The risks and costs of exotic forest pests to the Australian forest industry

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Pest pressure, pathways and control activities

Pre-border: Off-shore compliance, International Standards (ISPM15), import restrictions (germplasm, seed), intelligence
Border: goods and passenger inspections, compliance, quarantine, diagnostics
Post-border: port-environ surveillance, emergency response procedures, capacity to respond
Pest pressure: how many pests are there

**Total pest species**
- Monterey pine aphid
- Giant pine scale

**“Top 50”**
- South African eucalypt rust
- Red needle cast
- Ceratocystis wilt
- Pine shoot moth

**High Priority Pests**
- Myrtle rust
- Pine wilt disease
- Sirex wood wasp
- Dothistroma needle blight
History of incursions

Cumulative establishments x Impact

- Diplodia canker
- Sirex wood wasp
- Ips bark beetle
- Elm leaf beetle
- Poplar rusts
- Monterey pine aphid
- Myrtle rust
- Dothistroma needle blight
- Giant pine scale

~20% of establishments have caused significant impact
Pest interceptions

Exotic forest pest interceptions 2000–2016

Forest pest interceptions (2003-2015)

Data source: DAWR (2016)
How they arrived, and where from

- 92% of interceptions arrived by sea

Data source: DAWR (2016)
Increasing risk: pathways for pest entry


Value of Australian imported packing cases, boxes, crates and drums by year (2000–2015)

Data source: ABARES (2015)
Interception of pests already established

Intecepts of Known Established Exotic Pests

Hylastes ater, Hylurgus ligniperda, Ips grandicollis, Arhopalus syriacus, A. rusticus, Hylotrupes bajulus, Xyleborus perforans, Sirex noctilio

Data source: DAWR (2016)
Conclusion

• *This work establishes that there is a clear and present — and ongoing and increasing — threat of exotic forest pests arriving to and establishing in Australia*
The $cost of exotic pests

• Paucity of analyses of the economic impact of forest pests
  • Sirex wood wasp:
    • Green Triangle outbreak killed 5 million trees costing $10–12 million (Haugen 1990)
    • Approximately $500,000 spent annually on sirex control in Australia (Carnegie & Bashford 2012)
  • Monterey pine aphid:
    • $21 million in lost wood production annually (May 2004)
    • Investment in biological control would return a NPV benefit of $15 million (May 2004)
  • Pine pitch canker:
    • Delaying entry by just two years could result in a benefit of $13 million (Cook & Matheson 2008)

“...a need to conduct Benefit-Cost Analysis to engage industry and demonstrate the benefits of biosecurity”
Eucalyptus leaf beetle

• Endemic; herbivorous pest of *Eucalyptus*
• Case study for potential incursion of an herbivorous pest (e.g. gypsy moth)
• Good data from Forestry Tasmania
  • Annual monitoring to identify treatment areas and threshold limits
  • Aerial application of insecticides
### Net cash-flow of costs and benefits of the leaf beetle program ($2015s)

Expenditure on leaf beetle research and management by cost category

Modelled value of the additional timber generated

Area of hardwood plantation

Additional Timber Revenue arising from IPM Program ($2015s) - BASE CASE
Sirex wood wasp

- Established and spreading since 1952: Tas, Vic, SA, NSW, s-e Qld
- Green Triangle outbreak killed 5 million trees
- National Sirex Strategy: biological control using nematodes and parasitoids, surveillance, monitoring
  - National Sirex Coordination Committee & National Sirex Levy
Costs of sirex

- Impact on timber yield (outbreaks)
  - Pittwater, Delatite, Green Triangle
- Eradication (search & destroy)
- Research
- Biological control releases (parasitoids)
- Trap tree program
- Surveillance
New pests add costs to managing plantations

Expenditure on sirex control in Australia

Using 1952 as the baseline for discounting, total expenditure on sirex control in Australia had a NPV of $11.8 M or $44 per hectare

**Management costs: $0.70 per ha per year**
Pine wilt disease

- Pinewood nematode is vectored by Japanese pine sawyer beetle and causes pine wilt disease
  - Native to North America; invaded Japan, China, Korea, Portugal
  - Has killed hundreds of millions of trees
  - Cost tens of million of dollars in control and management
## Pest Risk Assessment

<table>
<thead>
<tr>
<th>ASSUMPTION</th>
<th>VALIDITY</th>
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<tbody>
<tr>
<td><strong>Likelihood of arrival of pinewood nematode and vectors</strong></td>
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<tr>
<td>Monochamus alternatus and Bursaphelenchus xylophilus have a <strong>high</strong> chance of arriving in Australia</td>
<td>Interception records reveal both are regularly intercepted at Australian ports; literature indicates both are intercepted regularly at international ports, including New Zealand. ISPM-15 not effective at negating the chance of these species arriving in SWPM.</td>
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<td><strong>Likelihood of establishment of pinewood nematode and vectors</strong></td>
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<tr>
<td>Bursaphelenchus xylophilus has a <strong>medium</strong> chance of establishing in Australia</td>
<td>Unequivocal evidence, with three recent examples of a Bursaphelenchus sp. establishing in port surrounds (Melbourne, Brisbane, Sydney). Secondary vectors of Bursaphelenchus (Arhopalus spp.) are established in Australia.</td>
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<tr>
<td>Monochamus alternatus has a <strong>negligible</strong> chance of establishing in Australia</td>
<td>No previous evidence of Monochamus species having successfully invaded new countries. Although probable that primary vectors of Bursaphelenchus spp. incursions (above) were Monochamus, none established.</td>
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<td><strong>Likelihood of spread of pinewood nematode and vectors</strong></td>
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<td>Likely spread of pinewood nematode in Australia, assuming M. alternatus established, is <strong>medium</strong></td>
<td>Pinus species common as amenity trees throughout urban and peri-urban environments; all species in Australia known hosts of pinewood nematode, and likely to be stressed and thus attractive to vectors. These would act as “stepping stones” to commercial plantations, which similarly have susceptible species often under water and heat stress. CLIMEX modelling indicates south-east Queensland and north-east NSW, and south-west WA, highly suitable climate for pinewood nematode and M. alternatus.</td>
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<td><strong>Likelihood of significant impact to coniferous plantations</strong></td>
<td></td>
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<tr>
<td>Likelihood of significant impact to commercial plantations is <strong>medium</strong></td>
<td>Pinus species planted in Australia likely to be resistant or only mildly susceptible to pine wilt disease. Ambiguity though over how these species retain this resistance when planted outside their native range in areas where drought and heat stress are common.</td>
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</tbody>
</table>
CLIMEX model: predicted distribution
Incursion scenario

- Japanese pine sawyer beetle with pinewood nematode arrives in SWP material at Brisbane
  - Transported to Caboolture
  - Escapes into amenity trees and Beerburrum plantation
- Spreads 1 km/y or 2 km/y
- 10%, 20%, 40% mortality over 30-year period
- Accidentally transported to Tuan-Toolara plantation
Economic impact of pine wilt disease

- Beerburrum 2 km/y spread rate: 22,000 ha
- Tuan-Toolara 2 km/y spread rate: 67,000 ha
Cost: Benefit of biosecurity

• The sum of the present value of annual damage costs over the 30-year simulation, when tree mortality is 20%:
  • $65 Million (1 km/y)
  • $106 Million (2 km/y)

• Given that arrival of pine wilt disease is not a certain event, expected present value of damage costs are more appropriate for biosecurity policy analysis.
  • 5% chance of establishment, 1 km/y spread, 20% mortality: $6.9 Million

• The total cost of eradication if detected early in the plantation; destroying all hosts in 5 km radius, including wildlings; is $30 Million (includes lost timber revenues of mature plantation)

• Economically efficient to spend up to $350,000/y on biosecurity to keep pine wilt disease from establishing in south-east Queensland
Cost to manage

Establishment / Time

$350,000/y

$65 Million

Eradication

$15–30 Million

0 30
Conclusion

• *Exotic pests that establish in Australia result in added costs to the forest industry*

• *The case studies have demonstrated the potential benefits of efficient spending on biosecurity activities*
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