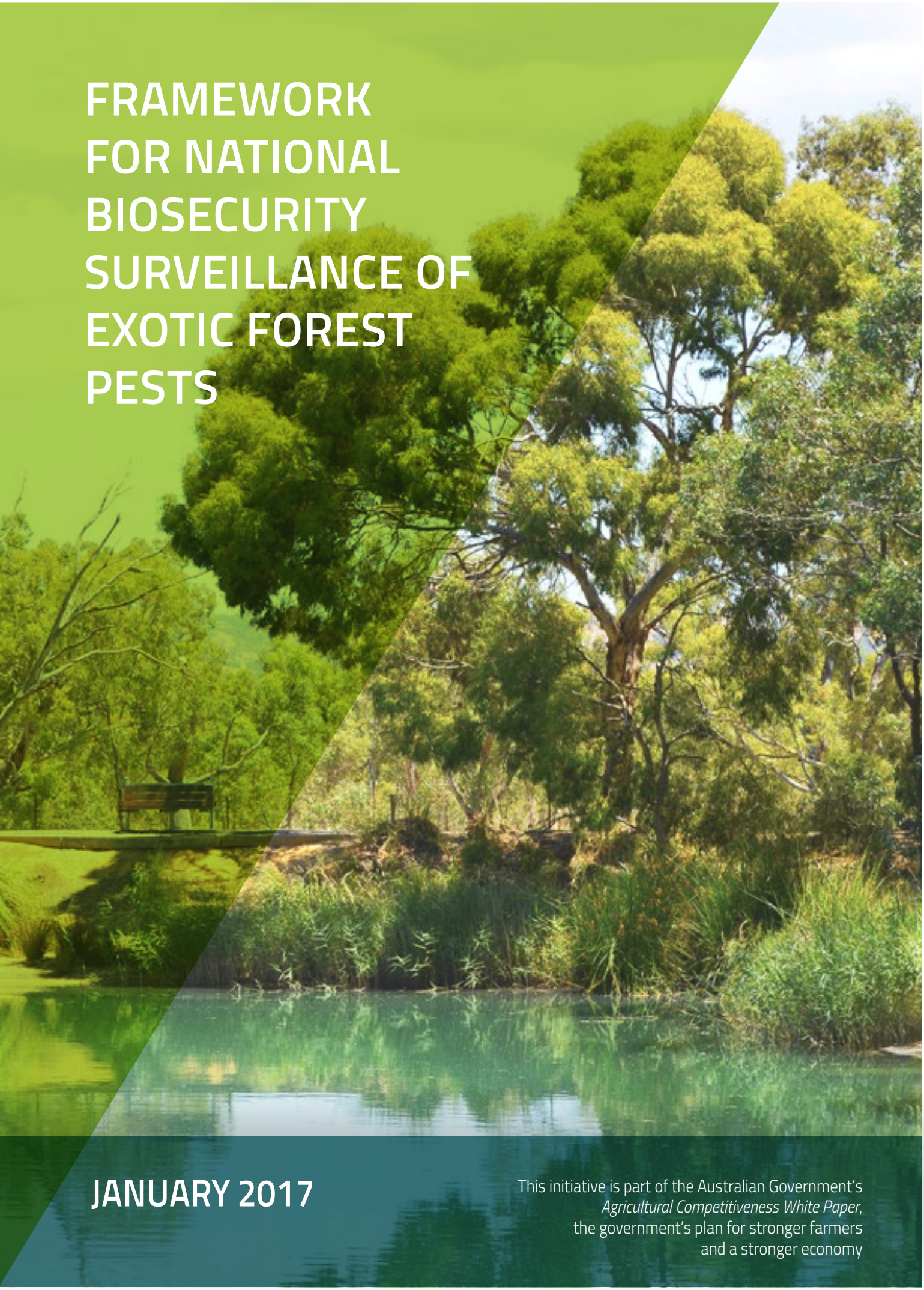
FRAMEWORK FOR NATIONAL BIOSECURITY SURVEILLANCE OF EXOTIC FOREST PESTS



JANUARY 2017

This initiative is part of the Australian Government's *Agricultural Competitiveness White Paper*, the government's plan for stronger farmers and a stronger economy

Australian Government
Department of Agriculture and Water Resources

Plant Health AUSTRALIA

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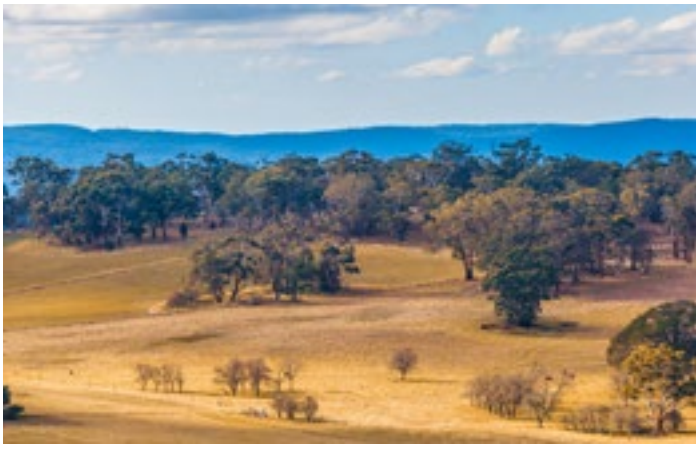


Acronyms

ACIAR	Australian Centre for International Agricultural Research
AFPA	Australian Forest Products Association
ALA	Atlas of Living Australia
AOP	Authorised Officer Program
APPD	Australian Plant Pest Database
BOLT	Biosecurity On-Line Training
CEBRA	Centre for Exotic Biosecurity Risk Analysis
DAWR	Department of Agriculture and Water Resources
EPPRD	Emergency Plant Pest Response Deed
FHaB	Forest Health and Biosecurity Subcommittee
FHS	Forest Health Surveillance
FWPA	Forest and Wood Products Australia
GVP	Gross Annual Value of Production
HPP	High Priority Pest
HRSS	High Risk Site Surveillance
IBIS	International Biosecurity Intelligence System
IGAB	Inter-Governmental Agreement on Biosecurity
IPMG	Industry Plantation Management Group
ISPM	International Standards for Phytosanitary Measures
IUFRA	International Union of Forest Research Organizations
NAQS	Northern Australia Quarantine Service
NBC	National Biosecurity Committee
NDP	National Diagnostic Protocols
NEBRA	National Environmental Biosecurity Response Agreement
NMDS	National Minimum Data Specifications
NPBDN	National Plant Biosecurity Diagnostic Network
NPBDS	National Plant Biosecurity Diagnostic Strategy
NPBS	National Plant Biosecurity Strategy
NPBSS	National Plant Biosecurity Surveillance Strategy
NPHSP	National Plant Health Surveillance Program
PaDIL	Pest and Disease Image Library
PBCRC	Plant Biosecurity Cooperative Research Centre
PHA	Plant Health Australia
PHC	Plant Health Committee
PFIBP	Plantation Forest Industry Biosecurity Plan
PLANTPLAN	Australian Emergency Plant Pest Response Plan
QAP	Quarantine Approved Premises
RD&E	Research, Development and Extension
SNFH	Subcommittee on National Forest Health
SNPHS	Subcommittee on National Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
WTO	World Trade Organization

Definitions

Forests are defined as collections of plants wherein tree species form a significant part of the whole. They exist at a variety of scales and environments ranging from urban forests, to plantation forests, to native woodlands and forests. Includes native tree species as well as exotic tree species important for wood production or as amenity trees.

Forest Products refer to traditional wood-based products such as firewood, timber and paper, but also include non-wood products such as native flowers, essential oils, honey production and forest-based services such as carbon sequestration, water catchment protection, tourism and recreation.

The **Forest Sector** involves multiple stakeholders directly or indirectly connected to forests, including: wood products growers and processors, non-wood products forest-based industries, government forestry agencies and government conservation agencies.

Forest Health refers to the status of key ecological and physiological processes (e.g. growth, photosynthesis, respiration, nutrition, water uptake) of the forest species. In a healthy forest these processes are operating within their normal bounds, while in an unhealthy forest these processes are abnormal and may lead to decline. Implicit in this definition are the effects of biotic (e.g. pests and pathogens) and abiotic (e.g. nutrients, climatic) agents as well as cultural practices (e.g. cultivation, thinning) that may cause these processes to shift outside their normal bounds.

Forest Biosecurity is the range of activities and processes that are used to manage the risks to forest health posed by the entry, establishment and spread of exotic pests and pathogens. In the context of this document forest biosecurity may refer to:

- biosecurity at national and individual state levels
- surveillance and monitoring for exotic forest pests pre-border, at the border and post-border
- all the activities in support of surveillance such as intelligence gathering, networking, risk analysis, pathways analysis and diagnostics.

Forest Pests are any biological species, strain or biotype that has a negative impact or poses a likely threat of having an impact on trees and forests and their associated products or ecosystem services. Weeds are not considered in this document.

Endemic Pests are known to occur naturally in Australia.

Exotic Pests are not currently present, or established, in Australia.

Established Pests are exotic pests that have become established in Australia.

Executive Summary

A Framework for National Biosecurity Surveillance of Exotic Forest Pests

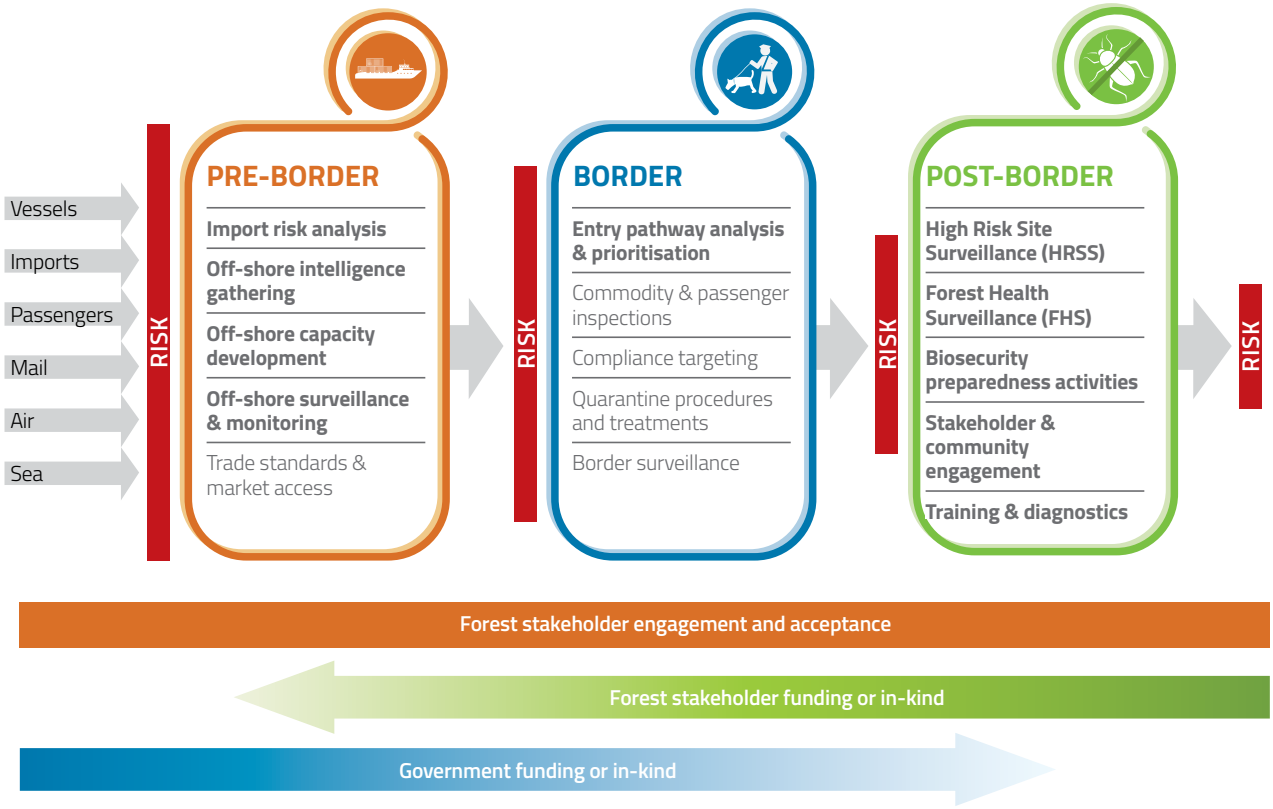
This Framework recognises that there is an initial need to effectively gather together and engage the multitude of stakeholders in the forest sector in order to drive fair investment in forest biosecurity. The recommendations contained in this Framework outline a system wherein the forest sector would, where appropriate, provide funding, in-kind operational support or provision of forest-specific expertise to assist or undertake the activities along Australia's biosecurity continuum (**Figure 1**).

The forest sector is already undertaking forest health surveillance and is well placed to assist with High Risk Site Surveillance. Government expertise and information is needed to support these post-border activities. Pre-border and border activities undertaken by Australian Government and state agencies such as pathways analysis, import risk analysis, surveillance, offshore intelligence gathering and capacity building all need to be reviewed and be considered in light of the threats posed by exotic forest pests.

The results of these activities need to be shared with the forest sector to assist benchmarking and improve the targeting of post-border surveillance. In turn, forest sector expertise and data can assist in guiding some of these activities.

In summary, the greater engagement and collaboration between the forest sector and government biosecurity agencies will allow biosecurity activities along the continuum to detect not only exotic pests important to Australia's agricultural sector but also those that affect the forest sector. This would better serve the needs of the forest industry and provide greater protection to the entirety of Australia's forests including conservation native forests and urban forests.

Figure 1: Stakeholder responsibility and investment across the biosecurity continuum



Stakeholder engagement and acceptance is fundamental to obtaining adequate funding from government and the forest sector. Bottom arrows indicate levels of government and forest sector responsibility and investment (cash or in-kind) along the continuum from high (dark shading) to low (light shading). Bold type indicates activities for future improved collaboration.

List of recommendations

Fundamental activities

Coordination	1.1 Improve national and government/ industry coordination of forest biosecurity surveillance including the appointing of a National Forest Biosecurity Coordinator
Stakeholder Engagement	1.2 Engage with a range of stakeholders in forest biosecurity and where possible include an analysis of the costs and benefits of biosecurity activities
Funding	1.3 That a working group be set up to resolve short to long term funding mechanisms

Capacity building

Pest Knowledge	2.1 Review and update knowledge regarding species of forest pest already present in Australia and the current list of forest High Priority Pests not present in Australia
Data Collection and Reporting	2.2 That forest sector surveillance data complies to standards (NMDS and ISPM) and is collated regionally and nationally
Training and Tools	2.3 Develop and implement training materials addressing forest biosecurity skill gaps across the forest sector 2.4 Develop and implement agreed methods and tools for coordination of forest health and biosecurity surveillance
Diagnostics	2.5 Review diagnostic capabilities specific to exotic forest pests and fill skill capacity gaps

Pre-border

3.1 Ensure relevant information is available from Australian Government to industry regarding what, where and how pre-border forest pest surveillance and capacity training is undertaken

3.2 Review current pre-border activities that relate to exotic forest pests and improve as needed

Border

4.1 Obtain data regarding border pest interceptions, pathway analysis and high risk points of entry that relate to forest pests

4.2 Review current national and state border activities in consideration of exotic forest pests and improve as needed

Post-border

High Risk Site Surveillance (HRSS)	5. 1 Develop national High Risk Site Surveillance program for detecting exotic forest pests
Forest Health Surveillance (FHS)	5.2 Develop tools and methods to allow operational forest health surveillance to contribute to area freedom status and early detection of exotic forest pests
Preparedness	5.3 Review current preparedness arrangements for emergency response to key exotic forest pests and implement improvements (e.g. generic incursion response plans)

Context

Funding for the development of this Framework for National Biosecurity Surveillance of Exotic Forest Pests (the Framework) was provided by the Australian Government Department of Agriculture and Water Resources (DAWR). A working group of forest health and biosecurity experts were asked to make suggestions for improvements to Australia's biosecurity with regards to the specific threats posed by exotic forest pests.
A workshop was held in Sydney, NSW, on 11 August 2015 to discuss the broad outlines of such a Framework.

Aims

This Framework for National Biosecurity Surveillance of Exotic Forest Pests aims to identify opportunities to strengthen current arrangements for the surveillance of exotic pests that threaten Australian forests and their stakeholders. As surveillance activities do not occur in isolation, improvements along the entire biosecurity continuum are suggested.

The Framework does not aim to duplicate work already being implemented by national plant biosecurity surveillance and diagnostic strategies but rather aims to complement them by including the specific needs of the forest stakeholders. It could be used by government and industry alike to:

- minimise the number and cost of incursion responses
- minimise the economic, environmental and social impacts resulting from exotic forest pests becoming established
- protect Australia's forest dependent industries
- maintain access to markets for forest sector products
- integrate forest biosecurity surveillance with wider plant surveillance activities
- improve communication and engagement between the forest sector and biosecurity agencies
- improve capability and capacity in forest biosecurity.

Scope

The proposed Framework aims to be a guide for how best to ensure the ongoing protection of Australia's tree and forest resources (planted, native or amenity). Its scope is limited to:

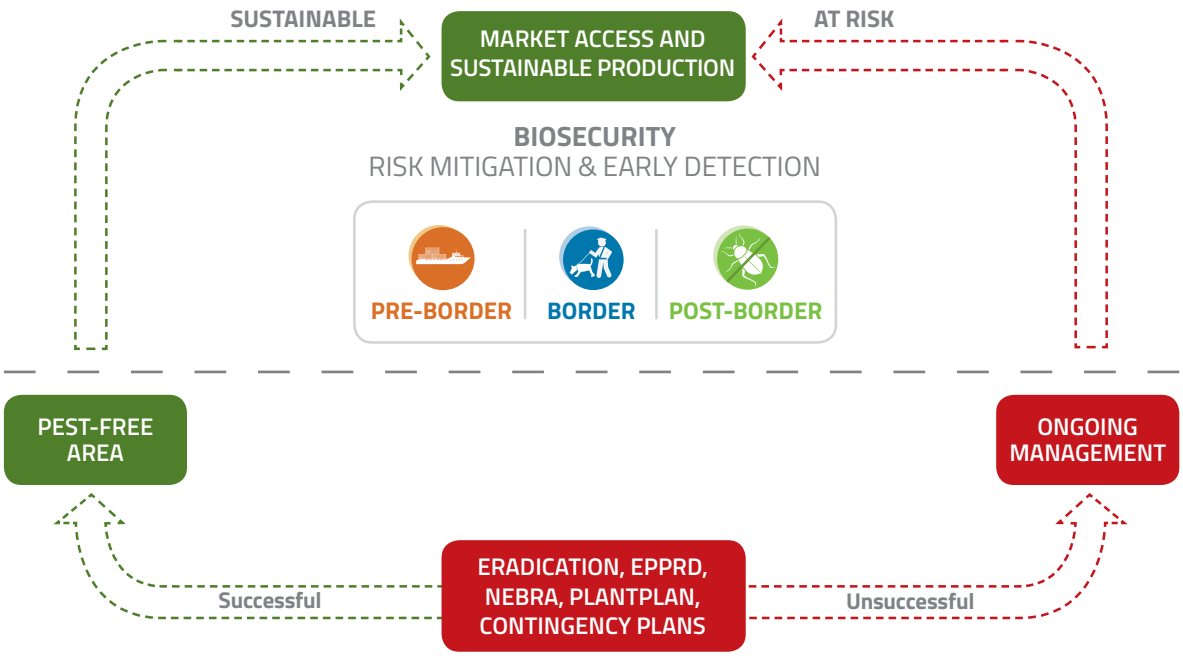
- highlighting any deficiencies in the current biosecurity system with regards to preventing the establishment of exotic forest pests
- providing recommendations to improve outcomes through strengthening current biosecurity arrangements.

The Framework does not cover the current arrangements for eradication of new incursions of exotic forest pests (**Figure 2**). These are covered within PLANTPLAN, the EPPRD and NEBRA (**see Acronyms**).

The implementation of the recommendations highlighted in this Framework is beyond the scope of this document although some suggestions are made where appropriate. Implementation will entail separate exercises to:

- set up formal arrangements to coordinate and, where necessary, fund biosecurity efforts between the forest sector, government agencies and community stakeholders
- conduct a gap analysis of the operational capabilities and capacity of government and industry groups to ensure effective implementation
- assign roles and responsibilities for activities set out in this Framework
- develop a work plan for agencies, industry and community groups to undertake their respective roles.

Figure 2: Scope of the Proposed National Biosecurity Forest Pest Surveillance Framework



The scope of this framework is limited to activities along the biosecurity continuum (pre-border, at the border and post-border) that are aimed at improving early detection of any exotic forest pest incursions thereby preventing their establishment in Australia (above the dashed line). Activities and arrangements relating to the eradication of an exotic pest should it enter the country are beyond the scope of this document.

Introduction

Australia has 123 million hectares (98%) of native forests and 2 million hectares (2%) of plantation forests: this comprises the seventh largest forest estate in the world (MPIG 2013). A further category commonly termed 'urban forests' is comprised of the collection of tree species in parklands, reserves and along streets in urban areas around Australia. The total area of urban forests in Australia has not been quantified.

Australia's forests are large and diverse encompassing native forests, planted forests and urban forests that provide many benefits to a multitude of stakeholders.

The forest wood, paper and timber products industry generated a gross annual value of production (GVP) from production forests (31% of the total forest) in excess of $20 billion and an industry value-added of $7 billion in 2012–13, making it the eighth largest manufacturing sector in Australia (SOFR 2013). Additionally, Australian non-wood forest products regarded as having high forest dependence, such as essential oils, honey and native bush foods, have an estimated GVP of $198 million (MPIG 2013). This compares to the combined GVP of $8.9 billion for horticulture (vegetables, fruit, nuts etc), $7.9 billion for wheat, $2.1 billion for oilseeds, $2.4 for barley, $2.0 billion for cotton and $1.2 billion for sugar (ABS 2015). The forest industry also directly employs 75,000 people, mainly in regional communities (MPIG 2013).

Many forests are managed to preserve values that are difficult to quantify in economic terms such as biodiversity, tourism, recreation and amenity. Forest environmental services such as carbon sequestration, soil conservation and watershed protection are also difficult to quantify. In an urban context forests can provide a range of services such as carbon sequestration, reduction of energy costs and improved air and water quality (**see Case Study 1**). Unfortunately, data of the dollar value for non-commercial forest-based services is mostly limited to case studies and dependent on subjective valuations (ABARES 2013; NUFA 2014). Nonetheless, it is widely accepted that forests and trees have a value beyond traditional commercial wood products. Protection of Australia's forest resources through a strong biosecurity system would contribute to the sustainability of Australia's forest industry and economy as well as its environment and communities.

The forest sector makes a significant contribution to the Australian economy, environment and community.

Over 70 exotic pests of arborescent hosts have established in Australia since 1900 (Carnegie, unpublished). One-in-five (20%) of these exotic species have caused significant impacts to amenity, plantation or natural forests and/or require significant expenditure for ongoing management (**Figure 3**). Examples include *Dothistroma septosporum* and *Sirex noctilio* on *Pinus*, *Puccinia psidii* on Myrtaceae, and *Melampsora larici-populina* on poplar. Only one has been successfully eradicated (pine wood nematode, *Bursaphalenchus hunanensis*) due to early detection within metropolitan Melbourne (Smith et al. 2008). The costs of ongoing management if eradication is unsuccessful can be significant. For example, outbreaks of *Sirex noctilio* in the Green Triangle killed over 8 million trees and cost $1.5 million (in 1990 dollars) to bring the outbreak under control (Haugen 1990), while continued management is estimated at $500,000 to $1 million annually (Carnegie and Bashford 2012).

The threat of damage from exotic forest pests is real and ever-increasing. Future protection of forest assets in Australia is dependent on robust biosecurity.

Biosecurity involves a continuum of activities from the pre-border to post-border (Mohammed et al. 2011, Bashford 2012, PHA 2013c). The Australian and state governments bear legislative and operational responsibilities for pre-border and border control. Under the principle of 'shared responsibility' industry groups and the community may also play a role in biosecurity (**Figure 4**).

Australia has a robust and improving biosecurity system based on a continuum of prevention and early detection activities pre-border, at the border and post-border.

CASE STUDY 1 - URBAN FOREST VALUES

Brisbane City Council, Queensland

575,000 street trees with 2,000 hectares of canopy coverage, stratified random sample over 80 plots of 16,600 trees, extrapolated across entire tree population.

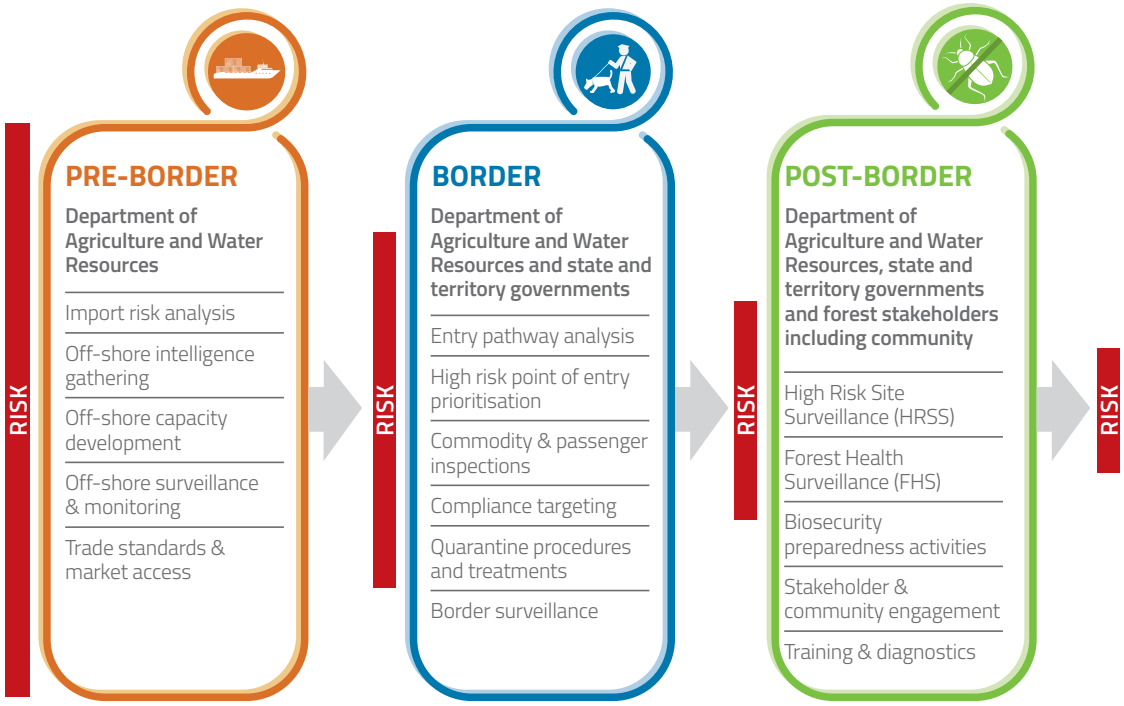
	ANNUAL	$AUD
Carbon dioxide sequestered:	7,300 tonnes	168,000
Air pollution removal:	87,200 tonnes	44,200
Rainfall interception:	653,733 m^3	1,444,533

NUFA (2014)

Figure 3: Cumulative establishments of arborescent pests in Australia

Cumulative establishments of arborescent pests in Australia from pine hosts (mainly Pinus) or other host genera, including Eucalyptus, Quercus, Populus and Salix. Red = significant pests. (Carnegie, unpublished).

Figure 4: Roles and responsibilities along the bioescurity continuum



The biosecurity continuum pre-border, at the border and post-border highlighting main groups responsible along it. Federal Government resources and responsibilities are concentrated pre-border and at the border, while stakeholders and the community play a more active role post-border. Adapted from the National Plant Biosecurity Surveillance Strategy 2013.

A review of Australia's biosecurity system (Beale et al. 2008) has led to a significant restructure of Australia's biosecurity. Australian and state governments have agreed to align legislation and operational arrangements through the Inter-Governmental Agreement on Biosecurity (IGAB; COAG 2012a). Industry has been asked to contribute to eradication efforts of exotic pest incursions by signing up to the cost-sharing arrangements outlined in the Emergency Plant Pest Response Deed (EPPRD; COAG 2012b). In turn, a technical emergency plant pest response plan – PLANTPLAN (PHA 2010a) – has been drawn up to provide nationally consistent guidelines on how to respond in the event of an Emergency Plant Pest incident.

The plantation segment of the forest sector, via the Australian Forest Products Association (AFPA), signed the EPPRD in 2013. The agreed biosecurity arrangements are broadly outlined in the Plantation Forest Industry Biosecurity Plan (PHA 2013a). Also, a Biosecurity Manual for the Plantation Timber Industry (PHA 2015) has been produced to highlight steps that the industry can undertake to improve biosecurity at an operational level. Native forests have their arrangements covered separately in the National Environmental Biosecurity Response Agreement (NEBRA, COAG, 2012b).

Urban forests are covered under NEBRA or EPPRD: the recent giant pine scale (*Marchalina hellenica*) response highlights the ambiguity over urban tree species that are also used in commercial plantations (e.g. *Pinus* spp.). All of the above documents set out the arrangements, roles and responsibilities in response to an exotic forest pest incursion. However, they do not address the necessary arrangements to improve prevention of incursions or early detection of exotic forest pests.

Australia's current arrangements for prevention and early detection of exotic forest pests along the biosecurity continuum are not clearly defined.

As part of the review process to improve biosecurity a National Biosecurity Committee (NBC) was set up. NBC subsequently formed a Plant Health Committee (PHC) responsible for guiding improvements in plant biosecurity through the strategies outlined in the National Plant Biosecurity Strategy (NPBS; PHA 2010b). The NPBS has in turn led to the National Plant Biosecurity Diagnostic Strategy (PHA 2012) and the National Plant Biosecurity Surveillance Strategy (PHA 2013c) (**Figure 5**). Implementation of the recommendations outlined in these documents has led to improvements to plant biosecurity and forest biosecurity.

Figure 5: Outline of part of Australia's National Plant Biosecurity decision support structures

NBC Members and observers

- Dept. of Agriculture and Water Resources
- Dept. of Primary Industries (NSW)
- Dept. of Economic Development, Jobs Transport and Resources (VIC)
- Dept. of Primary Industry and Fisheries (NT)
- Dept. of Primary Industries, Parks, Water and Environment (TAS)
- Dept. of Primary Industries and Regions (SA)
- Dept. of Agriculture and Food (WA)
- Dept. of Agriculture and Fisheries (QLD)
- Territory and Municipal Services Directorate (ACT)
- Plant Health Australia (PHA)
- Nominated experts

Outline of part of Australia's National Plant Biosecurity decision support structures. A number of strategy documents have been prepared to guide improvements to the biosecurity system. The various committees are mostly made up of representatives of federal and state government agencies. Plant industry groups (including forestry) are represented indirectly through Plant Health Australia. Scientific and policy experts may also be nominated to participate in the committees.

Historically, links between state-owned forest departments and primary industry agencies (legally responsible for biosecurity) led to close collaboration in biosecurity matters. More recently however, there has been a growing privatisation of government-held forest assets and disbandment of government forestry agencies across Australia. This has resulted in a growing disconnect between forest owners/managers and technical expertise in forest biosecurity within government agencies. Furthermore, agriculture-focused agencies dominate the decision-making groups of Australia's biosecurity structures (**Figure 4**). The forest sector is represented indirectly through Plant Health Australia (AFPA is a member of PHA) and forest health experts sit as observers in both the national subcommittees on surveillance (SNPHS) and diagnostics (SPHD) (**Figure 4**). It is fair to say that Australian biosecurity systems have focused on agriculture, while fewer planning, resourcing and preparedness efforts have been directed specifically at forest biosecurity. Recent forest pest introductions such as myrtle rust and giant pine scale have demonstrated that there is room for improvements.

Australia's plant biosecurity system, focused on the protection of Australia's agricultural industries, may not be adequately protecting Australia's forest resources.

Key concepts

With regards to the biosecurity threats posed by exotic forest pests the authors emphasise that:

1. The forest sector is unique in that it broadly encompasses planted forests, native forests and urban forests involving a multitude of stakeholders.
2. Forests make a significant contribution to the Australian economy, environment and community.
3. Exotic forest pests pose a real and increasing threat to all forest stakeholders.
4. Australia's plant biosecurity system, focused on the protection of Australia's agricultural industries, may not be adequately mitigating the risks posed by exotic pests to Australia's forests.
5. Current arrangements for prevention and early detection of exotic forest pests along the biosecurity continuum are not clearly defined or well connected.
6. Improved engagement both at the decision-making and operational levels between forest stakeholders and agencies responsible for biosecurity is needed to strengthen the current biosecurity system.

Gap analysis

Expert elicitation was used to conduct a gap analysis and identify deficiencies in the current biosecurity system with regards to exotic forest pests (**Table 1**). Some activities were deemed to apply across the biosecurity continuum and were grouped as either being 'fundamental' or 'capacity building' activities. Adequate information for pre-border and border biosecurity activities was not generally available. It was therefore difficult to make an accurate assessment regarding the adequacy or otherwise of current arrangements (e.g. offshore capacity building).

Fundamental Activities	Capacity Building	Pre-Border Activities	Border	Post Border Activities
Coordination ▪ No formal linkages between forest biosecurity experts and responsible biosecurity agencies ▪ Lack of decision-making power in biosecurity committees (observers) ▪ No national forest biosecurity coordinator	Knowledge ▪ Outdated Australian forest pest status and distributions ▪ Outdated exotic forest High Priority Pests (HPPs)	Import risk analysis ▪ Unclear if import risk analysis are undertaken with consideration of the high risk pests listed in the Plantation Forest Biosecurity Plan	Pathway analysis ▪ Lack basic data regarding pathways for exotic forest pests (e.g. commodity type, transportation method, etc)	Surveillance program ▪ Currently one exotic forest pest is surveyed nationally through federal funded program. Some further forest pests surveyed in QLD and VIC ▪ NSW pilot program funded by individual grower ▪ Results are not reported back to industry
Stakeholder Engagement ▪ No cost-benefit analysis to demonstrate the benefits of investment to industry ▪ Councils and state conservation agencies not engaged (presume government protection is adequate) ▪ Community unaware of risks	Data and Reporting ▪ Regional and national data poorly collated ▪ Current surveillance data may not meet standards for market access support	Market access ▪ No clear channel for area-freedom surveillance data to be reported from forest sector to government	Point of entry prioritisation ▪ Lack data regarding main points of entry for "risky commodities" ▪ No forest pest interception data available	High Risk Site Surveillance (HRSS) ▪ No national coordinated program exists
Funding ▪ No funding mechanism in place for forest biosecurity	Diagnostics ▪ Unclear what forest pest diagnostics available in Australia ▪ No forest pest diagnostic network exists to support surveillance and emergency response ▪ Limited industry access to government diagnostic expertise	Off-shore intelligence gathering ▪ Unclear what off-shore intelligence gathering is done in relation to forest pests ▪ No clear reporting channels from government to industry or vice-versa	Commodity/passengers inspections ▪ Unclear what methods and sampling intensity are used to mitigate the risks from exotic forest pests	Forest Health Surveillance (FHS) ▪ Remains focused on forest health ▪ Ad-hoc surveillance of exotic pests ▪ Data collected may not meet standards to support market access ▪ Methodologies not consistent or nationally coordinated
	Training ▪ Only training for general biosecurity or emergency response activities ▪ No forest biosecurity training available for pest ID or surveillance	Off-shore capacity development ▪ Unclear if any forest specific capacity building is being undertaken ▪ Ad hoc (e.g. Australian Centre for International Agricultural Research (ACIAR) projects)	Compliance targeting ▪ No data available	
		Sentinel plantings & off-shore surveillance ▪ No formal plantings or surveillance undertaken ▪ Ad-hoc sentinel plantings via some ACIAR projects - monitoring is infrequent	Quarantine procedures and treatments ▪ Adequate? Minimal data available	
		Phytosanitary standards (ISPM) ▪ No formal arrangements to elicit forest biosecurity expertise		

Table 1: Gap analysis of current biosecurity system with regards to prevention and early detection of exotic forest pests

Fundamental activities

A national biosecurity program that meets the needs of forest stakeholders will require a number of activities that provide the foundations for all other activities within the program.

Coordination

An audit of Australia's forest biosecurity arrangements (Mohammed et al. 2011) highlighted the need for national representation and coordination for the forest sector to engage with the wider plant biosecurity sector. Until recently the Subcommittee on National Forest Health (SNFH) had been serving this function. Unfortunately, rationalisation of the PHC committee structure in 2014 led to the disbandment of SNFH. Currently, the forest sector is minimally represented in the decision-making structures of Australia's biosecurity.

Positively, the Australian Forest Products Association (AFPA) recently endorsed and set up the Forest Health and Biosecurity (FHaB) Subcommittee. This group reports to AFPA's Resources Chamber Committee. FHaB gathers together the technical and operational expertise relating to matters of forest health and biosecurity in Australia. At a broad level, it aims to represent and inform forest sector views on biosecurity, guiding collaborative forest sector investment into operational biosecurity and RD&E. It also aims to be a source of active engagement with plant biosecurity decision-making (**Figure 6**).

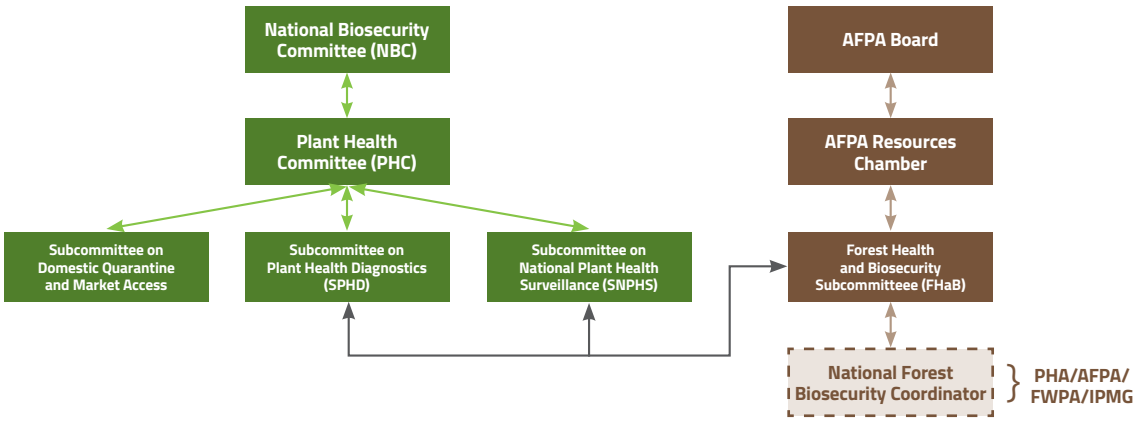
At an operational level, if activities outlined in this Framework are to be adequately implemented and coordinated there is a need for a National Forest Biosecurity Coordinator role to be created (**Figure 6**). The role would entail activities such as coordination of national surveillance activities, collation of data sets, reporting and training. PHA or industry groups such as AFPA, FWPA or Industry Plantation Management Group (IPMG) are organisations that could potentially employ a national forest biosecurity coordinator.

Rather than forest stakeholders working in isolation, the implementation of this Framework will require cooperation and expertise from the various PHC, Australian and state government agencies responsible for biosecurity.

Recommendation

1.1 Improve national and government/ industry coordination of forest biosecurity surveillance including the appointing of a National Forest Biosecurity Coordinator

Figure 6: Suggested engagement and communication structure between the plant biosecurity sector and the forest sector



Suggested engagement and communication structure between the plant biosecurity sector (green) and the forest sector (brown). Industry groups such PHA, AFPA, FWPA or IPMG are suggested organisations that could employ a national forest biosecurity coordinator on behalf of industry.

Stakeholder engagement

Exotic forest pests affect Australia's production forests but can also affect native conservation forests and urban forests. A large variety of stakeholders could be affected should an exotic forest pest become established. Mohammed's review of Australia's forest biosecurity arrangements identified 109 forest sector stakeholders (Mohammed et al. 2011). The large number of stakeholders, with different aims and levels of dependence on forests, complicates the formation of a consensus view on forest biosecurity matters.

Current engagement in forest biosecurity is being led by the forest wood products sector via the Forest Health and Biosecurity (FHaB) Subcommittee. Other important stakeholders such as Australian and state conservation agencies and local councils have not so readily engaged. This lack of engagement could be due to a variety of reasons, including:

- ignorance regarding forest biosecurity issues due to a lack of expertise on forest pests. This expertise has historically resided with production forest management agencies
- lack of awareness of their high risk exposure. For exotic forest pests that affect the environment, inter-jurisdictional biosecurity arrangements are in place through NEBRA. However, if eradication of any incursions proves unsuccessful these arrangements would no longer be valid. In this scenario, local governments and state conservation agencies in particular would face high ongoing pest management costs
- presumption that their exotic pest risks are being adequately considered by biosecurity agencies. This may not necessarily be the case as evidenced by a National Plant Health Surveillance Program that surveys for only one forest pest nationally, gypsy moths (Subasinghe pers. comm. 2015)
- difficulties in quantifying the value of their tree resources and therefore the cost–benefit of undertaking forest biosecurity activities.

Engagement and investment in biosecurity will likely be driven by evidence that the costs of maintaining biosecurity are less than any potential losses derived from exotic pests. In many cases such cost-benefit analyses become problematic as they are generally subjective. The potential costs following an exotic pest establishment are difficult to predict and the results of any analyses may be heavily influenced by the economic value placed on native forests, amenity trees or forest-based services.

It is envisaged that this Framework will act as the beginning of a stakeholder engagement process. Initial engagement and feedback will be sought from forest biosecurity experts (via FHaB), the forest grower sector and Australian Government and state biosecurity agencies. In the longer term, engagement with a larger pool of stakeholders will be sought (**Appendix I**).

Recommendation

1.2 Engage with a range of stakeholders in forest biosecurity and where possible include an analysis of the costs and benefits of biosecurity activities

Funding

The issue of who should fund biosecurity activities along the continuum can be contentious. In the forest sector often cited stumbling blocks include how much of the currently collected industry levy funds should be apportioned to biosecurity, and the perception that many non-wood product stakeholders would benefit without contributing. Nonetheless, there are examples of other industries with similar issues for the forest sector to examine. For example, the honey bee industry has initiated a bee biosecurity surveillance program that includes surveillance of current established pests in hives as well as surveillance for the early detection of exotic pests (**honeybee.org.au**). The program is managed by PHA and is funded by the honey bee industry via a biosecurity levy along with DAWR, Grain Producers Australia and in-kind contributions from state agencies.

In proportion to the risk that exotic pests potentially pose to Australia's forests, environment and communities the forest sector's current share in biosecurity funding for R,D&E and surveillance is small (**Figure 7A**). Funding has been ad-hoc with poorly coordinated projects not being part of an overall improvement strategy and not connected to the activities that are occurring in the wider plant biosecurity sector. This in part can be attributed to the forest sector's recent focus on its own economic and structural problems and the lack of participation in the Plant Biosecurity Cooperative Research Centre (PBCRC), the main plant biosecurity research cooperative. However, the disconnect between an increasingly privatised forest sector and government biosecurity agencies is also partly responsible. Agriculture focused biosecurity agencies at times fail to consider forest sector issues as 'core' responsibilities and as a result funding and resource allocations are not made.

An additional funding concern for the forest sector is the allocation of funds to different biosecurity areas. In forestry more so than in other plant industries the focus of biosecurity is resource protection rather than market access issues or pest management. That is, the sector would prefer to see greater resources put into improving preventative measures such a surveillance, risk analysis, modelling and diagnostics. In 2015, 37% of biosecurity RD&E investment was absorbed into pest management and crop improvement activities rather than prevention activities (**Figure 7B**). This approach seems to be counter-intuitive in light of the premise that investment in prevention of exotic incursion is more cost effective than ongoing pest management once exotic pests have established (PHA 2010b).

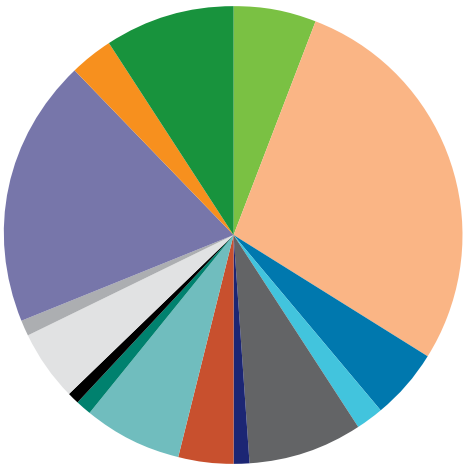
Some of the recommendations suggested in this Framework could already be done in-kind by the forest industry and government agencies. However, to improve and maintain capacity in forest biosecurity appropriate coordinated and long term funding models need to be implemented. This Framework aims to provide direction and coordination for funding forest biosecurity activities and RD&E. Practically, to achieve the Framework recommendations a series of implementation projects could be developed by a National Forest Biosecurity Coordinator (if appointed) along with the FHaB subcommittee. This would ensure strong industry input and backing. Funds for these project-based activities could be sought from PHC subcommittees, PHA, DAWR, PBCRC and FWPA, or directly from AFPA members. Funding arrangements (e.g. matching contribution or a levy) for larger ongoing operational projects such as High Risk Site Surveillance also need to be discussed and implemented.

Details of the size and type of funding model required for a forest biosecurity program lie outside of the scope of this Framework and would have to be discussed and developed amongst the main stakeholders as a separate exercise.

Recommendation

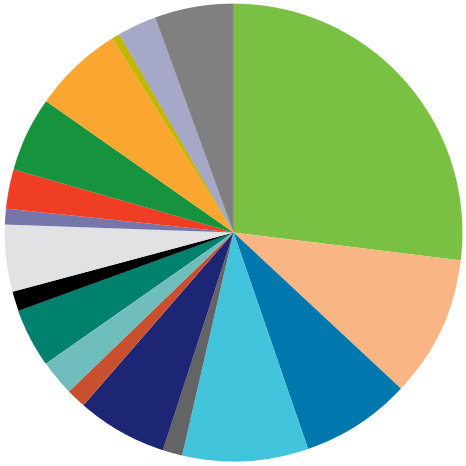
1.3 That a working group be set up to resolve short to long term funding mechanisms

Figure 7A: RD&E projects by crop type



6%	Cotton
28%	Grains
5%	Sugarcane
2%	Other broadacre
8%	Fruit
1%	Nuts
4%	Vegetables
7%	Other horticultural crops
1%	Forestry
1%	Nursery crops
5%	Natural environment
<1%	Multiple broadacre crops
19%	Multiple
3%	Other
9%	Multiple horticulture crops

Figure 7B: RD&E projects by biosecurity area



27%	Pest management
10%	Crop improvement
8%	Surveillance
9%	Diagnostics
<2%	Emergency response
6%	Risk analysis & modelling
<2%	Prevention
<3%	System approaches
4%	Market access support
1%	Information management
5%	Training & awareness
>1%	Other
3%	Communication & awareness
5%	Pest basic biology
6%	Host basic biology
<1%	Research centre or committee
3%	Host or pest identification
5%	Multiple

Figure 7: (A) RD&E projects by crop type; (B) RD&E projects by biosecurity area. From National Plant Biosecurity Status Report 2015 (PHA 2016).

Capacity building

These activities apply across the biosecurity continuum and are designed to enhance the capacity of both government biosecurity agencies and forest stakeholders with relation to the threat posed by exotic forest pests.

Pest knowledge

Existing endemic and established forest pests

Information regarding the presence of a particular pest species assists claims of regional area freedom since presence in one region may not mean presence in another (e.g. myrtle rust not found in WA). Furthermore, knowledge of the distribution of pest species already established in Australia can help model the risk and likely spatial distribution of similar exotic species not currently present in Australia.

Pest data records for Australia can be obtained from a number of sources such as the Australian Plant Pest Database (APPD) and Atlas of Living Australia (ALA), but relies on accurate identification, detailed surveys and data quality control to have been conducted by experts. Much of this information is garnered from insect or herbarium collections, does not necessarily include comprehensive distribution data, is not routinely updated and is incomplete for many species. For example, at the time of writing there were eight records in APPD for the nation-wide distributed pine pest *Essigella californica*: three of these are from lettuce in Victoria, and the remaining from Canberra. This limits the usefulness of this data for modelling and risk analyses.

Exotic forests pests

Target exotic forest species should initially include High Priority Pests (HPPs) already highlighted by experts in the Plantation Forest Biosecurity Plan (PHA 2013b). Over time the pest risk status of HPPs needs to be reassessed using agreed national risk assessment standards. However, consideration should also be given to state priorities. Risk assessments should be supported by pre-border intelligence gathering and border interception data (see recommendations in Pre-Border Biosecurity and Border Biosecurity).

Recommendation

2.1 Review and update knowledge regarding species of forest pest already present in Australia and the current list of forest High Priority Pests not present Australia

Training and tools

Training programs, workshops and tools are essential to support forest pest biosecurity surveillance nationally.

Plant Health Australia delivers the National Emergency Plant Pest Training Program to industry and government representatives, growers and other biosecurity stakeholders. The training program includes simulation exercises, face-to-face workshops and online modules (Biosecurity Online Training, BOLT). Three training courses for general biosecurity are also available through Australia's Nationally Recognised Training scheme. More in-depth general postgraduate qualifications in all aspects of biosecurity are also available through an innovative course structure run at multiple universities (**Table 2**). There is no specific training relating to exotic forest pest biosecurity.

Whether conducting general or targeted biosecurity surveillance, having agreed standardised data collection and reporting methods or tools is crucial in gaining both sectoral and jurisdictional confidence in the collected data. In agriculture a number of digitally based field guides and survey reporting tools have been developed (e.g. MyPestGuide Reporter). Unfortunately, similar yet slightly different applications and survey methods have been developed across companies, jurisdictions or industries. This has resulted in duplication of effort and a lack of data standardisation making the pooling and leveraging of surveillance data more difficult. This hampers efforts to have data sets that can provide early detection of observed exotic pests or support claims of area freedom.

Many of the training resources mentioned (**Table 2**) are of a general nature or focused on aspects of emergency pest response rather than supporting prevention activities such as improving field identification or surveillance. They do not specifically address any forest biosecurity capacity gaps. Similarly, while a number of digital tools are available, no widely used applications have been developed for forestry. Standardisation of data collection survey methods while long discussed amongst the forest health community (Stone 2000) is still to become a reality.

Recommendation

2.3 Develop and implement training materials addressing forest biosecurity skill gaps across the forest sector

2.4 Develop and implement agreed methods and tools for coordination of forest health and biosecurity surveillance

Table 2: Selection of biosecurity training courses available to the forest sector

Plant Health Australia planthealthaustralia.com.au
National Emergency Plant Pest Training Program
▪ Face-to-face workshops ▪ Simulation exercises ▪ Biosecurity Online Training, BOLT
National Recognised Training training.gov.au
▪ Certificate III in Public Safety (Biosecurity Response Operations) ▪ Certificate IV in Public Safety (Biosecurity Response Leadership) ▪ Diploma of Public Safety (Biosecurity Response Management)
Postgraduate Training
▪ Graduate Certificate in Plant Biosecurity ▪ Graduate Diploma in Plant Biosecurity ▪ Master of Plant Biosecurity

Diagnostics

All forest pest biosecurity surveillance activities along the continuum require strong diagnostic support. The National Plant Biosecurity Diagnostics Strategy (NPBDS; PHA 2012) outlines key recommendations for improvements in diagnostics including:

> develop a nationally integrated plant biosecurity diagnostic network that underpins Australia's plant biosecurity system
> implement and maintain appropriate quality management systems in diagnostic laboratories
> diagnostic capability and capacity for all HPPs be developed and maintained
> establish a national plant biosecurity information management framework for data sharing.

Implementation of all the recommendations within the NPBDS is underway. Notably:

> a National Plant Biosecurity Diagnostic Network (NPBDN) has been set up
> national diagnostic protocols (NDPs) for some High Priority Pests (HPPs) have been completed
> an ongoing review process of NDPs has been established.

It should be noted that of 21 forest HPPs only two have had NDPs completed (sudden oak death and red turpentine beetle) and a further five NDPs are still in draft form. Additional diagnostic resources have also been created such as the Australian Plant Pest Database (APPD), the Pest and Disease Image Library (PaDIL) and PestPoint, a remote diagnostic and expertise network (**Table 3**).

The forest sector is well served by field guides to assist forest health surveillance (FHS) pest identification and web-based guides of forest HPPs are also available (**Table 3**). However, a number of these resources are not actively maintained, require updating and may not include expertly reviewed information regarding the latest forest HPPs.

Despite the development of the new diagnostic resources mentioned above, these have not been taken up by the forest sector. This is thought to be mostly due to a lack of diagnostician personnel within the forest sector. Conversely, good diagnostic capability exists within government agricultural departments, but this is not always available to the forest sector or may not be adequately trained to identify forest pests specifically. The question of who funds the availability and training of the diagnostic expertise remains unresolved. In summary, there is a need to audit and improve the current forest pest diagnostics expertise and capabilities available in Australia to enable better identification generally and more importantly to support 'triage' diagnostics during an emergency response.

Recommendation

2.5 Review diagnostic capabilities specific to exotic forest pests and fill skill capacity gaps

Table 3: A selection of identification materials currently available to the forest sector

Field Guides

- AQIS (2000) Forests and timber: A field guide to exotic pests and diseases
- Carnegie AJ, Lawson SA, Smith TE, Pegg GS, Stone C and McDonald JM (2008) Healthy hardwood: A field guide to pests, diseases and nutritional disorders in subtropical hardwoods
- Matsuki M and Tovar F (2012) Field guide for Eucalyptus globulus plantations in Western Australia and the Green Triangle
- Phillips CL (1996) Insects, diseases and deficiencies associated with eucalypts in South Australia
- Smith D, Smith I and Collet N (2008) A field guide to plantation health surveillance in Victoria
- Stone C, Matsuki M and Carnegie A (2003) Pest and disease assessment in young eucalypt plantations: Field manual for using the crown damage index

Web-Based Resources

- Forestry and timber pests and diseases watch list **agriculture.gov.au/pests-diseases-weeds/forestry-timber**
- Australian Plant Pest Database, APPD **appd.ala.org.au/appd-hub/index**
- Pest and Disease Image Library, PaDIL **padil.gov.au**
- Remote diagnostics and reporting network, PestPoint **pestpoint.org.au**
- Farm Forestry Toolbox, Forest Health Keys **afg.asn.au/other-publications/farm-forestry-toolbox**
- Web-based reporting tool, MyPestGuide **mypestguide.agric.wa.gov.au**

National Diagnostic Protocols (forest pests)
plantbiosecuritydiagnostics.net.au

- Asian gypsy moth/gypsy moth complex DRAFT
- Guava/Eucalyptus rust DRAFT
- Pine pitch canker DRAFT
- Pine wilt nematode/pinewood nematode species complex DRAFT
- Red turpentine beetle
- Sudden oak death
- Western gall rust DRAFT

Pre-border biosecurity

The biosecurity continuum involves a number of pre-border activities that protect Australia's forests and environment from the threat of exotic pests (**Table 4**). At an operational level, pre-border activities have generally been conducted by Australian Government agencies that have the legislative support and international government links to support such activities (e.g. Department of Agriculture and Water Resources, Department of Foreign Affairs and Trade).

Currently there is little detailed information available as to the scope of pre-border activities that are undertaken in relation to exotic forest pests (**Table 4**). For example, it is unclear whether current import risk analyses consider the latest high priority forest pests (HPPs) listed in the Plantation Forest Biosecurity Plan (PHA, 2013).

The lack of detailed pre-border information makes it difficult to assess the risk exposure of the Australian forest sector or make sensible suggestions for improvement in this area.

It is also unclear what formal capacity building and off-shore intelligence gathering is being done to minimise the threats from exotic forest pests. In New Zealand there is a formalised system of off-shore intelligence gathering that uses reports and knowledge obtained from government, industry and community (Reed 2014; Carnegie and Last 2015). No such formal reporting system exists in Australia, although some progress is being made. For example, the International Biosecurity Intelligence System (IBIS) is an intelligent web-based platform that gathers biosecurity related information from reports published on the World Wide Web or submitted by registered members of the site (CEBRA 2013). However, whether it automatically forwards reports to responsible biosecurity agencies is unclear. The process for technical experts to report biosecurity intelligence to DAWR is also unclear, or how this information is used. Further work is also being undertaken to develop an intelligence gathering and information system, called AusPest*Check* (SNPHS 2015). Still in early development, it promises to provide real-time data of pest outbreaks in Australia and possibly overseas.

The setting up of an integrated National Forest Biosecurity Surveillance Program under the banner of 'shared responsibility' will require government agencies to better inform forest stakeholders of the relevant pre-border activities it currently undertakes. At the same time, opportunities exist for forest stakeholder pest expertise and data to support government agencies.

Recommendation

3.1 Ensure relevant information is available from Australian Government to industry regarding what, where and how pre-border forest pest surveillance and capacity training is undertaken

3.2 Review current pre-border activities that relate to exotic forest pests and improve as needed

Table 4: Main activities undertaken in pre-border biosecurity and relation to forest sector

Activities	Forest Sector
Import risk analysis Identify the risk imposed by the importation of commodities from other countries	Unclear if import risk analyses are undertaken with consideration of the high risk forest pests listed in the Plantation Forest Biosecurity Plan (PHA 2013)
Market access Work with importers and exporters to overcome market access issues (e.g. area freedom status, pest control procedures, phytosanitary certificates)	▪ Maintaining Australian import requirements (e.g. off-shore fumigation of logs) ▪ Authorised Officer Program (AOP) to allow industry to conduct inspections of wood products as part of their export requirements ▪ No clear channel for data reporting from forest sector to government to support market access
Off-shore intelligence gathering IBIS web-based report collation	▪ Unclear what activities the DAWR undertakes in relation to forest pests ▪ There are no clear reporting channels from industry to government and vice-versa ▪ Forest expertise exists and could be leveraged (e.g. International Union of Forest Research Organizations (IUFRO) Working Group on Southern Hemisphere Plantation Health, FHaB)
Off-shore capacity development ACIAR, NAQS running programs to improve diagnostic and surveillance capacity in neighbouring and trading countries	▪ There is a coordinated program being run by DAWR in Pacific countries and south-east Asia. However, it is unclear to what extent forest pests are covered ▪ There have been a number of forest specific projects funded by ACIAR and AusAID to improve capability in Pacific countries and south-east Asia (Wardlaw et al. 2012). However, the approach is ad-hoc, dependant on individual projects and biosecurity surveillance not necessarily a focus
Sentinel plantings and off-shore surveillance Planting native and exotic trees important to Australia and surveying and monitoring for emerging pest threats	▪ Some informal sentinel plantings in Vietnam and China through university lead research work in collaboration with ACIAR and FABI (Burgess pers. comm., 2015) ▪ Funding is precarious and monitoring ad-hoc
ISPM15 and related phytosanitary standards These govern the importation procedures and standards agreed to by WTO member countries to facilitate the safe transport of goods	Recent incursions at the border due to pallets of Chinese origin highlight the dangers of introductions from sources other than actual wood products

Border biosecurity

Border biosecurity involves much more than simple border inspections (**Table 5**). As part of the biosecurity continuum (**Figure 3**) border biosecurity activities directly or indirectly assist pre-border and post-border activities. Border activities focus on the detection of exotic pest threats at the border, before they can spread and establish. These activities are risk-based, informed by evidence (e.g. pathway analysis and interception records) and subject to review and continual improvement (DAWR and DEE 2014). DAWR has primary responsibility of biosecurity activities at the national level, while at the state level each jurisdiction's agriculture agency is responsible.

Currently it is difficult for industry or forest biosecurity experts to access data relating to both Australian Government and state border activities. Important data such as what forest pest pathways have been identified, where high risk points of entry may be located or what species, how often and from where forest pests are intercepted is largely unknown to non-government forest stakeholders. This information is crucial as it informs any attempts to conduct post-border surveillance in a logical and coordinated manner.

The lack of detailed border data makes it difficult to assess Australia's risks to exotic forest pests or make sensible suggestions for improvement. It is hampering development of coordinated efforts post-border.

Recommendation
4.1 Obtain data regarding border pest interceptions, pathway analysis and high risk of entry points that relate to forest pests
4.2 Review current national and state border activities in consideration of exotic forest pests and improve as needed

Table 5: Main activities undertaken in border biosecurity and relation to forest sector

Activities	Forest Sector
Pathway analysis Identify potential entry pathways for exotic pests (e.g. commodity type, transportation method etc)	Lack basic data regarding pathways for exotic forest pests (e.g. commodity type, transportation method etc)
High risk point of entry prioritisation Linking pathway analysis with interception data analysis (e.g. Quarantine Approved Premises (QAPs))	▪ Lack data regarding main points of entry for 'risky commodities' ▪ Lack forest pest interception data
Commodity and passenger inspections	Unclear what methods and sampling intensity are used to mitigate the risks from exotic forest pests
Compliance targeting	No data available
Quarantine procedures and treatments	Unsure if adequate for new and emerging pests?
Jurisdictional issues	Under changes to the Commonwealth Biosecurity Act 2015, state-based determinations and risk assessments may be questioned

Post-border biosecurity

Despite all the control activities in place, some imported goods, vessels and passengers may still harbour exotic pests of biosecurity concern after they enter Australia. Exotic pests can also arrive via illegal means or natural pathways. Biosecurity activities within Australia are delivered in partnership with state and federal governments, industry and other stakeholders (DAWR and DEE 2014). State and territory governments working in conjunction with affected stakeholders are responsible for eradication of exotic pests once they enter Australia. However, the current responsibilities regarding post-border surveillance are less clearly defined.

Post-border surveillance in the forest context can be viewed as consisting of two main activities: High Risk Site Surveillance (HRSS) and Forest Health Surveillance (FHS) (**Table 6**).

> HRSS aims to provide early detection of exotic forest pests that have 'escaped' detection at the border, thereby enabling an eradication response.

> FHS aims to provide data in support of area freedom status, although targeted exotic pest surveys conducted at the same time may also aid with early detection.

DAWR funds a National Plant Health Surveillance Program (NPHSP) that includes trapping and multi-pest surveillance in and around major ports. This is conducted by state agricultural agencies, with the focus mainly on agricultural and horticultural pests. The DAWR funding for this national program is approximately $750,000 pa, which is generally matched in-kind by the state agencies (Blomfield and Gillespie 2014). The pest target list for this program is not consistent across states and often focuses on personal interests and expertise within each state or state-based industry priorities (**Appendix II**). Recently, an agreement was reached to use an Analytical Hierarchical Process to produce pest risk status ratings (SNPHS 2015). This will eliminate personal or jurisdictional bias and surveillance activities will be determined on risk-based national priorities.

Currently, the forest sector is poorly served by the NPHSP. Surveillance targets for forestry or environment and amenity make up 8% and 11% respectively of all targets that are surveyed (**Figure 8**).

Table 6: Main activities undertaken in post-border biosecurity and relation to forest sector

Activities	Forest Sector
High Risk Site (biosecurity) Surveillance Systematic or general surveillance for exotic forest pests at 'high risk sites' in the immediate vicinity of points of entry or QAPs	▪ No national coordinated program exists for forest exotic pest ▪ Currently only one exotic forest pest is surveyed nationally through the National Plant Health Surveillance Program, with some further forest pests surveyed in QLD and VIC ▪ NSW has a separate industry led pilot program
Forest Health Surveillance (FHS) Systematic or general surveillance of established pests, pest population monitoring, targeted surveillance for exotic forest pests	▪ Forest health surveillance activities are occurring in NSW, VIC, SA, TAS and WA, although the level of effort and coordination varies widely ▪ Data collected do not necessarily conform to NMDS or ISPM standards
Preparedness For incursion response and eradication	Need for generic incursion response plans to fast track response and ensure adequate technical input
Coordination of national biosecurity surveillance By the Commonwealth	Need for surveillance and diagnostic capability and capacity building specific to forestry

Of the 31 exotic forest pests deemed to be of high to medium risk to Australia as presented in the Plantation Forest Biosecurity Plan (PHA 2013a) only one species is surveyed for at a national level (i.e. gypsy moth) (**Appendix I**). The accidental introduction of myrtle rust in recent years and the subsequent ongoing management costs to government and industry highlight the dangers posed by gaps in the surveillance for exotic forest pests.

It is unclear what pathway analyses of potential entry points for exotic forest pests have been conducted. Pathway analysis is necessary to identify high risk sites and is fundamental for efficient border and post-border surveillance to be undertaken. For example, lure traps for particular forest pests should be placed at high risk sites previously identified through pathway analysis.

There is also a lack of data regarding border interceptions of exotic forest pests. This is hampering efforts to improve surveillance efforts. For example, it is known that propagule pressure (i.e. how often an exotic pest is intercepted at the border or post-border) is a good predictor for eventual establishment of an invasive pest (Lockwood et al. 2009). Border interception data could potentially inform:

> pest risk status (e.g. change from medium to high risk)
> pre-border programs conducted at the countries of origin to minimise further incursions
> post-border programs to better target any potential 'escapees' from the border.

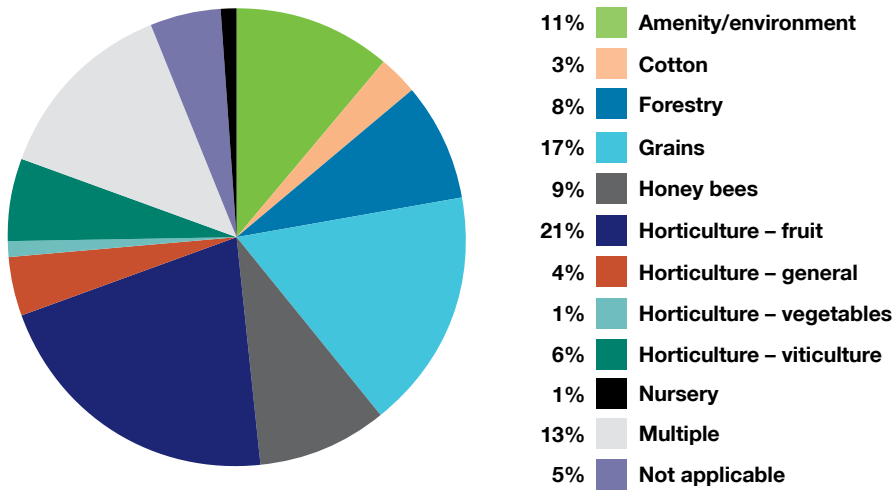
There is a need to improve communication along the continuum. For example, it has been noted that not all forest HPPs are on state notifiable watch lists (FHaB 2015).

There are knowledge, analytical and resource gaps in post-border biosecurity surveillance of exotic forest pests.

Suggested key requirements for the development of a post-border surveillance program for exotic forest pests include (Wylie et al. 2008):

> cataloguing endemic pests and already established exotic pests (**see Pest knowledge**)
> developing a high priority target list of exotic forest pests (**see Pest knowledge**)
> risk-based assessment of incursion pathways to optimise location and intensity of surveillance (**see Border biosecurity**)
> ensuring diagnostic capacity and expertise for collected samples (**see Diagnostics**).

Figure 8: Surveillance by target hosts



From National Plant Biosecurity Status Report 2015 (PHA 2016)

High Risk Site Surveillance (HRSS)

High Risk Site Surveillance involves conducting surveys at sites most likely to contain potential exotic forest pests such as points of entry (e.g. ports and airports) or quarantine approved premises that hold imported materials. This is because targeting surveillance closer to the likely point of entry improves the probability of early detection of introduced exotic pests. In turn, this will increase the chances of successful eradication of any incursion and minimise the costs associated with it.

High Risk Site Surveillance is pivotal for early detection of exotic forest pests, improving the probability of successful eradication and minimising the costs of the eradication.

There has been an awareness of deficiencies in post-border surveillance of forest pests for a number of years. Pilot port-environ surveillance projects targeting exotic forest pests were initiated in Brisbane and Tasmania in the early 2000s (Wylie et al. 2000). Further programs were initiated in 2005–06, with Australian Government funding, for high risk site surveillance in Brisbane and Tasmania (Wylie et al. 2008; Bashford 2012), with the Tasmanian program running through to 2011. A separate program focused on sentinel plantings was initiated in Victoria in the late 2000s, utilising local council tree databases to assist in identifying target host trees to survey or monitor during pest incursions (Smith et al. 2010). A more recent program was initiated in NSW, following the detection of Japanese pine sawyer beetle and Asian longhorn beetle, which focuses on trapping and sentinel tree monitoring (Carnegie et al. 2014). Despite these efforts post-border forest pest surveillance is not coordinated nationally and suffers from ad-hoc funding and operational support and relies heavily on the good will of individual forest health technical experts in each state.

There is no national High Risk Site Surveillance program for detecting exotic forest pests.

Recommendation

5. 1 Develop national High Risk Site Surveillance program for detecting exotic forest pests

Forest Health Surveillance (FHS)

As part of the biosecurity continuum forest health surveillance is vital in confirming the distribution of current endemic and exotic pest species and provides essential information in support of claims of national, state or regional pest area freedom.

In Australia, formal forest health surveillance activities began in the 1990s lead by the main growers in Queensland, NSW, Victoria, Tasmania and South Australia (Carnegie 2008). In 2010 Western Australia also commenced collaborative forest health surveillance and reporting activities amongst the main private plantation growers (Tovar pers. comm. 2015). Surveillance methodologies are similar between the states, although there are important differences based on circumstances within each growing region. Reporting standards have not been developed and collation of national data does not necessarily meet NMDS or ISPM standards (**see Recommendations**).

It should be noted that the focus of FHS for the most part is on forest health and not biosecurity (Carnegie et al. 2014). Research has also shown that routine forest health surveillance is not efficient at detecting cryptic disorders, such as those likely to be newly established exotic pests (Wardlaw et al. 2008). Nonetheless there are alternative approaches that can improve detection efficiencies and value-add to FHS. One such approach would involve identifying those forest High Priority Pests (HPPs) that have characteristic features or symptoms not likely to be confused with established pests. Training forest staff to recognise these HPPs and including them on lists to look for during routine FHS could rapidly generate area freedom data sets. A recent study investigating the use of general surveillance reports in the grains industry obtained a 98% confidence of area freedom for exotic pests by pooling the surveillance data obtained by agronomists over four successive visits (SNPHS 2016). Another approach would involve conducting targeted exotic pest surveillance where site conditions or observed symptoms may indicate their presence. For example, conducting surveys for exotic aerial *Phytophthora* species in high rainfall forest sites or inspecting for exotic bark beetles where trees have been recently killed and characteristic tunnelling is evident.

Lack of coordinated and standardised data collection and reporting is undermining the usefulness of current forest health surveillance in support of claims of area freedom or early detection of exotic forest pests.

Recommendation

5.2 Develop tools and methods to allow operational forest health surveillance to contribute to area freedom status and early detection of exotic forest pests

Preparedness

While arrangements set out in the EPPRD and PLANTPLAN clearly outline the process that occurs when a pest incursion is detected, recent national responses to myrtle rust and giant pine scale indicate that Australia is not adequately prepared for forest pest incursions. A lot of time and effort is spent during the early phase of an incursion gathering technical information about the pest, including pest biology, surveillance methods, diagnostics and control techniques. For myrtle rust, a pest-specific contingency plan had been developed (OCCPO 2007), but inexplicably, this was not freely accessible at the time of the incursion.

A threat specific contingency plan has been developed for gypsy moths (PHA 2009) and a generic incursion management plan for the forest industry (Gadgil et. al. 2000) and is out of date.

Robust preparedness arrangements are critical when post-border surveillance activities detect a forest pest incursion.

There is a need for generic incursion plans to be developed for key pest groups (e.g. bark beetles, longicorn beetles, aerial *Phytophthora* spp.) that include pest biology, techniques for surveillance and trapping (including lure type and availability in Australia), chemical control (and availability in Australia), possible quarantine and movement restrictions.

Recommendation

5.3 Review current preparedness arrangements for emergency response to key exotic forest pests and implement improvements (e.g. generic incursion response plans)

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Appendix I – Stakeholder engagement strategy

In order for the recommendations in this Framework to be properly supported and funded it is important to obtain a wide consensus amongst stakeholders in Australia's forests. It is envisaged that acting as a discussion document this Framework should begin the stakeholder engagement process. Initial engagement and feedback will be sought from forest biosecurity experts (via FHaB), the forest grower sector and federal and state biosecurity agencies. In the longer term, engagement and feedback from a larger pool of stakeholders will be sought. The review and comments process will be undertaken by the Forest Biosecurity Surveillance Working Group under the guidance of AFPA's FHaB subcommittee. A preliminary though not exhaustive list of stakeholders to be consulted is shown below.

Forest and Timber Organisations	
Australian Forest Growers (AFG)	**afg.asn.au**
Australian Forest Products Association (AFPA)	**ausfpa.com.au**
Forest and Wood Products Australia (FWPA)	**fwpa.com.au**
Australian Forestry Standard (AFS)	**forestrystandard.org.au**
Forest Stewardship Council Australia (FSC)	**au.fsc.org**
Institute of Foresters of Australia (IFA)	**forestry.org.au**
Forest Industries Association of Tasmania	**fiatas.com.au**
Forest Industries Federation WA	**forestindustries.com.au**
Timber NSW	**timbernsw.com.au**
Timber Queensland	**timberqueensland.com.au**
Victorian Association of Forest Industries	**vafi.org.au**
Timber Trade Industrial Association	**ttia.asn.au**
Government Agencies or Corporations (Forestry)	
Department of Territory and Municipal Services (TAMS) (formally known as ACT Forests)	**tams.act.gov.au**
Forest Product Commission WA (FPC)	**fpc.wa.gov.au**
Forestry Corporation of NSW	**forestrycorporation.com.au**
Forestry SA	**forestry.sa.gov.au**
Sustainable Timber Tasmania (formally known as Forestry Tasmania)	**sttas.com.au**
Private Forests Tasmania	**pft.tas.gov.au**
VicForests	**vicforests.com.au**

Government Agencies (Biosecurity, Conservation, Local government, Natural Resources)	
Department of Agriculture and Water Resources (DAWR)	**agriculture.gov.au**
Department of the Environment and Energy (DEE)	**environment.gov.au**
Australian Local Government Association (ALGA)	**alga.asn.au**
Department of Agriculture of Western Australia (DAFWA)	**agric.wa.gov.au**
Department of Parks and Wildlife (DePaW)	**dpaw.wa.gov.au**
NSW Office of Environment and Heritage	**environment.nsw.gov.au**
NT Department of Land Resource Management	**lrm.nt.gov.au**
Parks and Wildlife Commission NT	**parksandwildlife.nt.gov.au**
Primary Industries and Regions SA	**pir.sa.gov.au**
Queensland Department of Environment and Heritage Protection	**ehp.qld.gov.au**
Queensland Department of Agriculture and Fisheries	**daf.qld.gov.au/forestry**
Queensland Department of National Parks, Sport and Racing	**npsr.qld.gov.au**
Tasmanian Department of Primary Industries, Parks, Water and Environment	**dpipwe.tas.gov.au**
Victorian Department of Economic Development, Jobs, Transport and Resources	**economicdevelopment.vic.gov.au**
Victorian Department of Environment, Land, Water and Planning	**delwp.vic.gov.au**
Landcare and Community organisations	
202020 Vision (Horticulture Innovation Australia - Urban planting initiative)	**202020vision.com.au**
Bush Heritage Australia	**bushheritage.org.au**
Greening Australia	**greeningaustralia.org.au**
Landcare Australia	**landcareonline.com.au**
National Trust	**nationaltrust.org.au**
National Urban Forest Alliance	**nufa.com.au**
The Nature Conservancy Australia	**natureaustralia.org.au**
Timber Communities Australia	**tca.org.au**

Appendix II – National Plant Surveillance Program – 2016 Pest Target List[1]

Jurisdiction	Common name	Scientific name
NSW	**Exotic gypsy moths[2]**	*Lymantria* spp.
	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Spiralling whitefly	*Aleurodicus dispersus*
	Silverleaf whitefly	*Bemisia tabaci*
	Tramp ants	*Solenopsis* spp., *Wasmannia auropunctata, Anoplolepis gracilipes,* etc.
	Aphids	Many species
	Solenopsis mealy bug	*Phenacoccus solenopsis*
	Grape phylloxera	*Daktulosphaira vitifolia*
	Pierce's disease	*Xylella fastidiosa*
	Glassy winged sharpshooter	*Homalodisca vitripennis*
	Asian honey bee	*Apis cerana*
	Bee mites	*Varroa jacobsoni* and *Acarapsis woodii*
	Asiatic citrus psyllid	*Diaphorina citri*
	Huanglongbing (citrus greening)	*Liberibacter asiaticus*
VIC	**Exotic gypsy moths**	*Lymantria* spp.
	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Suzuki fly	*Drosophila suzukii*
	Black spruce longhorn beetle	*Tetropium castaneum*
	Brown spruce longicorn beetle	*Tetropium fuscum*
	Wood wasp	*Urocerus fantoma*
	Pine sawyer beetle	*Monochamus alternatus*
	Pine wilt nematode	*Bursaphelenchus* spp.
	Dutch elm disease	*Ophiostoma ulmi*

1. Data supplied by Dr Ranjith Subasinghe, Department of Agriculture and Water Resources, Canberra.

2. Bold lettering indicates forest pests.

Jurisdiction	Common name	Scientific name
QLD	**Exotic gypsy moths**	*Lymantria* spp.
	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Sugarcane longhorn stem borer	*Dorysthenes buqueti*
	Asian and citrus longhorn beetle	*Anoplophora* spp.
	Lychee longicorn beetle	*Aristobia testudo*
	Burnt pine longicorn	*Arhopalus ferus*
	Lateral-banded mango longhorn beetle	*Batocera rubus*
	Sawyer beetles	*Monochamus* spp.
	Dry wood longicorn beetle	*Stromatium barbatum*
	Ambrosia beetles, bark beetles	*Ips* spp.
	Pine beetles, bark beetles	*Dendroctonus* spp.
	Wood wasps	*Urocerus gigas*
WA	**Exotic gypsy moths**	*Lymantria* spp.
	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Citrus greening	*Liberibacter asiaticus*
	Citrus longhorn beetle	*Anoplophora chinensis*
	Fire blight	*Erwinia amylovora*
	Red imported fire ant	*Solenopsis invicta*
TAS	**Exotic gypsy moths**	*Lymantria* spp.
	Exotic fruitflies	*Bactrocera* and *Ceratitis* spp.
	Brown marmorated stink bug	*Halyomorpha halys*
	Clover root weevil	*Sitona lepidus*
	Brown rot	*Monilinia fructigena*
	Grapevine rust	*Phakopsora euvitis*

Jurisdiction	Common name	Scientific name
SA	**Exotic gypsy moths**	*Lymantria* spp.
	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Citrus greening	*Liberibacter asiaticus*
	Citrus canker	*Xanthomonas axonopodis* pv. *citri*
	Citrus variegated chlorosis (CVC)	*Xylella fastidiosa*
	Tomato potato psyllid	*Bactericera cockerelli*
	PSTVd	*Potato Spindle Tuber Viroid*
	Zebra chip	*Candidatus liberibacter solanacearum*
	Bacterial ring rot	*Clavibacter michiganensis* pv. *Sepedonicus*
	Glassy winged sharpshooter	*Homalodisca vitripennis*
	Pierce's disease	*Xylella fastidiosa*
NT	Exotic fruit flies	*Bactrocera* and *Ceratitis* spp.
	Giant African snail	*Achatina fulica*
	Red imported fire ant	*Solenopsis invicta*
	Citrus canker	*Xanthomonas axonopodis* pv. *citri*
	Huanglongbing (citrus greening)	*Liberibacter asiaticus*
	Asiatic citrus psyllid	*Diaphorina citri*
	Banana black sigatoka	*Mycosphaerella fijiensis*
	Banana freckle	*Phyllostica cavendishii*
	Pierce's disease	*Xylella fastidiosa*
	Glassy winged sharpshooter	*Homalodisca vitripennis*
	Grapevine leaf rust	*Phakopsora euvitis*
	Papaya mealy bug	*Paracoccus marginatus*
	Mango pulp weevil	*Sternochetus frigidus*
	Mango gall midge	*Procontarinia* spp.
	Mango Ceratocystis wilt (sudden decline)	*Ceratocystis manginecans, Ceratocystis mangicola, Ceratocystis mangivora*
	Asian honey bee	*Apis cerana*
	Bee mites	*Varroa jacobsoni* and *Acarapsis woodii*
	Vegetable leaf miners	*Liriomyza huidobrensis, Liriomyza sativae, Liriomyza trifolii*
	Bacterial wilt (melon and cucumber)	*Erwinia tracheiphila*
	Eucalyptus canker	*Chrysoporthe cubensis*
	Myrtle rust	*Puccinia psidii*

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