Independent Forestry Panel Presentation

NSW GOVERNMENT

Forest Health & Biosecurity

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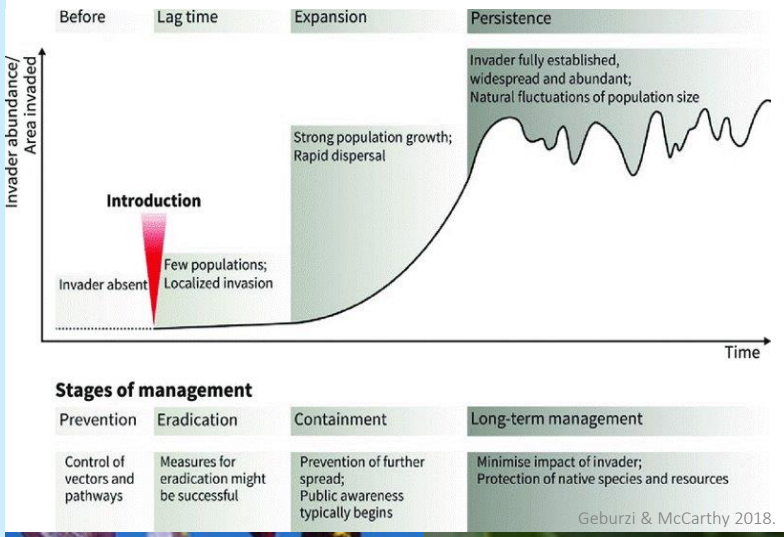
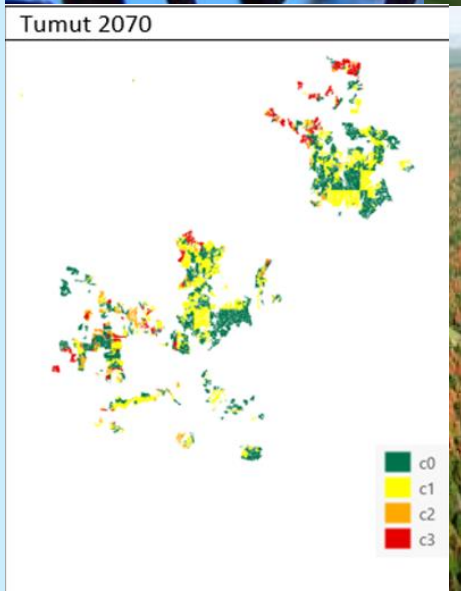
Adjunct Professor, Southern Cross University
Fellow of Australasian Plant Pathology Society

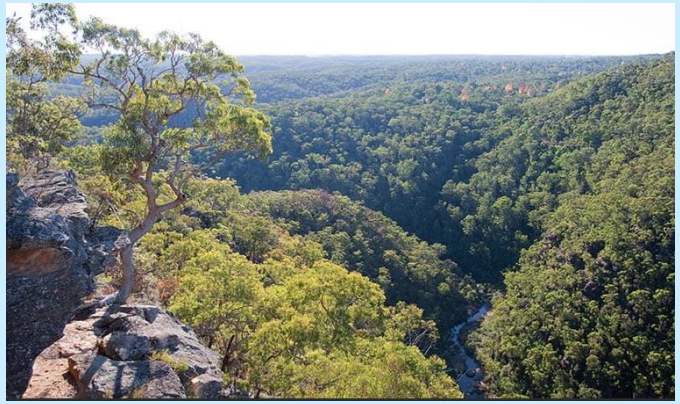
14 October 2024

regional.nsw.gov.au



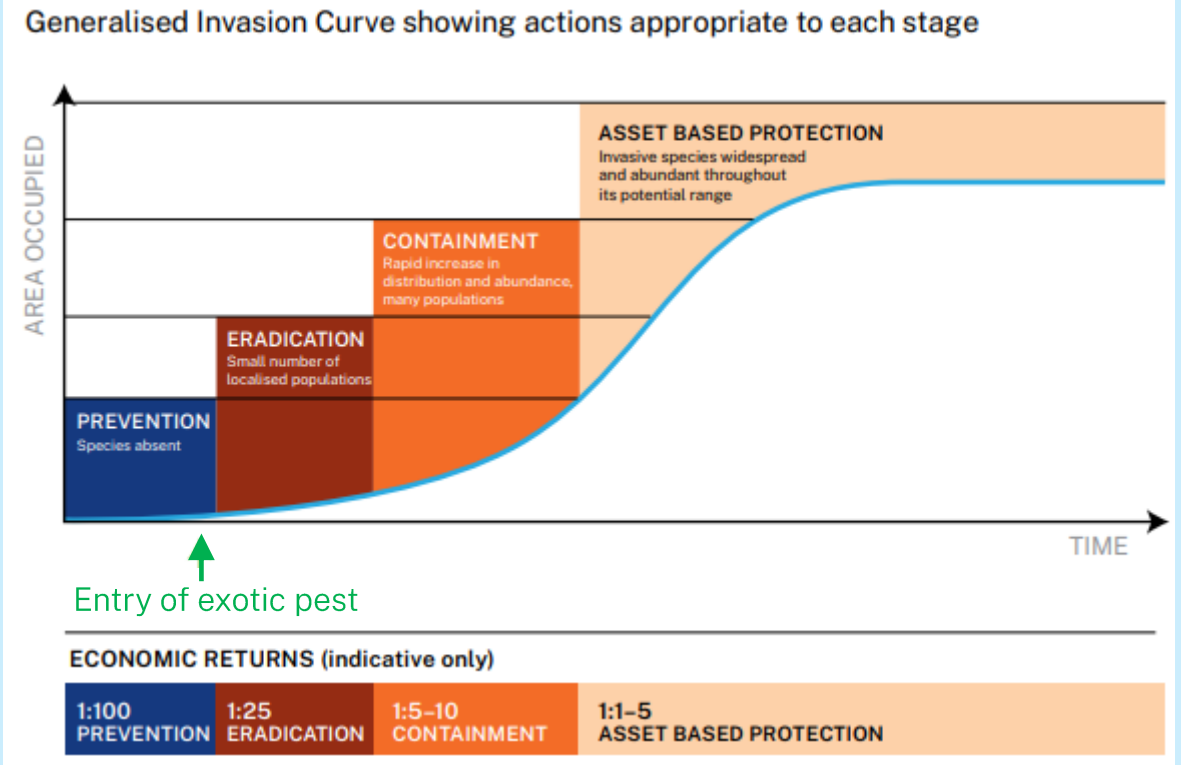


All forests in New South Wales (Australia)



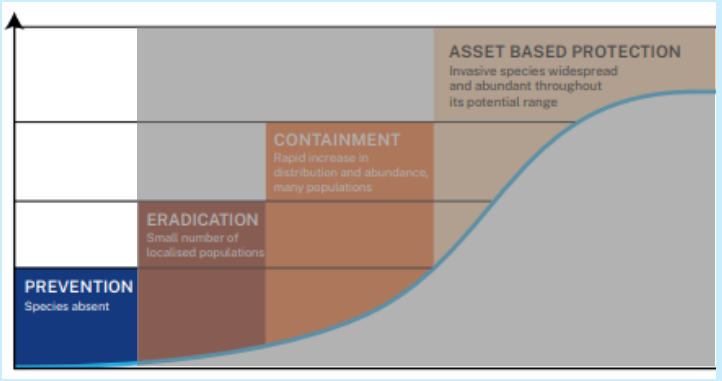
Risk, impact & management across the invasion curve

- Pathway & entry risk analysis
- Surveillance & diagnostics for early detection & response
- Surveillance, impact assessment, risk mapping (CC), & management strategies (biocontrol)



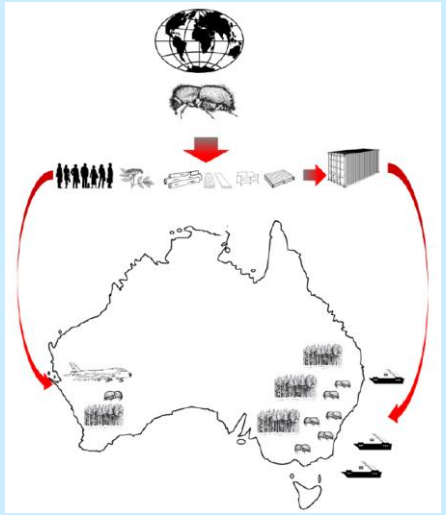
NSW Invasive Species Management Plan 2023-2028

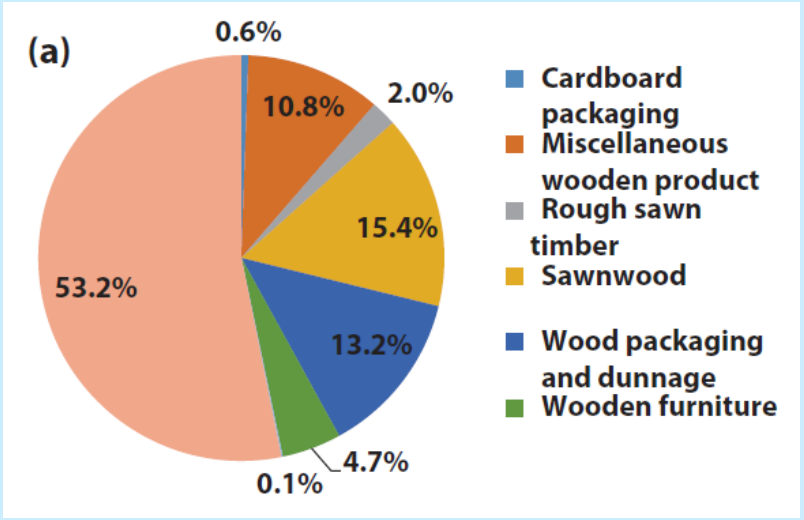
Pathway and entry risk analysis

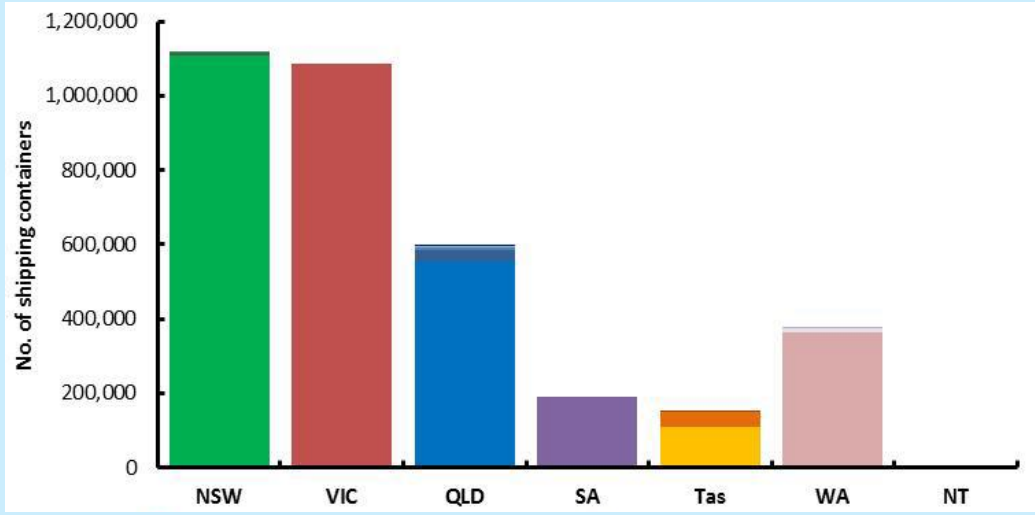


Identifying the risk of exotic pests and pathogens arriving and establishing in Australia

- Pathways for entry:

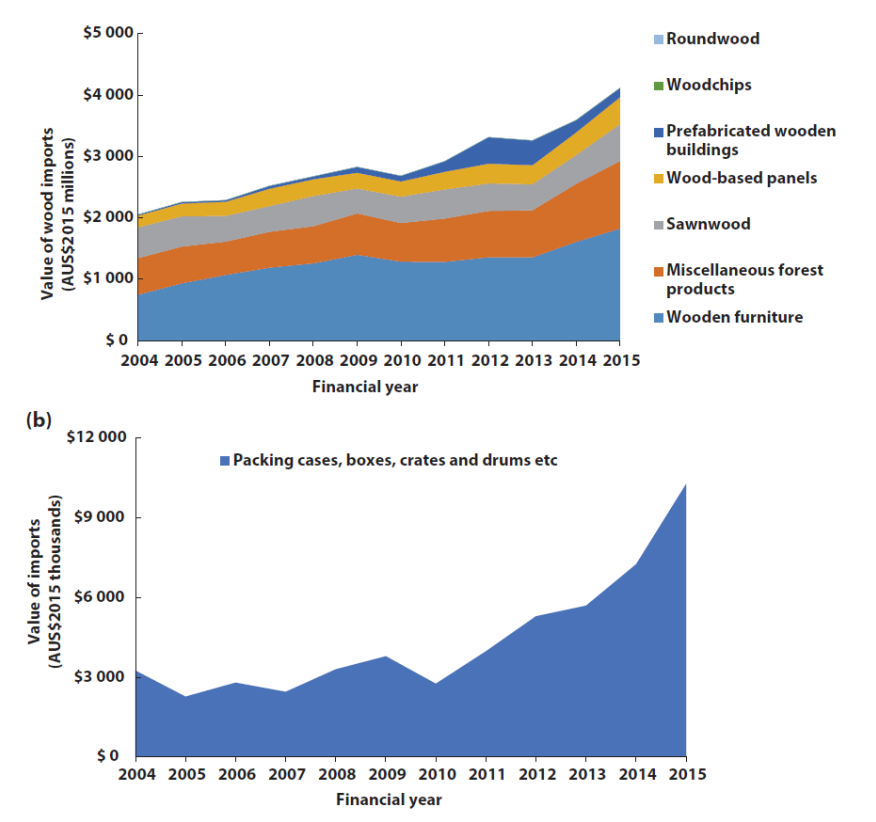






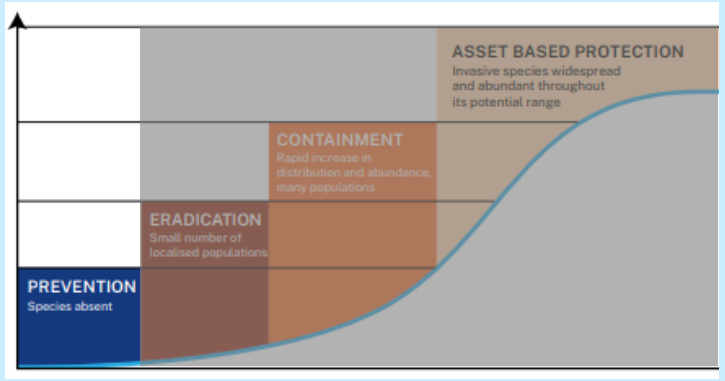
Carnegie et al. (2017) Evaluating the costs and benefits of managing new and existing biosecurity threats to Australia's plantation industry. FWPA Report: PNC362-1415.
Lawson, Carnegie et al. (2018) Risk of exotic pests to the Australian forest industry. *Australian Forestry* 81:3-13.

Increase imports of wood products...?



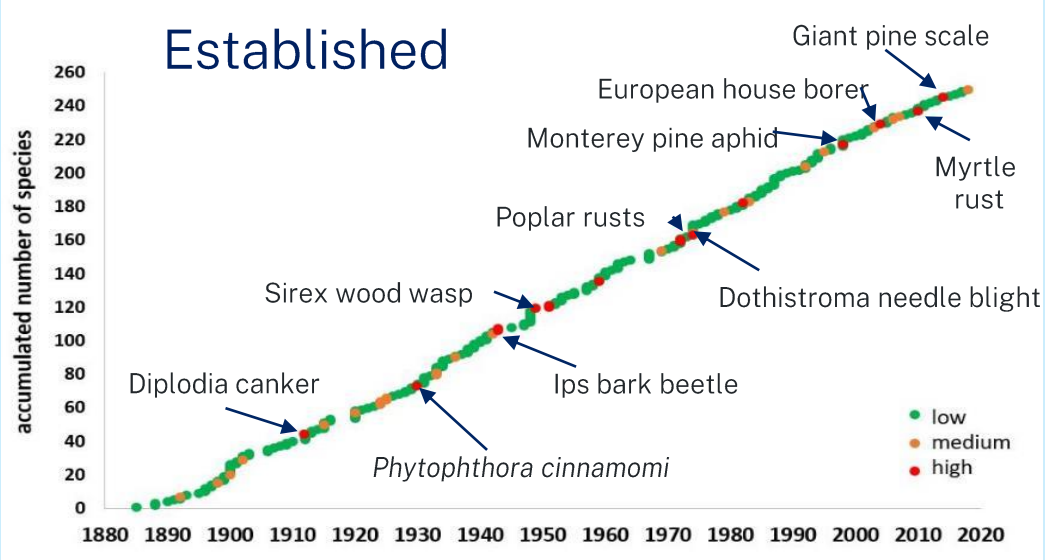
Lawson, Carnegie et al. 2018. Risk of exotic pests to the Australian forest industry. *Australian Forestry* 81:3-13.

Pathway and entry risk analysis

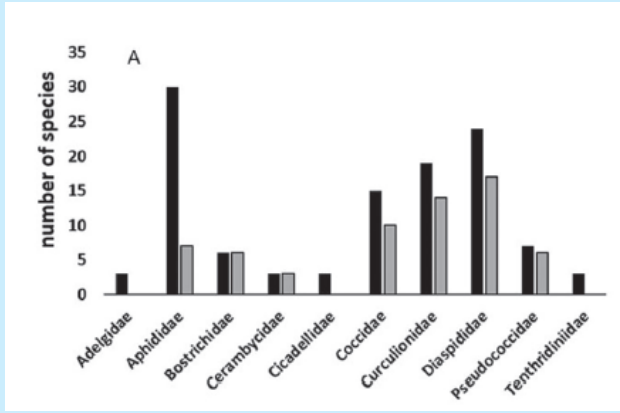


Identifying the risk of exotic pests and pathogens arriving and establishing in Australia

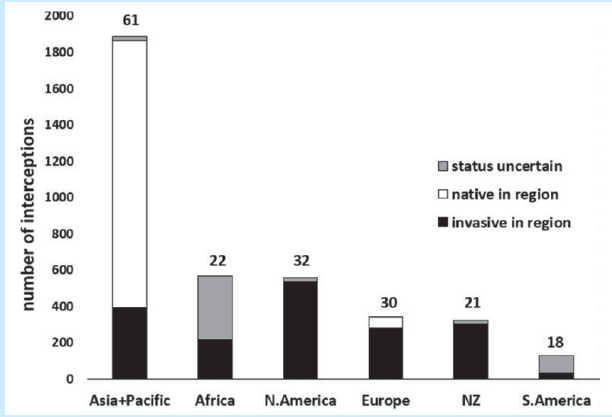
- What species arrive and establish:



Intercepted



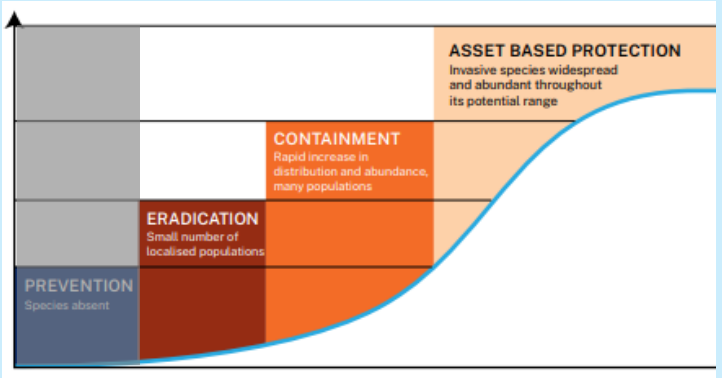
Insect Families



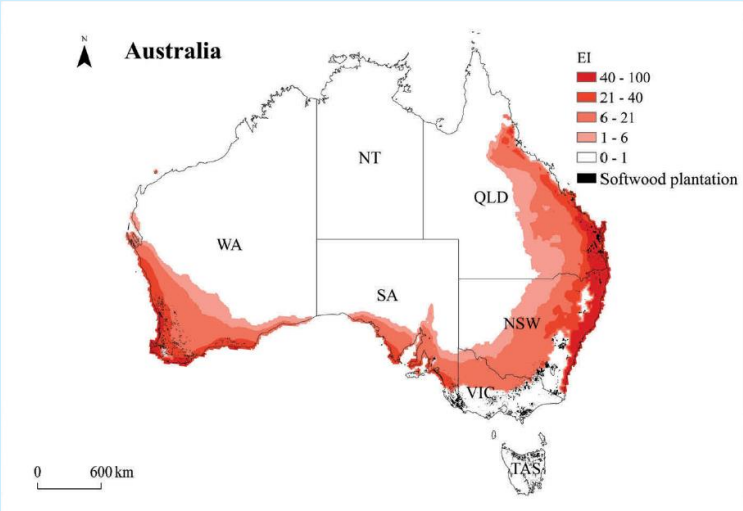
Country of origin

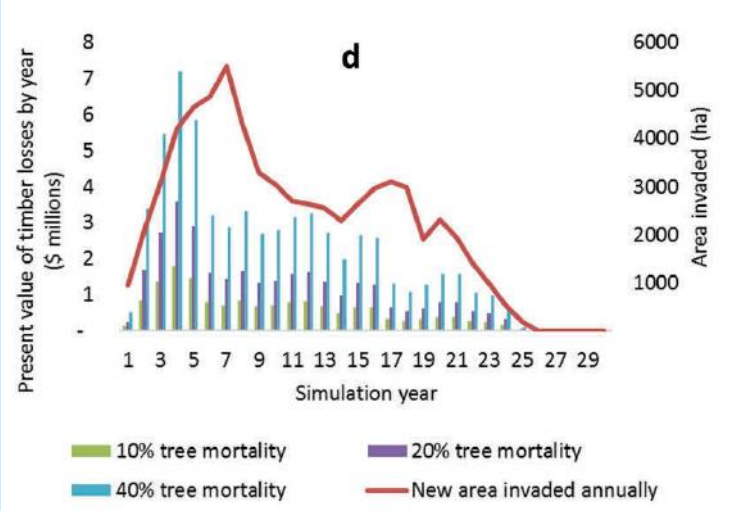
Nahrung & carnegie (2020) Non-native forest insects and pathogens in Australia: establishment, spread and impact. *Frontiers in Forests and Global Change* 3(37)
Nahrung & Carnegie (2021) Border interceptions of forest insects established in Australia: intercepted invaders travel early and often. *NeoBiota* 64:69–86.

Potential cost of exotic pests



Incursion risk scenario





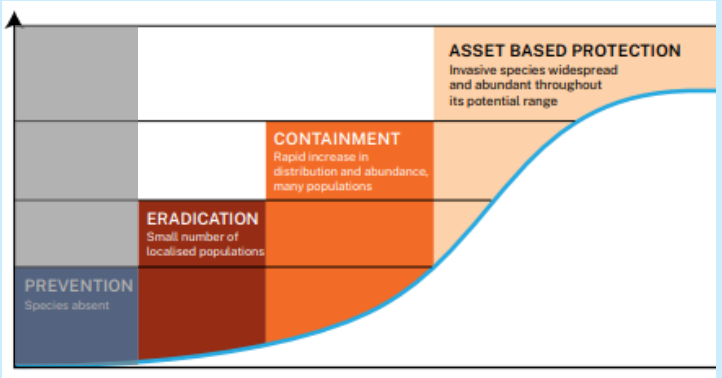
Eradication attempt:
- 2181 ha
- $26 million

Impact across one rotation (30 y):
- 90,000 ha
- 20% mortality
- $65 million to $106 million

Economically efficient to spend $345,000 pa on biosecurity activities

Carnegie et al. (2018) An analysis of the pest risk and potential economic impact of pine wilt disease to *Pinus* plantations in Australia. *Australian Forestry* 81:24-36

Actual cost of exotic pests



Myrtle rust -environment

- $3.5 M emergency response
- $9 M plant nursery costs
- >$5 M R&D
- Extinction of native flora
- *failure of environmental biosecurity system in Australia

Sirex wood wasp -plantation

- 5 million trees killed in single outbreak; $21 M impact
- $500,000 pa in management

Elm leaf beetle -urban forest

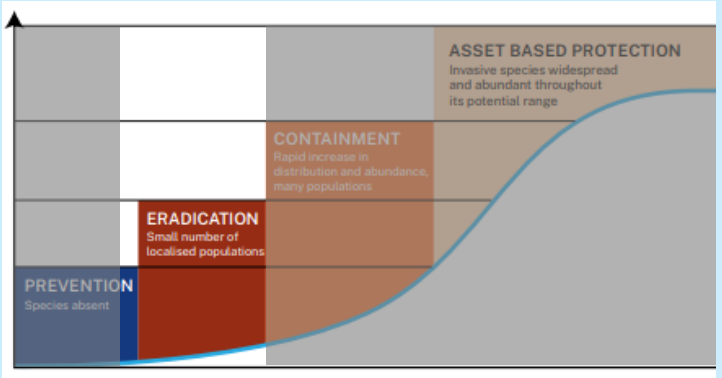
- $250,000 pa urban tree management (LGA)
- Lost amenity, danger

European house borer -houses

- >$40 M in eradication & control

Carnegie & Nahrung (2019) Post-border forest biosecurity in Australia: response to recent exotic detections, current surveillance and ongoing needs. *Forests* 10:336
Carnegie & Pegg (2018) Lessons from the incursion of myrtle rust in Australia. *Annual Review of Phytopathology* 56:457-478

Impact of this work:

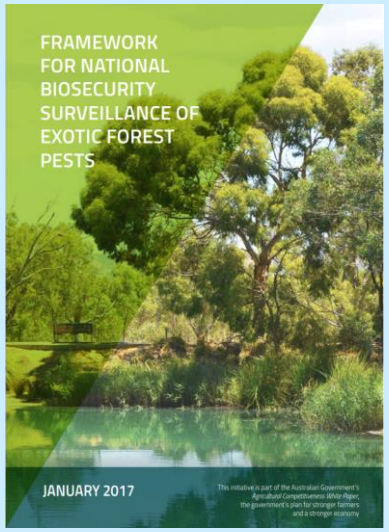


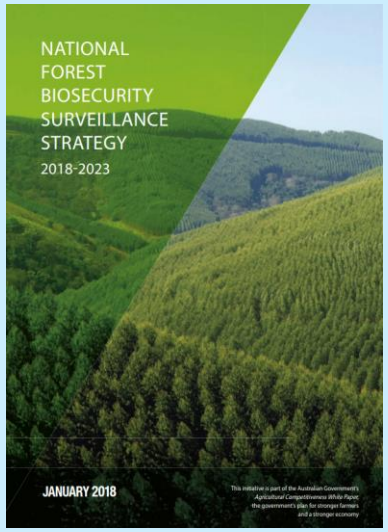
Plantation forest industry agree to Biosecurity Levy to fund national biosecurity activities

- National Forest Biosecurity Surveillance Program
- National Forest Biosecurity Manager (AFPA)

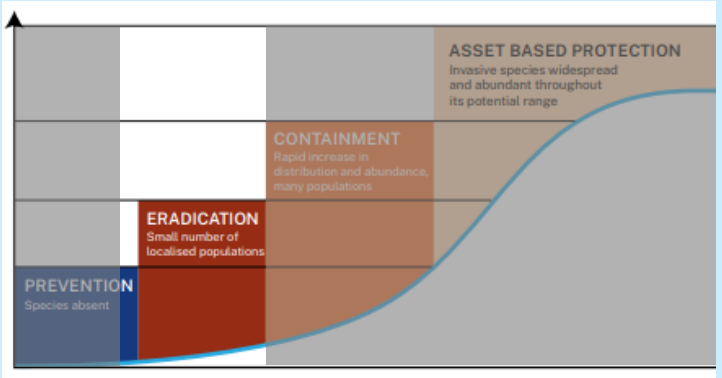
FOREST WATCH AUSTRALIA

www.planthealthaustralia.com.au





Early detection surveillance

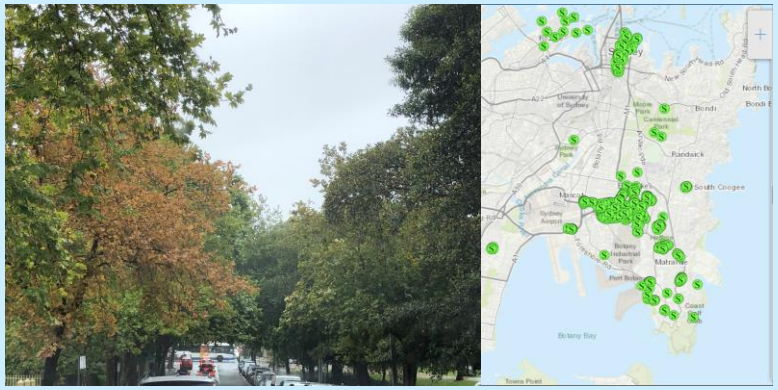


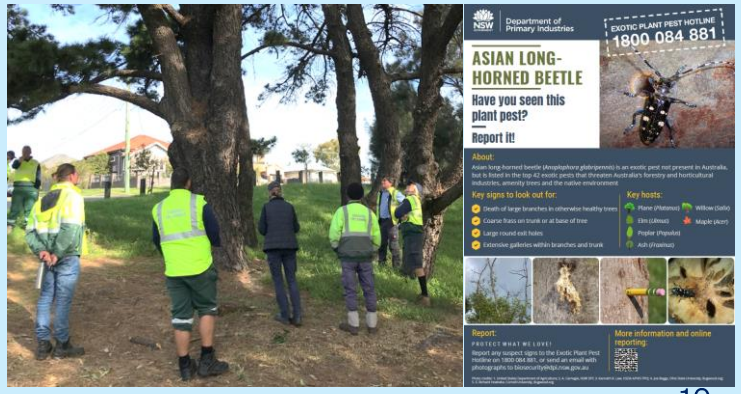
NSW forest biosecurity surveillance program since 2014

- Funded by Forestry Corporation of NSW

Forest Watch Australia program

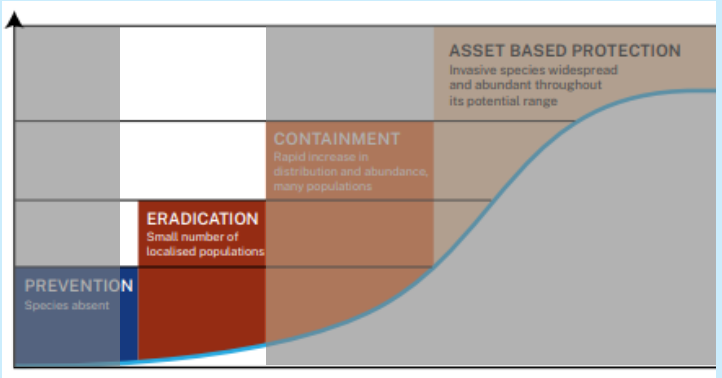
- Funded by plantation forest industry





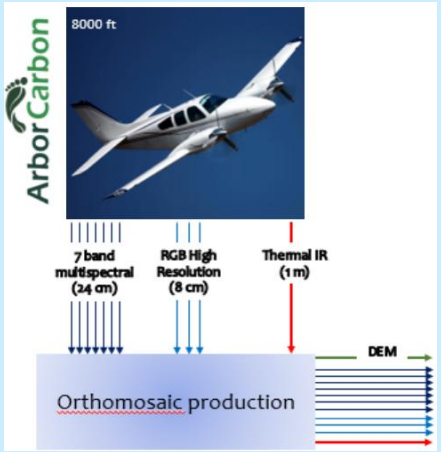
www.dpi.nsw.gov.au/forestry/science/forest-health

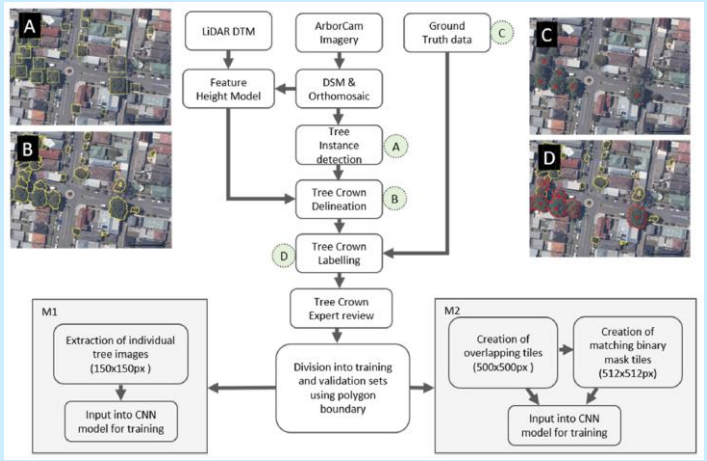
Remote sensing and AI



Using technology to improve early-detection and eradication

Aerial imagery and machine learning to locate and map hosts of forest pests in urban areas

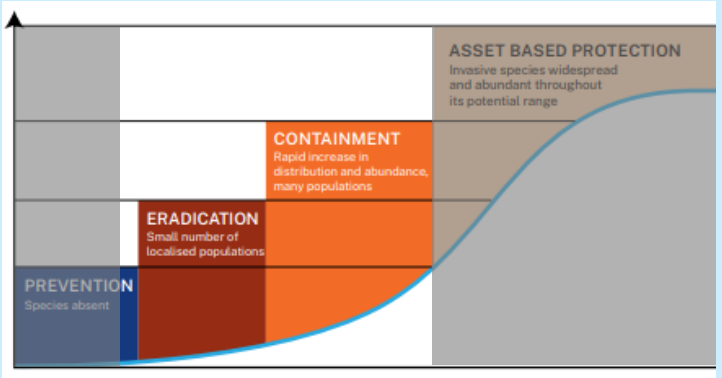




Pinus: 92% accuracy
Platanus: 95% accuracy

Carnegie et al. (2023) Airborne multispectral imagery and deep learning for biosecurity surveillance of invasive forest pests in urban landscapes. *Urban Forestry & Urban Greening* 81:127859

Pest & pathogen diagnostics

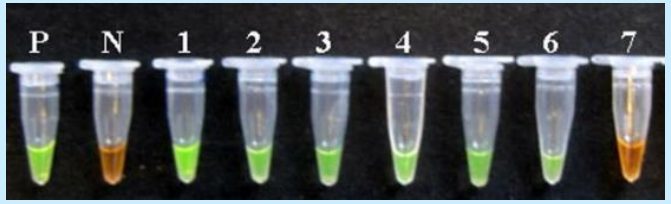


Developing and validating diagnostic protocols to improve accuracy and timeliness

Key pests and pathogens (High Priority Pests)

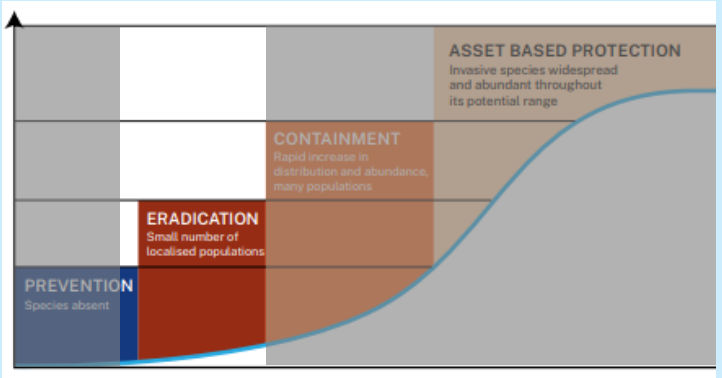
For early-detection surveillance and Proof of Area Freedom surveillance

- High-throughput sequencing
- eDNA
- In-field diagnostics



Trollip, Carnegie et al. (2023) High throughput screening of fungal phytopathogens caught in Australian forestry insect surveillance traps. *Frontiers in Forests and Global Change* 6:1149755

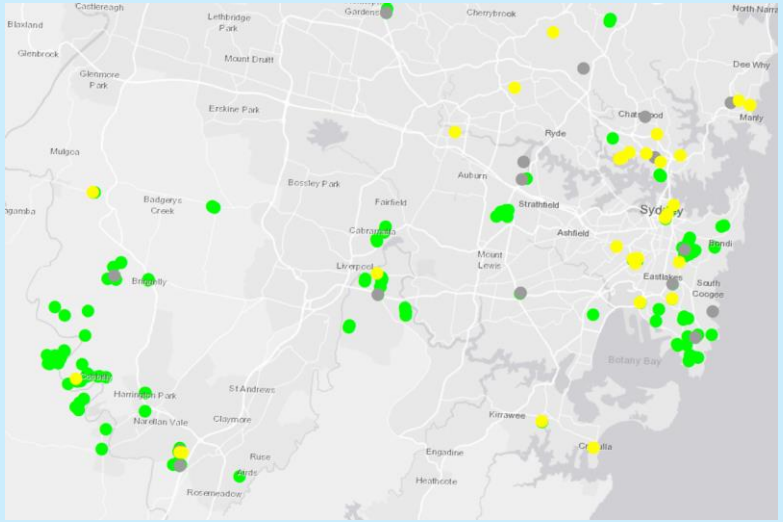
Emergency response surveillance



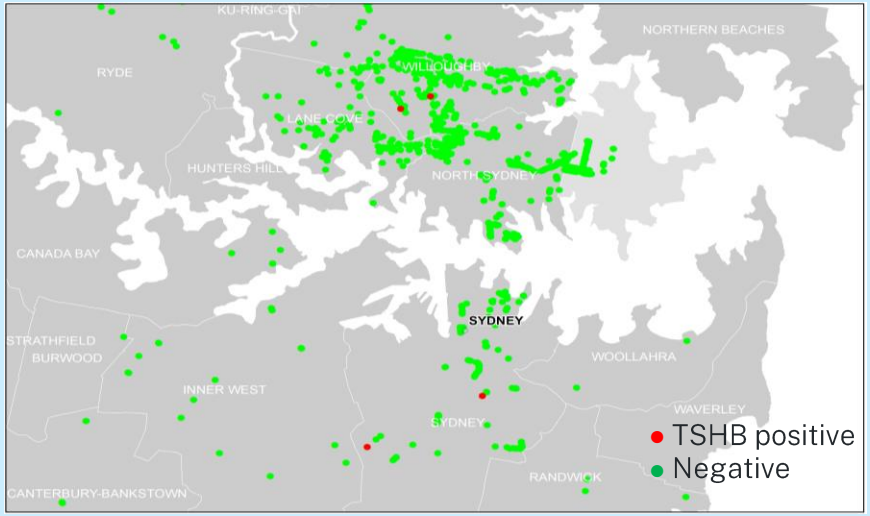
DPIRD Forest Science lead forest pest and pathogen responses in NSW

Collaborate with Plant Biosecurity

Exotic strain of myrtle rust

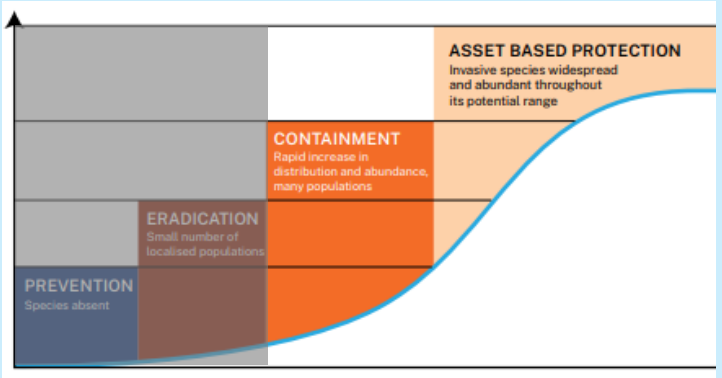


Suspect **Polyphagous Shot Hole Borer**



Callaghan, Carnegie et al. (2024) Response to the detection of Fusarium dieback associated with ambrosia beetles on *Acer negundo* in New South Wales. *Australasian Plant Pathology* 53:345–352

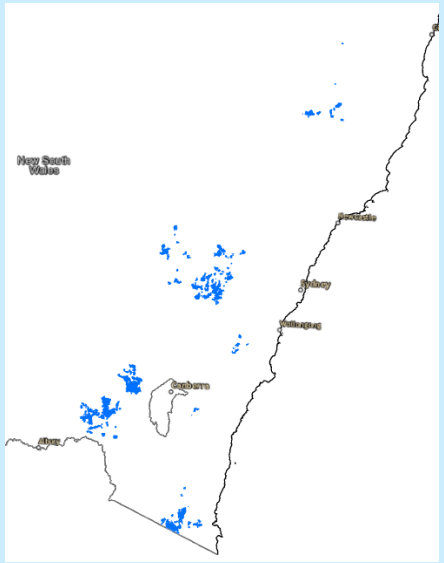
Forest health surveillance

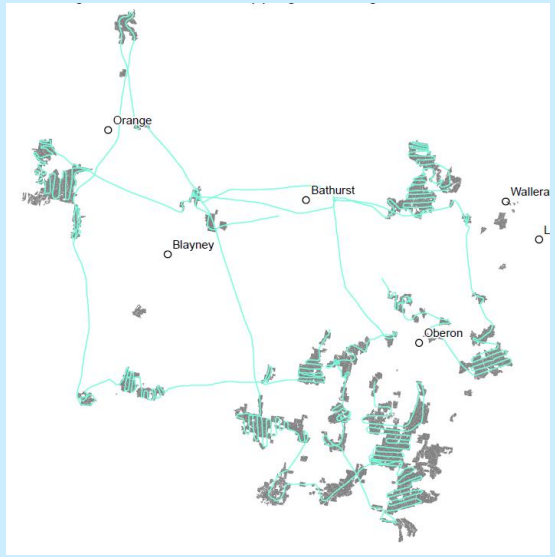


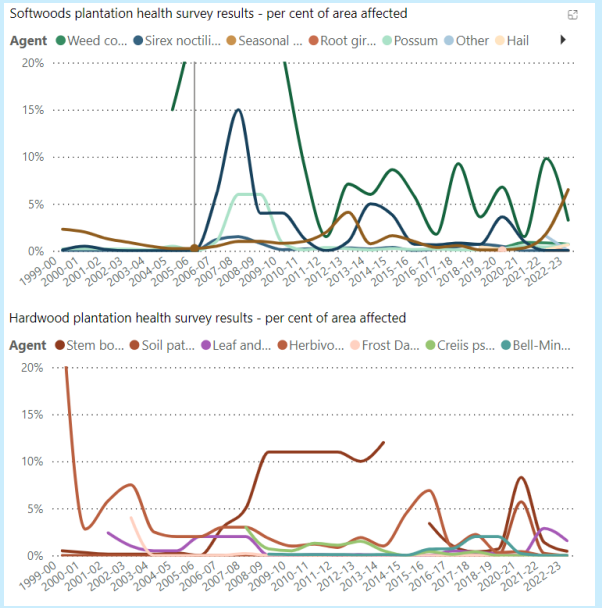
Map the extent and severity of damage agents in plantations

Insect pests, diseases, vertebrate pests, nutritional imbalances, climatic disorders, weeds…

220,000 ha pines; 35,000 ha eucalypts



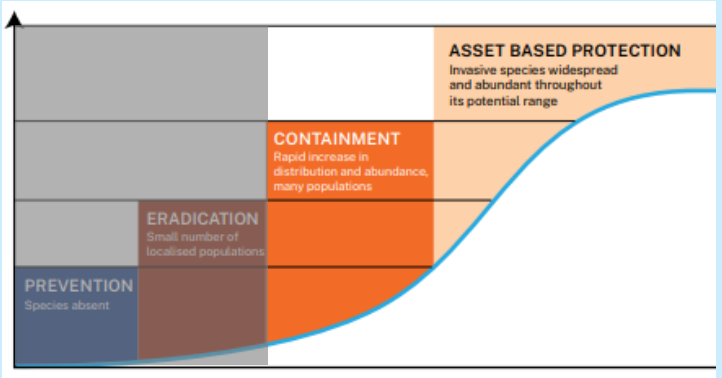




Carnegie et al. (2008) Forest health surveillance in New South Wales, Australia. *Australian Forestry* 71:164-176

Forestry Corporation of NSW

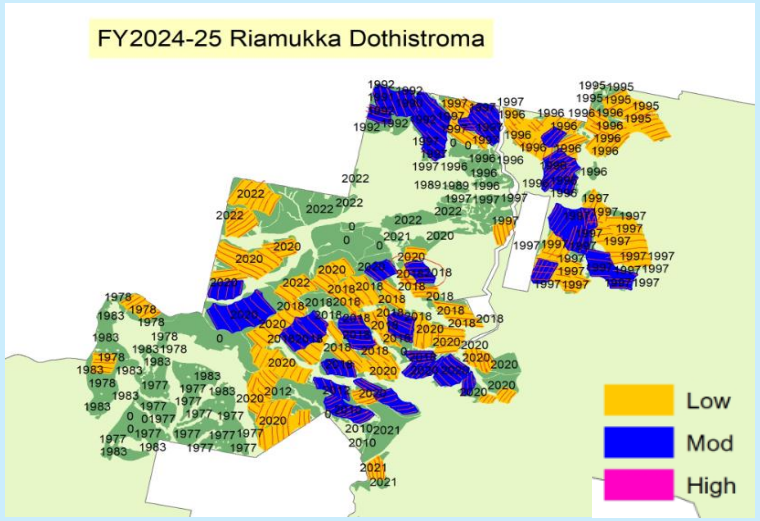
Pest & disease management

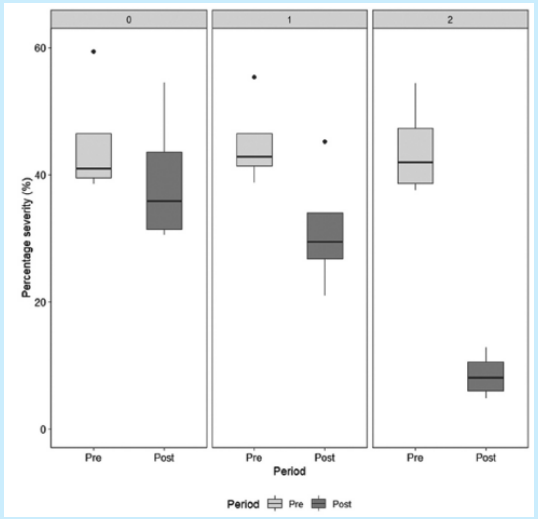


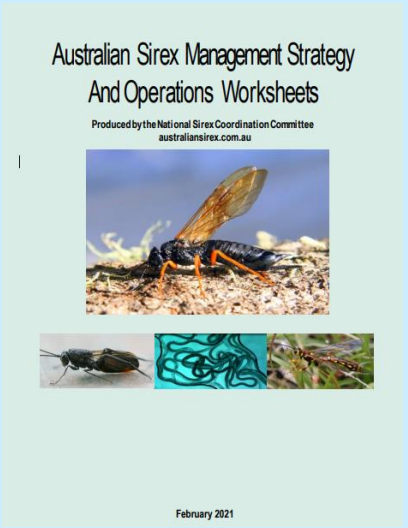
Pest & disease management strategies to protect plantations

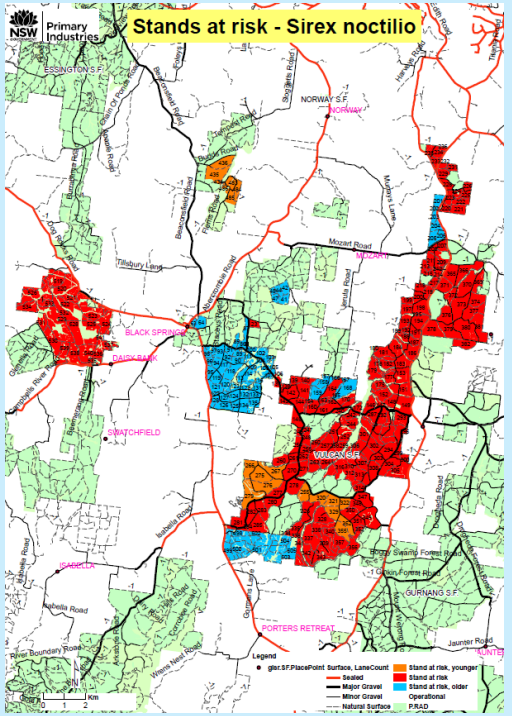
Biocontrol of sirex wood wasp

Fungicide control of dothistroma needle blight



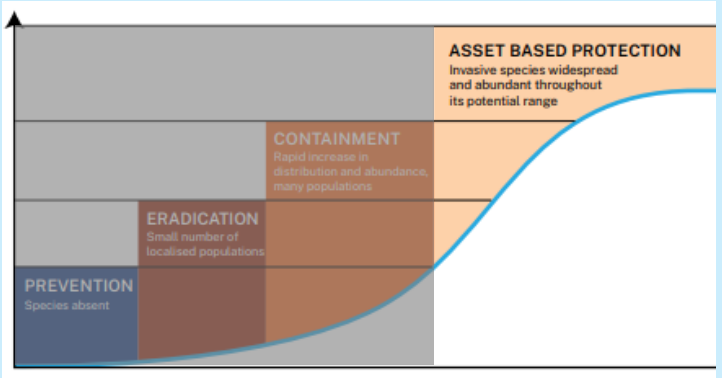




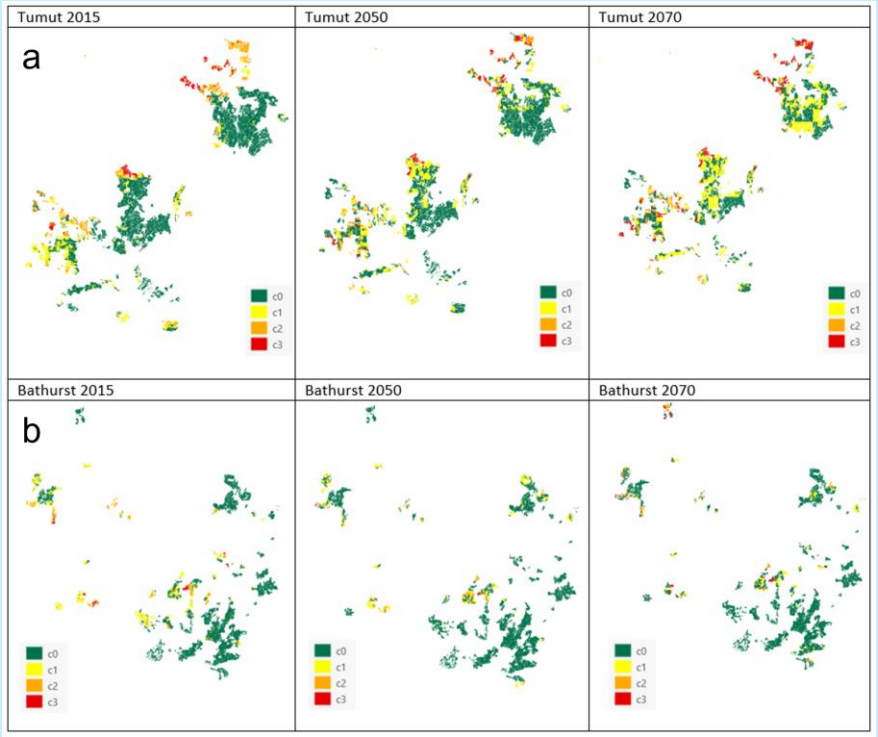


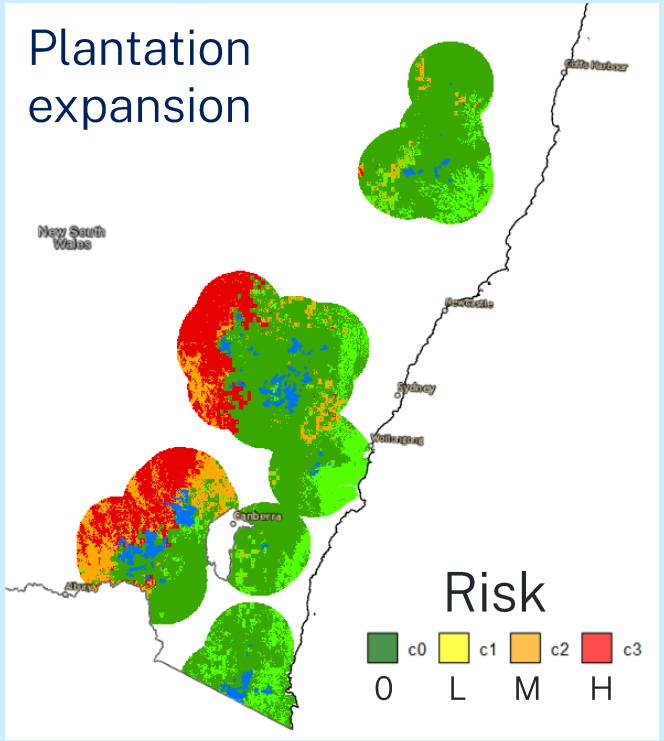
Carnegie & Bashford (2012) Sirex woodwasp in Australia: current management strategies, research and emerging issues. Springer.
Carnegie & Kathuria (2022) Efficacy of cuprous oxide for control of dothistroma needle blight in *Pinus radiata* plantations in Australia. *Australian Forestry* 85:178–186

Risk of climate change



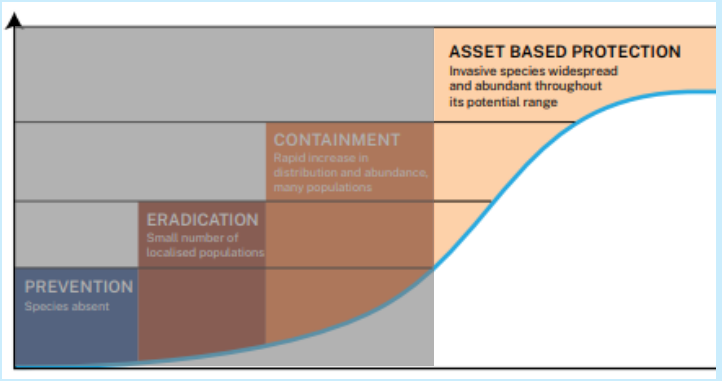
Risk of drought-induced tree mortality in pine plantations





Carnegie et al. (2022) Current and future risks of drought-induced mortality in *Pinus radiata* in New South Wales, Australia. *Australian Forestry* 85:161–177
Kathuria, Carnegie et al. (2024) https://mailchi.mp/dpi.nsw.gov.au/0jhg6mn691-8307974

Carnegie & Pegg (2018) Lessons from the incursion of myrtle rust in Australia. *Annual Review of Phytopathology* 56:457-478



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Impact of myrtle rust in native ecosystems

Biol Invasions (2016) 18:127–144
DOI 10.1007/s10530-015-0996-y

Impact of the invasive rust *Puccinia psidii* (myrtle rust) on native Myrtaceae in natural ecosystems in Australia

Angus J. Carnegie · Amrit Kathuria · Geoff S. Pegg · Peter Entwistle · Matthew Nagel · Fiona R. Giblin

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Assessment and prioritisation of plant species at risk from myrtle rust (*Austropuccinia psidii*) under current and future climates in Australia

K. Berthon[a,*], M. Esperon-Rodriguez[a], L.J. Beaumont[a], A.J. Carnegie[b], M.R. Leishman[a]

Austral Ecology (2018) **43**, 56–68

Impacts of the invasive fungus *Austropuccinia psidii* (myrtle rust) on three Australian Myrtaceae species of coastal swamp woodland

LAURA FERNANDEZ WINZER,[1,2*] ANGUS J. CARNEGIE,[2,3] GEOFF S. PEGG[2,4,5] AND MICHELLE R. LEISHMAN[1]

Australasian Plant Pathol. (2012) 41:13–29

Rapidly expanding host range for *Puccinia psidii* sensu lato in Australia

Angus J. Carnegie · Jonathan R. Lidbetter

Biol Invasions
https://doi.org/10.1007/s10530-018-1891-0

Predicting impact of *Austropuccinia psidii* on populations of broad leaved *Melaleuca* species in Australia

G. S. Pegg[1] · D. J. Lee[2] · A. J. Carnegie[3]

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ISSN 2070-2620 EISSN 2070-2639
https://doi.org/10.2989/20702620.2020.1819154

Fire and rust – the impact of *Austropuccinia psidii* (myrtle rust) on regeneration of Myrtaceae in coastal heath following wildfire

GS Pegg[1*], P Entwistle[2], FR Giblin[1] and AJ Carnegie[3]

Australasian Plant Pathology (2019) 48:385–393
https://doi.org/10.1007/s13313-019-00640-4

Endangered species face an extra threat: susceptibility to the invasive pathogen *Austropuccinia psidii* (myrtle rust) in Australia

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Direct and indirect community effects of the invasive plant pathogen *Austropuccinia psidii* (myrtle rust) in eastern Australian rainforests

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Trends in Ecology & Evolution

Imminent Extinction of Australian Myrtaceae by Fungal Disease

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ORIGINAL ARTICLE — WILEY

Genetic diversity of the myrtle rust pathogen (*Austropuccinia psidii*) in the Americas and Hawaii: Global implications for invasive threat assessments

PLANT DISEASE FEATURE

A Global Assessment of the State of Plant Health

and Global Plant Health Assessment Project (GPHA)

PLOS ONE

Impact of *Austropuccinia psidii* (myrtle rust) on Myrtaceae-rich wet sclerophyll forests in south east Queensland

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Myrtle Rust in Australia

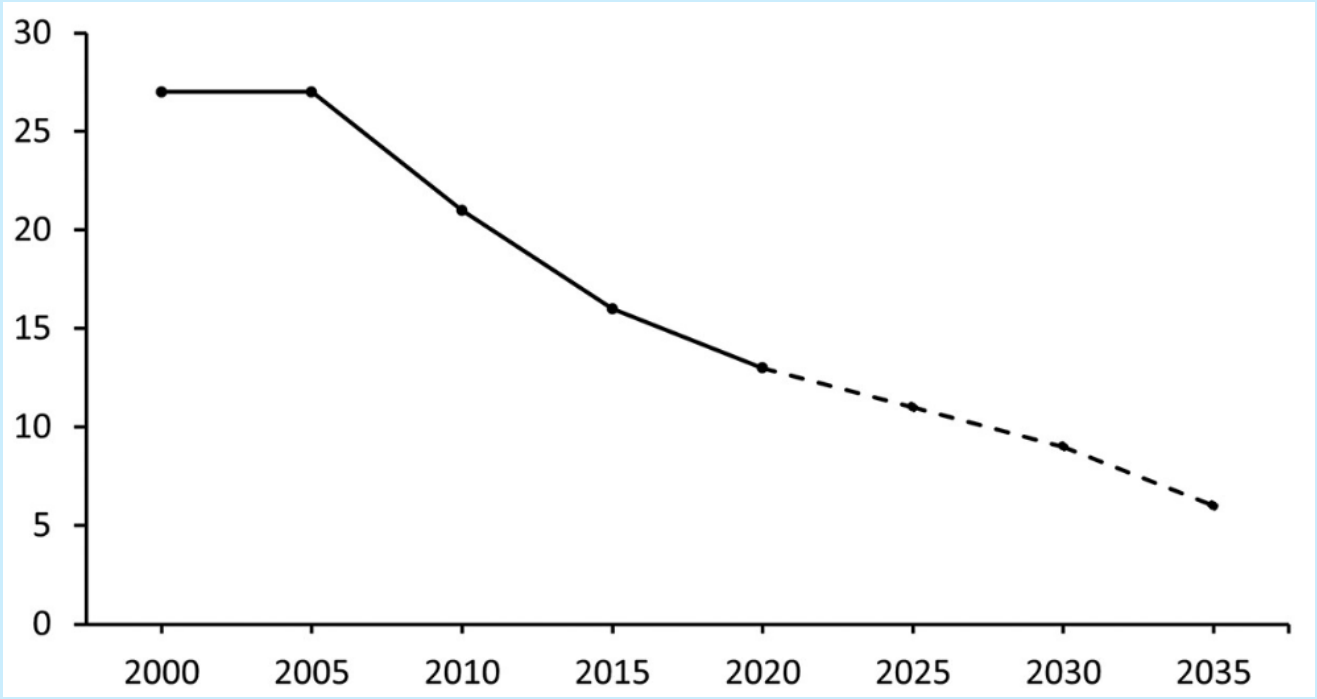
A National Action Plan

July 2020

RO Makinson, GS Pegg, AJ Carnegie

PLANT BIOSECURITY science foundation

Decline in forest health & biosecurity expertise



Decline in technical expertise in forest health and biosecurity in Australia, as represented by membership on the peak national technical expert committee.

The bulk of technical expertise is directly funded by the forest industry.

Carnegie et al. (2022). Editorial: Forest health and biosecurity in a changing world. *Australian Forestry* 85:141–145