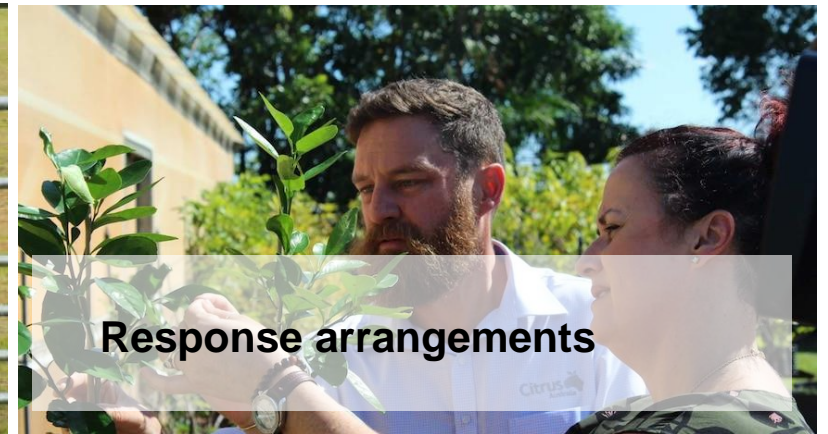


Preparing the Australian citrus industry for exotic pest incursions

Jessica Lye, Citrus Australia Biosecurity Manager

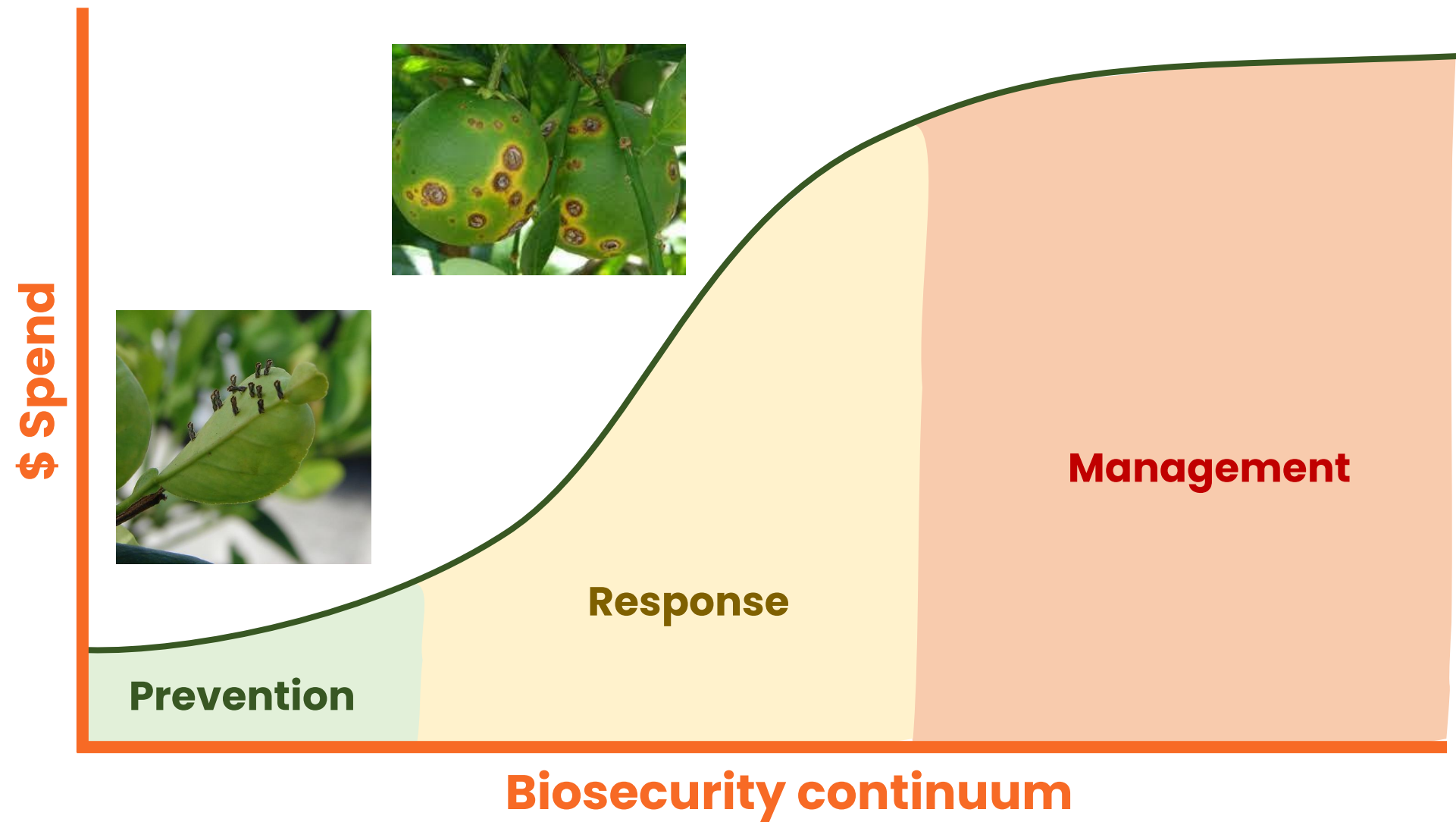
Citrus Biosecurity Symposium – March, 2024

What contributes to our industry biosecurity?





The value of prevention measures

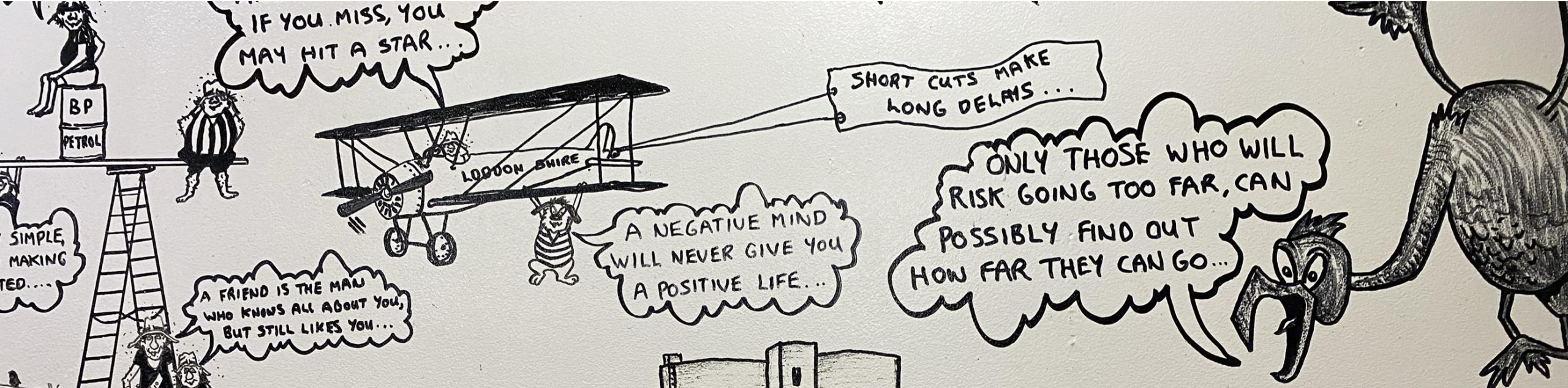


The value of prevention measures

A high benefit-cost example

- Northern Australian Quarantine Strategy
- Torres Strait is an active, high-risk pathway
- >20 surveys each year for early detection of citrus pests (including ACP trap network)
- Evidence of this program value each year, with annual exotic fruit fly surveillance and eradications





Success is simply a matter of luck; ask any failure!





Industry planning



CITRUS INDUSTRY BIOSECURITY STRATEGY

2023-2028



A culture of awareness and preparedness for a resilient citrus industry



PRIORITY 1:

Data & information

- » Improving data collection and interpretation
- » Identifying emerging risks
- » Improving our ability to address risks



PRIORITY 2:

Education & upskilling

- » Achieving a step-change in thinking towards biosecurity
- » Enhancing our local and national leadership capability
- » Boosting biosecurity advisory capacity



PRIORITY 3:

Business resilience & response preparedness

- » Raising industry level preparedness
- » Supporting farm level planning
- » Reducing biosecurity related market shocks



PRIORITY 4:

Communication & collaboration

- » Consolidating communication linkages
- » Improving crisis communication procedures
- » Developing strategic partnerships





Implementation Plan



Activity Area

Activity.
Output.
Outcome.

65 Activities.



Developing a roadmap for the strategy

Business resilience & response preparedness

Activity Area: Identification of response reference materials

Activity

Stocktake of contingency plans, National diagnostics protocols, National surveillance protocols, Business Continuity plans.

Output

A report identifying current response materials and prioritising the development of new materials.

Outcome

The prioritisation of preparedness materials will support the citrus industry in responding to exotic pests.



Biosecurity project partnerships

Project: CitrusWatch

Funding: Hort Innovation citrus R&D levy / Plant Health Australia levy

Project lead: Rohan Burgess, Plant Health Australia



Rohan Burgess



Yvonne Ogaji



Nathan Hancock



Jessica Lye



Jacqui Mitchell



Ben Burchitt



Alex Slavenko

Plant Health Australia

Citrus Australia

NT Gov

Cesar Australia

Project: HLB Preparedness

Funding: ACIAR / Hort Innovation citrus R&D levy

Project lead: Dr Jianhua Mo, NSW DPI



Jianhua Mo



Tahir Khurshid



Nerida Donovan



Steven Falivene



Jessica Lye



Andrew Beattie

NSW DPI

Citrus Australia



Biosecurity project partnerships

Project: Australian psyllids associated with citrus orchards (PhD)

Funding: Citrus Australia, PHA, AVR, LaTrobe Uni



Michael Edwards



Francesco Martoni



Mark Blackett



Paul Cunningham

Agriculture Research Victoria/LaTrobe University

Project: Reducing citrus smuggling

Funding: Hort Innovation citrus R&D levy

Project lead: Tim Herrman, Auscitrus



Tim Herrmann

Auscitrus



Nerida Donovan

NSW DPI



Paul Stephens

Citrus Australia



Nathan Hancock



Jessica Lye



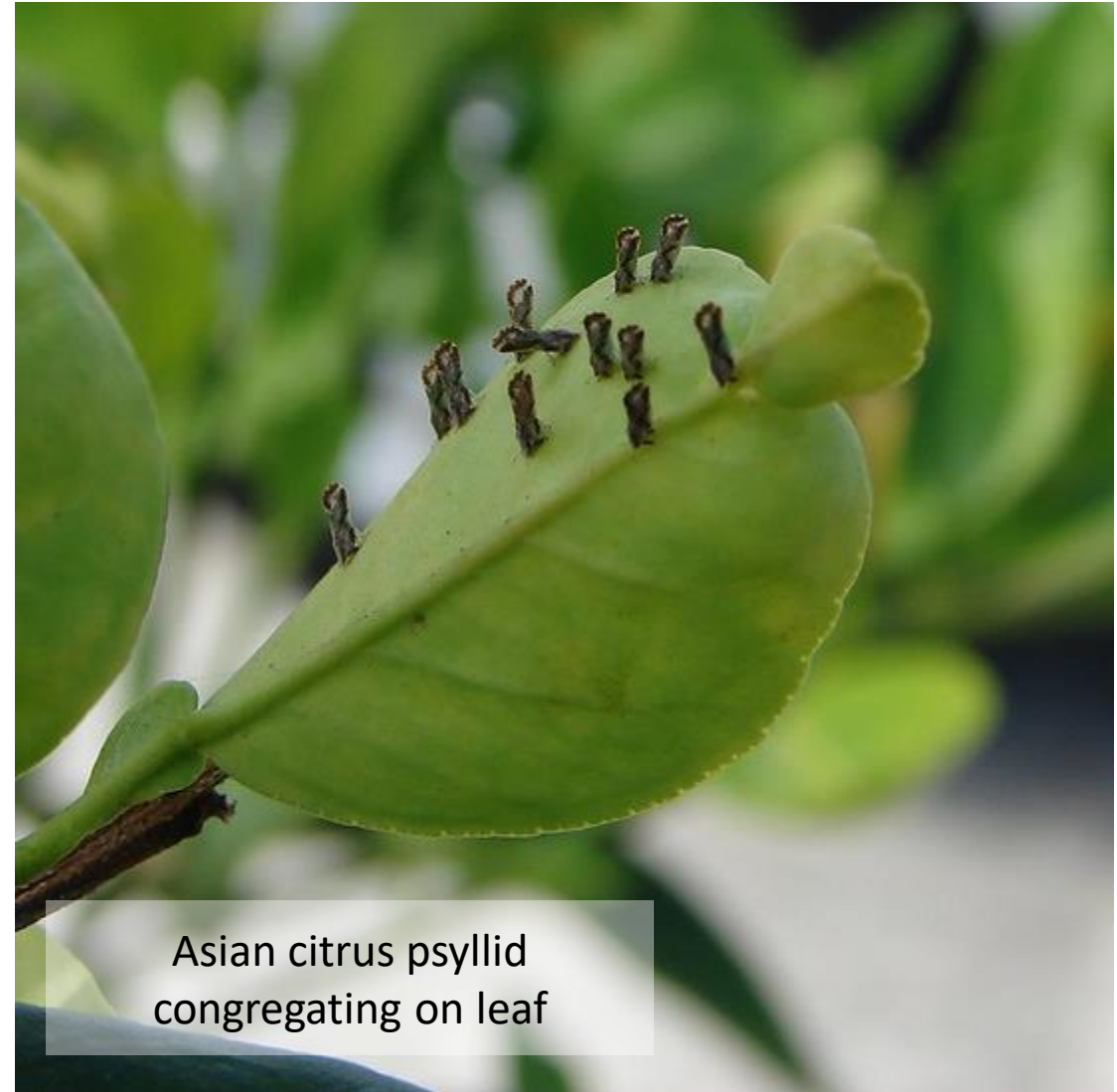
Activity examples



Activity Area: Horizon scanning for threats & opportunities

Developing an Industry Biosecurity Plan

- Desktop analysis of emerging pest threats
- Expert panel convened
- Considers how it can travel, damage to citrus, trade risk, varietal preferences, difficulty in control
- Panel assesses level of risk for 100s of species to create a shortlist of “High Priority Pests”



Asian citrus psyllid congregating on leaf



Activity Area: Horizon scanning for threats & opportunities

Table 1. Example of entry in a Threat Summary Table

Scientific name: <i>BACTROCERA CARAMBOLAE</i> Common name: CARAMBOLA FRUIT FLY		
Geographic distribution	Entry potential	Est. potential
ASIA, SOUTH AMERICA.	HIGH	HIGH
Spread potential	Economic impact	Overall risk
HIGH	HIGH	HIGH





Exotic fruit flies (9 species)



Thaumatotibia leucotreta
(False codling moth)



Cryptoblabes gnidiella
(Rind boring orange moth)



Citripestis sagittiferella
(Citrus fruit borer)



Halyomorpha halys
(Bown marmorated stinkbug)



Diaphorina citri
(Asian citrus psyllid)



Trioza erytreae
(African citrus psyllid)



Scirtothrips spp.
(Various citrus thrips)

Identification of HPPs



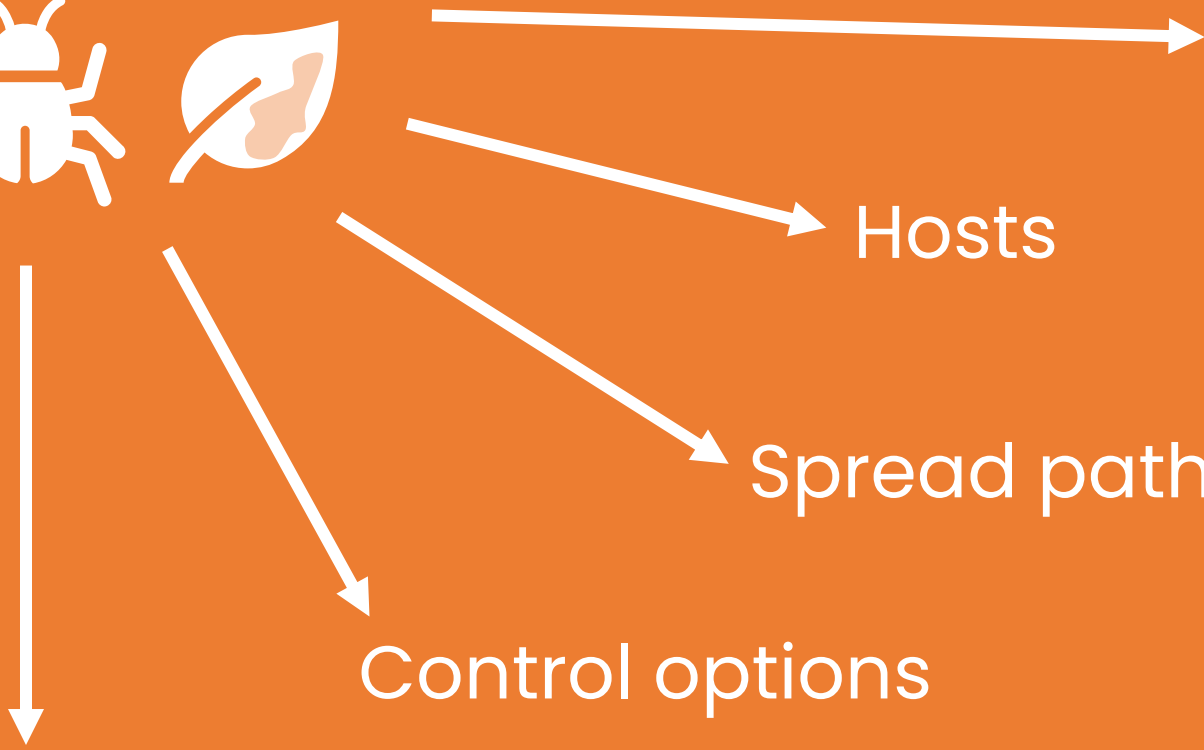
Awareness raising

Hosts

Spread pathways

Control options

Detection methods



Activity Area: Horizon scanning for threats & opportunities



HPP host list development

- What citrus varieties would be impacted or act as inoculum for High Priority pathogens?
- What citrus varieties would be fed on or act as breeding hosts for High Priority invertebrate pests?
- Important for border controls, limiting spread, eradication activities





Activity Area: Horizon scanning for threats & opportunities

Agrichemical reviewing

- What is available?
- What is effective?
- Field trial data
- Impact on beneficials
- Novel applications, e.g. biologicals

Literature reviews

- Seasonal population dynamics
- Monitoring & mass trapping techniques
- Cultural management & biological control
- Repellents, oviposition deterrents, and arrestants
- Resistance

Activity Area: Opportunities to build biosecurity leadership

Study tours

- 2023 tour to California and Florida
- Visited governments and growers to learn about management and containment of ACP/HLB
- Next tour is late March 2024
- Taking Australian biosecurity staff for discussions with California Department of Agriculture



Hygiene at Brite Leaf Nursery

Activity Area: Opportunities to build biosecurity leadership



Events & resources

- Online information sessions for biosecurity staff
- Presentations at grower forums
- Online biosecurity training (pest identification & monitoring)
- Simply sign up for an account through the PHA website

Psyllid look-alikes

Psyllids are related to aphids, scale insects, phylloxera, and whiteflies. Together, these invertebrate superfamilies are categorized under the Suborder Sternorrhyncha, which is one suborder within the Order Hemiptera (true bugs). Adult psyllid may be confused with:

- **Winged ants**
- **Whitefly**
- **Thrips**
- **Winged mealybug**
- **Winged aphid**
- **Adult psocids**

Learn more about psyllids and psyllid look-alikes in the What is a psyllid fact sheet under the resources tab.

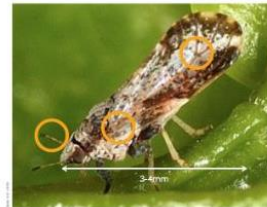


Whitefly
Bemisia tabaci
Exotic species absent from Australia



Identification

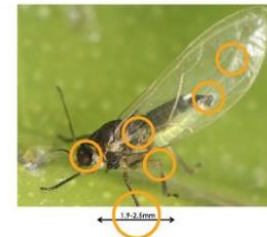
Asian citrus psyllid morphology - adults



Morphology

The wings are mottled brown around the outer edge except where a clear stripe breaks up the pattern at the back (distal end). The distal end (tip) of the wing is broad and blunt in shape.

African citrus psyllid morphology - adults



Morphology

The adult psyllid is initially green in colour, however it darkens to a light-brown colour over time after completing **sclerotisation** (within about 5 days).

Challenges in identifying exotic citrus psyllids

In Australia, there are many native psyllid species. This means that native psyllids, which may sometimes be blown onto citrus trees from nearby vegetation, may be confused with exotic citrus psyllid species.

Understanding some key morphological features of exotic citrus psyllid species can help reduce confusion.



Left to right, top to bottom: Australian native psyllids: *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*, *Aspidiotus perniciosus*.



Identification

Asian citrus psyllid morphology – eggs and nymphs

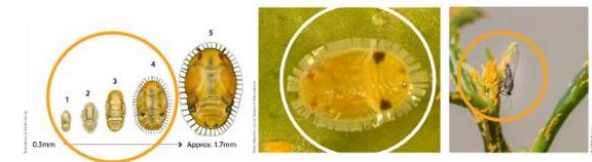


Nymphs are wingless with flat bodies that are yellow or orange to brownish and appears slightly transparent. Nymphs range in size depending on the instar. From 0.25 mm long during the 1st instar, and 1.8 to 1.7 mm in last (5th) instar. Late instar nymphs have distinctive red eyes.



Morphology

African citrus psyllid morphology – eggs and nymphs



Morphology

Activity Area: Opportunities to build biosecurity leadership

Events & resources

- Online information sessions for biosecurity staff
- Presentations at grower forums
- Online biosecurity training (pest identification & monitoring)
- Simply sign up for an account through the PHA website

CITRUSWATCH IDENTIFICATION SHEET

Asian Citrus Psyllid
Diaphorina citri

Lifecycle
Asian citrus psyllid (ACP) matures via multiple stages from egg, through 5 nymph instar phases, and adult. Eggs are laid on young parts of citrus plants such as folded leaves, buds, and flushes, requiring 3-10 days to hatch. The 5 nymph instars take 11-40 days for completion. First and second-instar nymphs mainly remain stationary around buds and folded leaves, only moving when disturbed. Adults are often found on leaves with their head toward the leaf surface and body at a 40° angle to feed. ACP can overwinter as an adult, surviving up to 6 months.

Identification

Egg

- 0.31mm, laid upright
- Yellow to orange coloured

Nymph

- 0.3 - 1mm, oval shaped
- Light pink to orange with maturity, may be blue or green
- Red eyes always visible
- Secretes long strands of honeydew

Adult

- 2-4mm long
- Brown and white mottled wings
- Body brown, legs grey/brown

Damage

- Feeds on plant phloem, deforming and stunting growth
- Honeydew secretion which may develop sooty mould
- Carrier of *Candidatus liberibacter* spp. causing citrus greening disease which leads to bitter, asymmetrical fruit

Image credits:
a. Jeffrey W. Lutz, Florida Department of Agriculture and Consumer Services, Bugwood.org
b. USGS Bee Inventory and Monitoring Lab
c. David Hall, USDA Agricultural Research Service, Bugwood.org
d. INRA-Sorbonne, Institut National de la Recherche Agronomique, Bugwood.org
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Labels:
a. Asian citrus psyllid eggs
b. Asian citrus psyllid nymphs
c. Adult Asian citrus psyllid
d. damage, nymphs and honeydew
e. nymphs and honeydew

Text:
Hemiptera

Footer:
If you see anything unusual, contact the Exotic Plant Pest Hotline on 1800 084 881

CITRUSWATCH IDENTIFICATION SHEET

Brown Marmorated Stinkbug
Halyomorpha halys

Lifecycle
The Brown marmorated stinkbug (BMSB) matures through 3 stages. Eggs are laid on leaves in groups of 20-30 and hatch after 4-5 days. After hatching BMSB matures through five nymphal stages taking 44-55 days, first and second instars remain around the eggs, whereas later instars leave to feed. Adults have been seen to live from 56-224 days, and females can lay over 200 eggs, requiring just one mating to oviposit for half her lifetime.

Identification

Egg

- 1.6mm, barrel shaped
- Light yellow or blue

Nymph

- Early instars oval shaped with red and black colouring
- Later instars similar to adults yellow or brown with red and black mottling
- Newly moulted BMSB are white and red

Adult

- Males 12mm and female 14mm, shield-shaped
- Mottled in a variety of colours, brown, grey, yellow, brown
- Edges have white and black bands
- Antennae and legs with white markings

Damage

- Nymphs feed on leaves, adults on fruit
- Fruit shows necrotic blotches, grooves, brown discoloration, and softened spots
- Known to overwinter in houses and furniture

Image credits:
a. Eric Sprock
b. T. Judy Gallagher, 2 & 3. Gillen San Martin
c. Tereza
d. N. N. Kapran
e. Charles Pickett

Labels:
a. eggs and early instar BMSB
b. mid-late instars and newly moulted
c. BMSB Adult
d. external feeding damage
e. BMSB and citrus damage

Text:
Hemiptera

Footer:
If you see anything unusual, contact the Exotic Plant Pest Hotline on 1800 084 881

Activity Area: Awareness & education in urban areas



Extending reach in urban areas

- ACP entry & establishment risk model (Cesar Australia)
- Relationship development with key 'knowledge broker' organisations, e.g:
 - Council relationships
 - Zoos & botanic gardens
 - Community houses & gardens
- Webinars, fact sheets, articles, Instagram posts

CITRUSWATCH

Spotted something UNUSUAL???

REPORT EXOTIC CITRUS PESTS:
What are we most worried about?

Please call the Exotic Plant Pest Hotline on 1800 084 881 OR...
Submit a report with MyPestGuide Reporter
Report your observations
MyPestGuide® Reporter via app or online: mypestguide.apnic.wa.gov.au

Asian citrus psyllid (ACP)

What is it? A sap-sucking insect that can spread the disease, huanglongbing (HLB; also known as 'citrus greening') by feeding on plants' leaves and stems (refer to Page 2).
What does it look like? Adults are small (3-4 mm), brownish with mottled brown patches on forewings. Nymphs are dull orange with red eyes, and eggs are yellow-orange and almond shaped.
Which plants are affected? All commercial citrus: native and ornamental mock orange (*Murraya* spp.), and curry tree.

African citrus psyllid (AfCP)

What is it? Like the ACP, it is also a sap-sucking insect that can spread the disease, huanglongbing (HLB; also known as 'citrus greening') by feeding on plants' leaves and stems (refer to Page 2).
What does it look like? The adults are small (4 mm) with large, transparent forewings that have distinct veins. Nymphs vary from yellow, olive- green to dark grey and are flat with distinct marginal fringe of white, waxy filaments. Eggs are yellowish orange, cylindrical with sharp points.
Which plants are affected? All commercial citrus: native and ornamental mock orange (*Murraya* spp.), and curry tree.

Glassy-winged sharpshooter (GWS)

What is it? Large leafhopper that causes direct damage through its feeding activities, and excrement 'showers'. It is also highly efficient at spreading a bacteria which causes citrus variegated chlorosis (refer to Page 2).
What does it look like? Adults are 12-14 mm long with a large flat head that have yellow dots, prominent eyes, and translucent wings with reddish veins. Nymphs are dark grey to grey, and eggs are 'sausage' shaped.
Which plants are affected? Over 100 plant species including commercial hosts like citrus.

Budstick Blitz Information Session

September 2023
Jessica Lye, Citrus Biosecurity Manager

Play (k) 0:05 / 95:38

Citrus Australia CITRUSWATCH

CitrusWatch: Surveillance activities

Information Session
14th June 2023

Rohan Burgess - Project Lead, Plant Health Australia

Play (k) 0:07 / 56:28

CITRUSWATCH

Play (k) 1:31 / 3:07

CITRUSWATCH



Activity Area: Awareness & education in urban areas

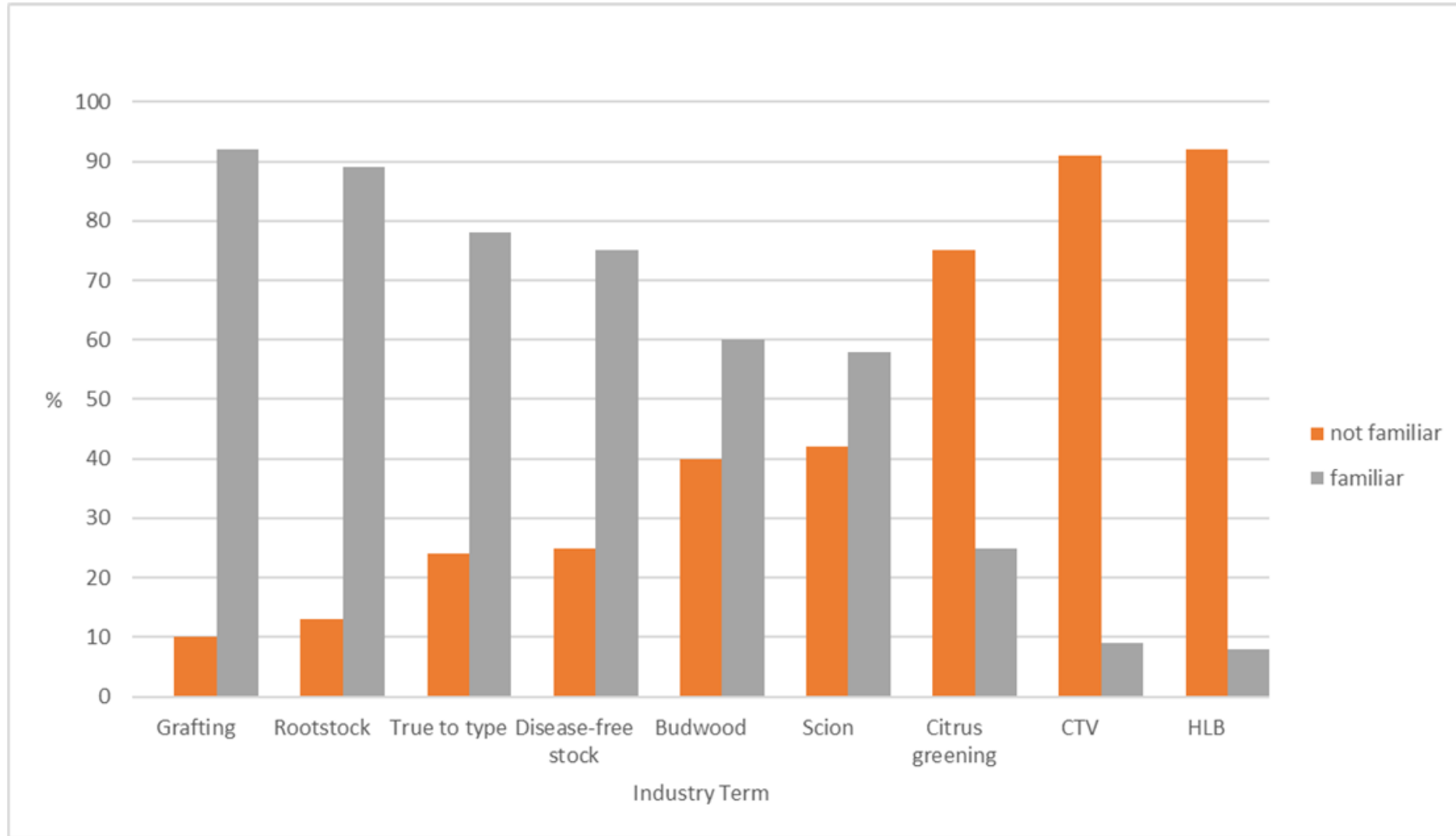


Figure 1. Level of familiarity with various citrus related terms.

Activity Area: Awareness & education in urban areas



Extending reach in urban areas

- ACP entry & establishment risk model (Cesar Australia)
- Relationship development with key 'knowledge broker' organisations, e.g:
 - Council relationships
 - Zoos & botanic gardens
 - Community houses & gardens
- These sites are often good candidates for early detection surveys



Activity Area: Awareness & education in urban areas



Extending reach in urban areas

- ACP entry & establishment risk model (Cesar Australia)
- Relationship development with key 'knowledge broker' organisations, e.g:
 - Council relationships
 - Zoos & botanic gardens
 - Community houses & gardens
- These sites are often good candidates for early detection surveys

Northern Australia
400 sticky traps per year.
Targeted surveys for key pests.

Southern Australia
600 sticky traps per year.
Targeted surveys for key pests.

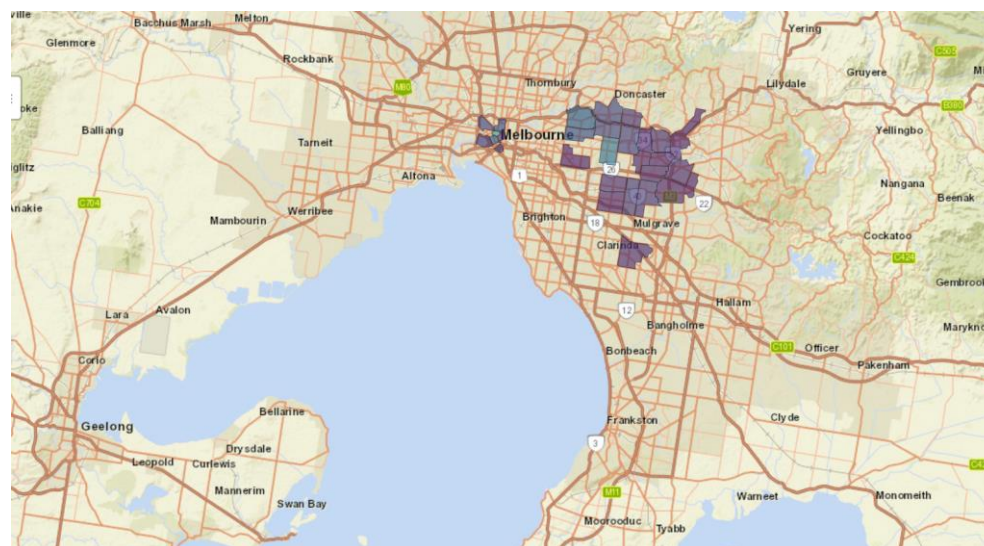
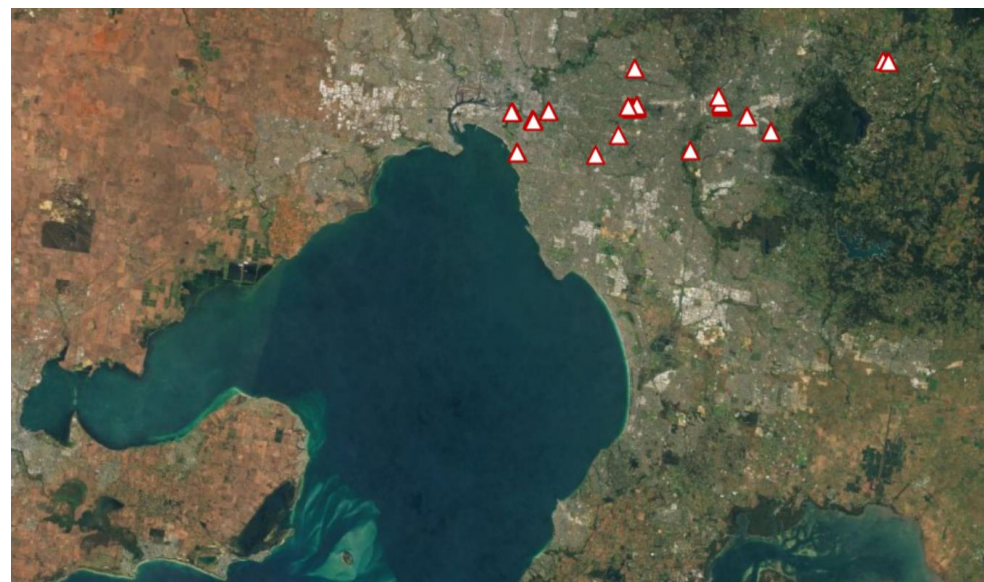
residential citrus orchards community gardens green waste transfer stations zoos schools/universities

Activity Area: Improve surveillance rigour

Risk-based surveillance & high quality data collection

- ACP entry & establishment risk analysis (Cesar Australia)
- Survey app – reduces paperwork & potential for error
- AusPestCheck™ – central PHA database
- Surveillance plan & field protocols

Right: Completed tree surveys across Melbourne (top) and predicted entry and establishment risk for ACP (bottom).

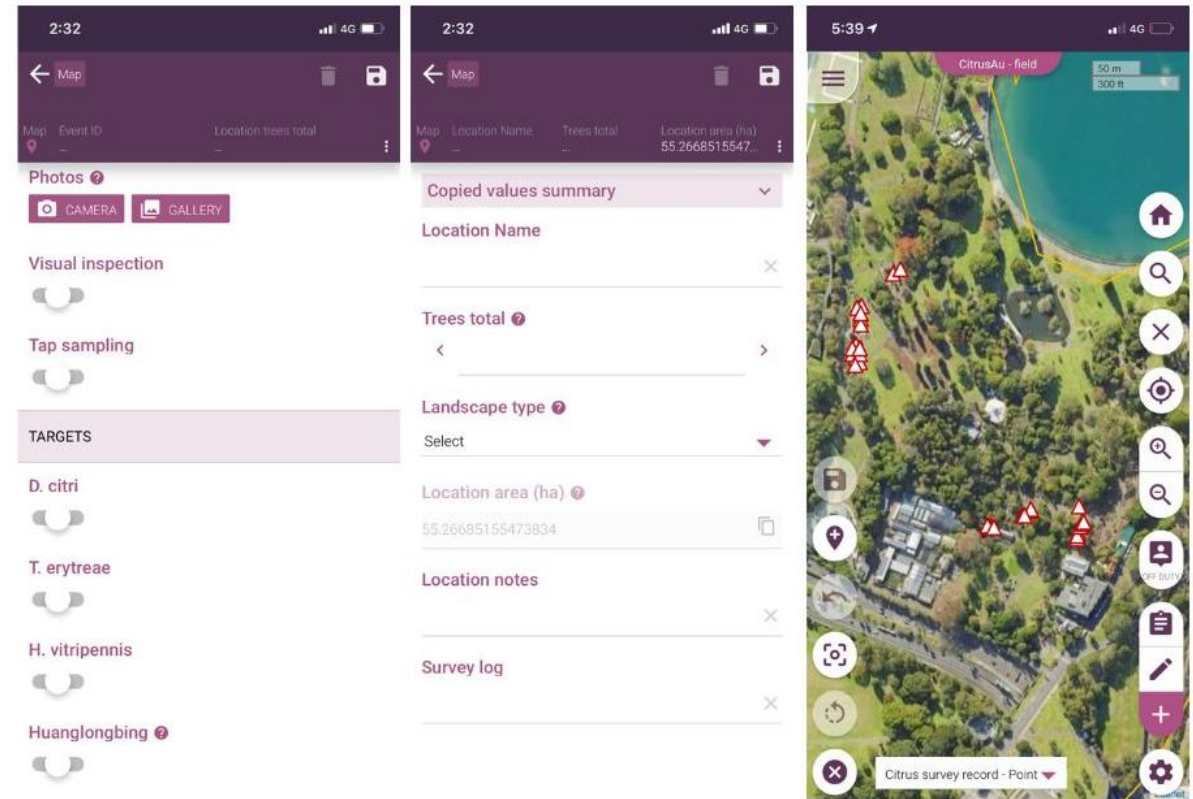


Activity Area: Improve surveillance rigour



Risk-based surveillance & high quality data collection

- ACP entry & establishment risk analysis (Cesar Australia)
- Survey app – reduces paperwork & potential for error
- AusPestCheck™ – central PHA database
- Surveillance plan & field protocols



Activity Area: Improve surveillance rigour

Risk-based surveillance & high quality data collection

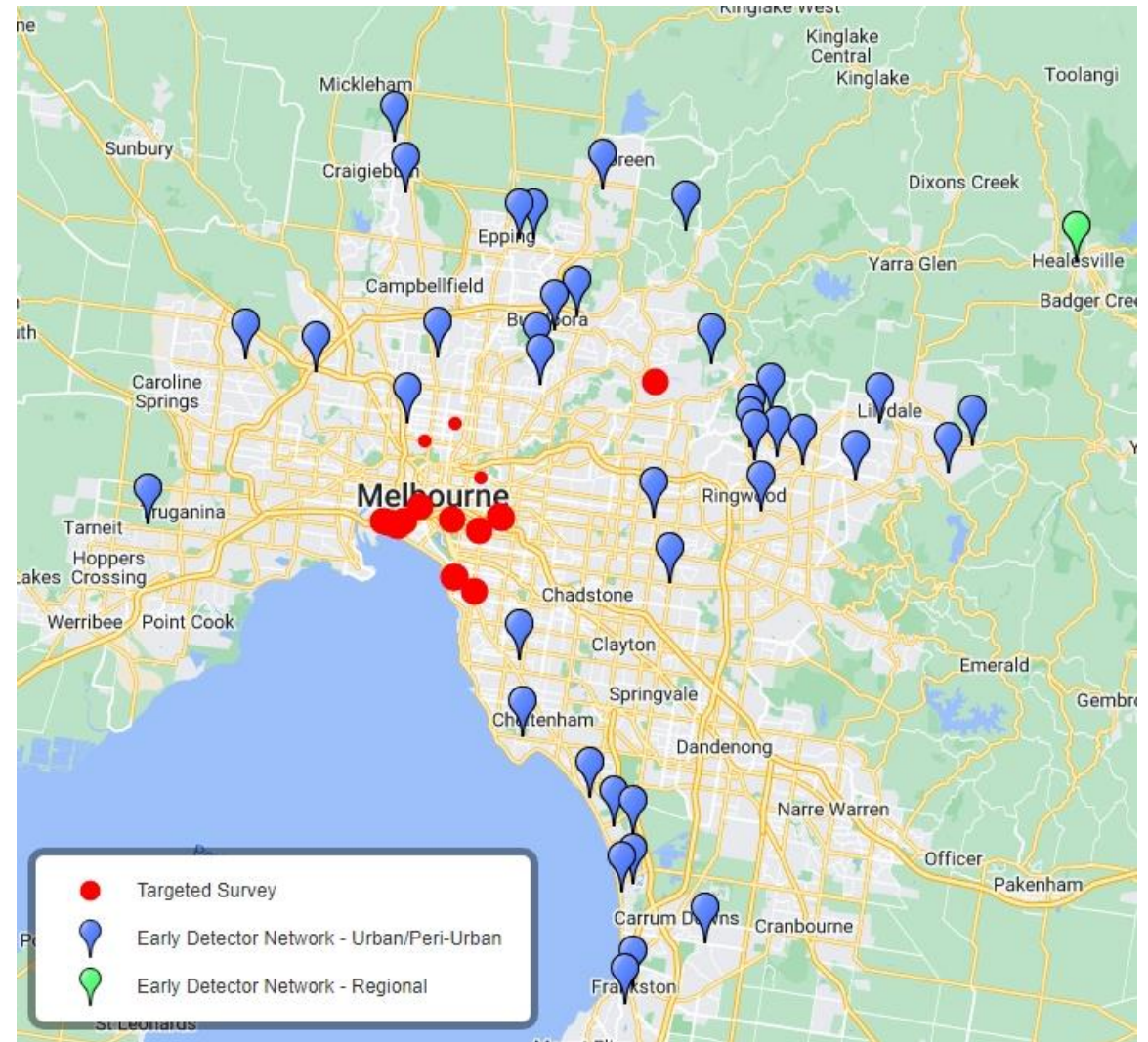
- ACP entry & establishment risk analysis (Cesar Australia)
- Survey app – reduces paperwork & potential for error
- AusPestCheck™ – central PHA database
- Surveillance plan & field protocols

Input	Description	Data Type	Acceptable values
Recorded By	The name (preferred) of the person who performed the surveillance event/observation (including taking the sample). If a name cannot be recorded for 'privacy' reasons, an identifier defined by the source Agency. (ISPM6 requirement)	String	Email or full name
Event ID	Description of survey event and abbreviated name for survey event.	String	Free text descriptor of survey and alpha-numeric code for event (Org name: survey type: months & year)
Site description	Provide a description of the trapping or survey site.	String	Short description that indicates land usage, urban setting or rural setting, private/public ownership.
Hosts	Trap host or plant surveyed. If known, include host scientific name. The lowest taxonomic classification known should be provided. Common names accepted where scientific name is not known.	String	Simple descriptor
Inspection ID	The identifier for a single tree inspection in the field.	Alpha numeric code	Unique inspection ID
Trap ID	The identifier for a single trap deployed in the field.	Alpha numeric code	Unique trap ID. (Barcodes supplied through CitrusWatch).

Activity Area: Improve surveillance rigour

Risk-based surveillance & high quality data collection

- ACP entry & establishment risk analysis (Cesar Australia)
- Survey app – reduces paperwork & potential for error
- AusPestCheck™ – central PHA database
- Surveillance plan & field protocols

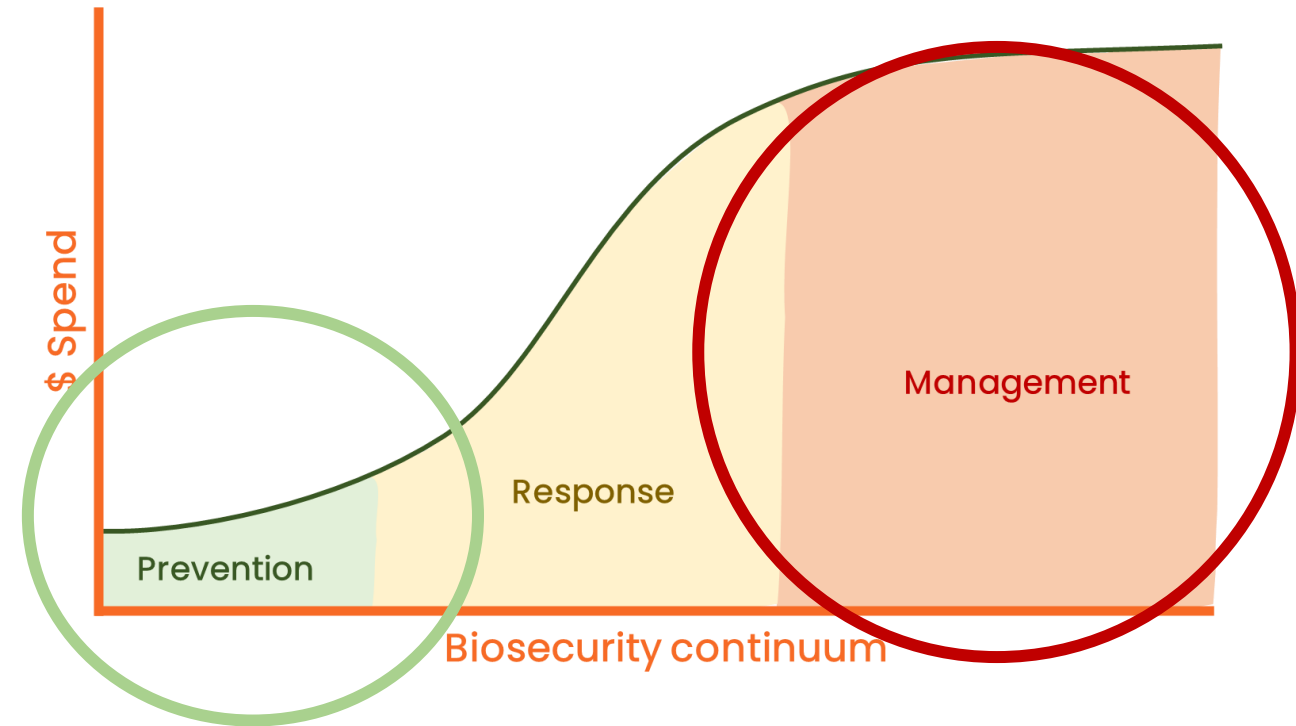




Where to from here?

From the CA perspective...

- Continue tracking industry progress against the strategy
- Look for opportunities to fill activity gaps
- Continue building of partnerships, domestic and international
- Encourage other orgs to refer to the strategy
- Horizon scanning for threats and opportunities



Acknowledgements

CitrusWatch Project Team

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Ben Burchett (NT DITT)
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Andrea Sinclair (Nt DITT – previous)

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Early Detector Network volunteers
Urban Plant Health Network (DEECA)
Ebony Faichney
WA DPIRD
PIRSA
NAQS/DAWE
Citrus WA
Auscitrus
Andrew Beattie
All US hosts
UGM & CRIC

Riverina IPM
BugLuke
Citrus Monitoring Services
CitriCare
Dr Francesco Martoni
Michael Edwards
Dr Nerida Donavan & team (EMAI)
Dr Greg Chandler
Dr Sharyn Taylor
Dr Jianhua Mo
Dr Tahir Khurshid
Dr Steven Falivene



Department of Primary Industries
Department of Regional NSW



Australian Government
Australian Centre for
International Agricultural Research



Cesar Australia

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Thank you.



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