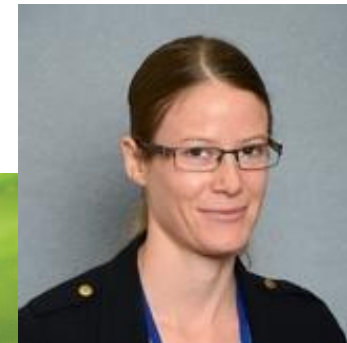


# Insect pest risk appraisal for *Pinus radiata*

Stephanie Sopow, Rebecca Turner & Helen Nahrung  
October 2023



# Distribution of *Pinus* – native range and plantations

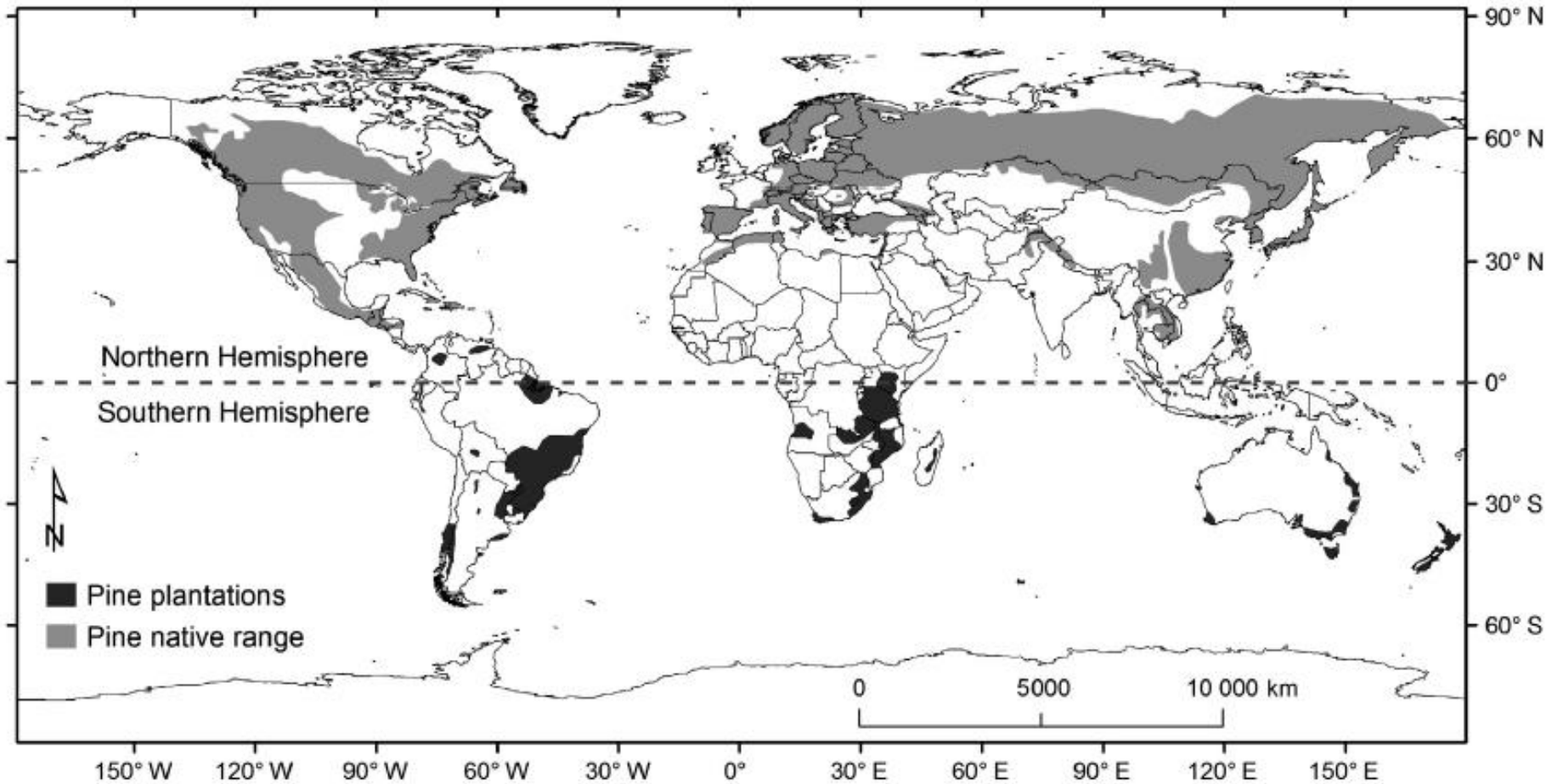
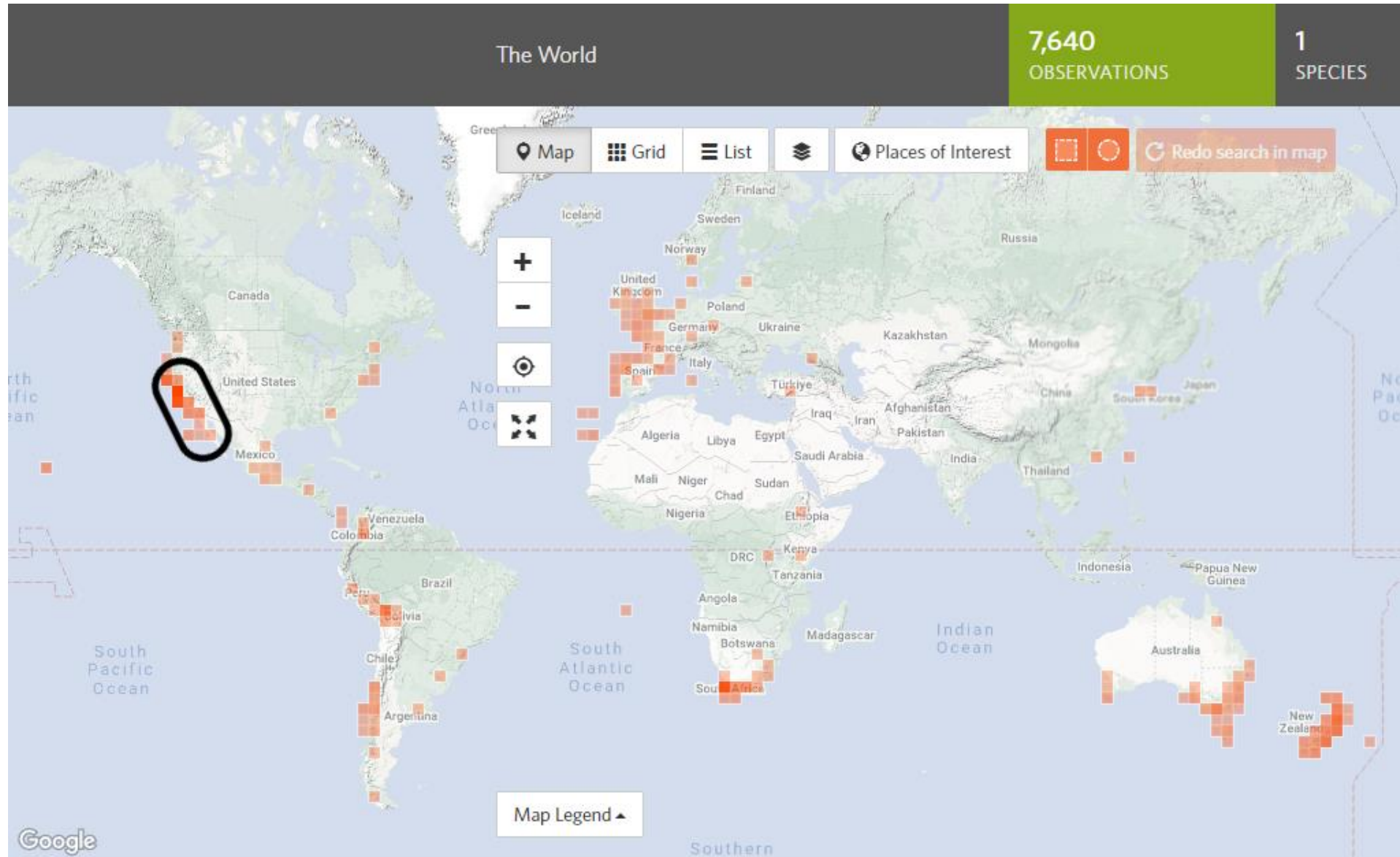


FIG. 1. Native range of pines, and distribution of pine plantations in the Southern Hemisphere.

From: Lantschner MV, Atkinson TH, Corley JC, Liebhold AM. 2017. Predicting North American Scolytinae invasions in the Southern Hemisphere. *Ecological Applications* 27(1): 66-77.

# iNaturalist records of *P. radiata* – native range encircled



# Global list of insects feeding on *Pinus radiata* – objectives

First phase of a larger biosecurity risk assessment project

Objectives:

- Compile a comprehensive list of worldwide records
- Summarise where the insects are native and where they have invaded
- Categorise impact according to damage caused or plant pathogens vectored
- Examine border interceptions to determine pathways

*Marchalina hellenica* (Giant pine scale)



# Global list of insects feeding on *Pinus radiata* – sources and constraints

- Previous lists by Ohmart (published), Bain (unpublished) and Nahrung (unpublished)
- Literature and database searches (Scopus, Google Scholar, CABI Invasive Species Compendium, Global Biodiversity Information Facility, New Zealand Organisms Register, Atlas of Living Australia, Australian Faunal Directory, Australian Plant Pest Database...)
- Excluded timber in service pests (but included dead wood feeders associated with trees)
- International interception dataset as described in Turner et al 2021 “Worldwide border interceptions provide a window into human-mediated global insect movement” (plus further data from South Africa, Japan, NZ and USA)



*Monochamus galloprovincialis* (Black pine sawyer) – vector of pine wilt nematode

# Global list of insects feeding on *Pinus radiata* – impact categories

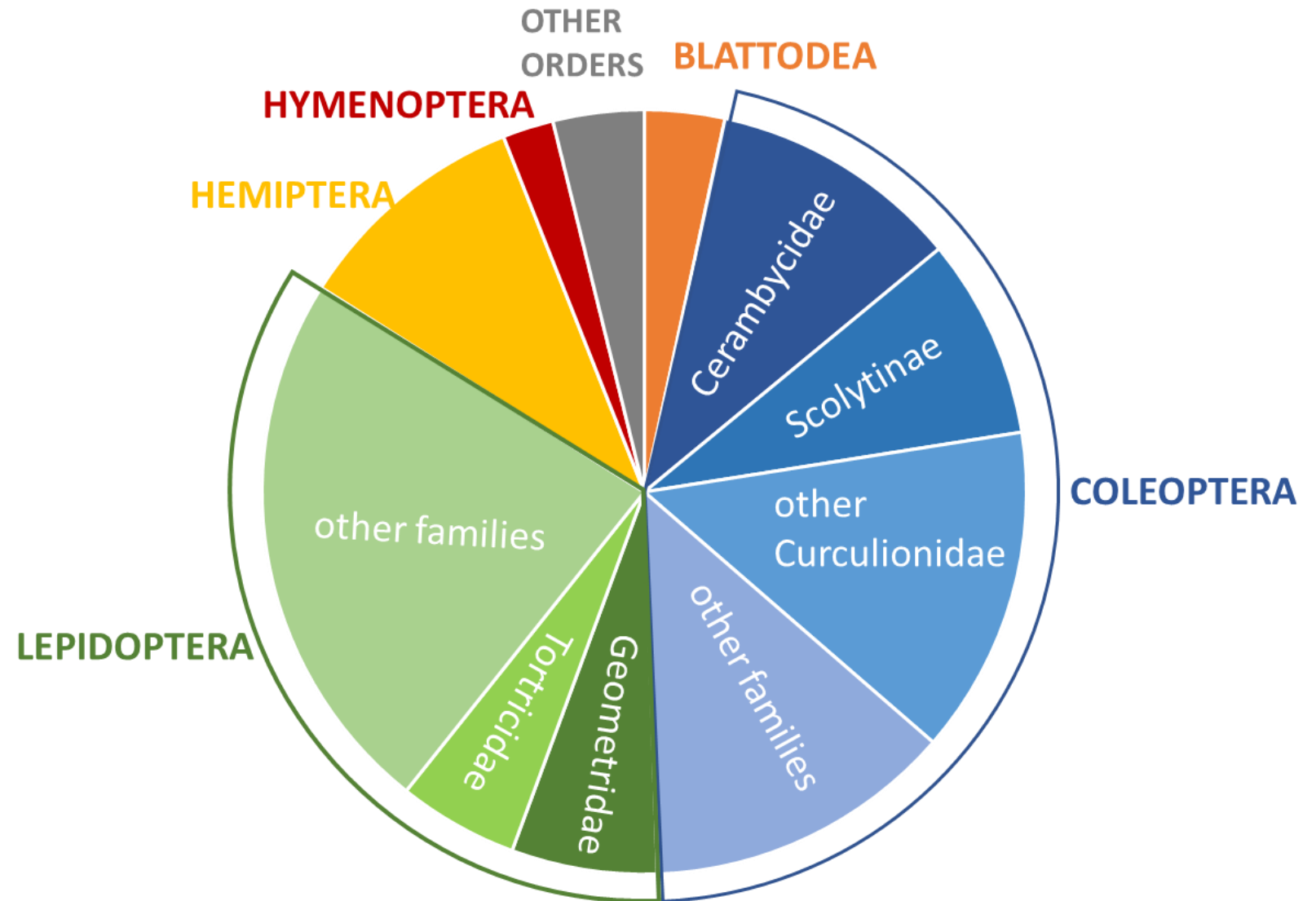
- **High impact:** species that required ongoing management and/or had significant economic effects (somewhere), such as severe damage to forest or amenity trees and/or are important vectors of highly damaging pathogens of *P. radiata*
- **Low – medium impact:** any recorded evidence of damage, management or control was either short-term, localised or minor
- **Negligible impact:** no records of interventions, management or damage were found



*Rhyacionia buoliana* (European pine shoot moth) - major pest of *P. radiata* in Chile – categorised as high impact

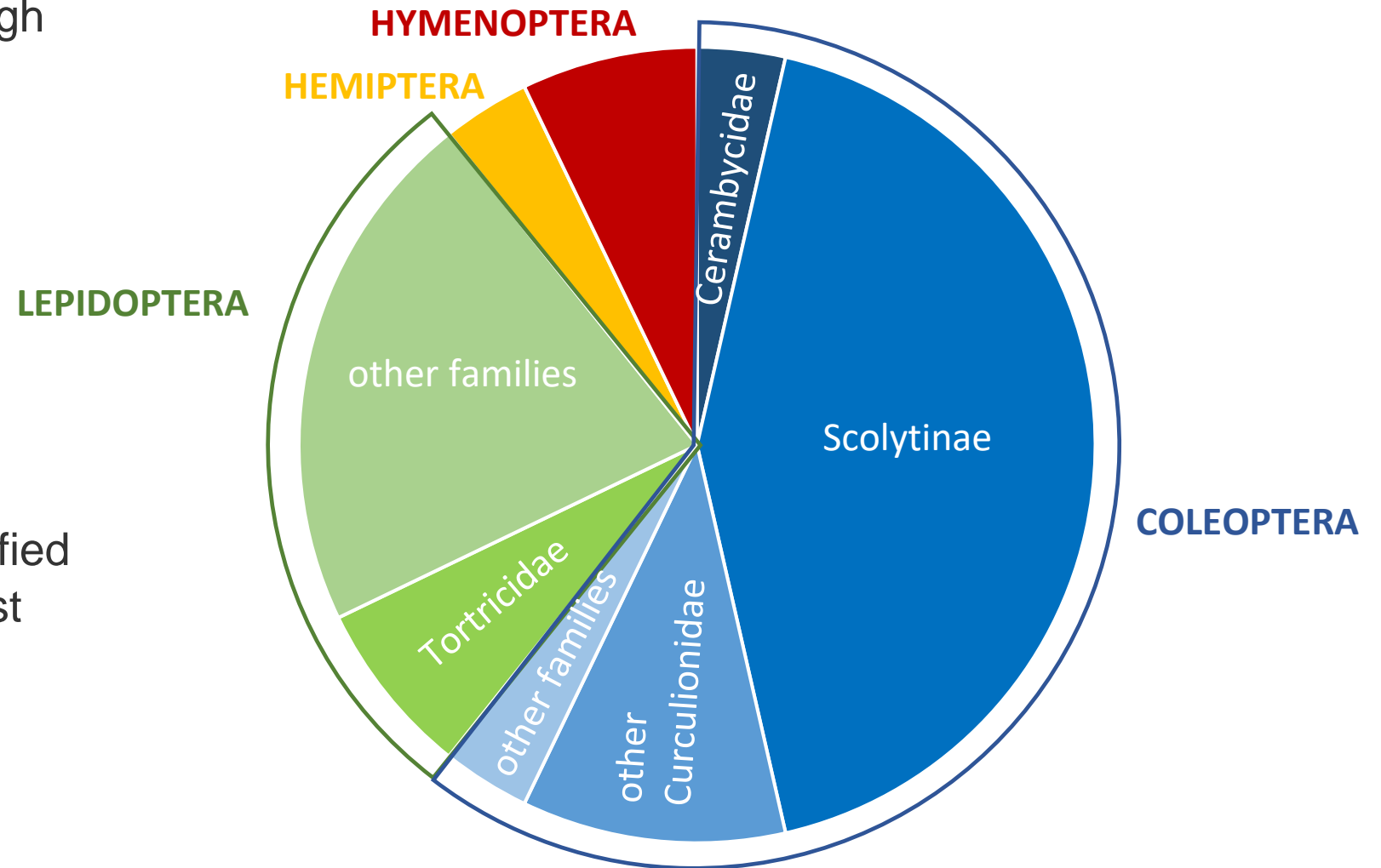
# Global list of insects feeding on *Pinus radiata* – all records

- 649 species (plus 11 more at generic level – these all considered negligible impact)



# Global list of insects feeding on *Pinus radiata* – high impact species

- 28 species classified as high impact
  - 12 true bark beetles
  - 8 Lepidoptera
  - 5 other Coleoptera
  - 2 Hymenoptera
  - 1 Hemiptera
- Further 168 species classified as low-medium impact, rest considered negligible





# Which of the 28 high impact species are present in Australia and NZ?

## Present in both countries:

- *Essigella californica* (Monterey pine aphid)
- *Hylastes ater* (Black pine bark beetle)
- *Sirex noctilio* (Sirex woodwasp)



## One additional (invasive) species in Australia:

- *Ips grandicollis* (Eastern five-spined bark beetle)



# Remaining 24 high impact species – 17 more borers... (2 moths, rest beetles)

- *Conophthorus radiatae* (Monterey pine cone beetle)
- *Ernobius punctulatus*
- ***Hylastes angustatus***
- *Hylobius abietis* (Large pine weevil)
- *Ips mexicanus* (Monterey pine engraver)
- *Ips paraconfusus* (California five-spined Ips)
- *Ips plastographus maritimus*
- *Ips sextendatus* (Six-toothed bark beetle)
- *Monochamus galloprovincialis* (Black pine sawyer)
- ***Orthotomicus erosus*** (Mediterranean pine beetle)



- ***Pissodes castaneus*** (Small banded pine weevil) ↑
- ***Pissodes nemorensis*** (Deodar weevil)
- *Pityophthorus carmeli*
- *Pityophthorus setosus*
- ***Rhyacionia buoliana*** (European pine shoot moth)
- *Rhyacionia frustrana* (Nantucket pine tip moth)
- ***Tomicus piniperda*** (Common pine shoot beetle)

# Remaining 24 high impact species – and 7 more defoliators (1 sawfly, rest moths)

- *Dioryctria sylvestrella* (New pine knot-horn)
- *Hyalarcta huebneri* (Common leaf case moth)
- ***Lymantria dispar*** (Spongy moth)
- *Lymantria monacha* (Black arches, nun moth)
- ***Neodiprion sertifer*** (European pine sawfly)
- *Ormiscodes cinnamomea*
- *Thaumetopoea pityocampa* (Pine processionary moth)



*Hyalarcta huebneri*



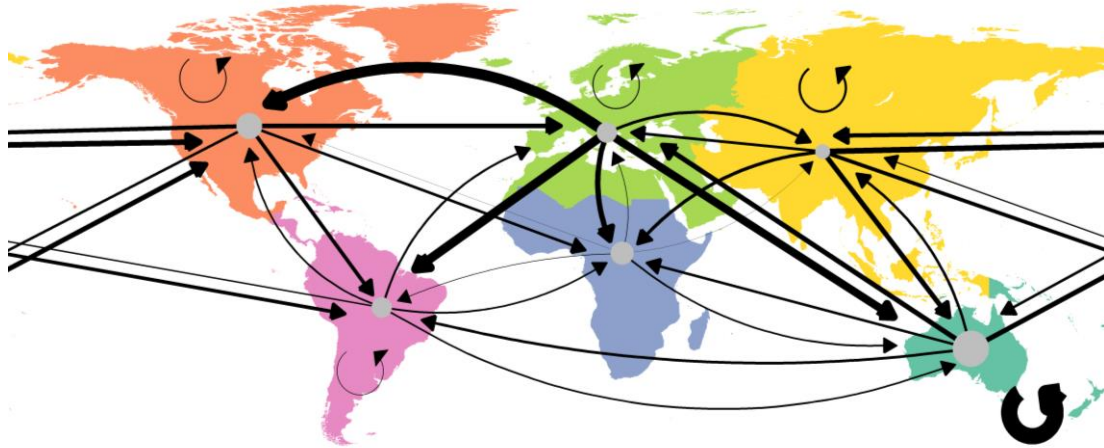
*Neodiprion sertifer*



*Thaumetopoea pityocampa*

# Global movement of all insects feeding on *Pinus radiata*



All species: 139 movers



Species with some impact: 51 movers



Ecoregion

	Afrotropic		Nearctic		Southwest Pacific
	Eastern Palearctic		Neotropic		Western Palearctic

- Europe is a dominant source of establishing species, particularly ones with recorded negative impacts, despite the native range of *Pinus radiata* being in North America.

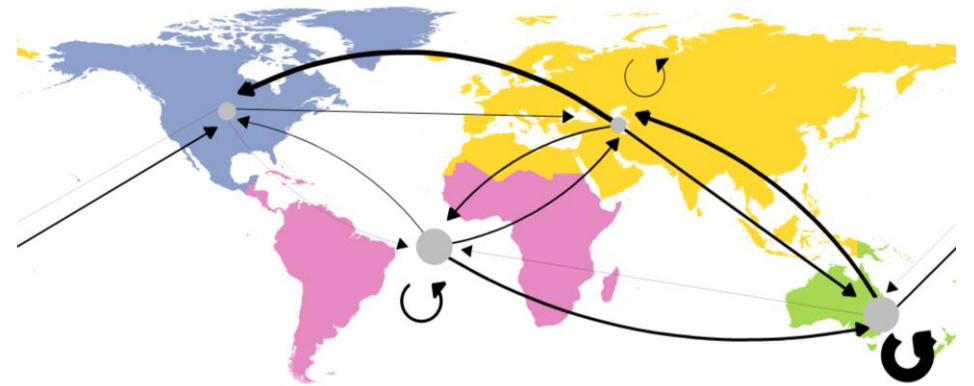
\* Excluding cosmopolitan species

# Global establishments by feeding group

Borers: 268 species, 65 movers



Defoliators: 276 species, 29 movers



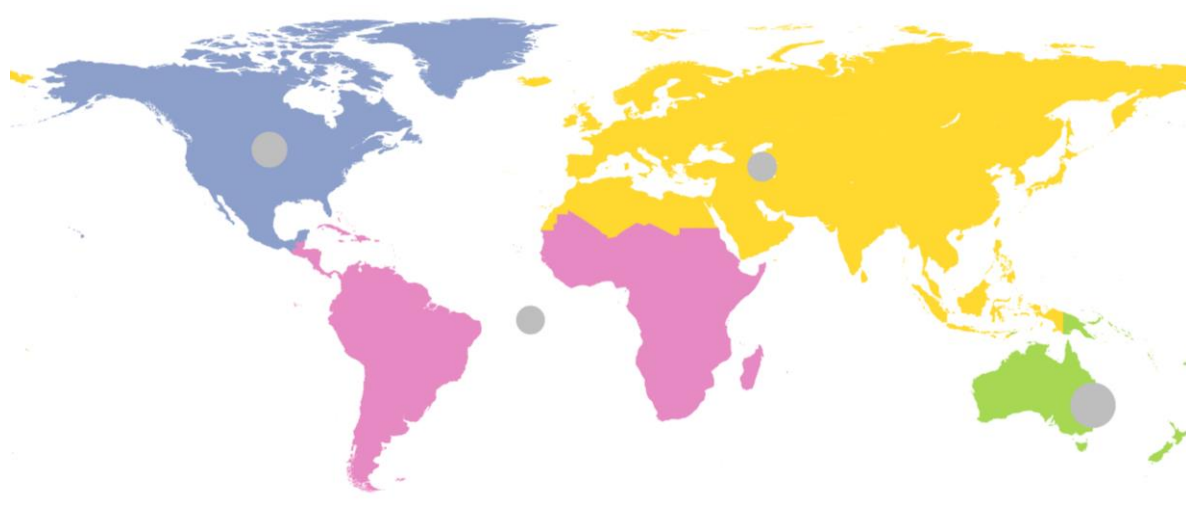
Sap-feeders: only 64 species, but 34 movers



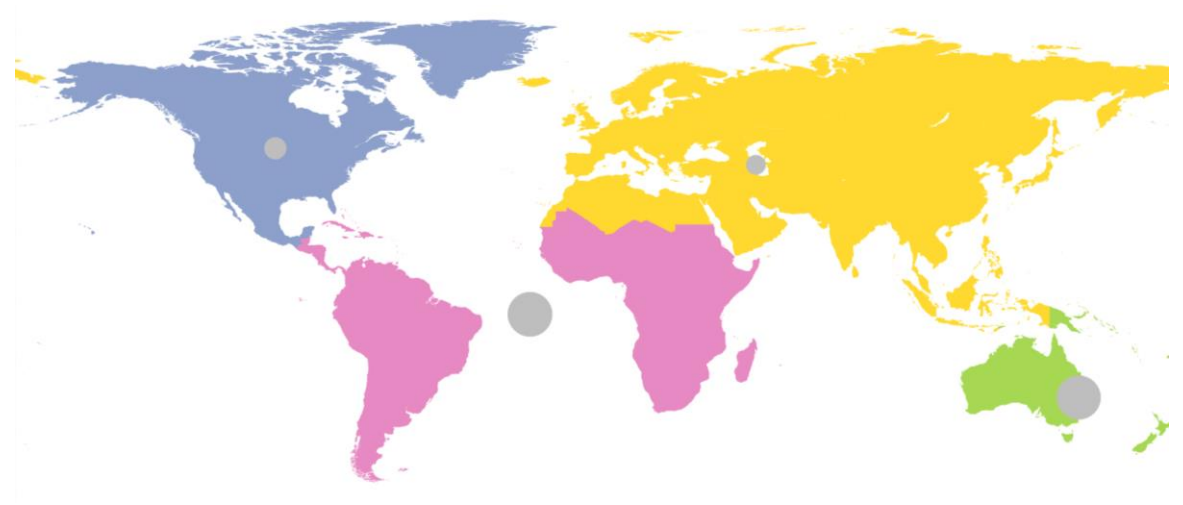
\* Excluding cosmopolitans

# Borers versus defoliators: native regions

Borers: 268 species



Defoliators: 276 species



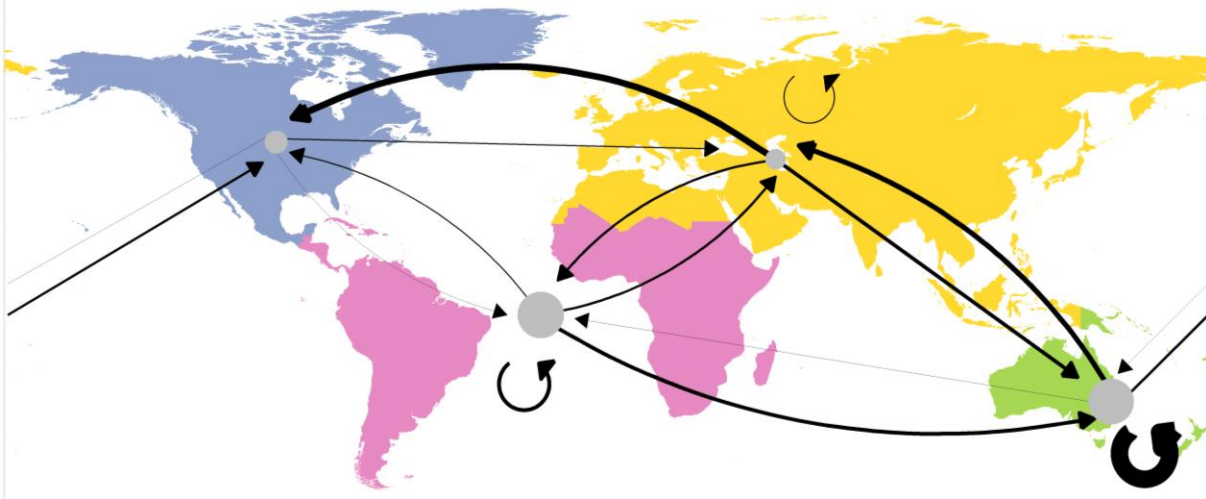
\* Excluding cosmopolitans

# Borers versus defoliators: movement

Borers: 268 species

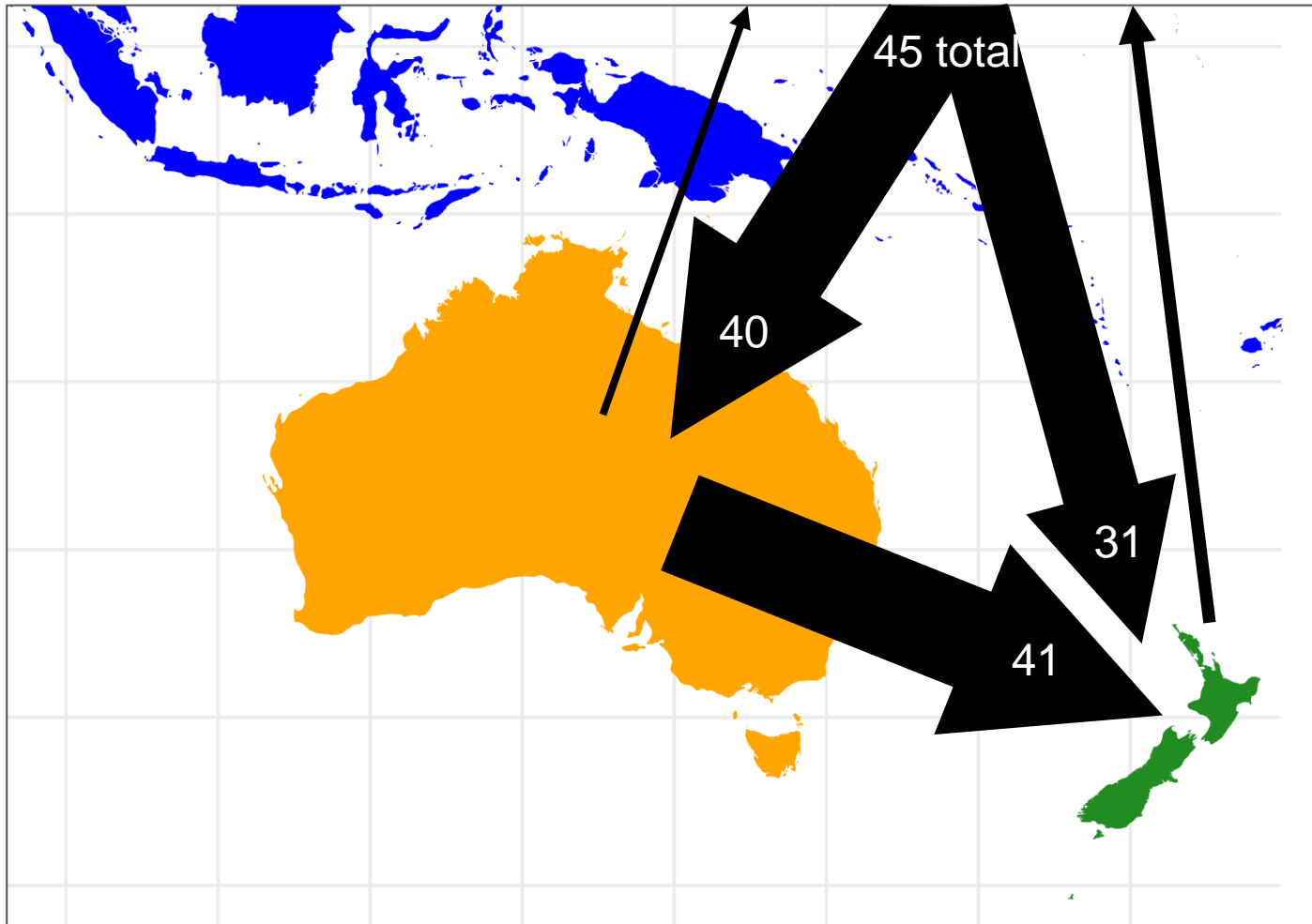


Defoliators: 276 species



\* Excluding cosmopolitans

# Focus on Australia and New Zealand



\* Not showing  
bridgehead  
movements

Region ■ Australia ■ Elsewhere ■ NZ

## Local risks for Australia:

The only low-med impact pest established in NZ but not Australia is *Arhopalus ferus*.

NZ has the native *Pseudocoremia suavis*, a defoliator established in Europe.

## Local risks for NZ:

Australia has four low-med impact species established from elsewhere which NZ has not - borers and sap-feeders from Palearctic.

Australian native *Orthorhinus klugii* has established in Hawaii

NZ is at risk from Australian moths crossing on the wind pathway.



# Future work

- Now have a list of species likely to establish in NZ, and are planning to assess potential spread and impact
- Expansion of list
  - Insects recorded from additional *Pinus* species: *P. muricata* and *P. taeda*
  - Chinese literature search completed by AgResearch
  - List now includes 16 further species on *P. radiata* and 828 species in total
  - May add further *Pinus* species, focussing on closest relatives
- Plan to assemble list of pathogens known from *Pinus radiata*
- Continual process of fine-tuning risk evaluation – we have a semi-automated framework and that each time the framework is run, should be closer to the truth!



Pitch canker caused by *Fusarium circinatum*

## Based on publication, including additional authors:

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D. Kahle and H. Wickham. ggmap: Spatial Visualization with ggplot2. The R Journal, 5(1), 144-161. URL <http://journal.r-project.org/archive/2013-1/kahle-wickham.pdf>

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RESEARCH ARTICLE

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Advancing research on alien species and biological invasions

## Pining away and at home: global utilisation of *Pinus radiata* by native and non-native insects\*

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