NATIONAL CITRUS BIOSECURITY SURVEILLANCE STRATEGY

2018–2028

This initiative is part of the Australian Government's *Agricultural Competitiveness White Paper*, the government's plan for stronger farmers and a stronger economy.

Executive summary

The Australian citrus industry is free from many significant exotic pests that impact production and trade overseas. While Australia has a comprehensive biosecurity system comprised of activities through the continuum of pre-border, border and post-border, protecting the citrus industry from exotic pests remains a continual challenge. Surveillance is an essential component of this continuum by maximising the likelihood of early detection of new and emerging pests and by providing data on pest distribution and pest absence to support trade.

The National Citrus Biosecurity Surveillance Strategy (NCBSS) has been developed to provide a framework for national coordination and implementation of surveillance activities carried out by government and industry for exotic citrus pests and pests of market access concern.

The NCBSS outlines improved pre-border and border risk and pathway assessment to better understand and target surveillance efforts. For post-border surveillance, the NCBSS describes an enhanced partnership approach of industry, government and community in a national program. Surveillance systems will be supported by diagnostic tools and triage networks, and data collection and reporting methods to enable surveillance efforts to be captured, monitored and improved.

The NCBSS is comprised of four Goals and twelve Actions which will form the basis of an implementation plan. These Actions are interconnected, with overall delivery of the NCBSS aiming to achieve an enhanced partnership approach and the strengthening of national surveillance efforts for early detection of exotic citrus pests and improved understanding of pest status to support market access requirements.

NCBSS Goals and Actions

GOAL 1 – Improved partnerships through coordination and collaboration	
Action 1.1	Establish a nationally coordinated Citrus Biosecurity Surveillance program
GOAL 2 – Enhanced capability and capacity to undertake citrus biosecurity surveillance	
Action 2.1	Establish, coordinate and maintain a citrus diagnostic network and diagnostic triage system to support surveillance in the citrus industry and surveillance hubs
Action 2.2	Maintain and enhance a nationally coordinated First Detector Network (FDN) to underpin surveillance for high priority exotic pests of citrus
Action 2.3	Establish, coordinate and maintain surveillance hubs in commercial production areas and high risk or high impact urban and peri-urban communities
Action 2.4	Improve and enhance surveillance for citrus pests in remote high risk areas
GOAL 3 – Smart surveillance through risk assessment, analysis, tools and diagnostics to support detection of citrus pests	
Action 3.1	Assess exotic citrus pest impacts, establishment potential and entry pathways into and within Australia to design surveillance programs to cost effectively mitigate risks.
Action 3.2	Develop surveillance protocols for high priority pests of citrus appropriate for commercial, urban and peri-urban areas
Action 3.3	Develop and deploy tools that maximise detection of citrus pests from surveillance hubs and remote locations
Action 3.4	Develop and deploy diagnostic tests for improved, cost effective detection of exotic citrus pests and provision of surveillance data
GOAL 4 – Improved capture and analysis of citrus pest surveillance data	
Action 4.1	Identify, modify or develop and maintain tools for capturing surveillance data from FDN and urban and peri-urban surveillance hubs
Action 4.2	Improve data collection and pest reporting from all stakeholder groups
Action 4.3	National capture of surveillance data for citrus pests

The definition of a plant pest used within this strategy covers any species, strain or biotype of invertebrate pest or pathogen injurious to plants, plant products or bees or impacting social amenity or the environment. Exotic pests are those not currently in Australia. Established pests are those present in Australia.

CITRUS BIOSECURITY IN AUSTRALIA

Citrus production throughout the world faces numerous crop protection challenges, and Australia's freedom from important exotic pests that affect citrus species overseas provides advantages that assist the Australian industry achieve profitable yields and produce high quality fruit. To maintain freedom from exotic pests, Australia places a high priority on a biosecurity system that operates through the continuum of pre-border, border and post-border, assisting to protect the citrus industry from pest threats. The system works through partnerships between government and industry (see Figure 1).

PRE-BORDER

Department of Agriculture and Water Resources

- Risk analysis and import approvals
- Regional biosecurity
- Export market access negotiations
- Offshore assessment, audit and verification
- International standards development
- Capacity building in overseas countries
- Gathering global pest intelligence

AT THE BORDER

Department of Agriculture and Water Resources

- Inspection and monitoring
- Enforcement and compliance
- Implementation of risk management system
- Policy implementation
- Education and awareness
- Monitoring and surveillance

POST-BORDER

Department of Agriculture and Water Resources, state and territory governments, plant industries, PHA, producers and community

- Monitoring and surveillance
- National coordination and response to pest incursions
- Domestic quarantine movement restrictions
- Pest management
- Breeding of resistant varieties
- Emergency preparedness activities
- Simulation exercises
- Education and awareness
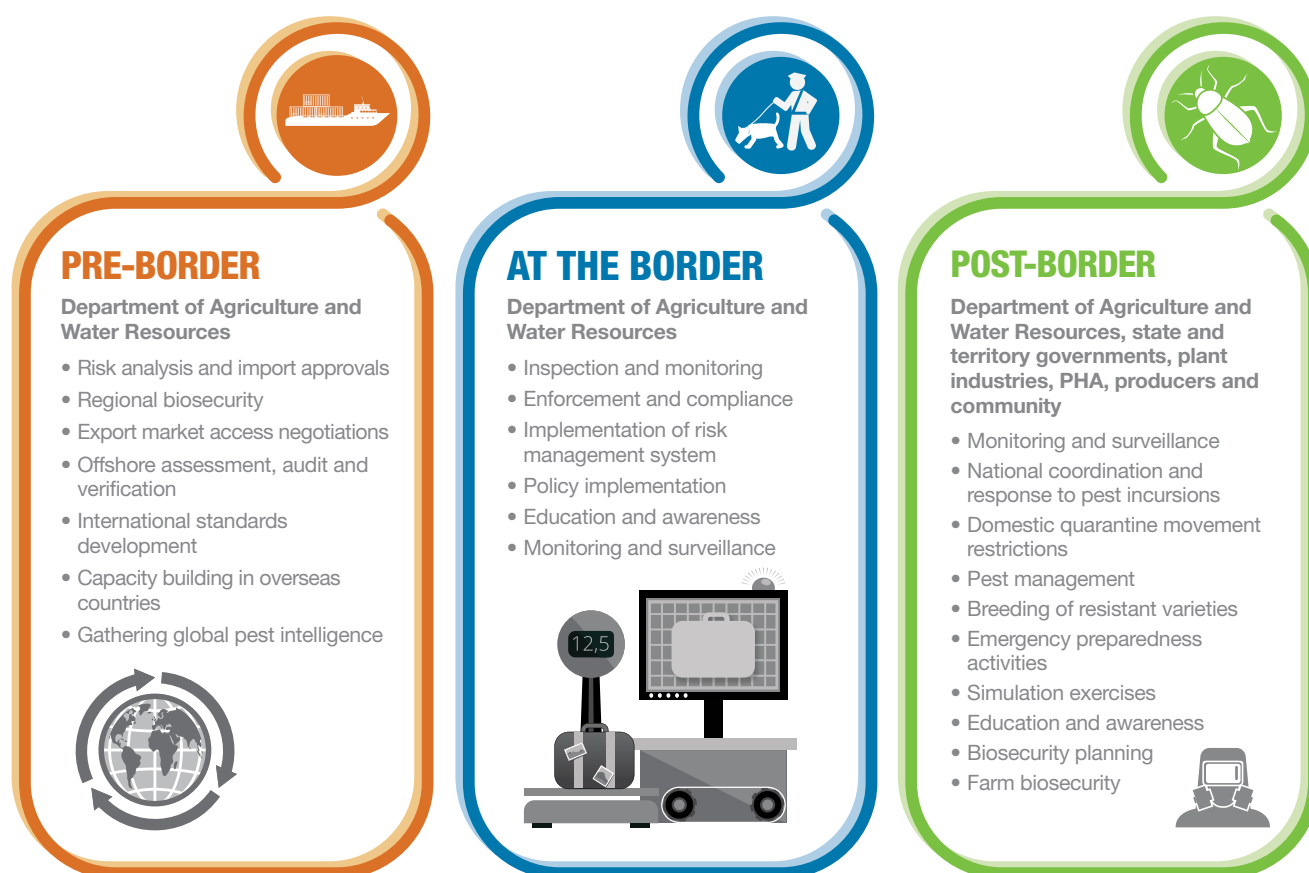- Biosecurity planning
- Farm biosecurity

Figure 1. The key components of Australia's plant biosecurity continuum

Plant pest surveillance is the process of checking for the presence or absence of particular plant pests. There are three main uses for surveillance data:

1. Surveillance checks carried out to provide early detection of any new pests that might have made it through border controls. New pest incursions must be detected early if there is to be a chance of eradication or containment.

2. Negative results (where pests are not found) are also valuable, providing evidence to support claims of area freedom from pests, helping maintain trade for export and domestic markets.

3. Surveillance, in conjunction with complementary activities such as crop monitoring, provides an understanding of pest status and distribution. This assists in delivering more effective management of new and emerging pest issues.

THE AUSTRALIAN CITRUS INDUSTRY

The citrus industry provides significant value to rural communities and the Australian economy and is undergoing a period of significant growth, with access to export markets becoming an increasingly high priority. In 2014-15, citrus production was valued at $411 million produced from 660,000 tonnes (National Plant Biosecurity Status Report, 2016).

Citrus is the largest fresh fruit exporting industry in Australia with major export markets including Hong Kong, Japan, China, Malaysia, Indonesia, Singapore, the United States and New Zealand. In 2014-15 approximately 160,000 tonnes of fresh citrus were exported with a value of $206 million. This represents 26% of the national production, a further 38% is used for the domestic fresh fruit market and the remaining 36% is used for processing (Hort Innovation 2016).

Oranges are the most commonly grown citrus fruit in Australia, followed by mandarins, lemons, grapefruit, tangelos and limes. Currently around 12 million trees, covering approximately 30,000 hectares, form the base of the citrus industry in Australia. Approximately 40% of growers have total citrus areas of between 0.25 and 5 hectares.

Citrus crops are grown commercially throughout Australia, with the exception of Tasmania and the Australian Capital Territory. Commercial citrus plantings are widely distributed with major growing areas in the Riverina (New South Wales [NSW]), Central Burnett and Emerald (Queensland [Qld]), Riverland (South Australia [SA]) and Murray Valley (Victoria/NSW). Production also occurs in Western Australia (WA) and there are a small number of plantings in the Northern Territory (NT) and other locations in NSW (Central Coast, Narromine), Qld (Bundaberg, Sunshine Coast, Mareeba) and WA (Carnarvon, Donnybrook, Gin Gin, Perth, Kununurra).

This widespread distribution provides resilience to meet production for domestic and export demand, however it also provides challenges when undertaking surveillance for exotic pests.

NON-COMMERCIAL CITRUS

In addition to important commercial citrus plantings, citrus species are widespread in urban and peri-urban communities, in home gardens and in small peri-urban holdings.

Australia also has a range of native plant species such as native limes and *Murraya* spp. that can act as hosts for high priority exotic citrus pests. These plantings represent significant amenity, landscape and environmental value within communities and the natural environment, but due to their widespread distribution are a potential source of risk for pest establishment that could threaten commercial production and native vegetation.

HIGH PRIORITY CITRUS PESTS

As part of the original introduction of citrus rootstocks and seed during early European settlement, several important citrus pests became established in Australia, and over time, despite maintenance of a rigorous quarantine system, further introductions have occurred. While some of these new introductions have been detected early enough to enable successful eradication, such as the incursion of citrus canker in the Emerald region in 2004, others such as Fuller's rose weevil have become established and pose a market access concern for some trading partners.

Several significant citrus pest species have not been detected in Australia, and biosecurity measures are in place to keep them out. The main exotic pest threats for citrus were identified during a government and industry biosecurity planning process which developed the citrus industry biosecurity plan (2014). Table 1 gives a list of these exotic High Priority Pests, as well as established pests with regional distribution and/or of market access and production concern.

These exotic pests may be carried into Australia by a range of means including air currents, air and sea travellers, air and sea cargo, movement of people across the Torres Strait carrying citrus material or via illegally imported material of citrus and citrus relatives, as trees, budwood, cuttings, fruit or leaves (e.g. leaves of the condiments kaffir lime and curry leaf).

Citrus Australia is the peak industry body representing Australia's commercial citrus growers. Established in 2008, Citrus Australia provides expert advice for industry in key areas including policy and advocacy, development and promotion of market access, communication, provision of information on crop forecasting and plantings and RDE coordination. In addition, Citrus Australia has an important focus on biosecurity through support for awareness and surveillance programs, a high health budwood scheme and by representing industry as a signatory to the Emergency Plant Pest Response Deed.

Table 1. Prioritised Pest targets for citrus surveillance

Pest target	PEST STATUS IN AUSTRALIA			MARKET ACCESS CONCERNS
	Exotic	Established	Priority*	
Huanglongbing (HLB) (*Candidatus* Liberibacter asiaticus, *Ca* L. africanus and *Ca.* L. americanus)	✔		High	Seed only
Asiatic citrus psyllid *(Diaphorina citri)*	✔		High	
African citrus psyllid *(Trioza erytreae)*	✔		High	
Citrus canker *(Xanthomonas citri* subsp. *citri)*	✔		High	Fresh fruit and propagative material
Citrus variegated chlorosis *(Xylella fastidiosa* subsp. *pauca)*	✔		High	Seed
Glassy winged sharpshooter (GWSS) *(Homalodisca vitripennis)*	✔		High	*Vitis* spp., *Malus* spp., and *Prunus persica* nursery stock
Exotic fruit flies including Mexican fruit fly *(Anastrepha ludens)*, Caribbean fruit fly *(A. suspensa)*, New Guinea fruit fly *(Bactrocera trivialis)*, Oriental fruit fly *(B. dorsalis)*	✔		High	Fresh fruit
Citrus tristeza virus (CTV) (*Citrus tristeza virus* – established and exotic strains)	✔	✔	High	
Mediterranean fruit fly (Medfly) *(Ceratitis capitata)*		✔	High	Fresh fruit
Queensland fruit fly (Qfly) *(Bactrocera tryoni)*		✔	High	Fresh fruit
Fuller's rose weevil (FRW) *(Asynonychus cervinus)*		✔	High	Nursery stock and fresh fruit
Light brown apple moth (LBAM) *(Epiphyas postvittana)*		✔	High	Fresh fruit
Brown rot *(Phytophthora hibernalis)*		✔	High	Fresh fruit
Navel orange worm *(Amyelois transitella)*	✔		Medium	*Prunus persica* nursery stock
Mal secco *(Phoma tracheiphila)*	✔		Medium	Nursery stock
Exotic thrips including Bean thrips *(Caliothrips fasciatus)* and Florida flower thrips *(Frankiniella bispinosa)*	✔		Medium	
Powdery mildew *(Oidium citri* and *Oidium tingitaninum)*	✔		Medium	
Citrus leprosis *(Citrus leprosis virus)*	✔		Medium	
Citrus stubborn disease *(Spiroplasma citri)*	✔		Medium	Nursery stock
Mealybugs including Citrus mealybug *(Planococcus citri)*, Longtailed mealybug *(Pseudococcus longispinus)* and Spherical mealybug *(Nipaecoccus viridis)*		✔	Medium	Fresh fruit, and cuttings (various species)
Scale insects including Soft brown scale *(Coccus hesperidum)*; Black scale *(Saisseta oleae)*; Citricola scale *(Coccus pseudomagnoliarum)*; Red scale *(Aonidiella aurantii)*		✔	Medium	Olive nursery stock
Septoria spot *(Septoria citri)*		✔	Medium	Fresh fruit
Citrus fruit borer *(Citripestis sagittiferella)*	✔		Medium	

* The priority assigned to pests in Table 1 was agreed by industry and government participants at a national Citrus Biosecurity Workshop held in 2016.

STATUS OF CITRUS BIOSECURITY IN AUSTRALIA

The Australian government and state and territory governments work under the principles set out in the Intergovernmental Agreement on Biosecurity (IGAB) which aims to strengthen partnerships and improve outcomes for biosecurity including national surveillance and diagnostic capacities.

The National Plant Biosecurity Strategy, National Plant Biosecurity Surveillance Strategy and National Plant Biosecurity Diagnostic Strategy have been developed to outline a vision for improvements to the plant biosecurity system, further strengthening national biosecurity arrangements.

The National Citrus Biosecurity Surveillance Strategy (NCBSS) will complement these frameworks by developing and integrating a partnership approach for surveillance for citrus pests of market access and production concern. The NCBSS will form part of wider integration of industry-specific strategies into the national plant biosecurity system.

THE BIOSECURITY CONTINUUM

The biosecurity continuum is made up of activities and measures applied along the continuum of pre-border, border and post-border (Figure 1). The Australian government is responsible for managing biosecurity risks along the continuum although its focus is mainly in post-border and border activities. State or territory governments are responsible for delivery of plant biosecurity operations and supporting legislation within their borders. In partnership with industry, government jurisdictions undertake surveillance activities to support early detection of new pests, delimit the extent of pests and provide data to support area freedom.

Stuart Pettigrew

PRE-BORDER AND BORDER ACTIVITIES TO SUPPORT SURVEILLANCE

The Australian Government is responsible for identifying global risks and pathways for entry of exotic pest threats of citrus into Australia. It also works with trading partners to mitigate risks posed by movement of goods and passengers entering Australia. Activities aimed at reducing the risk of entry of pests include engagement in bilateral and multi-lateral forums, import risk assessments and audit and offshore treatment/inspections to ensure that exporting countries meet Australia's biosecurity requirements.

Through the Department of Agriculture and Water Resources (DAWR) the Australian Government undertakes considerable programs of capacity building in the Asia-Pacific region to improve biosecurity, build diagnostic networks, and assist to manage phytosanitary risks that safeguard trade between Australia and neighbouring countries. DAWR Offshore Surveillance Program and the Northern Australia Quarantine Strategy conducts pest surveys and training activities in the near neighbouring countries of Papua New Guinea, Indonesia, Timor-Leste and the Solomon Islands as well as a program of risk assessment and surveillance along Australia's northern coastline including the islands of the Torres Strait.

These activities support surveillance for citrus pests by providing improved understanding of the potential risk pathways for exotic pests entering Australia, and building capacity and capability in near neighbouring countries to undertake surveillance for citrus pests.

These pre-border and border measures provide early warning for new and emerging or imminent pest threats for Australian citrus production and are an important component of identifying and prioritising targets for surveillance onshore.

At the border, DAWR has primary responsibility for border biosecurity activities such as screening and inspection of cargo, passengers, mail, plants and plant products for quarantine risk materials. Between 2004 and 2014, approximately 40% of the pest species on the citrus high priority pest list have been intercepted and eradicated at the border on at least one occasion. In addition, DAWR has established a border surveillance program which monitors incursions of exotic plant pests in and around major ports of entry.

POST-BORDER SURVEILLANCE

Government surveillance programs

DAWR coordinates the National Plant Health Surveillance Program, assisting state and territory jurisdictions deliver post-border surveillance programs. These programs target high priority citrus pests including exotic fruit flies, citrus variegated chlorosis (*Xylella*), glassy winged sharp shooter, citrus canker, huanglongbing, Asiatic and African citrus psyllids. In addition, state and territory jurisdictions conduct a number of surveillance programs specific to their regions targeting exotic and established citrus pests.

States and territories within Australia, through industry and government support, provide expertise in both surveillance and diagnostic services for monitoring of established and exotic pests of citrus.

Industry surveillance and crop monitoring programs

The majority of pest surveillance in commercial citrus orchards is undertaken through regular monitoring and inspection of citrus trees and harvested fruit by a range of personnel within the citrus supply chain. Across most of the major production areas, crop monitoring scouts are widely used by commercial citrus growers as part of pest control programs for established pests. Along with this crop monitoring, others including sales agronomists, researchers and government staff regularly inspect trees or fruits within citrus production systems.

In addition to monitoring of trees and fruit during seasonal production, a range of inspections on fruit are undertaken through the harvesting and packing process. The intensity of these activities depends on the market for the product, with fruit intended for export markets undergoing a more comprehensive range of inspections including on-arrival visual inspection at the packing shed, regular inspection of cartons of packed fruit through the packing process and end-of-line inspections.

Together, the personnel working in commercial orchards, packing sheds and the research community have been organised by Citrus Australia into a group called the First Detector Network (FDN). Through their activities in regular crop and fruit monitoring, the FDN represent an important potential resource for surveillance for exotic pests as they have significant expertise in identifying abiotic and biotic stresses within orchards or packing sheds and are therefore well placed in recognising new or unusual pests or symptoms. While it is recognised that the activities of the FDN provide significant surveillance capacity, limited data has been captured from the FDN at a national level for analysis to determine the presence or absence of pests. Improvements in national coordination of crop monitoring efforts therefore offer significant potential in providing data for early detection and evidence of absence from exotic citrus pests.

NATIONAL CITRUS BIOSECURITY SURVEILLANCE STRATEGY

Given the number of significant high priority exotic citrus pest threats that have the potential to affect market access and production on a regional or national basis, the distribution of citrus plantings and the benefits of an effective surveillance system, there is a need for a coordinated, long-term strategy for citrus biosecurity surveillance.

The National Citrus Biosecurity Surveillance Strategy has been developed to guide the coordination of surveillance efforts in a partnership approach between government, industry and the community to maximise efficiency and effectiveness of surveillance efforts.

Citrus Australia

Implementation of the NCBSS is expected to provide the following important outcomes:

- An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom.

- Prioritisation of activities and resources that maximise efficiency of surveillance using input from industry, government and community sources in a partnership approach.

- Improved capacity and capability in government, industry and community for surveillance.

- Sustainable funding mechanisms for citrus surveillance activities.

- Coordination of surveillance and data capture, sharing, analysis and reporting for high priority pests and pests of market access concern across industry, government and the community.

- Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs.

- Increased responsiveness to new citrus biosecurity issues as a result of improved awareness of biosecurity.

- Increased levels of understanding and 'ownership' of citrus biosecurity issues in urban and peri-urban communities.

- Improved understanding of the risk of entry of citrus pests through import and natural pathways.

- Diagnostic networks, tools and tests to support surveillance for citrus pests.

SCOPE OF THE NCBSS

The NCBSS provides a framework for coordination and implementation of citrus pest surveillance activities across the continuum of pre-border, border and post border. The NCBSS has been developed to align with the National Plant Biosecurity Surveillance Strategy (see Table 2) and builds on existing activities undertaken by industry and government to provide recommendations to support and enhance surveillance efforts for exotic citrus pests and pests of market access concern.

OBJECTIVES

The objectives of NCBSS are:

OBJECTIVE 1	Improve the availability and quality of surveillance data to support market access requirements and the early detection of exotic citrus pests.
OBJECTIVE 2	Optimise surveillance efforts for citrus pests at points of highest risk and greatest return.
OBJECTIVE 3	Maximise the effective use of resources for citrus surveillance activities through a risk-based, partnership approach between industry, government and community.

THE FUTURE STATE OF CITRUS SURVEILLANCE

The future citrus biosecurity surveillance system (Figure 1) will be underpinned by this NCBSS and its implementation. The NCBSS is comprised of four Goals.

GOAL 1	Improved partnerships through coordination and collaboration.
GOAL 2	Enhanced capability and capacity to undertake citrus biosecurity surveillance.
GOAL 3	Smart surveillance through risk assessment, analysis tools and diagnostics to support detection of citrus pests.
GOAL 4	Improved capture and analysis of citrus surveillance data.

Activities will be delivered and monitored through an Implementation Plan that supports this strategy. Implementation of the Goals and Actions within the NBCSS will complement and address recommendations in the National Plant Biosecurity Surveillance Strategy as outlined in Table 2.

Figure 1. The future state of citrus biosecurity surveillance
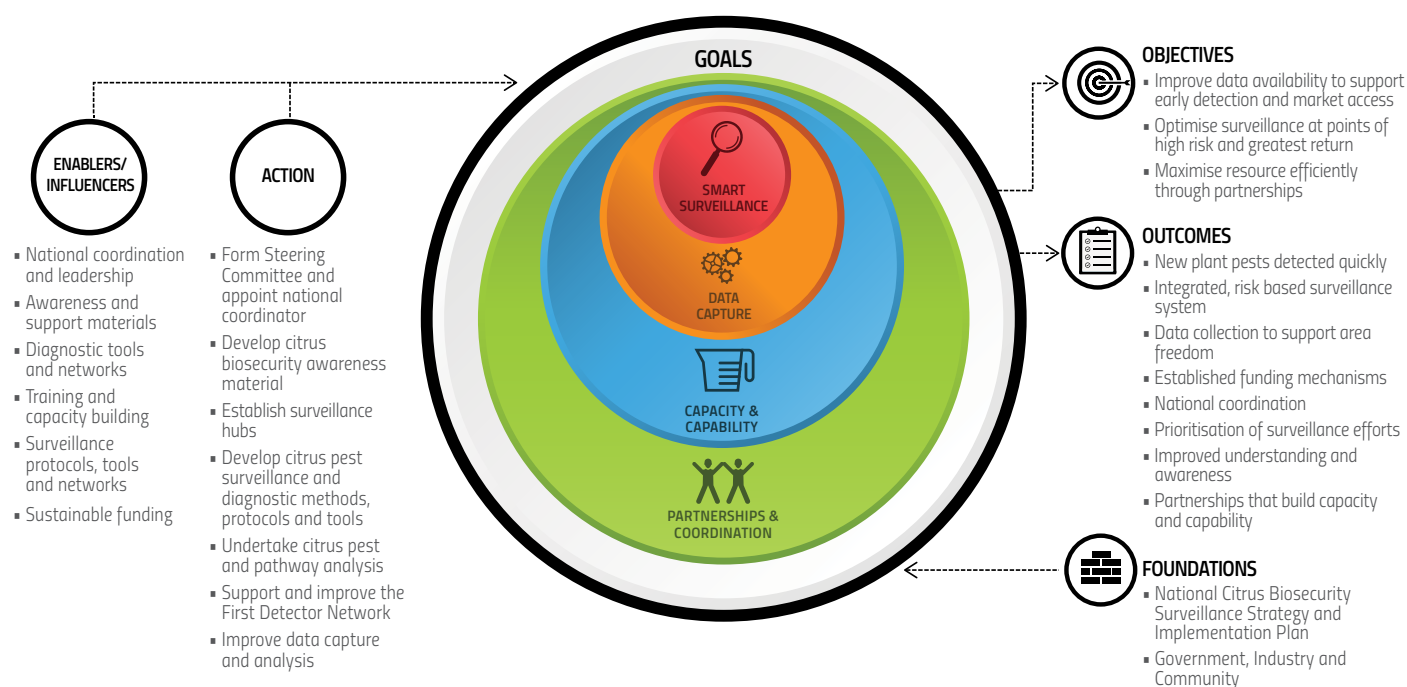
GOAL 1
IMPROVED PARTNERSHIPS THROUGH COORDINATION AND COLLABORATION

To implement and monitor the activities described within the NCBSS and achieve the overarching objectives, establishment of a national citrus biosecurity surveillance program will be required to manage and coordinate activities in a consistent, effective manner and provide confidence in the surveillance system's performance. National coordination will facilitate and sustain the partnership between government and industry and develop networks within urban and peri-urban areas to undertake surveillance activities.

Coordination and leadership for implementation of the NCBSS will also maximise efficiency and develop and maintain consistent standards for surveillance to support market access and early detection. Coordination within citrus biosecurity surveillance will facilitate data collection from different stakeholders and monitor the effectiveness of the system over time. In addition, overarching coordination of training and awareness will ensure that consistent information is delivered within the program and that surveillance activities undertaken by industry, government and community are maintained.

Actions to deliver Goal 1

ACTION 1.1	TASKS	PERFORMANCE MEASURES
Establish a nationally coordinated Citrus Biosecurity Surveillance Program	1.1.1 Establish a National Steering Group comprising members of PHA, DAWR and Citrus Australia to oversee the National Citrus Biosecurity Surveillance Program	▪ Improved efficiency and effective use of resources ▪ Sustainable funding mechanisms for surveillance activities ▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern ▪ Improved partnerships between industry, government and community
	1.1.2 Define the national citrus biosecurity surveillance program and identify key stakeholders	
	1.1.3 Establish capability and funding arrangements for an efficient and effective program	
	1.1.4 Appoint and maintain a Coordinator to coordinate and monitor activities and resourcing requirements Identify mechanisms to improve efficiency of surveillance efforts	
	1.1.5 Identify mechanisms to improve efficiency of surveillance efforts within commercial production areas and other high risk areas	

OUTCOMES
▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom   ▪ Prioritisation of activities and resources that maximise efficiencies using input from industry, government and community sources in a partnership approach   ▪ Sustainable funding mechanisms for citrus surveillance activities   ▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern across industry, government and the community   ▪ Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs

GOAL 2
ENHANCED CAPABILITY AND CAPACITY TO UNDERTAKE CITRUS BIOSECURITY SURVEILLANCE

The establishment of 'surveillance hubs' in commercial and peri-urban and urban areas is a key component of enhancing capacity and capability amongst surveillance stakeholders. Surveillance hubs will be comprised of sites and networks of individuals that act as focal points within a production area, region or community. These hubs will undertake surveillance for pests and provide ongoing awareness of the importance of biosecurity and potential impact of exotic pests.

Surveillance hubs will require that a number of support elements are developed, delivered and maintained through partnership arrangements between government, industry and the community. These elements will require coordination and support material including:

- The development and delivery of training material and data capture tools to build capacity and capability to recognise and report new pests or pest symptoms.
- The provision of tools to support surveillance such as traps for different pest types.
- An efficient and effective diagnostic system which comprises access to expertise, tools and networks to ensure that pests can be identified.
- Coordination and ongoing engagement to ensure that hubs are maintained.

For all pest targets, development of diagnostic support that provides responsive feedback will be needed to maintain the ongoing activities of surveillance hubs and the FDN. Links to the National Plant Biosecurity Diagnostic Network will be required as well as an investment model that provides funding and capacity to diagnose samples of suspected exotic pests submitted as part of the surveillance activities. For some exotic pests or their symptoms, the use of images for initial diagnosis will increase the efficiency of the system and provide more rapid feedback for surveillance undertaken within urban, peri-urban and commercial hubs.

The First Detector Network (FDN) has been identified as an important resource to undertake surveillance for early detection of exotic pests and provide evidence of absence for pests of market access concern. Training on key exotic pests for members of the FDN will improve and maintain surveillance activities and encourage reporting of new pests or symptoms.

The expanding role for the FDN to undertake and collect surveillance data for exotic pests could be achieved through their accreditation and authorisation by the Australian Government to allow personnel to undertake specific exotic pest monitoring and data collection to ensure commodities meet importing country requirements.

Significant plantings of citrus species occur within urban and peri-urban environments, providing opportunities for the establishment of exotic pests should they enter through major ports or other high risk pathways. While surveillance for citrus pests in urban and peri-urban communities is challenging because of the large number of potential properties and the range of stakeholders, engagement with these communities will provide opportunities for strengthening the overall biosecurity system through improved awareness of biosecurity issues and increased reporting of exotic pests. In urban and peri-urban communities, surveillance hubs are proposed as a mechanism for ongoing engagement to establish and maintain a focal point for surveillance networks.

Australia's vast coastline and relatively sparse population provides challenges for surveillance for citrus pests as a result of remoteness and the distances to be covered. Remote locations in northern Australia have additional challenges resulting from the proximity to neighbouring countries, increasing the potential for pest dispersal through movement of people or wind and water currents.

The development and deployment of innovative surveillance tools will be needed to assist the delivery of surveillance activities in remote locations (see Goal 3) and the establishment of surveillance hubs in remote communities will improve capacity and capability for surveillance for exotic pests.

Actions to deliver Goal 2

ACTION 2.1	TASKS	PERFORMANCE MEASURES
Establish, coordinate and maintain a citrus diagnostic network and diagnostic triage systems to support surveillance in the citrus industry and surveillance hubs	2.1.1 Establish triage processes for images or samples to be assessed within the citrus diagnostic network	▪ Responsive diagnostic system capable of undertaking efficient and effective identification of high priority pests of citrus
	2.1.2 Establish processes for feedback and response for sample submission	▪ National capability and capacity to assess or triage images of symptoms of high priority citrus pests to improve early detection
	2.1.3 Establish and maintain a citrus diagnostic node within the National Plant Biosecurity Diagnostic Network	▪ Ongoing implementation of surveillance hubs by providing feedback and increased capacity for diagnosis of samples to support surveillance for citrus pests
	OUTCOMES	
	▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom	
	▪ Improved capacity and capability in industry and community for surveillance	
	▪ Increased responsiveness to new citrus biosecurity issues as a result of improved awareness of biosecurity	
	▪ Diagnostic networks, tools and tests to support surveillance for citrus pests for different stakeholder and surveillance needs	

ACTION 2.2	TASKS	PERFORMANCE MEASURES
Maintain and enhance a nationally coordinated First Detector Network (FDN) to underpin surveillance for high priority exotic pests of citrus	2.2.1 Define requirements for an FDN network for citrus biosecurity surveillance within the National Citrus Biosecurity Surveillance Program	▪ An ongoing FDN program for surveillance of citrus pests
	2.2.2 Identify key FDN personnel in each region	▪ A third party accreditation scheme for detection of pests of market access concern and high priority exotic pests established and deployed
	2.2.3 Develop support material and training for FDN	
	2.2.4 Establish and maintain a program for training and engagement with FDN for surveillance for high priority pests of citrus	
	2.2.5 Develop an accreditation program to authorise key FDN personnel to undertake surveillance for citrus pests of market access concern	
	OUTCOMES	
	▪ Improved capacity and capability in industry and community for surveillance	
	▪ Coordination of surveillance and data capture, sharing, analysis and reporting for high priority pests and pests of market access concern across industry, government and the community	
	▪ Increased responsiveness to new citrus biosecurity issues as a result of improved awareness of biosecurity	

ACTION 2.3	TASKS	PERFORMANCE MEASURES
Establish, coordinate and maintain surveillance hubs in commercial production areas and high risk or high impact urban and peri-urban communities	2.3.1 Define requirements of surveillance hubs as part of activities within the FDN network in commercial production areas and within the communities in peri-urban and urban areas	▪ Establishment and maintenance of surveillance hubs in commercial production areas
	2.3.2 Establish surveillance hubs in commercial production areas and within communities in peri-urban and urban areas	▪ Establishment and maintenance of surveillance hubs in peri-urban or urban regions targeting highest risk or highest impact sites for surveillance of citrus pests
	2.3.3 Develop and implement an engagement plan for surveillance hubs in commercial production, peri-urban and urban communities	▪ Improved detection of citrus pests through the removal of barriers for surveillance and reporting
	2.3.4 Develop and maintain a web portal and support material for community surveillance hubs in peri-urban and urban areas	

OUTCOMES
▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom
▪ Prioritisation of activities and resources that maximise efficiencies using input from industry, government and community sources in a partnership approach
▪ Improved capacity and capability in industry and community for surveillance
▪ Coordination of surveillance and data capture, sharing, analysis and reporting for high priority pests and pests of market access concern across industry, government and the community
▪ Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs
▪ Increased responsiveness to new citrus biosecurity issues as a result of improved awareness of biosecurity
▪ Increased levels of understanding and 'ownership' of citrus biosecurity issues in urban and peri-urban communities

ACTION 2.4	TASKS	PERFORMANCE MEASURES
Improve and enhance surveillance for citrus pests in remote high risk areas	2.4.1 Define capacity and capability needs for surveillance for citrus pests in remote locations	▪ Improved confidence in the detection of citrus pests in remote locations
	2.4.2 Investigate cost effective solutions for surveillance in remote locations, using a risk based approach	
	2.4.3 Develop and deploy a program for surveillance for citrus pests in remote high risk areas for establishment of exotic citrus pests	

OUTCOMES
▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom
▪ Improved capacity and capability in industry and community for surveillance
▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern across industry, government and the community

GOAL 3

SMART SURVEILLANCE THROUGH RISK ASSESSMENT, ANALYSIS TOOLS AND DIAGNOSTICS TO SUPPORT DETECTION OF CITRUS PESTS

The risk potential posed by the entry and establishment of exotic pests into different commercial production areas and urban and peri-urban communities requires identification and evaluation to prioritise surveillance activities. In addition, while remote areas such as regions of northern Australia have limited commercial citrus production, assessment of the entry and establishment probability in these regions as a pathway into larger commercial citrus production areas is required.

Analysis of the types and scope of surveillance and crop monitoring in different regions is required to quantify efforts that support pest status at both a regional and national level. Risk-based interpretation of surveillance will support and improve activities undertaken by the FDN and surveillance hubs.

The development of surveillance protocols specific to pests, pathways, regions or high risk areas should be undertaken using statistically sound, risk-based approaches. Surveillance protocols ensure consistent interpretation of surveillance efforts between regions and will be an important tool in ensuring resources are targeted effectively and the outcomes of the NCBSS can be described and measured.

Given the large areas that surveillance activities need to cover in Australia, the development and deployment of innovative tools such as smart traps and sensors for remote locations will improve the efficiency of surveillance efforts and increase the likelihood of early detection of exotic pests. Other tools that will support the surveillance system include the development of data capture tools such as smart phone apps (see Goal 4).

Accurate and efficient diagnosis of plant pests underpins a successful surveillance system. Development of high throughput, multi-assay diagnostic tests or field based molecular tests will maximise efficiencies for surveillance efforts and improve the speed of diagnosis of citrus pests. Several of the high priority pests of citrus are considered to be cryptic, meaning the pest or its symptoms are hard to distinguish from other biotic or abiotic factors and their presence or absence can only be confirmed using specific sampling and diagnostic assessment. For these cryptic pests, visual assessment of citrus trees or fruit is insufficient and sample collection, coupled with development and deployment of diagnostic assays will increase our confidence of early detection.

Actions to deliver Goal 3

ACTION 3.1	TASKS	PERFORMANCE MEASURES
Assess exotic citrus pest impacts, establishment potential and entry pathways into and within Australia to design surveillance programs to cost effectively mitigate risks	3.1.1 Assess exotic citrus pest impacts, establishment potential and entry pathways into and within Australia	• Improved efficiency and effective use of resources
	3.1.2 Identify high risk areas for entry and establishment of each pest type	• Surveillance efforts focussed in areas of highest risk and greatest return
	3.1.3 Collate and analyse the types and scope of crop monitoring activities undertaken in different regions to quantify surveillance efforts	• Improved ability to assess and monitor the effectiveness of a national citrus biosecurity surveillance program
	3.1.4 Develop surveillance models that incorporate risks and quantify surveillance efforts to estimate the pest status of citrus pests	
	OUTCOMES	
	• An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom	
	• Prioritisation of activities and resources that maximise efficiencies using input from industry, government and community sources in a partnership approach	
	• Improved understanding of the risk of entry of citrus pests from pathways into northern Australia	

ACTION 3.2	TASKS	PERFORMANCE MEASURES
Develop surveillance protocols for high priority pests of citrus appropriate for commercial and non-commercial plantings	3.2.1 Review existing surveillance protocols for citrus including identification of the surveillance purpose and scope, stakeholder group undertaking surveillance and pest targets for each region or site.	▪ Surveillance protocols for all high priority pests of citrus deployed ▪ Consistent and coordinated data collection for citrus pests across and between regions
	3.2.2 Develop surveillance protocols and a Surveillance Operations Manual for high priority pests and/or their vectors for deployment in the Citrus Biosecurity Surveillance Program	
	OUTCOMES	
	▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom ▪ Improved capacity and capability in industry and community for surveillance ▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern across industry, government and the community	

ACTION 3.3	TASKS	PERFORMANCE MEASURES
Develop and deploy surveillance tools that maximise detection of citrus pests from surveillance hubs and remote locations	3.3.1 Identify and develop surveillance tools such as remote cameras, multi-pest lures, traps etc to improve efficiency and effectiveness of detection of high priority pests of citrus	▪ Increased likelihood of detection of exotic pests in surveillance hubs and remote locations ▪ Improved coverage of surveillance efforts resulting from the ability to deploy surveillance tools in more locations
	3.3.2 Deploy surveillance tools for real-time detection of citrus pests in high risk areas of entry and establishment	
	OUTCOMES	
	▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom ▪ Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs	

ACTION 3.4	TASKS	PERFORMANCE MEASURES
Develop and deploy diagnostic tests for improved, cost effective detection of exotic citrus pests and provision of surveillance data	3.4.1 Identify and prioritise citrus pest targets for the development of high throughput and/or field diagnostic tests based on impact and inability to diagnose using visual symptoms	▪ High throughput molecular tests for high priority pests of citrus are available ▪ Field-based molecular tests for detection of high priority citrus pests available ▪ Ongoing surveillance for key high priority exotic citrus pests through data collection from budwood high health schemes
	3.4.2 Develop and deploy high throughput and/or field diagnostic tests to support surveillance for high priority citrus pests	
	OUTCOMES	
	▪ Diagnostic networks, tools and tests to support surveillance for citrus pests for different stakeholder and surveillance needs	

GOAL 4
IMPROVED CAPTURE AND ANALYSIS OF CITRUS SURVEILLANCE DATA

Collection of data into a national system that allows reporting and dissemination of information will provide information on pest status to support market access and give confidence in the effectiveness of surveillance for the early detection of exotic pests. National data collection will also provide the ability to undertake a gap analysis of surveillance efforts and ongoing evaluation of the NCBSS.

Within the NCBSS, improvements to the identification and collection of surveillance data are proposed through an expansion of the FDN and the development of surveillance hubs within commercial production areas and urban and peri-urban communities (see Goal 2). While these hubs have been proposed as an important source for data collection for exotic pests affecting the citrus industry, identification of incentives for surveillance or barriers for data collection and pest reporting for both the FDN and urban and peri-urban communities, will be required to ensure surveillance activities can be initiated and maintained.

Development of data capture tools will be needed to ensure surveillance data are captured consistently and can be integrated into a national system for data analysis. For surveillance data collection from crop monitoring in commercial production, it is anticipated that data capture tools will ideally align with existing business practices to reduce disincentives for personnel to undertake surveillance and provide data. Provision of tools or resources for surveillance hubs in urban and peri-urban environments will assist with data capture as well as reporting suspected detections of new or emerging pest issues.

Actions to deliver Goal 4

ACTION 4.1	TASKS	PERFORMANCE MEASURES
Identify, modify or develop tools for capturing surveillance data from the FDN and urban and peri-urban surveillance hubs	4.1.1 Identify existing surveillance data capture tools suitable for use by for FDN or surveillance hubs to assist aggregation of data into national databases	• Improved information on status of high priority pests through collation of required data in a consistent manner • Tools to assist capture and collation of surveillance data available
	4.1.2 Modify existing data capture tools or develop new data capture tools and deploy them to assist national aggregation of surveillance data from various sources including FDN and Surveillance hubs	
	4.1.3 Develop and maintain programs to train stakeholders to use and adopt new data capture tools	

OUTCOMES
• An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom
• Improved capacity and capability in industry and community for surveillance
• Coordination of surveillance and data capture, sharing, analysis and reporting for high priority pests and pests of market access concern across industry, government and the community
• Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs

ACTION 4.2	TASKS	PERFORMANCE MEASURES
Improve data collection and pest reporting from all stakeholder groups	4.2.1 Identify barriers for undertaking surveillance, providing surveillance data and pest reporting from the FDN and from peri-urban and urban communities	▪ Improved information on status of citrus pests in Australia, as a result of the identification and implementation of incentives, or the identification and removal of barriers to surveillance and reporting
	4.2.2 Implement measures to remove barriers and enhance incentives for data collection from the FDN, surveillance hubs and urban and peri-urban communities	

	OUTCOMES
	▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom
	▪ Improved capacity and capability in industry and community for surveillance
	▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern across industry, government and the community

ACTION 4.3	TASKS	PERFORMANCE MEASURES
Develop specific pest 'profiles' in national databases including AusPestCheck for all high priority pests of citrus	4.3.1 National capture of surveillance data for citrus pests	▪ Improved information on status of high priority pests through collation of required data in a consistent manner
	4.3.2 Identify or develop and deploy mechanisms for transferring surveillance data from various sources to national databases including AusPestCheck	

	OUTCOMES
	▪ An integrated, risk-based surveillance system that facilitates early detection of exotic pests and provides evidence of pest status to support area freedom
	▪ Improved capacity and capability in industry and community for surveillance
	▪ Coordination of surveillance and data capture for high priority pests and pests of market access concern across industry, government and the community
	▪ Coordination and development of a range of support materials and tools to support different stakeholder and surveillance needs

Alignment between the National Citrus Biosecurity Surveillance Strategy and the National Plant Biosecurity Surveillance Strategy

NATIONAL CITRUS BIOSECURITY SURVEILLANCE STRATEGY (NCBSS)	NCBSS ACTIONS	NATIONAL PLANT BIOSECURITY SURVEILLANCE STRATEGY
GOAL 1 – Improved partnerships through collaboration and coordination	1.1 Establish a nationally coordinated Citrus Biosecurity Surveillance Program	**RECOMMENDATION S1 –** Provide mechanisms for coordinating and establishing nationally integrated and consistent plant biosecurity surveillance system
GOAL 2 – Enhanced capability and capacity to undertake citrus biosecurity surveillance	2.1 Establish, coordinate and maintain a citrus diagnostic network and diagnostic triage system to support surveillance in the citrus industry and surveillance hubs	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting
	2.2 Maintain and enhance a nationally coordinated First Detector Network (FDN) to underpin surveillance for high priority exotic pests of citrus	**RECOMMENDATION S3** – Establish mechanisms to engage industry, regions and communities to ensure broader recognition of importance of surveillance and collection of surveillance information
	2.3 Establish, coordinate and maintain surveillance hubs in commercial production areas and high risk or high impact urban and peri-urban communities	**RECOMMENDATION S3 –** Establish mechanisms to engage industry, regions and communities to ensure broader recognition of importance of surveillance and collection of surveillance information
	2.4 Improve and enhance surveillance for citrus pests in remote high risk areas	**RECOMMENDATION S3 –** Establish mechanisms to engage industry, regions and communities to ensure broader recognition of importance of surveillance and collection of surveillance information
GOAL 3 – Smart surveillance through risk assessment, analysis tools and diagnostics to support detection of citrus pests	3.1 Assess exotic citrus pest impacts, establishment potential and entry pathways into and within Australia to design surveillance programs to cost effectively mitigate risk	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting
	3.2 Develop surveillance protocols for high priority pests of citrus for commercial and non-commercial plantings	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting
	3.3 Develop and deploy surveillance tools that maximise detection of citrus pests	**RECOMMENDATION S4** – Enhance national capacity and capability to undertake plant pest surveillance underpinned by targeted RDE.
	3.4 Develop and deploy diagnostic tests for improved, cost effective detection of exotic citrus pests and provision of surveillance data	**RECOMMENDATION S4 –** Enhance national capacity and capability to undertake plant pest surveillance underpinned by targeted RDE.

NATIONAL CITRUS BIOSECURITY SURVEILLANCE STRATEGY (NCBSS)	NCBSS ACTIONS	NATIONAL PLANT BIOSECURITY SURVEILLANCE STRATEGY
GOAL 4 – Improved capture and analysis of surveillance data	4.1 Identify, modify or develop and maintain tools for capturing surveillance data from FDN and urban and peri-urban surveillance hubs	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting
	4.2 Improve data collection and pest reporting from all stakeholder groups	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting
	4.3 National capture of surveillance data for citrus pests	**RECOMMENDATION S2 –** Establish national surveillance information framework including surveillance standards and protocols to optimise data collection, analysis and reporting

Definitions, Acronyms and Abbreviations

ABBREVIATION	DEFINITION
CTV	Citrus tristeza virus
Cryptic pests	Pests, pathogens, symptoms or diseases that are indistinct and/or easily confused with abiotic stresses or similar, established pests.
DAWR	Department of Agriculture and Water Resources
Established pest	Pests present in Australia
Exotic pest	Pests not currently in Australia
First Detectors	Personnel with an active role in pest and orchard management supporting citrus commercial production. Examples of first detectors are crop scouts, grower liaison officers, agronomists and chemical resellers.
FDN	First Detector Network
FRW	Fullers' rose weevil
General surveillance	A range of crop monitoring activities outside of specific surveys that can be used to detect the presence or absence of pests, including the presence of new or unusual pests or symptoms. Examples of general surveillance activities in citrus crops include inspections of citrus trees to inform crop management procedures; inspections of harvested fruit for quality defects.
GWSS	Glassy winged sharpshooter
HLB	Huanglongbing
IGAB	Intergovernmental Agreement on Biosecurity
LBAM	Light brown apple moth
MICoR	Manual of Importing Country Requirements
NCBSS	National Citrus Biosecurity Surveillance Strategy
NSW	New South Wales
NT	Northern Territory
Pest	Any species, strain or biotype of invertebrate pest or pathogen injurious to plants, plant products or bees or impacting social amenity or the environment.
PHA	Plant Health Australia
Qld	Queensland
RDE	Research, Development and Extension
SA	South Australia
Surveillance protocol	Technical instructions for site specific methodology for surveillance including purpose, scope, pest target(s), timing, area or site selection, statistical design, data collection and sample handling.
Specific survey/ surveillance	A surveillance activity conducted over a defined period of time that records the detection of, or confirms the absence of, specific pests.
WA	Western Australia

Australian Government

Department of Agriculture and Water Resources

Plant Health
AUSTRALIA

This initiative is part of the Australian Government's *Agricultural Competitiveness White Paper,* the government's plan for stronger farmers and a stronger economy.