

Forest biosecurity risk assessment:



Australian **FORESTRY'S GREATEST HIT LIST**

MUSIC
EVERY BREATH YOU TAKE
CHEN CHEN LADY 1
WHAT IS LOVE 4
SWEET DREAMS 5
LISTEN TO YOUR HEART 1
I'VE TALKED - TONY 7
SWEET DREAMS 8 1
LOVING MY BELONGING 9



Forest
Research
Institute



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Improving pathway and risk assessment for forest pests in Australia

project team

Helen Nahrung (UniSC)
Geoff Pegg (Qld DPI)
Angus Carnegie (NSW DPIRD)
Paco Tovar (AFPA)
James Camac (University of Melbourne)
Rebecca Turner (Scion)

steering committee

Allie Muneri (PFOlsen) - Chair
Michael Ramsden (HQPlantations)
Karl Wotherspoon (STT)
Ben Bradshaw (ABP)
Jodie Mason/Jarrold Gooden (FWPA)



Queensland
Government

PFOLSEN



Sustainable
Timber
Tasmania



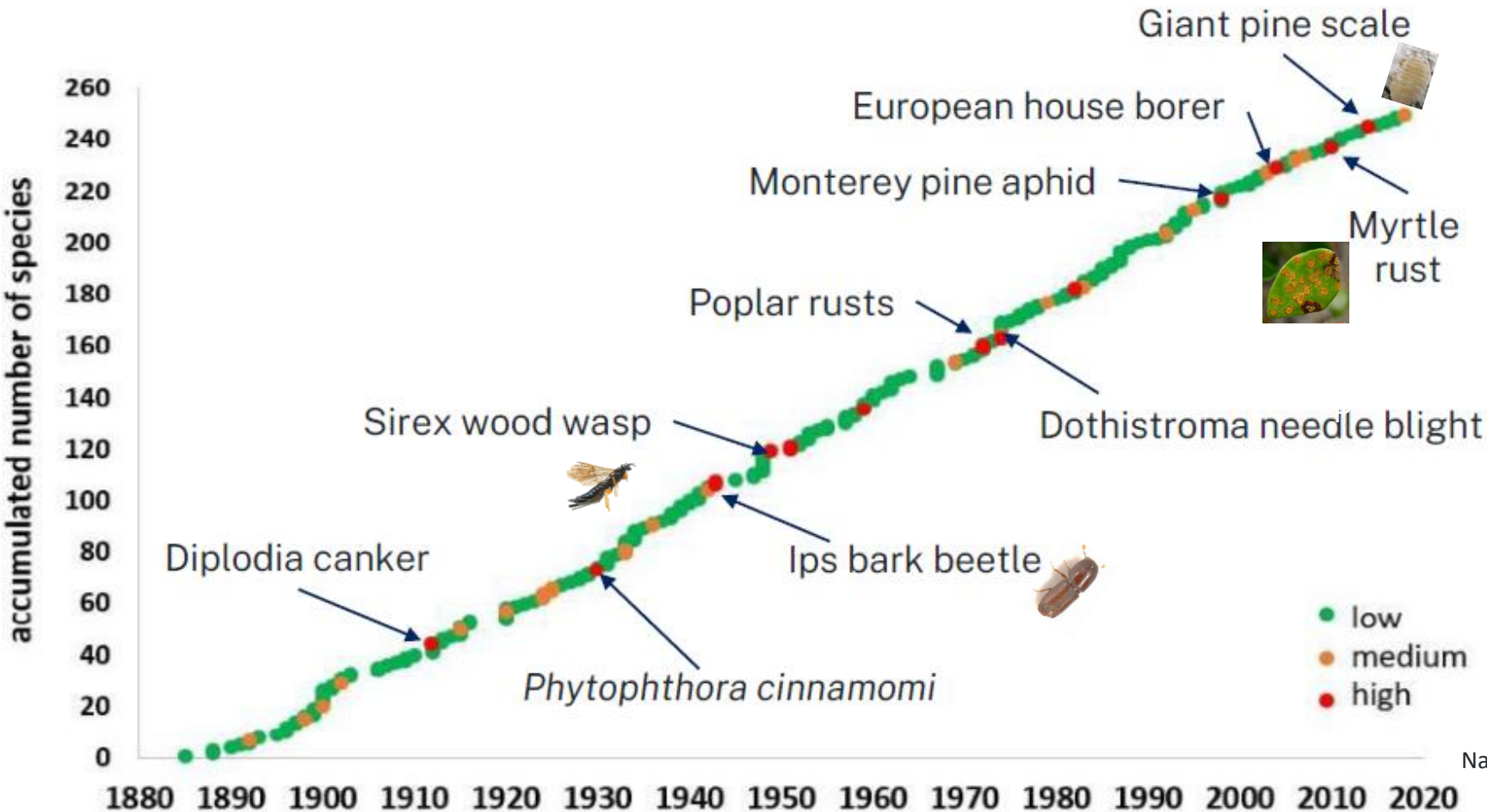
background

~300 non-natives in 130 y
>2/year

20% M-H impact

quarantine/movement restrictions
control/management costs
yield/growth/productivity losses
(inc. wood quality)
trade and market access
timber-in-service

(+ indirect costs for R&D)



Nahrung & Carnegie 2020

costs of invasive forest species



Sirex woodwasp

- 1950s/1960s
- GT outbreak – 5M trees
- ~\$40M m'ment, research, losses
- \$0.5M pa m'ment



Ips bark beetles

- 1940s
- bluestain
 - Sirex biocontrol
- harvest, salvage & trade
- \$100sM



Giant pine scale

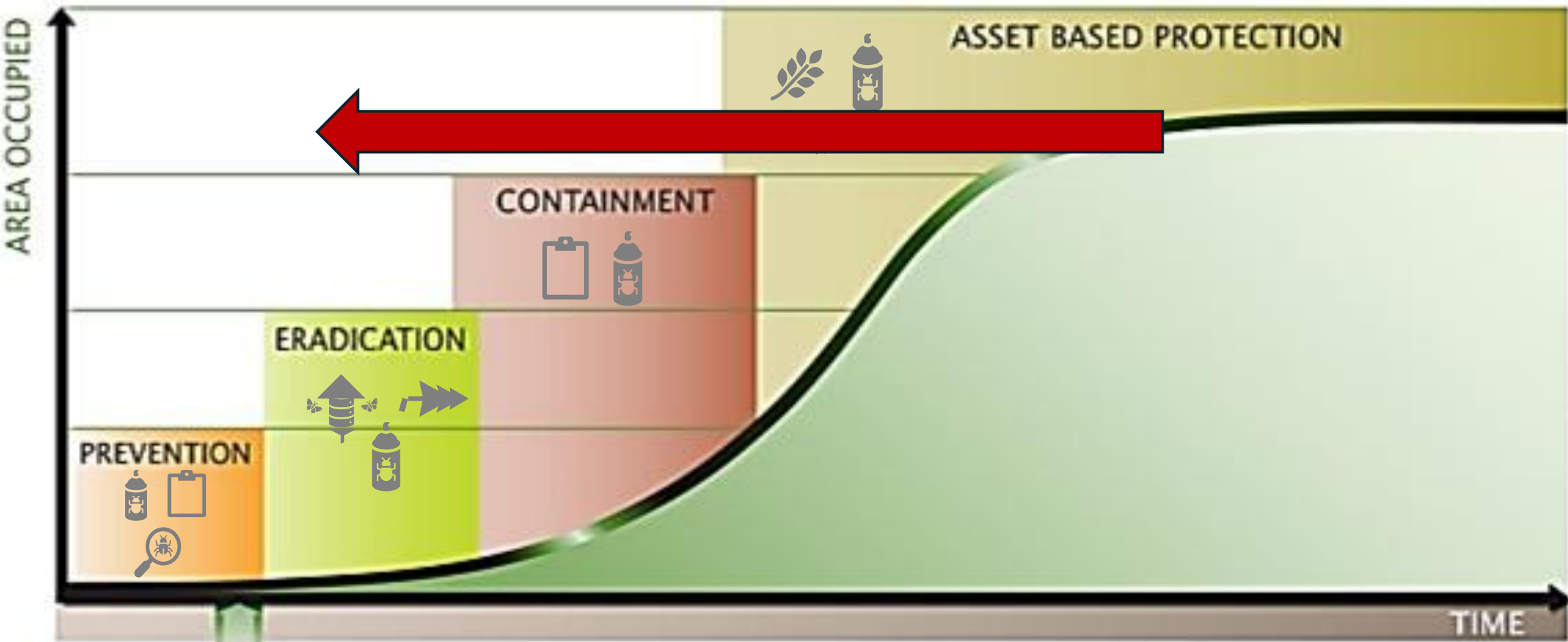
- 2014 (2022)
- Vic, SA
- >\$4M eradication
- \$3M research
- \$?M tree removal



Myrtle rust

- 2010
- extinction
- \$3.5M eradication
- \$9M nursery industry
- >\$4M research

biosecurity continuum – relative costs



species
absent

entry

small
population

expanding
populations

widespread and abundant, many
populations

National Biosecurity Committee 2016

ECONOMIC RETURNS (INDICATIVE ONLY)

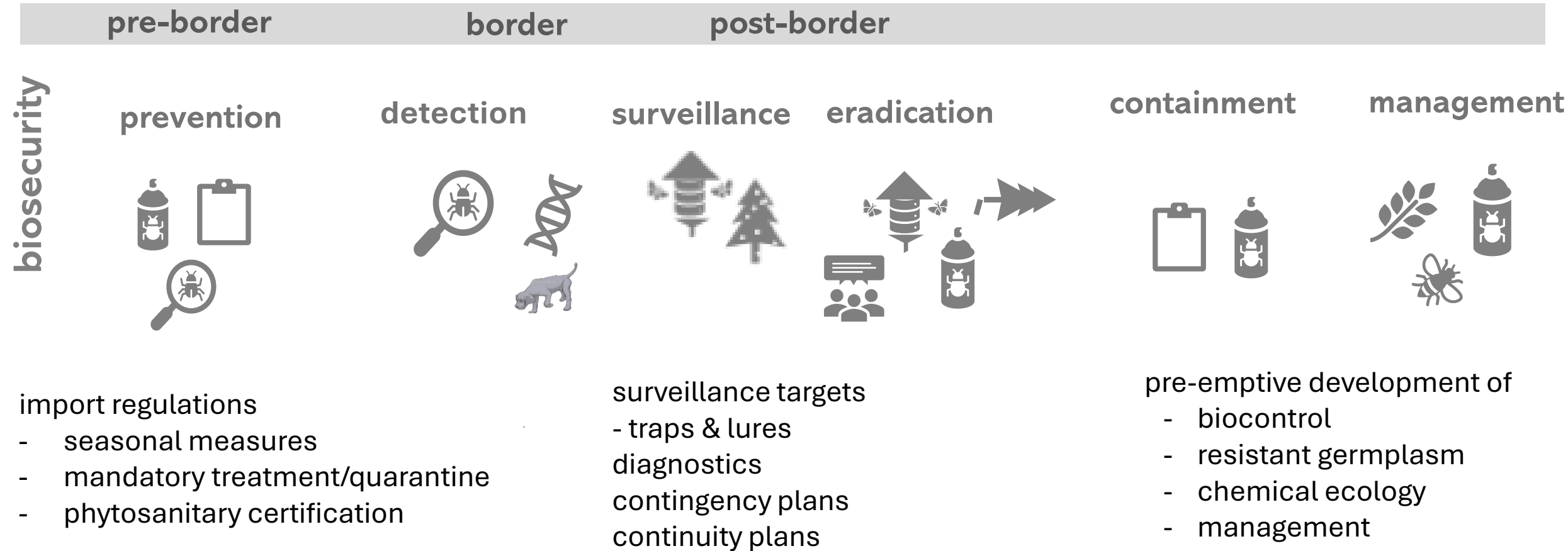
1:100
Prevention

1:25
Eradication

1:5-10
Containment

<1:1-5
Asset Based Protection

what are risks and why do we need to list them?



(increase awareness)

greatest hits lists - 1

National Action Plan for Pests of Trees And Timber 2024–2034



Plant Health Committee

National Action Plan for Pests of Trees and Timber 2024 – 2034

Table 1: Pests in scope of this National Action Plan

Common name	Scientific name
Airborne Phytophthora	<i>Phytophthora kernoviae</i>
	<i>Phytophthora ramorum</i>
Ceratocystis wilt ⁷	<i>Ceratocystis</i> spp. (including <i>Ceratocystis manginecans</i>)
Dutch elm disease	<i>Ophiostoma novo-ulmi</i>
Exotic drywood termites	<i>Cryptotermes brevis</i>
	<i>Cryptotermes dudleyi</i>
	<i>Incisitermes minor</i>
Exotic longhorn beetles	<i>Anoplophora</i> spp.
Exotic strains of myrtle rust	<i>Austropuccinia psidii</i>
Exotic subterranean termite	<i>Coptotermes formosanus</i>
	<i>Coptotermes gestroi</i>
Pine pitch canker	<i>Fusarium circinatum</i>
Pine wilt nematodes and exotic sawyer beetle vectors	<i>Bursaphelenchus cocophilus</i>
	<i>Bursaphelenchus xylophilus</i>
	<i>Monochamus</i> spp.
Polyphagous shot hole borer with Fusarium wilt ⁸	<i>Euwallacea fornicatus</i>
	<i>Fusarium euwallaceae</i>

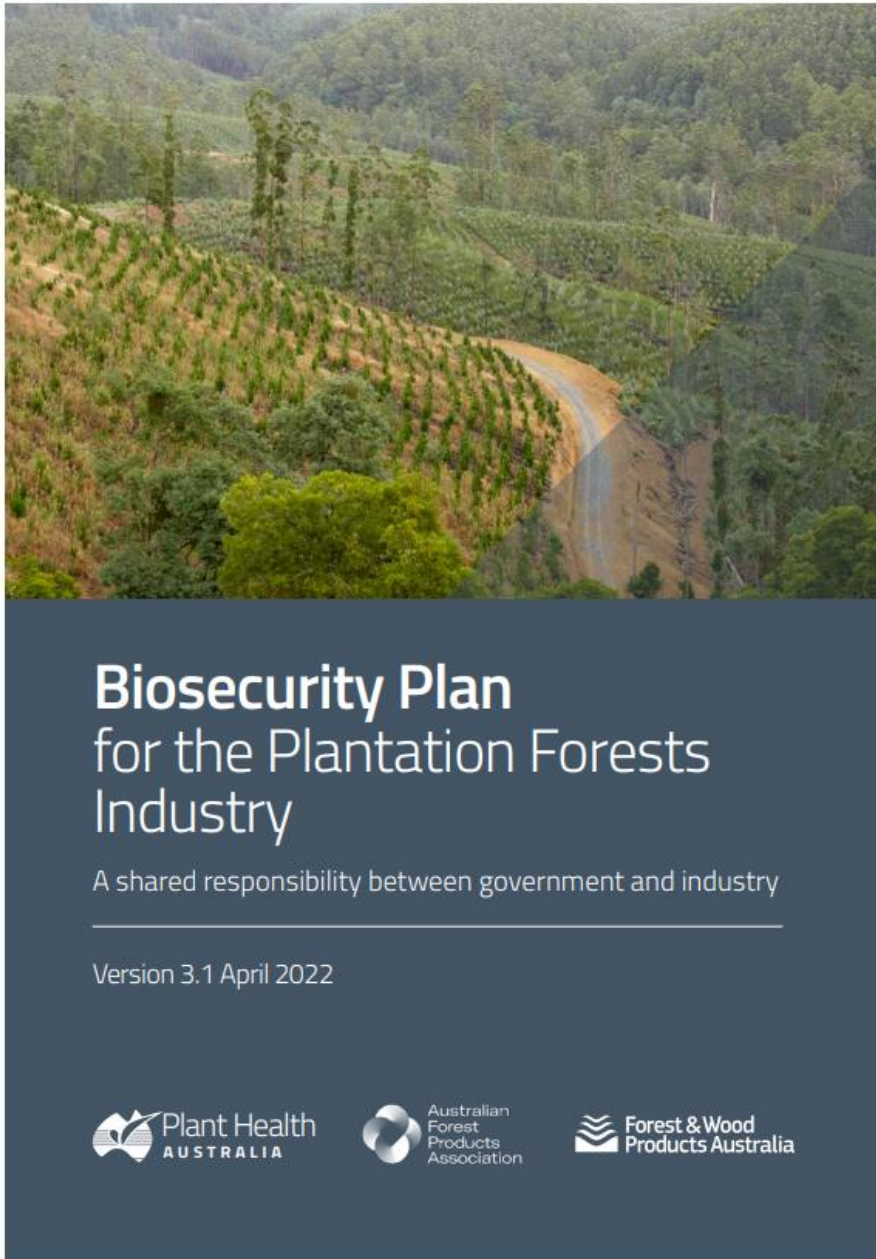
15 things

greatest hits lists - 2

Table E1: Pest information, surveillance protocols, plantation forest HPPs.

SCIENTIFIC NAME / COMMON NAME
<i>Arhopalus ferus</i> Burnt pine longicorn
<i>Dendroctonus valens</i> Red turpentine beetle
<i>Monochamus alternatus</i> , <i>M. galloprovincialis</i> , <i>M. titillator</i> , <i>M. saltuarius</i> , <i>M. scutellatus</i> and <i>Monochamus</i> spp. with associated nematodes including <i>Bursaphelenchus xylophilus</i> . Japanese pine sawyer, Pine sawyer, Southern pine sawyer, White-spotted sawyer
<i>Tomicus piniperda</i> Pine shoot beetle
<i>Lymantria dispar</i> complex Gypsy moth complex, Spongy moth complex
<i>Austropuccinia psidii</i> (exotic strains) Myrtle Rust (including <i>Eucalyptus</i> strain)
<i>Fusarium circinatum</i> Pitch canker
<i>Teratosphaeria destructans</i> Eucalypt leaf blight
<i>Phytophthora pinifolia</i> Daño Foliar del Pino
<i>Phytophthora pluvialis</i> Red needle cast
<i>Phytophthora ramorum</i> Sudden oak death
<i>Bursaphelenchus</i> spp. with insect vectors Pinewood nematodes (PWN)
<i>Coptotermes formosanus</i> Formosan subterranean termite
<i>Coptotermes gestroi</i> Asian subterranean termite

14 things



Biosecurity Plan for the Plantation Forests Industry

A shared responsibility between government and industry

Version 3.1 April 2022





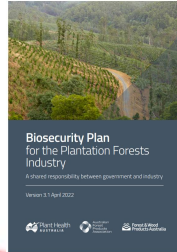
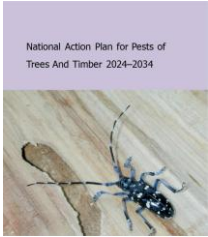
greatest hits lists - 3



SCIENTIFIC NAME COMMON NAME	SURVEILLANCE TYPE		
	TRAPPING	VISUAL SURVEYS	STAKEHOLDER REPORTING
<i>Arhopalus ferus</i> Burnt Pine Longicorn	✓	✓	✓
<i>Austropuccinia psidii</i> (exotic strains) Myrtle rust (other exotic strains)		✓	✓
<i>Bursaphelenchus</i> spp. Pinewood nematode spp. complex		✓	✓
<i>Coptotermes formosanus</i> Formosan subterranean termite			✓
<i>Coptotermes gestroi</i> Asian subterranean termite			✓
<i>Dendroctonus</i> spp. Bark beetles	✓	✓	✓
<i>Dendroctonus valens</i> Red turpentine beetle	✓	✓	✓
<i>Fusarium circinatum</i> Pine pitch canker		✓	✓
<i>Incisitermes minor</i> Western drywood termite			✓
<i>Lymantria dispar</i> Spongy moth		✓	✓
<i>Lymantria monacha</i> Nun Moth	✓	✓	✓
<i>Monochamus</i> spp. Longhorn beetles	✓	✓	✓
<i>Monochamus alternatus</i> Japanese pine sawyer beetle	✓	✓	✓
<i>Phytophthora pinifolia</i> needle disease of <i>Pinus radiata</i>		✓	✓
<i>Phytophthora pluvialis</i> Red needle cast		✓	✓
<i>Phytophthora ramorum</i> Sudden oak death		✓	✓
<i>Teratosphaeria destructans</i> Eucalypt leaf blight		✓	✓
<i>Tomicus piniperda</i> Pine shoot beetle	✓	✓	✓

17 things

greatest hits lists compilation



Austropuccinia psidii (exotic strains)
Bursaphelenchus spp
Coptotermes formosanus
Coptotermes gestroi
Fusarium circinatum
Phytophthora ramorum

N=25



how good are we at predicting risk?

- of the last ~30 forest pests to establish:
 - 85% not considered high risk
 - 4 high impact (2 predicted)

some we'd **never even heard of**
eg GPS, *Pseudocercospera*, *Essigella*...

(the known unknowns)



established

139 species

70 1° forestry

20 moderate-high impact

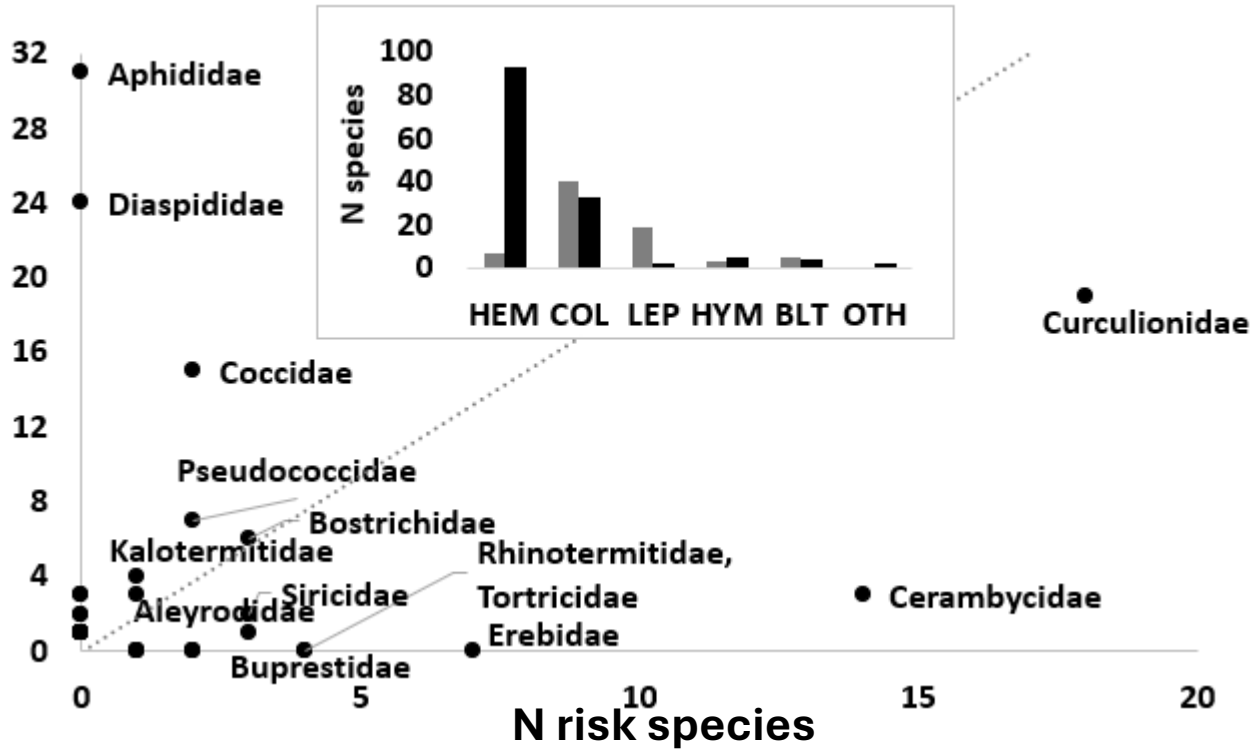
risk

74 species

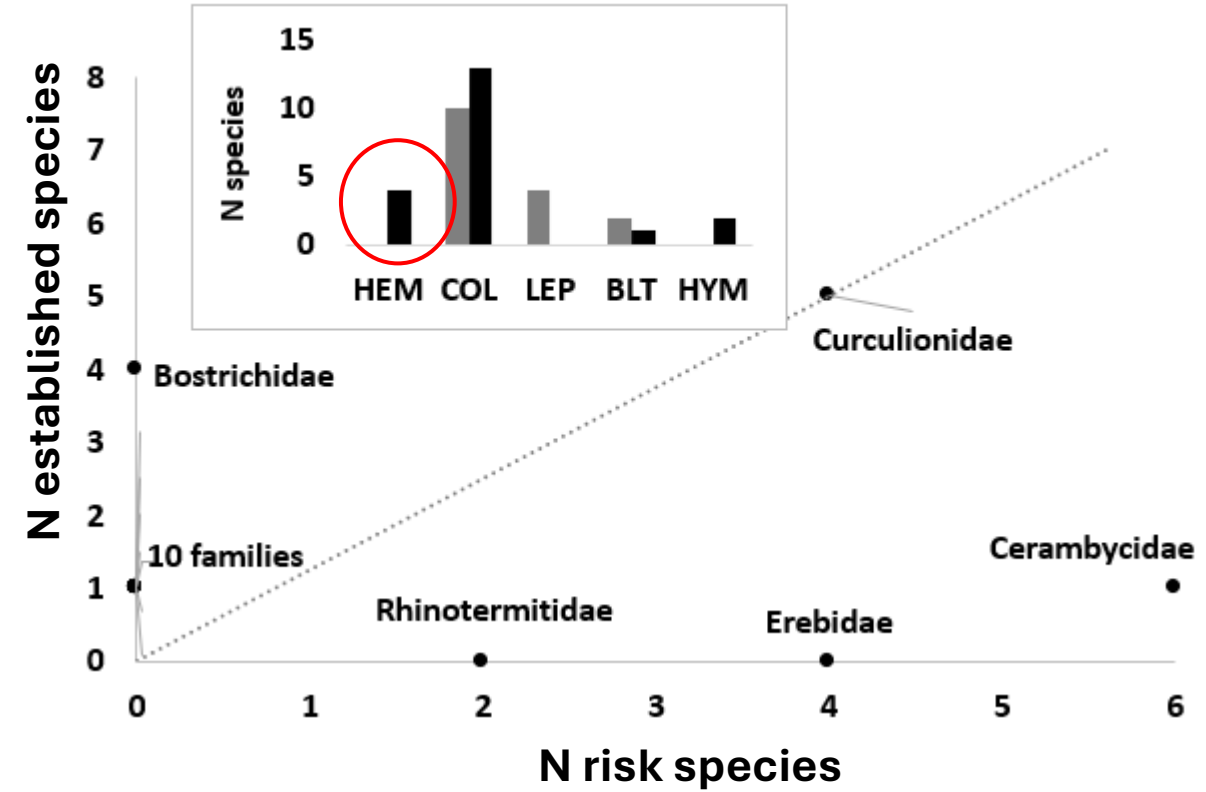
44 1° forestry

16 moderate-high priority

N established species



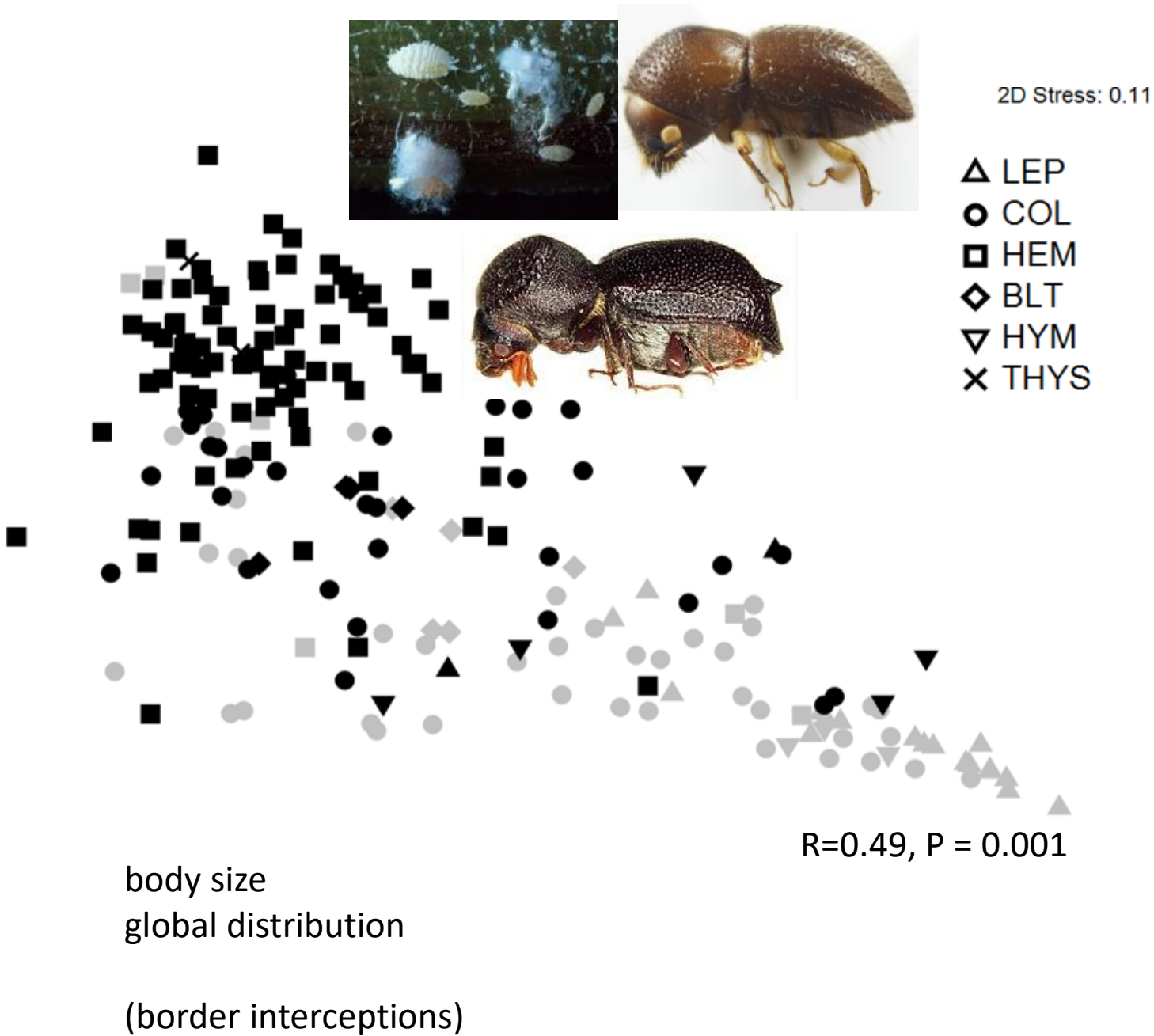
N established species



established (139)
risk (74)

body size
repdve mode
distribution
polyphagy
concealment
host-association

border interceptions



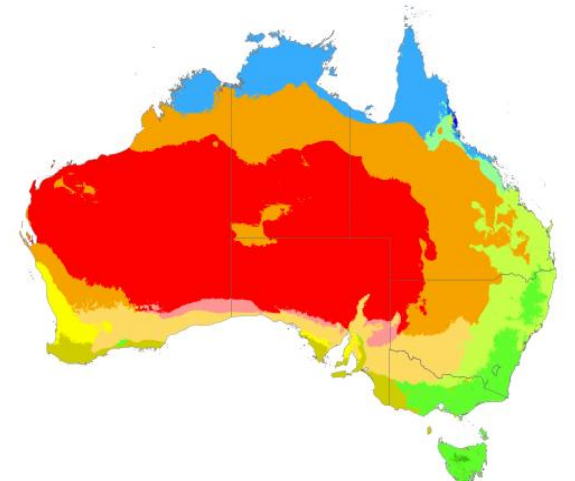
can we do it better?

can we use:

- global records
- trait/taxonomic representation
- arrival data (border detections)
- climate-matching
- trade/population data
- other risk factors

to:

- reduce known unknowns
- improve our risk assessments
 - mitigate potential pathways
 - surveillance for early detection
 - pre-emptive tools/controls



Improving pathway and risk assessment for forest pests in Australia

objectives

1. Collate records of all exotic insects and pathogens using Australia's key forest plantation taxa overseas.
2. Develop and apply risk rating model to prioritise pests using evidence-based criteria not currently considered in forest biosecurity risk assessments, and compare with current outputs.
3. Conduct pathway analysis to improve surveillance targets and strategies towards early detection of new exotic pests.



1. Collate records of all exotic insects and pathogens using Australia's key forest plantation taxa

softwoods

Pinus radiata
Pinus taeda
Pinus caribaea
Pinus elliottii
Pinus pinaster
Araucaria spp.

hardwoods

Eucalyptus spp.
Corymbia spp.

✓insects	1,178	2,299	= 6,559 (!)
✓fungi + fungi-like organisms	1,022	2,060	

- literature & database searches for **host** records (APPD, CABI, EPPO, USDA, scalenet, NHM HOSTS etc)
- names checked and cleaned for taxonomy/synonyms etc → one consistent name per organism
- searches for **distribution** records (GBIF, ALA, iNaturalist, CABI, EPPO, ESDA, scalenet, NHM etc)
- allocation of native/invasive status where possible (mostly for the insects)

✗ nematodes, mites, viruses, bacteria...

✗ *Pinus* spp.

2. Develop and apply risk rating model – pathogens, softwoods

1,022 → **discard** 540 in Australia → database

= 482 not present

discard: sp only records (79)
non-pathogens/wood decay etc (177)
limited host & distbn spp (99)
pathologist call (24)

= 103 retained

discard: lower impact
rusts with alternative hosts
(pathologists)

= 50 retained for in-depth risk assessment (objective 3)

- conduct pathway analysis to improve surveillance targets and strategies towards early detection of new exotic pests.

3. Pathway analysis to towards early detection of new exotic pests

a new greatest hits list!

A U S T R A L I A N

Week Ending 22nd December, 1985

AUTHORISED AND ENDORSED BY THE AUSTRALIAN RECORD INDUSTRY ASSOCIATION

TOP FIFTY SINGLES

TW	LW	TI	TITLE	ARTIST	DIST.	CAT.No.
1	2	3	PROCE PROCEASE (How EP)	Michael G	CSI	SA 1203
2	1	18	THE POWER OF LOVE	Amelie Bush	CSI	BA 1211
3	4	9	POWERS CLASS MAN	Steve John	CSI	BA 1212
4	5	4	SAY YOU SAY ME	Amelie Bush	CSI	SA 1203
5	6	10	ROCKY OIL	Amelie Bush	CSI	SA 1203
6	7	11	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
7	8	12	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
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175	176	180	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
176	177	181	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
177	178	182	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
178	179	183	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
179	180	184	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
180	181	185	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
181	182	186	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
182	183	187	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
183	184	188	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
184	185	189	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
185	186	190	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
186	187	191	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
187	188	192	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
188	189	193	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
189	190	194	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
190	191	195	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
191	192	196	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
192	193	197	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
193	194	198	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
194	195	199	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
195	196	200	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
196	197	201	THE POWER OF LOVE	Amelie Bush	CSI	SA 1203
197	198	202	THE POWER OF LOVE	Amelie Bush	CSI	

Improving pathway and risk assessment for forest pests in Australia

outcomes

1. Collate records of all exotic insects and pathogens using Australia's key forest plantation taxa
 - databases of species present in Australia associated with AU forestry hosts, their native/invasive status (insects only) and whatever else useful info I can include...
 - databases of species using AU forestry hosts overseas (and why we didn't consider them a high-priority risk)
2. Develop and apply risk rating model to prioritise pests using evidence-based criteria not currently considered in forest biosecurity risk assessments, and compare with current outputs.
 - top 50 each of insects and pathogen risks to softwoods and hardwoods in AU (=200 things) based on aforementioned risk-rating criteria (global/invasive distributions, phylogenetic signal, border detections, etc)
 - avoid awkward detection scenarios...
3. Conduct pathway analysis to improve surveillance targets and strategies towards early detection of new exotic pests.
 - recommendations for surveillance etc based on climatic suitability, trade values, population sizes etc (of the top 50 picked above); further refinements for Biosecurity Plan, ForestWatch Australia, EPPRD (with expert elicitation etc).

Thank you!



Carnegie AJ & Nahrung HF (2019) Post-border forest biosecurity in Australia: response to recent exotic detections, current surveillance and ongoing needs. *Forests* <https://doi.org/10.3390/f10040336>

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Nahrung HF & Carnegie AJ (2022) Identifying forest pest threats in Australia: are risk lists worth the paper they're written on? *Global Biosecurity* <https://doi.org/10.31646/gbio.148>

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