Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Protect
Grow
Innovate

Species, what's in a name?

The challenges of species identity in Plant Biosecurity. An Australian Perspective.

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[3]Department of Agriculture, Fisheries and Forestry

Thank You

- Scientific committee
- Organising committee
- EPPO
- AGES
- DPIRD colleagues
- DAFF colleagues

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Department of
Primary Industries and Regional Development

Australian Government

Department of Agriculture, Fisheries and Forestry

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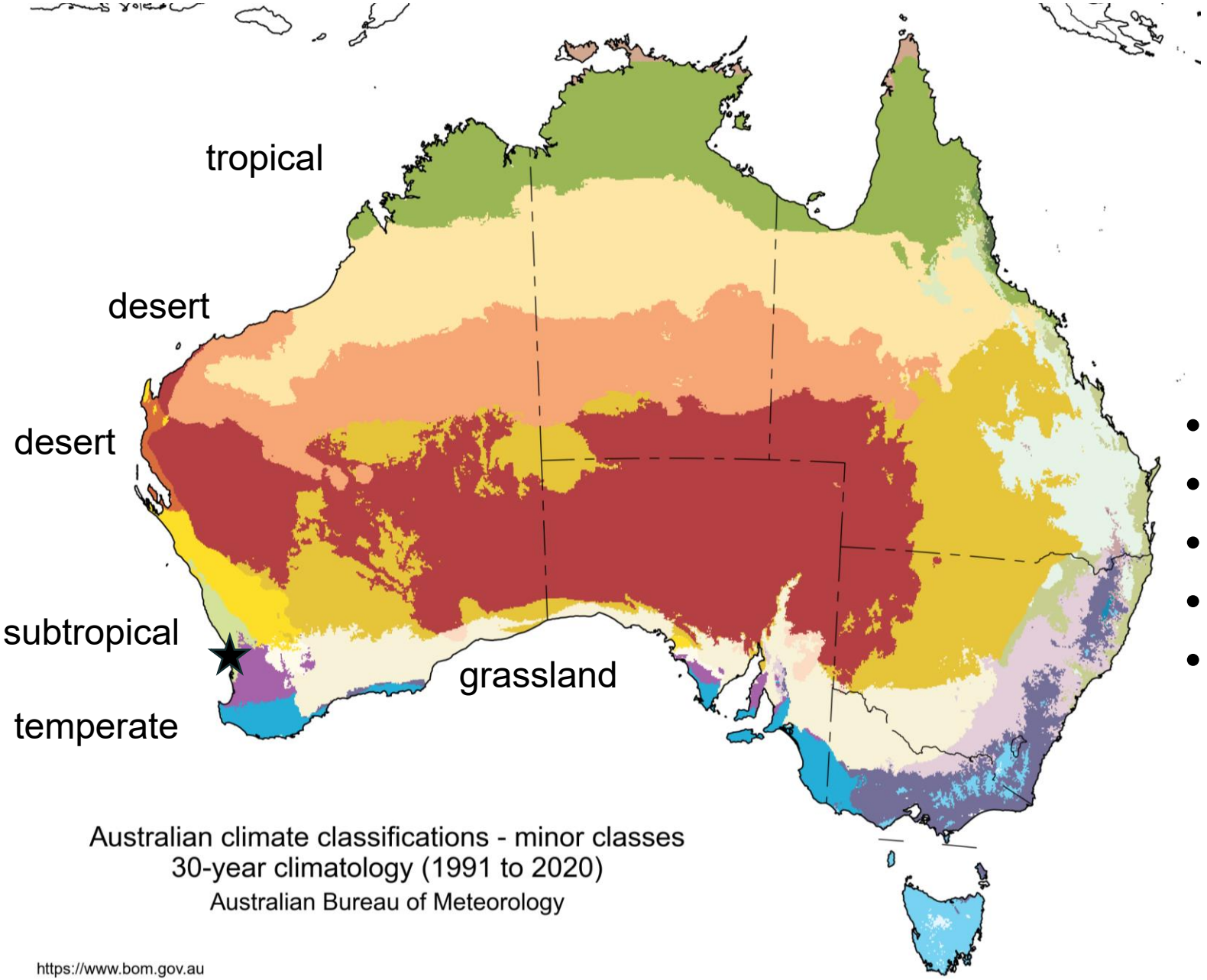

A remote & diverse country

- Land area of 7.69 million km^2
- Isolated for ~ 45 MY
- ~80% plants native
- Tropics – temperate climate
- Agricultural exports ~$71 billion

International and National Agreements

International obligations to use science-based, risk-proportionate measures that protect plants and biodiversity while supporting trade.

- World Trade Organisation - Agreement on the Application of Sanitary and Phytosanitary Measures
- International Plant Protection Convention
- Convention on Biological Diversity
- Bilateral and regional Free Trade Agreements

Nationally, biosecurity is a shared responsibility across governments, industry and the community, with clear coordination and oversight.

Intergovernmental Agreement on Biosecurity 2019

- Contractual cost and responsibility sharing for emergency animal diseases, emergency plant pests and environmental biosecurity (the deeds)
- Shared decision making on matters of national significance
  - Agriculture Ministers' Meeting
  - Agriculture Senior Officials' Group
  - National Biosecurity Committee
  - National Management Group

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National Coordination

National Biosecurity Committee (NBC)

strategic leadership in managing national approaches to emerging and ongoing biosecurity policy issues

Plant Health Committee (PHC)

peak government plant biosecurity policy and decision-making forum

- Subcommittee for **Market Access Risk and Trade** (SMART)
- Subcommittee on **Plant Health Diagnostics** (SPHD)

Oversight of Australia's plant biosecurity diagnostics

- coordinate national diagnostic protocols and networks,
- implement the National Plant Biosecurity Diagnostic Strategy
- support diagnostic tool development
- deliver training
- laboratory accreditation and proficiency testing

- Subcommittee on **Plant Health Surveillance** (SNPHS)
- **Plant Biosecurity Preparedness** Working Group (PBPWG)
- **Australian Fruit Fly Technical Advisory** Subcommittee (AFFTAC)

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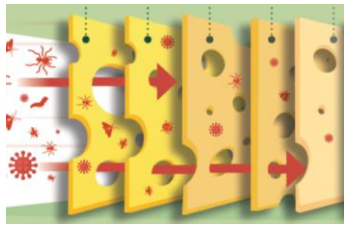
Biosecurity

"swiss cheese" model



Pre-border
decrease risk of pests reaching Australia

- Importation requirements
- Offshore inspection & treatments

DAFF - national framework & direction

Border
stop pests entering Australia

- Border verifications & assessments
- Onshore inspection, treatments & quarantine

States – implements & enforces biosecurity locally

Post-Border
minimise impact of pests

- Active surveillance programs
- Public surveillance and reporting
- Biosecurity responses
- Farm biosecurity practices

Top 10 National Priority Plant Pests

1

Xylella & exotic vectors

Over 700 plant host species including native, commercial and ornamental plants

2

Khapra beetle

Dried plant or animal products, grains, rice, oilseeds, dried fruits

3

Spotted wing drosophila

Berries, cherries, peaches, nectarines, apricots, plums, prunes and grapes; apples, pears and other fruit with thicker skins once fruit begins to rot

4

Fruit flies (exotic)

Berries, citrus, avocado, mango, papaya, passionfruit, melon, olive, summerfruit, lychees, cherries, apples and pears, and grapes

5

Karnal bunt

Wheat, durum wheat, triticale

6

Huanglongbing & vectors

Commercial varieties of citrus, especially oranges, mandarins and tangelos as well as related ornamentals

7

Spongy moth

More than 1000 plant species including eucalypts and pine forests, fruit and nut trees

8

Stink bugs (exotic)

Over 300 agricultural and ornamental plant species; our way of life

9

Mites of bees (Apis spp.)

Australia's bees and the pollination services they provide to certain crops

10

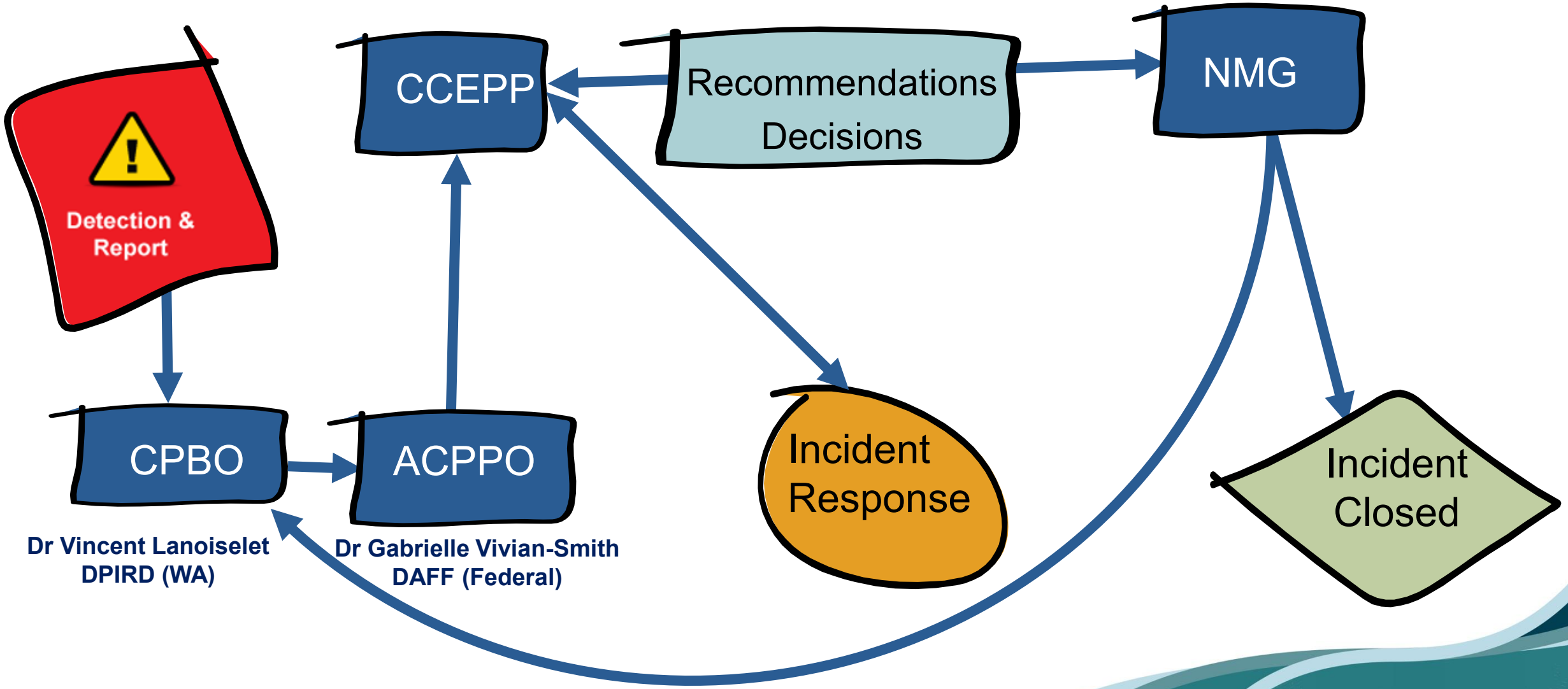
Myrtle (eucalyptus) rust (exotic strains)

Over 100 known host plant species, mainly from the Myrtaceae family; eucalypt plantations, native forests and urban plantings

- Pest Definition
- Pest Status
- Pest Impact
- Pest Entry
- Pest Establishment & Spread

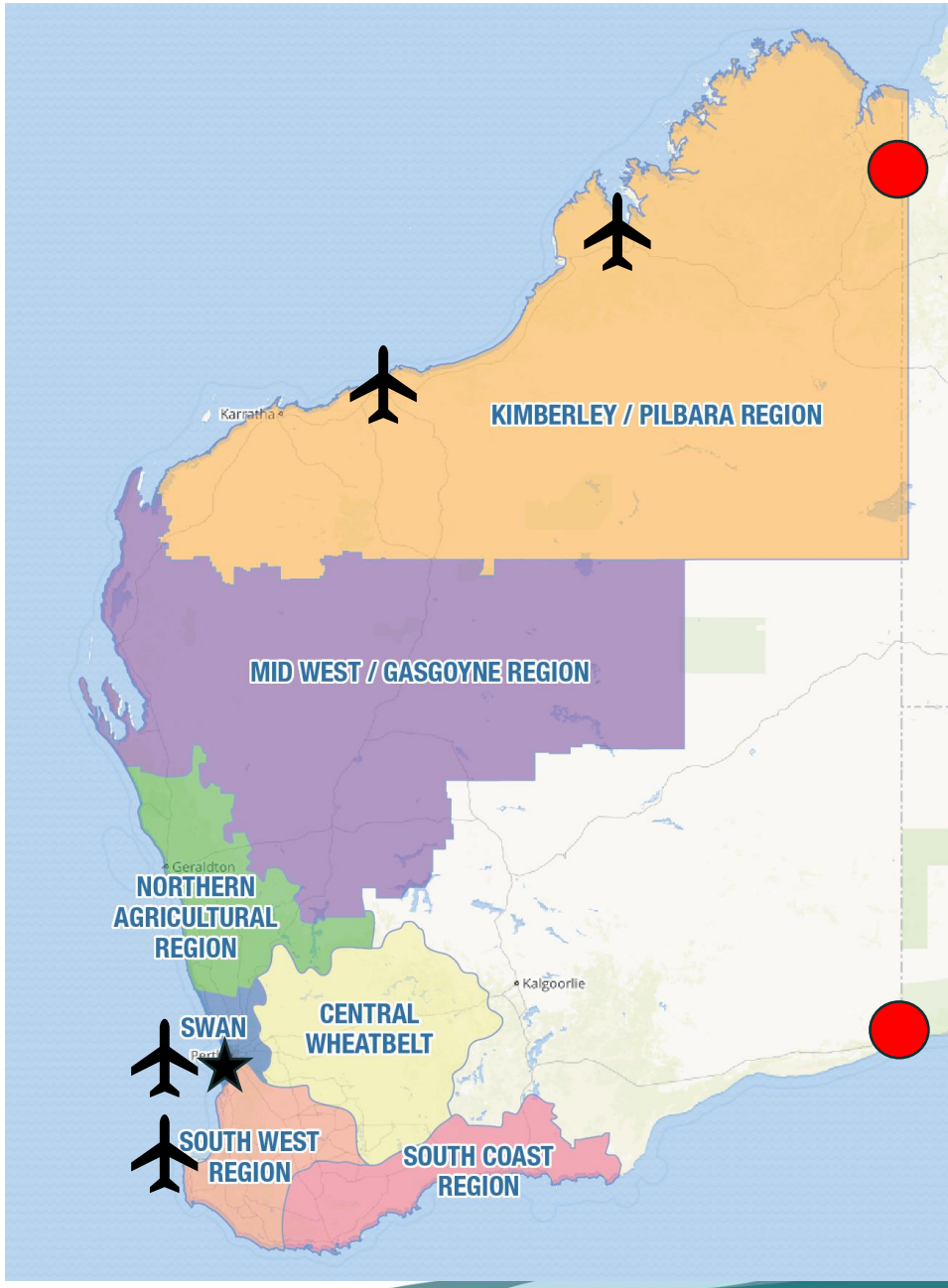
[National Priority Plant Pests (2024) - DAFF]

Nationally Coordinated Response



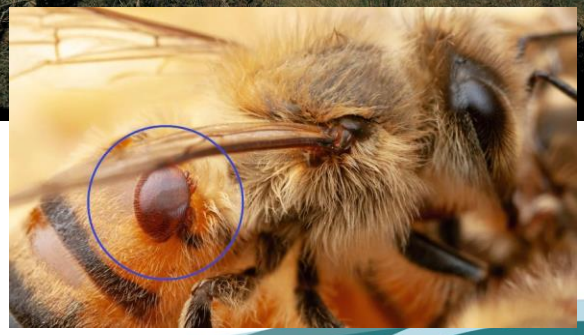
Large, sparsely populated, resource rich: WA

- Land area of 2.53 million km²
- 20,788 km coastline
- Land borders of 1874 km in length
- ~1.18 people per km²
- Biodiversity hotspot 4000+ endemic plant species



54 plant commodities

- Grains (cereals, oilseeds and pulses)
  - Wheat, canola, barley, lupin, oats.
  - Major canola producing state- EU for biofuels
- Horticulture- fruit, nuts, vegetables, amenity
  - Avocado, carrots, wine grapes, cut flowers
- Honey
  - Honey, honey products & pollination services

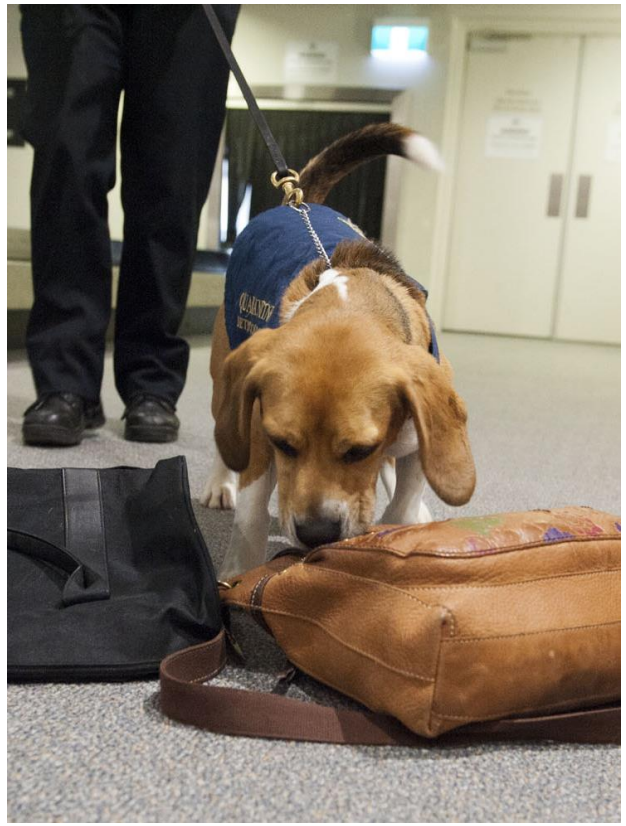


Department of Primary Industries & Regional Development (DPIRD)

Safeguards WA from the ***risk*** and ***impact*** of biosecurity threats

Protect Australia and WA's biosecurity status

- Regulate domestic imports and risk pathways
- Market access
- Export certification and assurance
- Early detection and assurance, surveillance and investigations
- Stakeholder engagement and education
- Emergency responses, including as HMA within State Emergency Management Framework
- Containment programs



Food safety and product integrity

- Manage livestock traceability systems and feed controls
- Regulate chemical residues, agricultural veterinary chemicals

Diagnostics and laboratory services

Reduce impact of widespread and established pests and diseases

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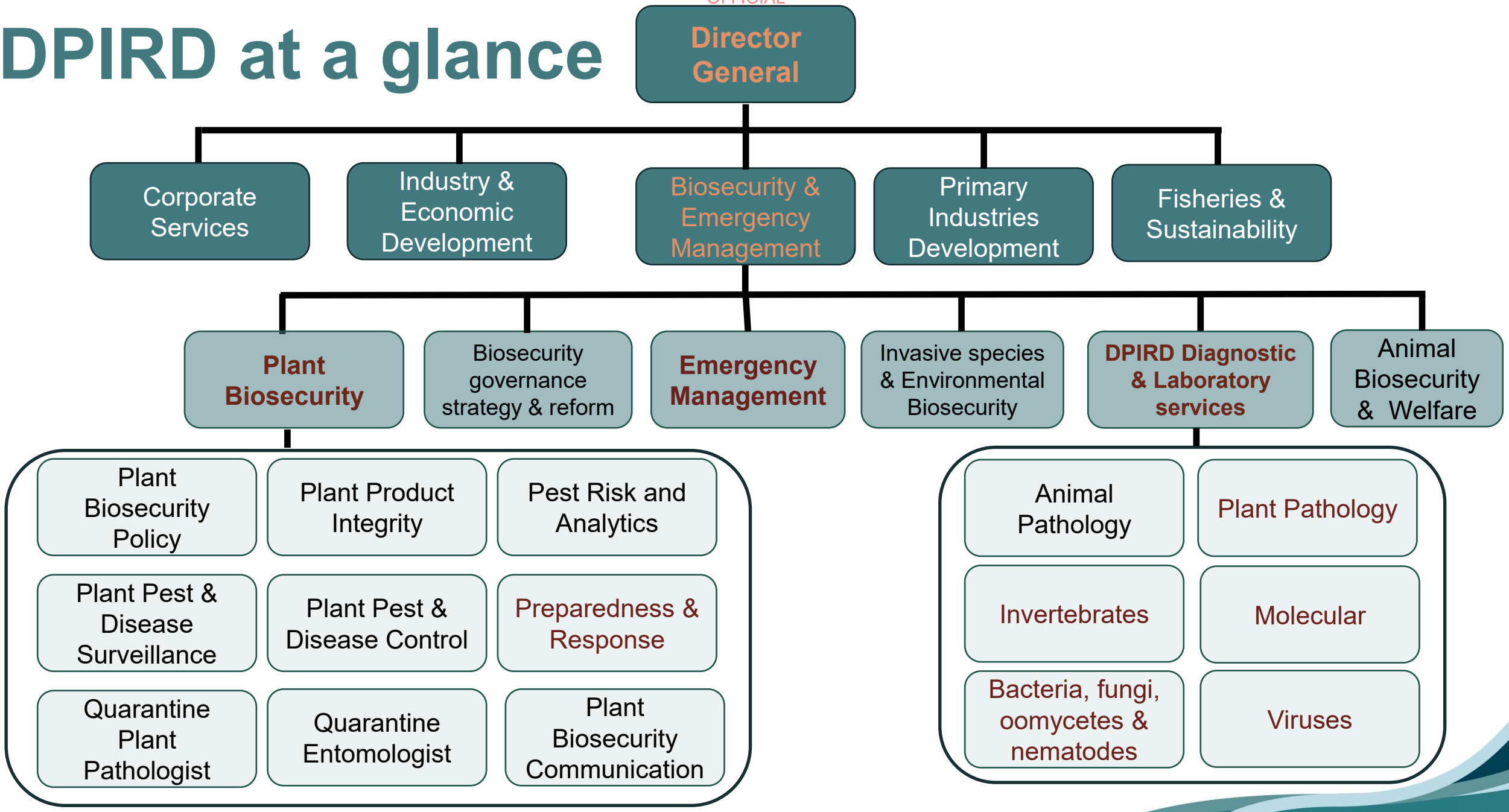
DPIRD at a glance



Risks are escalating

- Climate change
- Trade and travel patterns
- Decreasing biodiversity reducing resilience
- Changes in land use patterns
- Illegal activities
- Major global disruptions
- Arrival of pests and diseases at regional neighbours

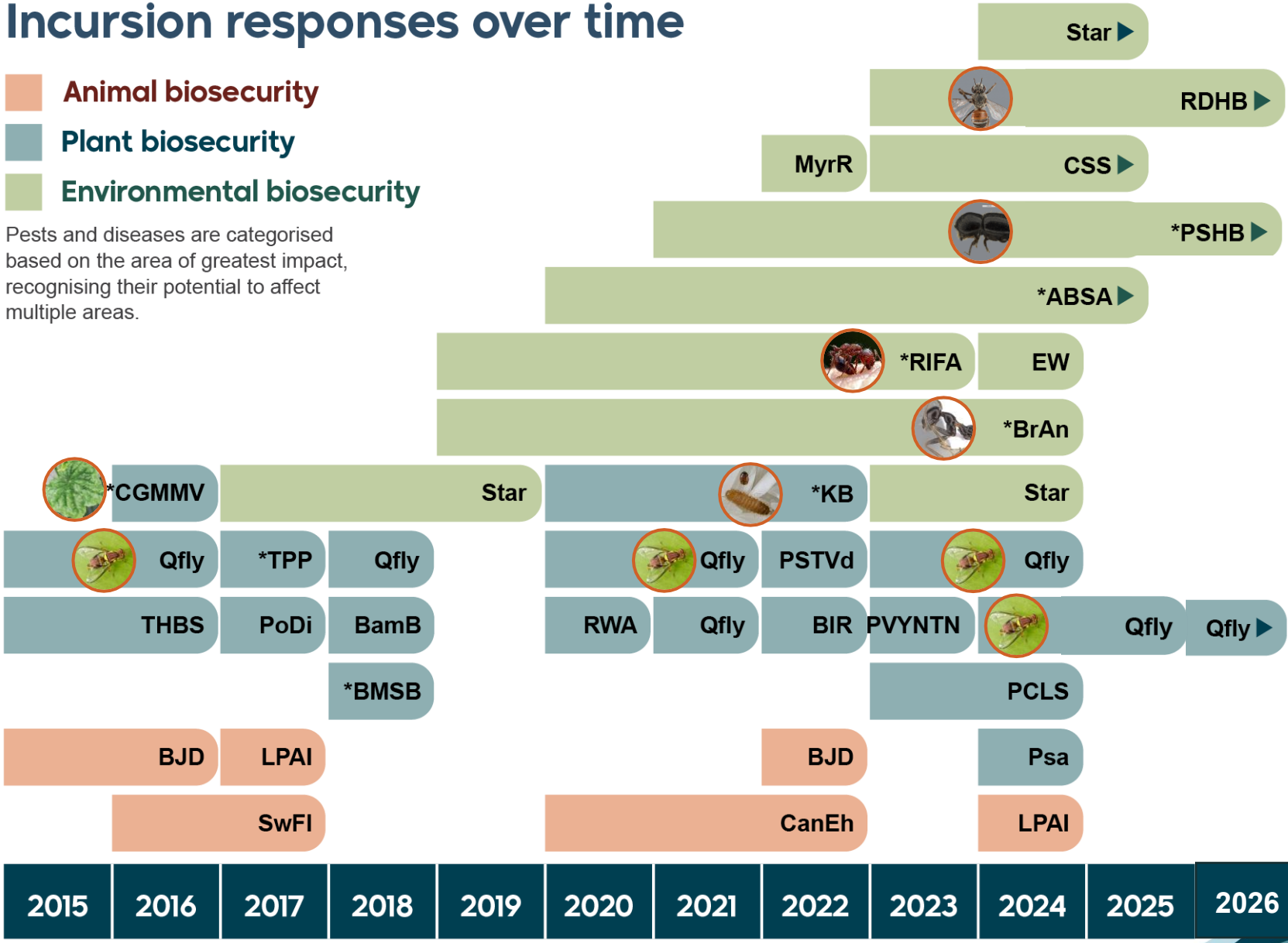
Incursion responses over time

Animal biosecurity

Plant biosecurity

Environmental biosecurity

Pests and diseases are categorised based on the area of greatest impact, recognising their potential to affect multiple areas.



▶ Response ongoing as at 1 March 2025

* Nationally cost-shared response

Polyphagous shot-hole borer
Euwallacea fornicatus

+ *Fusarium* sp. [AF-18]

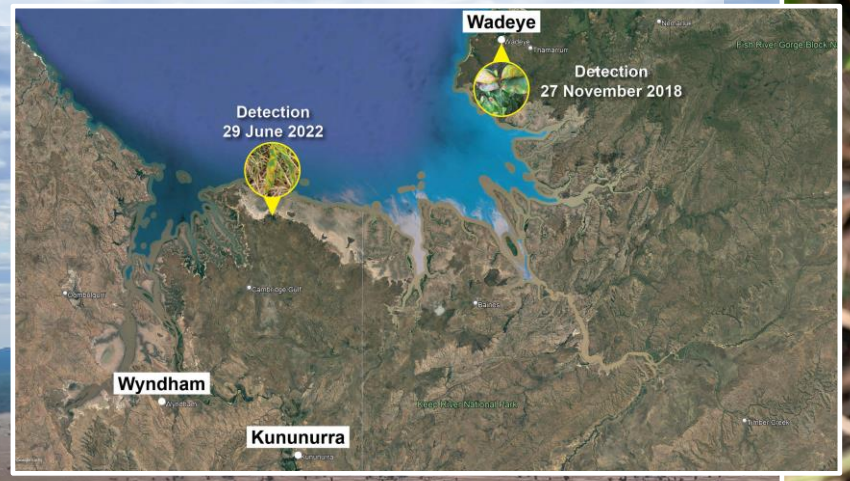
Lives in symbiosis with a Fungus – *Fusarium species*

Beetle galleries and fungus disrupt plant vascular systems

Detected August 2021
Perth Metro area
Transitioning to Management

Myrtle rust

Austropuccina psidii



Detected June 2022
Remote station in the Kimberley (NE WA)
Contained

Red dwarf honeybee

Apis florea

7-10mm, smaller than the European honeybee

Creates exposed single combs

Detected March 2023
Burrup Peninsula
Nationally cost-shared response

Queensland fruit fly

Bactrocera tryoni

Highly invasive agricultural pest, infesting more than 300 species of cultivated fruits and vegetables

WA has successfully eradicated ten times since 1989

Detected March 2026
Como + South Perth
State response

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Species - in Biosecurity

Surveillance & Diagnostics

enable accurate detection, testing, & reporting

Legislation & Regulation

define prohibited, restricted, & reportable organisms

A precise, globally shared way to identify, regulate, monitor, and respond to biological risks

Border & Trade Controls, Market Access

underpin import/export conditions and international agreements

Prevention, Preparedness, Response & Recovery

ensure appropriate prevention/ control measures

Risk Assessment

link organisms to known impacts, pathways, & hosts

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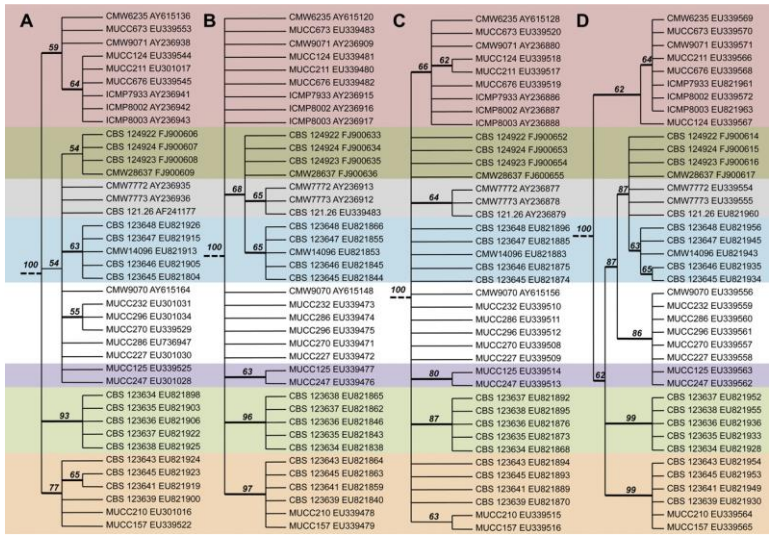
Species- what's in a name…

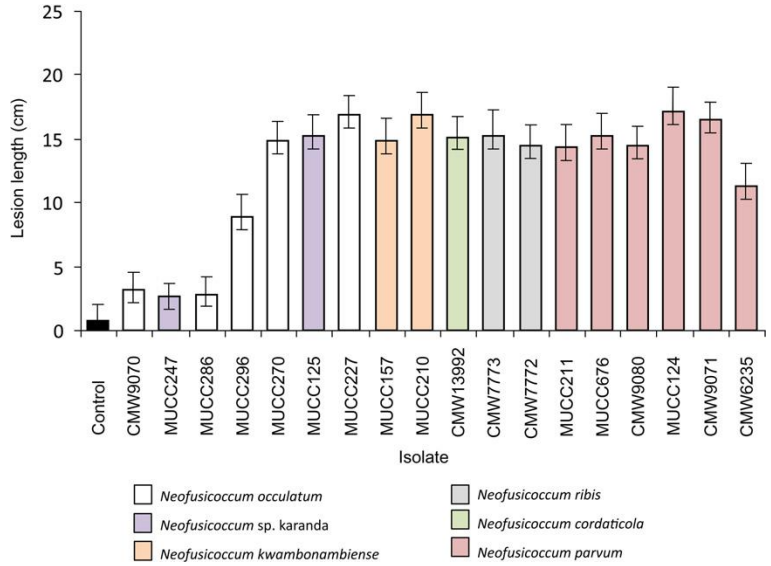
Evolutionary Species Concept

"An entity composed of organisms which maintains its identity from other such entities through time and over space, and which has its own independent evolutionary tendencies and historical fate" (Wiley and Mayden, 2000).

Species Recognition Criteria

- Genealogical Concordance
- Morphological
- Biological
- Ecological





Neofusicoccum. occulatum Sakalidis, M. L., Burgess, T. I., sp. nov.MB 518777 Etymology. Named from the latin word for hidden, concealed. Refers to the cryptic nature of this species.

N. occulatum a speciebus aliis loco 1 nuclearibus differt: loco "translation elongation factor (1-a)" dicto situ 164 (A).

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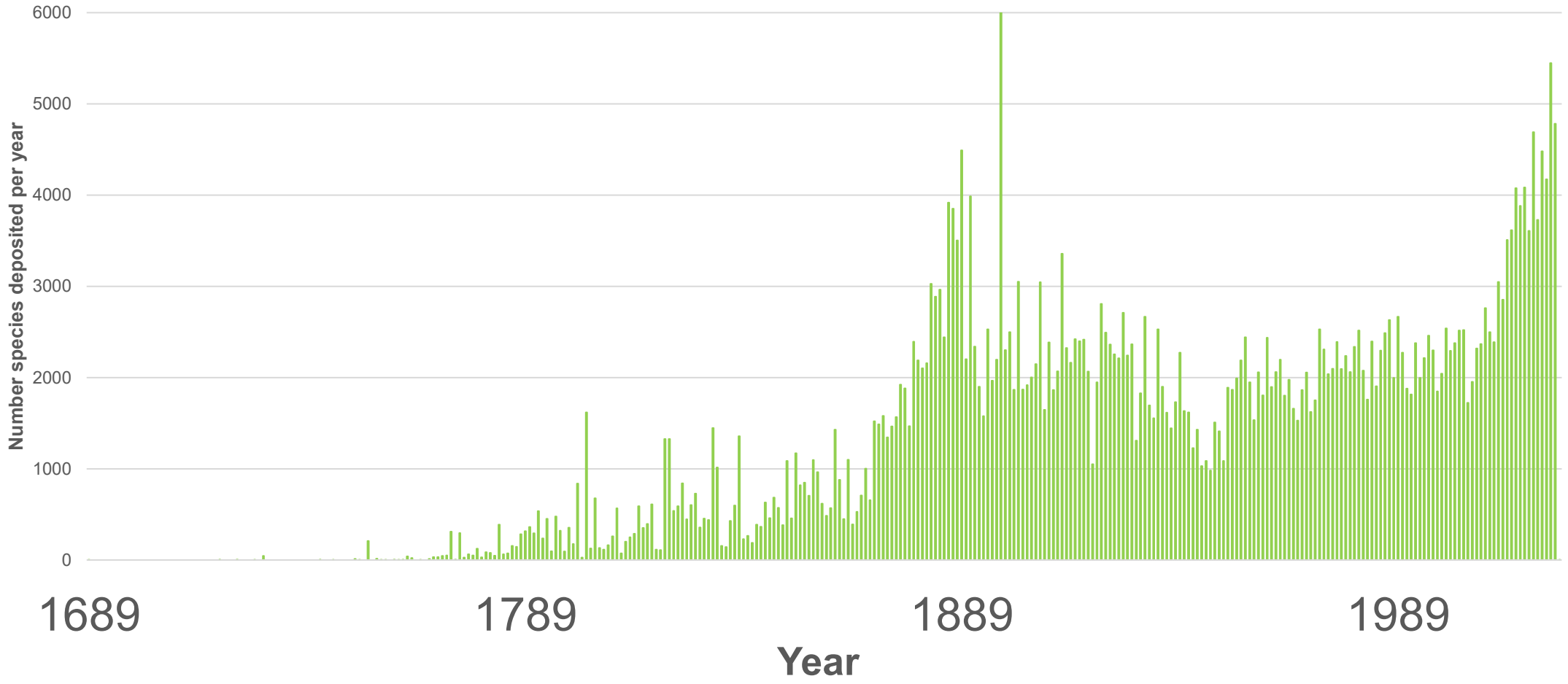
Massive increase in new fungal species descriptions



1689-2025

https://www.mycobank.org/Stats%20page

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Redefinition of species names invalidates previous pest records

- Difficult to regulate
- Existing import requirements become questionable
  - ? Presence or absence
  - ? Capable of causing disease

Legislation & Regulation

Requires

- Re-identification of isolates held in culture collections
- Field surveillance
- Collect impact data

A saga of 20+ years- *Heterodera avenae* - Cereal cyst nematode

Prior to 2002 status was 'permitted' & considered present throughout Australia

→

Species complex- *Heterodera australis* (Subbotin, 2002)

-Morphologically indistinguishable from *H. avenae*.

→

15 years of taxonomic dispute (Smiley et al. 2017)

↓

Surveillance in 3 states (SA, WA, VIC) supported *Heterodera avenae absence* (Huston et al 2024)

→

WA was able to change the status for *H. avenae* to prohibited.

- Australia cereals bred for resistance to *H. australis*
- Crop losses if *H. avenae* introduced

It’s like questionable photos on the internet….it can take years to correct

- Old records still accessible
- Process to update records slow and arduous

Official international recognition of absence requires:

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Phytophthora capsici and *Phytophthora drechsleri*

Burgess et al. (2021) consider that both species are absent from Australia following molecular re-identification of Australian isolates

- *P. capsici* - current status Absent: pest records invalid.
- *P. drechsleri* - current status Present: no details- reports in Australia cannot be confirmed as there are no living cultures & no molecular data.

Distribution details in Australia

Situation

Current pest situation evaluated by EPPO on the basis of information dated 2021: **Absent, unreliable record**

Comments

Burguess et al. (2021) consider that the report by Weinert et al. (1999) is not valid. Therefore, P. capsici may be absent from Australia.

References

* Burgess TI, Edwards J, Drenth A, Massenbauer T, Cunnington J, Mostowfizadeh-Ghalamfarsa R, Dinh Q, Liew EC, White D, Scott P, Barber PA (2021) Current status of Phytophthora in Australia. Persoonia-Molecular Phylogeny and Evolution of Fungi 47(1), 151-177. https://doi.org/10.3767/persoonia.2021.47.05

* Weinert MP, Smith BN, Wagels G, et al (1999) First record of Phytophthora capsici from Queensland. Australasian Plant Pathology 28, 93.

EPPO Global Taxon Database

Distribution details in Australia

Situation

Current pest situation evaluated by EPPO on the basis of information dated 2021: **Present, no details**

From CABI Disease map 281 (1991): Present, no details

Comments

Burgess et al. (2021): There are reports of P. drechsleri from every jurisdiction in Australia on a range of cultivated and native hosts. However, all these reports cannot be confirmed as there are no living cultures and no molecular data associated with this species in Australia.

References

* Burgess TI, Edwards J, Drenth A, Massenbauer T, Cunnington J, Mostowfizadeh-Ghalamfarsa R, Dinh Q, Liew EC, White D, Scott P, Barber PA (2021) Current status of Phytophthora in Australia. Persoonia-Molecular Phylogeny and Evolution of Fungi 47(1), 151-177. https://doi.org/10.3767/persoonia.2021.47.05

Poorly characterized species complexes

Delay and complicate decision making & associated actions

Harder to regulate

- National & international consensus
- Industry understanding

Difficult to quantify the risk

- Likelihood of entry
- Likelihood of establishment
- Likelihood of spread
- Potential impact

Diagnostics & Surveillance

- General vs targeted
- More resources
- Longer process

Mango Malformation Disease

Fig 1: Mango production areas in Australia

Source: Australia Mango Industry Association (AMIA)

Mangos

- Major production in QLD & NT

MMD

- Distorts growth
- Little to no fruit set
- Huge yield loss
- Major economic impact

Pest Status in Australia

- Not widely distributed & under official control

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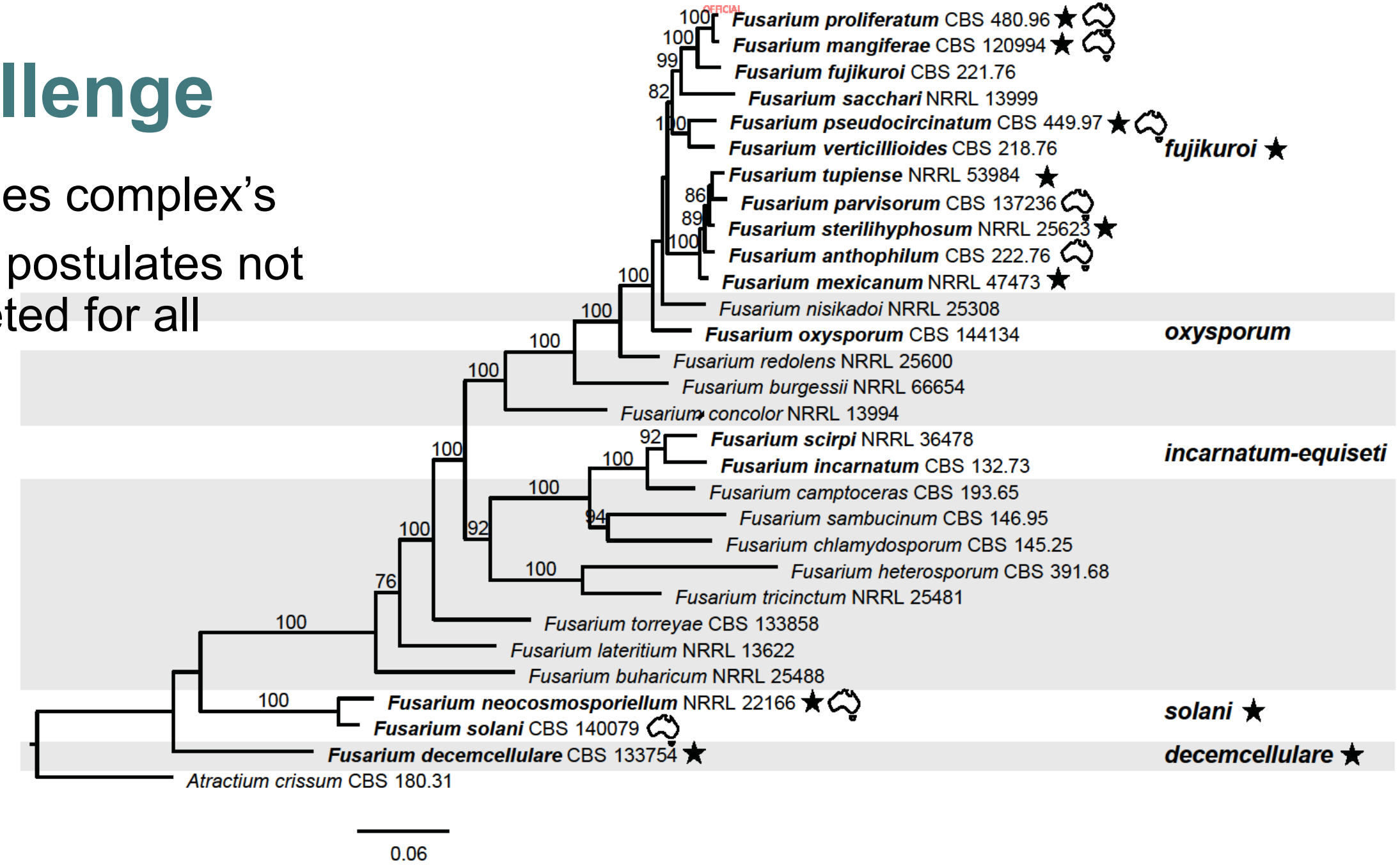
Challenge

- 5 species complex's
- Koch's postulates not completed for all



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Assess risk, confirm threat & take action- MMD case study

- *Fusarium* sp. 1 detected for multiple years in NWA and NT
  - Within Fujukuroi complex
  - Lack of additional phenotypic data

? What biosecurity action to take
? What advice for growers
? mango bud mite

Well characterized complexes support better biosecurity outcomes

- **Provides clarity**
  - to assess and communicate risk
  - complete efficient & effective surveillance
  - develop targeted diagnostics
  - improves response outcomes- eradication and/or management.

- **Ultimately better support for industry**

Bacterial canker disease- kiwifruit

Pseudomonas syringae pv. *actinidiae* biovar 3

Detected Dec 2023
Greater Manjimup region (SW WA)
Management

Responses rely on trust, partnerships & rapid decision making with incomplete information

- Logistical constraints (Christmas period)
- Diagnostic protocol required validation
- Limited detectability
  - Hot, dry weather, routine spraying, pruning
- Concern that surveillance could spread Psa3
- Disbelief that Psa3 was present

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DNA extraction

2 x PSA specific PCRs

If both PCRs don't amplify

Report result: *Pseudomonas syringae* pv. *actinidae* **NOT DETECTED**

PCRs both AMPLIFY

PSA3 LAMP

LAMP amplifies

Report result: **PSA3 DETECTED**

LAMP no amplification

Report result: PSA detected, **PSA3 NOT DETECTED**

For any results that are inconclusive:

ADDITIONAL PCR & sequencing

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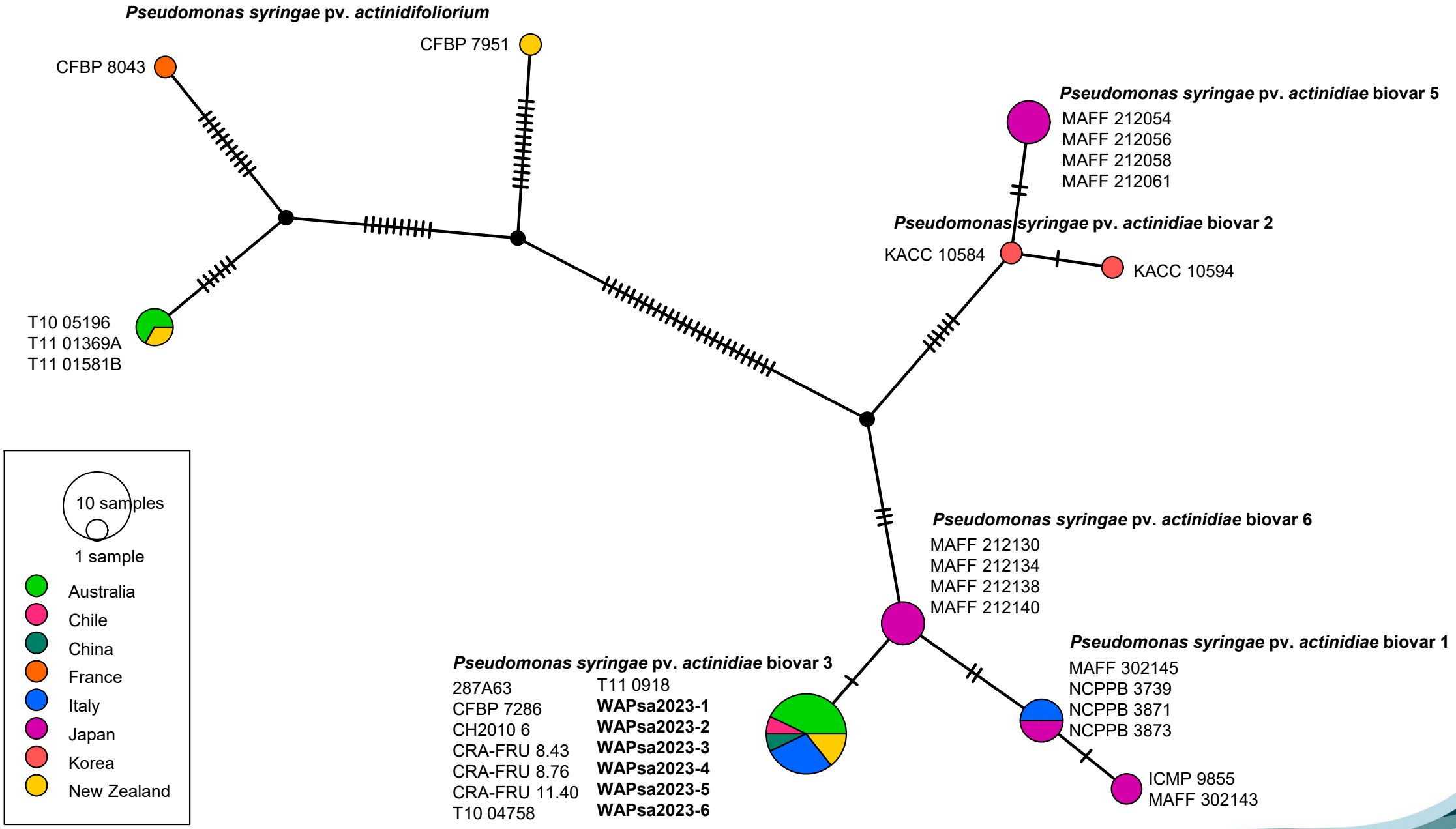

Pseudomonas syringae pv. *actinidifoliorium*
CFBP 8043
CFBP 7951
T10 05196
T11 01369A
T11 01581B
Pseudomonas syringae pv. *actinidiae* biovar 5
MAFF 212054
MAFF 212056
MAFF 212058
MAFF 212061
Pseudomonas syringae pv. *actinidiae* biovar 2
KACC 10584
KACC 10594
Pseudomonas syringae pv. *actinidiae* biovar 6
MAFF 212130
MAFF 212134
MAFF 212138
MAFF 212140
Pseudomonas syringae pv. *actinidiae* biovar 1
MAFF 302145
NCPPB 3739
NCPPB 3871
NCPPB 3873
ICMP 9855
MAFF 302143
Pseudomonas syringae pv. *actinidiae* biovar 3
287A63
CFBP 7286
CH2010 6
CRA-FRU 8.43
CRA-FRU 8.76
CRA-FRU 11.40
T10 04758
T11 0918
WAPsa2023-1
WAPsa2023-2
WAPsa2023-3
WAPsa2023-4
WAPsa2023-5
WAPsa2023-6
10 samples
1 sample
Australia
Chile
China
France
Italy
Japan
Korea
New Zealand

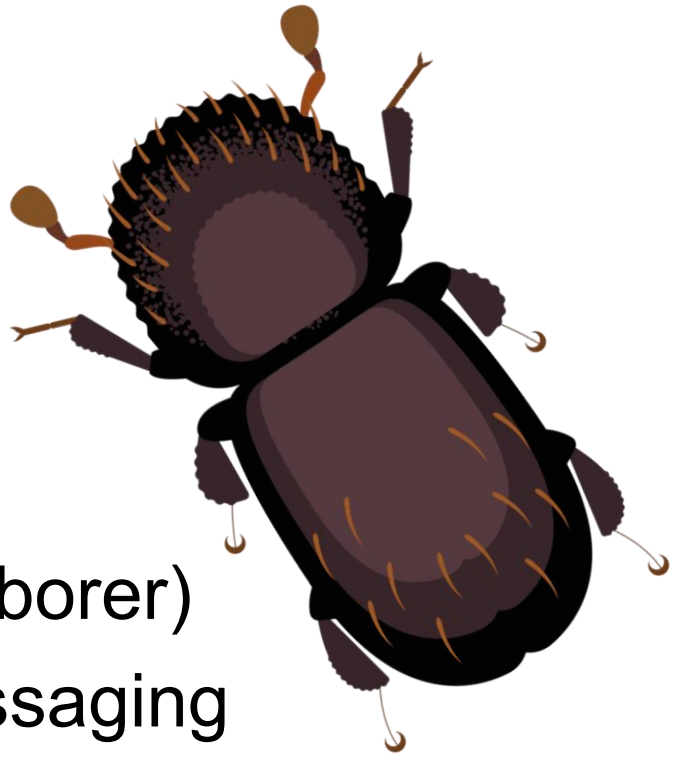
Species names don’t just describe organisms - they shape risk perception, trust, and action.

- Species naming traditionally prioritises taxonomic precision
- In biosecurity responses, names function as communication tools
- Poorly framed names can reduce stakeholder trust, engagement & complience

Polyphagous shot-hole borer

Euwallacea fornicatus

Case Study: Polyphagous shot-hole borer



Where naming failed

- “Polyphagous” confused non-technical audiences
- Acronym use (PSHB) hid meaning
- Pronunciation variation weakened credibility
- Confusion with other borers (e.g. European house borer)
- External renaming (“bullet beetle”) fragmented messaging
- Scientific name errors due to autocorrect appeared in public communications including media….fornicate rather then *fornicatus*

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What This Means For Plant Biosecurity

- Names and visuals shape risk perception
- Geographic names (e.g. Queensland fruit fly) mislead during outbreaks
- Images showing impact prompt action better than images of pests alone

Key Learnings

- Social license depends on how species identity is framed, not just how it is defined
- Biosecurity responses must integrate taxonomy, communication, and stakeholder perception

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Challenge Ahead

Recognise

- Species are more than differences in DNA.
- They hold space in evolutionary time & within the Anthropocene.
- Identifying something as different is only the first step.

Responsibility

- Fully characterize new pathogens
- Training
- Consider use of names beyond the scientific community

Need

Time, knowledge & funding.

How

Connections & collaborations between university, government, private sector and funding bodies.

- Recognise the needs
- Allocate sufficient resources
- Prioritise as necessary not extra

Thank you

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