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Scoping Study to Develop a Regional Biosecurity Framework for the Northern Adelaide Plains

Project VG 09085

Prepared for : **Horticulture Australia Ltd**

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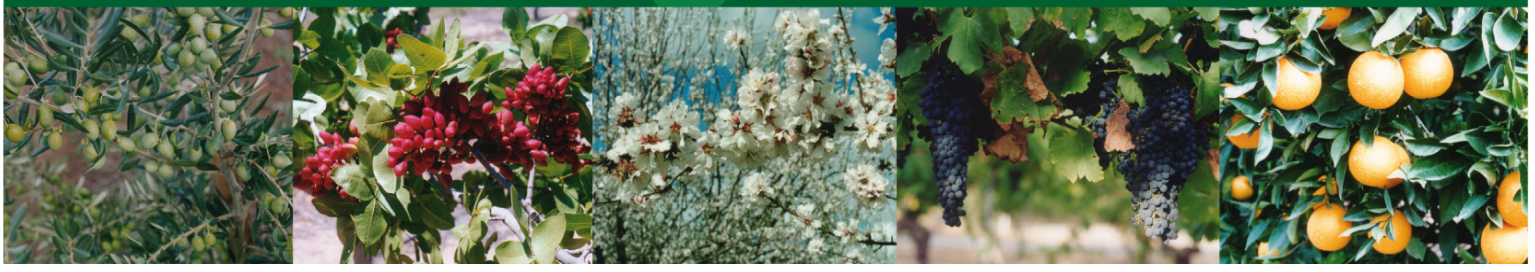
Date : **May 2010**



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PROJECT TITLE

Scoping Study to Develop a Regional Biosecurity Framework for the Northern Adelaide Plains

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PURPOSE OF REPORT

This report provides guidance to those considering the practical advancement and feasibility of regional biosecurity. It outlines the considerations, optional approaches, and cost-effective means to commencing and making progress. The On-farm Biosecurity Manual for NAP vegetable growers provides a ready-to-use guide to the threats the region is facing, and should be read in conjunction with this report. The identified threats are considered in the framework design and range, options presented and in the discussion of feasible approaches for adding value to existing activities. Neither document is an operational plan for NAP biosecurity, but together they should assist any vegetable growing region to improve their biosecurity.

ACKNOWLEDGMENTS

The Scholefield Robinson team is particularly grateful for the support provided by the Commonwealth government, Horticulture Australia Limited (HAL) and Kim James (HAL Biosecurity Program Manager), the SA State government through PIRSA and SARDI personnel (Tony Burfield, Bruce Baker, Peter Morrison), Plant Health Australia (Stephen Dibley, Jo Slattery and Sharyn Taylor), the City of Playford (Council), primary producers from several commodity groups, and allied business operators on the NAP.

DISCLAIMER

MAY 2010

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GLOSSARY

Term/Abbreviation	Definition
ABIN	Australian Biosecurity Intelligence Network
Agri-industry	A sector of the economy engaged in agricultural enterprise, not necessarily based on-farm.
Alert pest	Pest not local but with proximity, e.g. in the country but not region under discussion.
ALPP	Area of Low Pest Prevalence
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service- operating under the Department of Agriculture, Fisheries and Forestry, Australia. AQIS is charged with the responsibility for quarantine matters and the export certification of live animals, animal products, plants and plant products.
AusBIOSEC	Australian Biosecurity System for Primary Production and the Environment
Awareness	The establishment or improvement of understanding about a topic or issue, and its priority.
Bio-geographical	An area with common environmental factors of relevance to grouping purpose (e.g. climate, soil, ecology etc.).
BioSIRT	Biosecurity, Surveillance, Incident Response and Tracing.
BOM	Bureau of Meteorology
Border	Boundary of a defined area, including jurisdictions.
BRS	Bureau of Rural Sciences
BSGA	Biosecurity Services Group
CALD	Culturally- and linguistically-diverse, e.g. ethnic stakeholders who do not speak English as first language.
CBD	Central business district.
CCEPP	Consultative Committee on Emergency Plant Pests
Communication	Deliberate, planned and sustained effort to gain and maintain awareness and understanding.
Community	A group of people defined by an aspect of their life – eg where they live, what occupations they have.
Containment	Application of measures around an infested area, aimed at prevention of spread.
CoP	Code of Practice
CRCNPB	Cooperative Research Centre for National Plant Biosecurity

Term/Abbreviation	Definition
DAFF	Department of Agriculture, Fisheries and Forestry, Australia.
Delimiting survey	Survey conducted to establish the boundaries of an area considered to be infested by or free from a pest.
Detection	Survey or investigation in an area to determine if pests are present or absent.
Detection survey	Survey conducted in an area to determine if pests are present.
Diagnostics	Process of identifying a pest.
DQMAWG	Domestic Quarantine and Market Access Working Group (sub-committee of PHC, within DAFF)
Economically-significant	An organisms detrimental to quality, yield, market accepatance, social amenity and/or well-being
Endemic pest	A pest present and often 'native' in the region under discussion.
EPA	Environmental Protection Agency.
EPPRD	Emergency Plant Pest Response Deed
Eradication	Application of phytosanitary measures to eliminate a pest from an area.
Establishment	Perpetuation, for the foreseeable future, of a pest within an area after entry.
ES levy	Emergency Services levy.
EU	European Union
Exotic pest	Pest not present in the country under discussion
Farm	Land used for purpose of primary production in agriculture (not mining).
Free from	(of a consignment, field or place of production) Without pests (or a specific pest) in numbers or quantities that can be detected by the application of phytosanitary procedures.
FSANZ	Food Standards Australia and New Zealand
HAL	Horticulture Australia Limited
Harmonisation	The establishment, recognition and application by different countries of phytosanitary measures based on common standards (FAO, 1995; revised CEPM, 1999; based on the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures).
HECC	Horticultural Exports Consultative Committee
IBP	Industry Biosecurity Plan
ICA	Interstate Certification Assurance
ICM	Integrated crop management

Term/Abbreviation	Definition
IDO	Industry development officer
Information management	Processes and tools used to store, access, utilise and manipulate data.
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present and/or to determine compliance with phytosanitary regulations.
Introduction	The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.
Invasive species	An alien species whose introduction does or is likely to cause economic or environmental harm to human health.
IPM	Integrated pest management
IPPC	International Plant Protection Convention, a multilateral treaty for international cooperation in plant protection was deposited with FAO in 1951 and administered through the IPPC Secretariat and subsequently amended.
IRM	Integrated resistance management
ISPM	International Standard for Phytosanitary Measures.
IVCA	Import Verification Compliance Arrangement.
LBAM	Light Brown Apple Moth
LGA	Local Government authority, e.g. Councils.
Management	Evaluation, selection and implementation of options to reduce the risk associated with a pest's presence, introduction, spread, and/or impact.
Monitoring survey	Ongoing survey to verify the characteristics of a pest population.
MRL	Maximum Residue Limit
NAP	Northern Adelaide Plains.
Native species	With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.
NFFS	National Fruit Fly Strategy
NOI	Notice of Intention
NPHS	National Plant Health Strategy
NPPO	National Plant Protection Organization: Official service established by a government to discharge the functions specified by the IPPC. 1 Officially Established, authorized or performed by a National Plant Protection Organization.
NPSRT	National Plant Surveillance Reporting Tool.

Term/Abbreviation	Definition
NRM	Natural Resource Management
NRS	National Residue Survey
OCPPO	Office of the Chief Plant Protection Officer (within DAFF)
Operational plan	A plan of specific activities and steps that can be readily adopted.
PaDIL	Pests and Diseases Images Library
PEQ	Post-entry quarantine.
Peri-urban	A rural area that borders an urban area and exhibits varied land use, property sizes, and reliance on agricultural income amongst residents.
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products.
PFA	Pest Free Area, an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained.
PFPP	Pest Free Place of Production - place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period.
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industry and Resources South Australia
PRA	Pest Risk Analysis. The process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it.
Prevention	The act of intercepting. Use of foresight to prevent something from becoming present or spreading.
QA	Quality assurance
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.
R&D	Research and Development
RDC	Research and Development Corporation
Regulations	Official rules; government policy

Term/Abbreviation	Definition
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party.
SARDI	South Australian Research and Development Institute
Seed transmitted	Organism present in the seed embryo (in the case of viruses eg Tobacco mosaic virus, pathway by which the pathogen is transferred to the seedling).
Seedborne	Organism transferred on or in the seed coat.
SPS	Sanitary and Phytosanitary (refers to the WTO Sanitary and Phytosanitary Agreement)
SRG	Surveillance Reference Group
Stakeholder	Anyone with a vested interest in the topic or region of discussion
Surveillance	A process of collecting and recording relevant observations and data, through surveys, trapping, monitoring etc.
Survey	Methodical procedure to determine the characteristics of a pest population or to determine which species occur in an area.
Training	The process of acquiring or transferring relevant skills or knowledge. Linked with 'education'.
VHC	Virginia Horticultural Centre
WTO	World Trade Organisation

1 SUMMARY

Plant biosecurity is about managing our landscape and agricultural livelihood and human health threats. Sharing biosecurity responsibility (with government) demands collaboration. In a regional sense that means collaboration within and across enterprises, governments and the community. Coordinated efforts to address biosecurity are more likely to be effective than individual efforts, but every effective step requires that responsible and aware individuals are operating in an enabling environment.

The considerations required to advance regional biosecurity are discussed in this report. The steps towards regional biosecurity encompass understanding of the region and the threats; the stakeholders and their capacity; impediments and solutions. The methodologies include investigation, consultation, communication, motivation, consolidation and evaluation.

This project required broad consultation, initially to expand understanding of the term 'biosecurity' and ultimately to identify the steps needed to improve regional biosecurity. The northern Adelaide plains (NAP) are a complex horticultural region. This region was chosen for the case study because of its crop (and animal) diversity, demographic diversity, peri-urban location and range of biotic and abiotic threats.

The threats against which protection is required are those biological pests, diseases and weeds yet to arrive (exotic) and those already present; contaminated inputs and/or those with or limited availability; poor practices; and a lack of human and financial resources.

The major threats on the NAP are pests and diseases, but practices related to hygiene, waste removal, surveillance, recording and reporting were also noted. Surveillance activity is undertaken in the region by the government, but is limited on-farm. Property identification codes and grower registers were highlighted as means to increasing both engagement and tracebacks. Economic incentives and regulatory assistance and pressure were identified as motivators for increasing on-farm and regional biosecurity. Face-to-face meetings and greater cross-region communication were preferred engagement and awareness tools.

Impediments were linked the limited knowledge and vision ("know-how"), regional pride, leadership and resources in the area, in addition to the existing weakness of communication networks and the unclear economic imperatives of plant biosecurity on the NAP. The solutions identified not surprisingly were identified in similar areas – more extension and training support and resources (e.g. On-farm Manual for NAP vegetables) for all stakeholders (including those with culturally- and linguistically-diverse backgrounds); increased leadership and collaboration (e.g. a NAP Biosecurity Committee); demonstrated links between pests and diseases, and economic returns and market access; added value to existing practices (e.g. surveillance, reporting, waste removal services); and regulatory support (e.g. by-laws, grower registers).

The inclusion in this report of the 'first 10 steps", maps, roles and responsibilities for each stakeholder groups, and success parameters, allow stakeholders on the NAP (and other regions) to immediately take initial steps towards regional biosecurity. Although government assistance and regulatory support have been identified as significant in terms of making progress, the stakeholders on the NAP generally agreed that the key drivers of regional biosecurity must be leading industry (commodity) group representatives. As such the first step to be taken is noted as "*Industry–driven meeting with key stakeholder and political leaders*'.

2 BACKGROUND

Australia's quarantine system aims to achieve and maintain a very low risk of plant pests entering and establishing in Australia. "Zero-risk" is not an achievable, nor reasonable target, and a range of post-border measures are therefore required to extend the detection and management quarantine continuum to individual farms and communities.

Biosecurity is the protection of livelihoods, lifestyles and the environment. Simply put, improved regional biosecurity should in a practical sense involve the whole of the community and provide greater protection against the introduction of exotic and unwanted pests and diseases.

As the obligations to meet international and inter-state market access requirements increase, as travel and global trade hastens the movement of threats, as urbanisation encroaches on horticultural regions, and as the costs of production and pest management increase, collaborative efforts focussed on regional protection, with a shared burden of responsibility are increasingly non-negotiable.

Although growers, agri-businesses, the states and the Commonwealth have for a long time invested in pest and disease research and management, returns in proportion to their investments, have not always been apparent to each party. It is today agreed, that risk creators and beneficiaries must contribute in proportion to their perceived potential benefit. For example, government contributions should reflect the potential public good to be delivered, and industry contributions should reflect the benefits that would flow to the investing commodity group/s. In accepting this shared investment and responsibility approach, it is clear that collaboration and co-operation is now essential because all contributors earn through their contribution, the right to have 'a say' in decision-making.

The process requires a united front across the whole landscape, but with stepping stones starting on-farm in regional areas. Time and expertise investments will be required at all levels. This report is intended to give direction to, and outline the thinking required to underpin any such investments. Many steps are required to advance regional biosecurity. They include those intended to identify the targets and key messages; steps to gauge and then increase awareness, commitment, and capacity; steps to increase preparedness and technical capability; and others that are focussed on leadership that extends beyond any commodity group within the region. The potential benefits lie in avoidance of costs/losses, reduced production costs, improved market access and produce safety; government/industry collaboration; sustainability and environmental protection.

3 INTRODUCTION

Today many regions that include horticultural production are identified, formally by a geographic feature and/or climatic zone (as with geographic indicators for wine grapes) or informally as a production region identified by location (e.g. Bundaberg region; Sydney basin; Riverland or Sunraysia; or Northern Adelaide Plains [NAP]). Today, there are perceived and real benefits to inclusion within particular zones. For example, those areas free of Mediterranean or Queensland fruit flies or other pests of international concern, may earn market access[1] and trade

[1] The broad definition of 'market access' includes new market entry, improved market entry and retained market entry as negotiated between governments that consider the health and safety of products in their decision making. Phytosanitary issues (pests and diseases) are given primary consideration, but sanitary issues (contaminants, residues etc) are equally important. Technical data on food safety and biosecurity therefore underpin product integrity and market access applications.

recognition and advantages; those with specific 'terroir' may demand premiums for perceived quality; and those in particular climatic regions benefit from early or late produce availability.

Recognition dependent on a region's pest status today requires documented evidence of scouting and testing. The demonstrated absence of a pest is a requirement of declarations of pest freedom. Horticultural industries and regional authorities are aware that there are costs associated with advancing, and also ignoring, biosecurity. The benefits, or negative impacts, of a region's biosecurity status, affect the whole community, and therefore costs and commitment need to be shared.

The vegetable industry in association with Plant Health Australia (PHA) has developed an Industry Biosecurity Plan (IBP). Although generic, it is aligned with this framework, state biosecurity strategies and the vegetable on-farm biosecurity manual (developed as part of this project). The on-farm manual (Appendix 1) provides guidance on 'internal' practices to minimise the threat to farms derived from in-coming and out-going plant material and other inputs, people and equipment. See also the 2010 PHA document *Biosecurity Induction Manual* (for Bundaberg).

With diverse stakeholders and targets, limited resources and capacity, regional biosecurity is necessarily complex. It is however believed possible because the primary aim is shared by all. This document is a stepwise guide to identification of regional biosecurity issues that have potential technical, financial, social and/or environmental impact. They are the issues that demand consideration prior to operational decision-making on regional biosecurity. This document has utilised the NAP as a case study region, but it is sufficiently general to be transferable to other horticultural regions.

Should the decision to advance regional biosecurity be accepted, stakeholder industries, commodity groups, the resident community, and state and local authorities, have responsibility for preparing an operational plan from such a framework. An operational plan would include the specific actions and assigned stakeholder responsibilities that are relevant for the target region, whereas the framework includes the options available to each. An overarching regional coordinating authority would be appropriate for developing a regional plan and driving implementation of a resultant operational plan.

4 OBJECTIVES OF A REGIONAL BIOSECURITY PLAN

Biosecurity is of practical, strategic and economic importance to countries, industries and regions. Global trade has resulted in international biological threats reaching previously pest-free areas within hours. The increased threat 'pool' and the decreased time taken for threats to spread globally have also resulted in an increase in costs associated with border and domestic protection. Recent experiences with citrus canker and equine influenza have provided Australian evidence of the costs to production, lifestyles and livelihoods, of disease outbreaks/incursions. Pre-border protection, management, containment and eradication costs are increasingly the responsibility of private sector, as are the on-farm quality and data management systems that support market access negotiations, and where necessary, eradication campaigns.

The generally-recognised national, state and industry benefits of achieving regional biosecurity are tabulated below. While they clearly have the potential to deliver tangible 'value' to the whole community, each region must identify the objectives and desired outcomes of their regional plan, for regional participants. The priority each is given and the urgency with which they are pursued, will likely reflect the current pest status and perceived impact (e.g. high costs of management; loss of markets), and the current proportion of expected participants familiar with the costs/benefits of minimising or removing the threats.

4.1 Vision

An informed community partnered with agri-business and government, actively advancing protection of the region, and with participants seeing value in the resultant collaboration and threat minimisation.

4.2 Mission

To minimise the negative effects of biological and other threats in the region, through targeted efforts to curb their introduction and establishment.

Table 1 : Benefits of biosecurity to stakeholders

Commonwealth Government	Steve/Territory Governments	Horticultural Industries	Local Government and General Community
Reduced management costs	Improved state quarantine	New/improved (or perceived) market access	Greater awareness and collaboration
Improved value of non-commercial amenities	Harmonised domestic trade regulations	Increased interstate trade	Whole-of-community reflected in strategies and participation
Reduced environmental impact	Strengthened collaboration with industry	Increased international trade	Improved biosecurity
Improved regional economies	Consistent messages reinforced across regions	Harmonised regulations, easier compliance	Engaged ethnic groups
Food security	Integrated, targeted R&D	Improved on-farm yields and quality; biosecurity	Actively shared responsibility
Evidence- and science-based compliance and pest/disease knowledge	Evidence- and science-based compliance and pest/disease status	Improved value chain involvement, and profitability	Valued regional reputation and 'sense of community'
Shared responsibility	Shared responsibility and investment	Reduced threat of incursions; increased vigilance, hygiene	Informed volunteers with sense of purpose
Knowledge repositories populated from multiple sources	Knowledge repositories populated and used by multiple groups	Targeted R&D; knowledge and reporting repositories accessible	Feedback received; responsiveness and behavioural change
	Resource allocations linked to risk	Shared responsibility – with other industries, regions, governments	Beneficiaries and perpetrators engaged
	Sustainability increased	Sustainability; preparedness improved	

Source: adapted from draft National Fruit Fly Strategy (PHA, 2008)

5 COMPONENTS OF A REGIONAL BIOSECURITY FRAMEWORK

A regional plan requires at a minimum, the following components. A framework must outline the considerations needed to underpin the components and to connect the contributing parties.

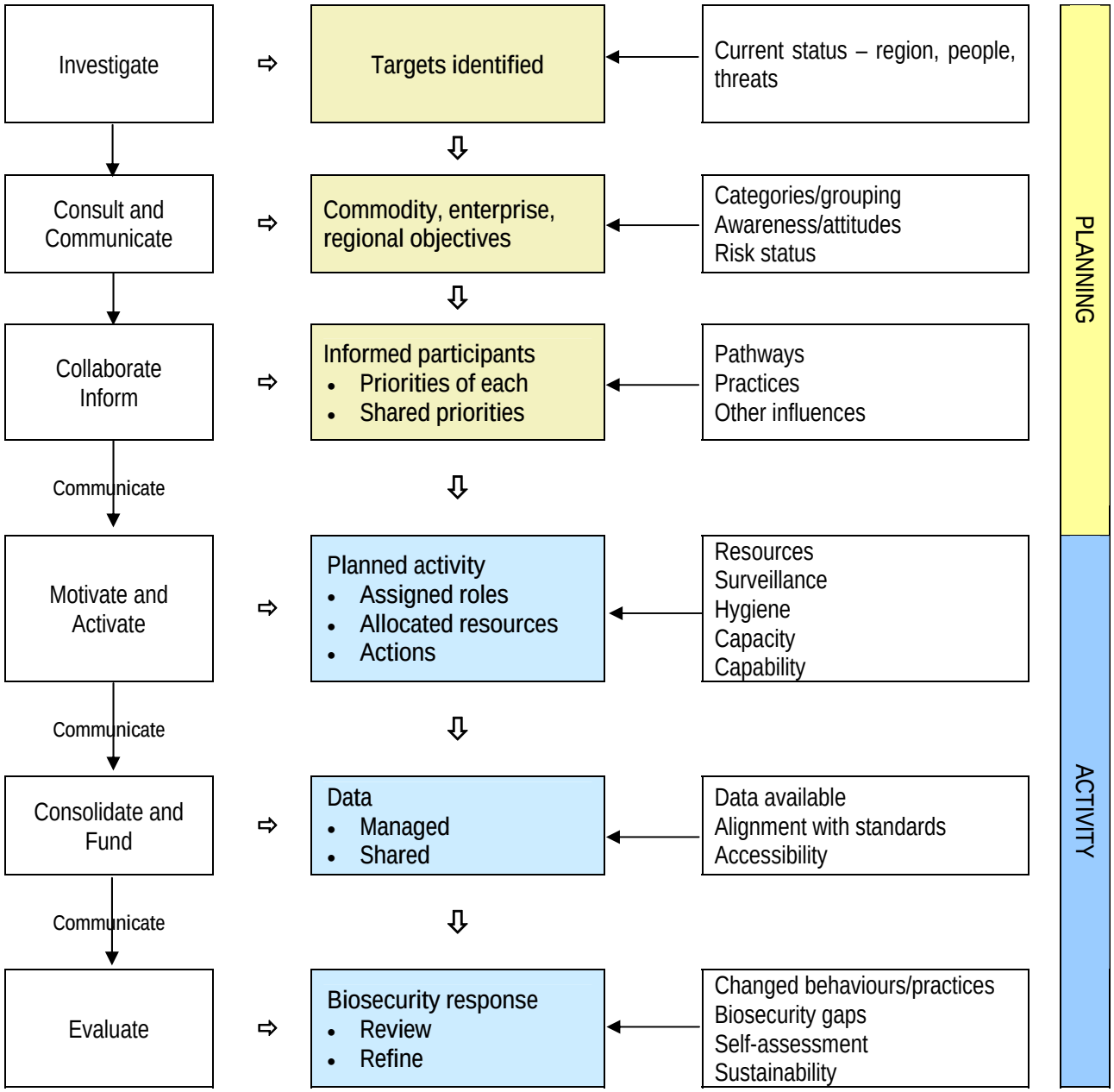
The steps are linked by 'communication' and this ensures the process is dynamic, flexible, capable of accommodating continuous improvement. (A partial stepwise guide is shown in Figure 1):

- Understanding the target region
- Understanding and informing stakeholders
- Agreed Objectives
- Threat identification
- Informed activity
- Roles and responsibilities
- Communication
- Resources
- Progress/Success measures

Investigate ⇨ Consult ⇨ Collaborate, inform ⇨ Motivate, activate ⇨ Consolidate, fund ⇨ Evaluate			
communicate	communicate	communicate	communicate

Figure 1, outlines the framework. In planning, an early understanding of the biosecurity targets (stakeholders, threats in region etc.) is needed. They may be identified through investigation of the region, people and the awareness of threats. The methodology/activity (left hand column) combined with knowledge needed (right hand column) deliver the biosecurity progress steps as a progressive set of achievements (central column). There is flexibility in the steps as determined by the various feeders.

Figure 1 : Regional Framework Steps



6 UNDERPINNING A BIOSECURITY FRAMEWORK

Considerable consultation within a region must be undertaken before a framework for effectively increasing biosecurity of the region, may be outlined. This report identifies the groups and areas in which this should take place. Development and implementation of a regional biosecurity plan requires further consultation, as does contingency and response planning.

6.1 Understanding the Region

'Understanding a region' requires knowledge of the region's characteristics, participants, and activities that potentially have a role in influencing risk and biosecurity. This is a critical component of a regional framework as it is the first step to effectively and efficiently making progress within a region. Stakeholders, land uses, threats, capabilities and capacity, resources and conditions that influence a region's vulnerability need to be documented. From them, action priorities may be identified.

6.2 Understanding the Stakeholders and Participants

Biosecurity is a 'whole of community' and 'whole of landscape' issue. All necessary participants and potential beneficiaries need to be identified. In formulating a framework for regional biosecurity it is also advisable to understand who (as individuals or alliances) has the potential to influence the outcome, both internally (from within region), and externally.

For a region to become practically and effectively 'biosecure', it is insufficient to have passive interest in biosecurity alone. The relative efficiency of co-ordinated biosecurity efforts (e.g. community-based, commodity-based, and regulatory-based programmes) over individual efforts has been demonstrated, despite acceptance that the continuum starts at the on-farm level (from industry perspective) or ends at the farm level (government perspective).

As the public good derived from activity or the social impact of a threat (e.g. a food safety threat or threat to a region's amenity) increases, government activity and support will increase. Industry is best placed to drive and contribute to less-complex biosecurity initiatives that provide returns for commonly-shared problems e.g. industry support for shared annual crop threats, can deliver broad returns to multiple growers.

Influence, activity and a level of goodwill are required, and both government–led and industry-led scenarios benefit from the participation of all parties, despite the 'drivers' and 'leaders' being different in each case. Successful regional biosecurity (as with OrdGuard in WA) has required active participation; time, expertise, financial and in-kind commitment and leadership, from the Commonwealth, State and local governments, agri-business and individuals within the region, including the general public.

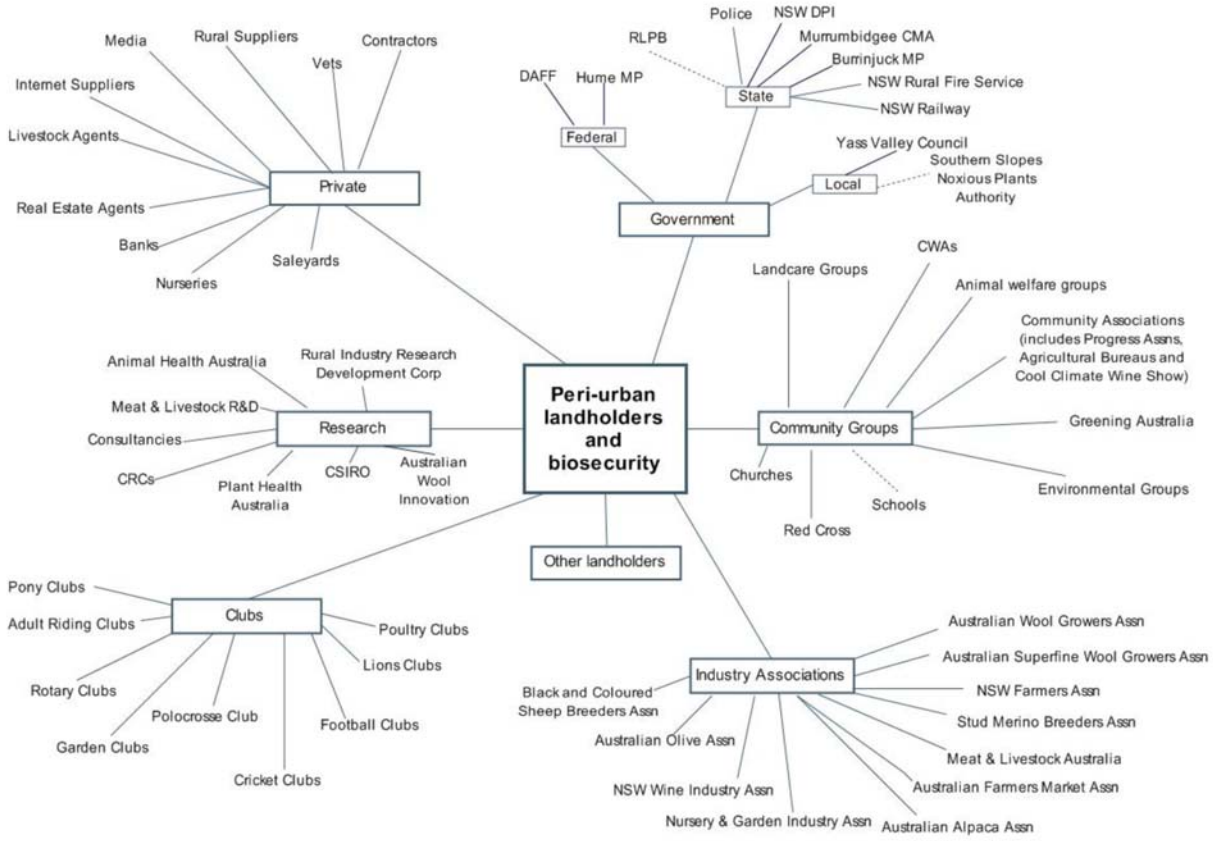
Each stakeholder group is an integral component of the framework. For biosecurity purposes, stakeholders may be grouped in a variety of ways – by land use, business focus, ethnicity, residential location, threat exposure etc. Within each group, a range of attitudes, capabilities, awareness and capacity, exists. In order to collectively achieve regional biosecurity, each stakeholder group requires specific consideration, e.g. of their engagement potential, practices, threat profile, knowledge, capacity to respond and contribute, and resources available to them.

Many horticultural production regions are peri-urban in location. Collectively, peri-urban residents are a stakeholder group largely supportive of rural 'lifestyle' but not often reliant on rural activity for their livelihood. Hobby and peri-urban 'lifestyle' landowners are not often members of peak industry commodity bodies, nor community groups. They have a semi-rural lifestyle and frequently have chosen this as a means of avoiding the more onerous demands of both urban and rural lifestyles. They have diverse backgrounds and values and may not always

live on-site. They may direct-sell small volumes of organic produce or flowers through farmers' markets or roadside stalls, keep a range of livestock and pets, be unconcerned about the threat posed by green waste, manure piles, vermin, weeds, volunteer or feral plants. They are however a most important stakeholder in biosecurity. Gilmour *et al.* (2009) prepared a stakeholder map for such a region (Yass, NSW) and this is reproduced as Figure 2. It shows the diversity of stakeholders and contributors in the region.

Urban residents are a 'threat' in part because of their day-to-day movement and practices, but primarily because of their lack of knowledge and experience in biosecurity. Unlike commercial primary producers, they do not generally seek or receive plant, animal or natural resource management information from multiple sources. The biosecurity of a region requires these residents to be informed, and this requires specific communication and education efforts.

Figure 2 : Stakeholder map for biosecurity in the Yass local government area (LGA)



Source: (Gilmour *et al.*, 2009)

Generalised groupings of stakeholders and participants for a horticultural region are tabulated below (Table 2). Partnerships and communication between and within these groups are vital to the success of biosecurity planning, development, implementation and management.

Table 2 : Stakeholder groupings and potential membership in a horticultural region

Stakeholders	Examples
Government authorities	Programme managers in Commonwealth departments (e.g. DAFF which include AQIS, BSG, Product integrity etc); EPA, Landcare, Greening Australia; CSIRO; universities
	Managers in State government departments and authorities (eg. BiosecuritySA, PIRSA, SAWater, catchment/NRM boards)
	Local government (e.g. planning, event and infrastructure committees)
Peak bodies	Local representatives in peak commodity (or enterprise) groups; Plant Health Australia
Allied businesses	Re-sellers and suppliers (chemicals, fertiliser, seed, bin and pallet hire, packaging, biological control and pollination services, irrigation equipment, fuel and equipment dealers etc); value chain businesses – processors, packers, transport companies, marketing companies, wholesalers, providores, food service companies; exporters, coolroom and storage facilities; abattoirs; waste removal compost industries; rural media/journals; consultants etc.
Allied labour	Permanent and itinerant labour crews; earthmovers; labour contractors; contract spraying, harvesting operators; researchers and consultants; inspectors; roadside and local market operators, U-pick staffs
Primary producers	Nurseries; crop, livestock, poultry/bird producers and breeders
Other land owners/users	Absentee farmers, hobby farmers, landfill sites; government facilities – water or utility bases, regional airports, race tracks, ovals and parks, street landscapes etc.
Community	General public; CFS, CWA, RSPCA, local police, sporting clubs; CALD communities; community groups, counselling, charity and service groups (Rotary, Kiwanis, Rostrum, Red Cross, Lions etc), focus groups (Neighbourhood Watch, Trees for Life; Landcare; Friends of the River, Churches etc); land valuers/estate agents; regional event coordinators; local residents, tourists/visitor centres, schools, caravan parks; official rest stops on arterial roads

6.3 Identifying Engagement potential

6.3.1 Strategies

Engagement requires specific and deliberate planning, and much research has been devoted to this. It is known that each stakeholder group is likely to respond to different engagement drivers. Each group will also respond differently to engagement methodology because they are influenced by the delivery process, their capacity to respond, the resources needed, the context in which they are operating and their perception of the context into which they are being asked to engage.

Key to engagement however across most stakeholder groups are: clear benefits, relevant messages/requests delivered by trusted agencies or individuals, through local networks or support forums. For individuals (primary producers, allied industry or community members), it appears an important biosecurity driver is appreciation of the link between plant (and animal) health and economic viability (of a farm, enterprise and region). Demonstrating this link is time-consuming, particularly in regions that do not have a strong sense of community or regional pride.

Kruger *et al.* (2010) and the Bureau of Rural Sciences (BRS) investigated and documented potential engagement strategies and their suitability for different biosecurity partners (see Appendix 2). Their methods and others identified through regional consultation on the NAP, are tabulated below for various stakeholder groups (Table 3).

Allied industries and labour are likely to be engaged when relevant regulations dictate involvement, a liability attributable to them or their activities is perceived, or when their increased attention to biosecurity is seen to provide value-adding potential (e.g. repeat business; extended funding periods).

While primary producers are usually mindful of biosecurity measures relevant to their farm and commodity group, their engagement across industry and regional biosecurity cannot be assumed.

Primary producers are likely to be engaged as a reaction to peer pressure, or a prior or potential experience with negative economic impact; as the result of regulatory changes or, proactively, when regional or commodity-based prospects of new or increased market access, easier compliance, cost savings etc., are presented.

Engagement efforts should highlight the potential economic benefits of participation and the potential costs to all parties, of poor regional biosecurity. Where communication links are strong, it is likely the community will respond and serve as first detectors for unusual entries or activities, and valuable scouts in biosecurity and risk mitigation initiatives.

Table 3 : Engagement drivers, methods and tools

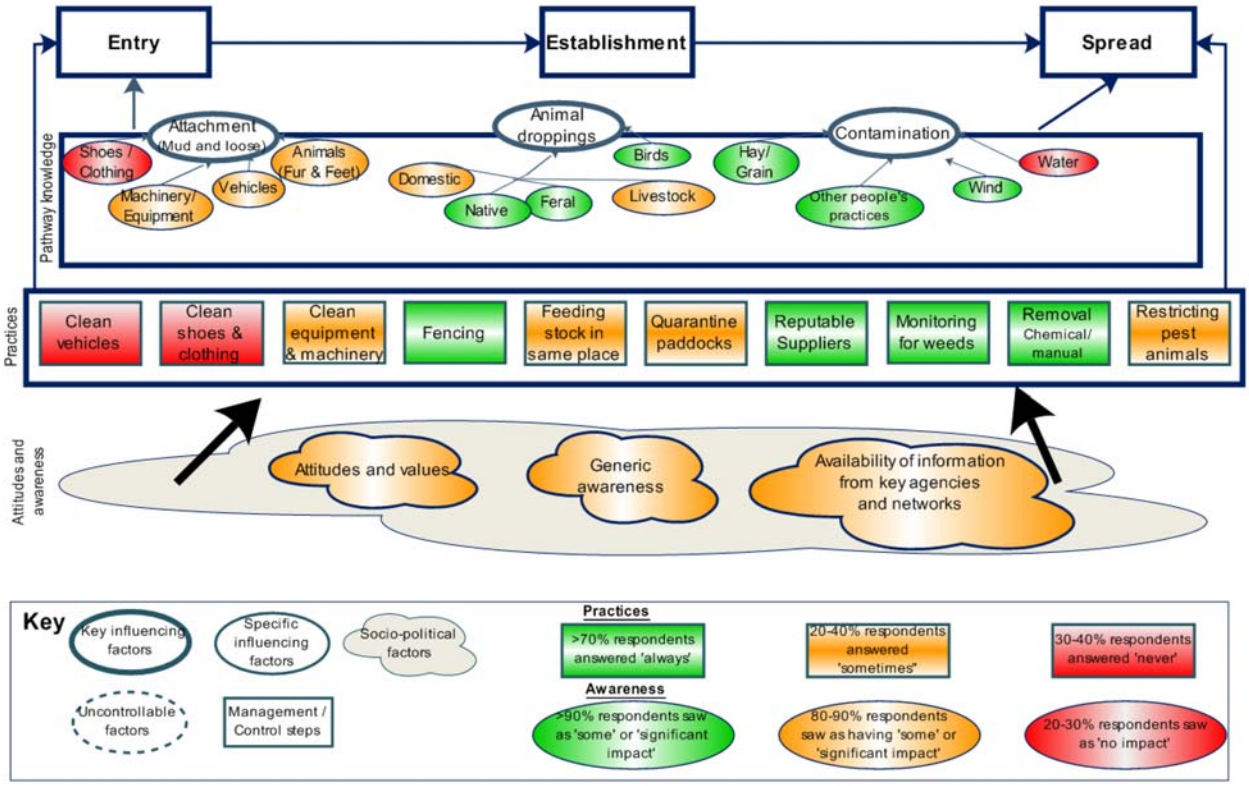
Stakeholder group	Engagement drivers, methods and tools
Government authorities	Directives and leadership - Other government agencies; government-industry conferences; national and international market conditions; Meeting state and national legal obligations; industry, agri-political pressure
	Economic imperative (for primary producers and public good) – knowledge of threats and potential impact; food safety
	Cost-effective responses matching financial and technical support available (trapping grids)
	Science underpinning policy and economic security
	Previous experiences – providing adequate protection; meeting food security expectations
	Potential to leverage existing activities/regulations – inspections, grower registers, property codes
Allied business	Regulations; economic imperative; liability mitigation; increased knowledge; trust
	Business potential – training accreditation, research, provision of resources; access to experts
	Meeting leadership expectations
	Previous experiences
	Planning forums, extension efforts; public meetings
Allied labour	Fear of liability
	Awareness material; internet; Manuals, posters, peer pressure
	'Ownership' active involvement and achievement rewards;
	Training linked to economic returns; job security
Primary producers Peak bodies	Research findings (conferences, reports); government, PHA obligations
	Economic imperative; new markets; market access; member pressure
	Liability mitigation; 'good neighbour' reputation
	Liability mitigation; pest knowledge and Regulations (residues); codes of practice
	Free diagnostic services; websites, surveys, toll free numbers
	Experience and awareness; trust
	Activity linked with resource provisions
	Face-to-face contact; focus groups; field days; on-farm manuals
Other land owners	Regulations; non-compliance penalties; good neighbour pressure
	Economic imperative
	Websites, surveys, toll free numbers; posters, newsletters, newspapers
Community	Community service culture
	Regional pride; valued partner recognition
	Non-compliance penalties
	Face-to-face; Posters, newsletters, newspapers; goodwill/conscience; phone, radio, television; information via service groups; brochures in key locations
Culturally- and linguistically-diverse (CALD) participants	Fear of non-compliance, penalties
	Meeting expectations - of neighbours and ethnic group members
	Respected ethnic leader/champion
	Ethnic radio; translated signs, newsletters, brochures; social networks

A key step in advancing regional biosecurity is to involve the community in detecting and managing pests, diseases and weeds. If the community/general public are to be engaged and mobilised in the long-term, it must believe itself to be a necessary and valued partner, with a respected voice and/or presence. Community participation requires the general public to see in their voluntary role 'public good' in the regional, state and/or national interest, and that their 'investment' is reciprocated, e.g. through real or perceived benefits, transparent and comparable investment by others (including the local government and industry etc.).

Areas lacking regional pride are more difficult to motivate. If the community is not fully informed of biosecurity threats, they risk becoming not only a lost resource, but a confused party, that may reject management options and disruptions to their region and economy (social, environmental and financial costs), should an incursion occur.

Gilmour *et al.* (2009) illustrated the 'thinking' of peri-urban stakeholders in relation to weed entry and spread (Figure 3). Understanding the knowledge and awareness amongst potential participants, allows more focussed biosecurity engagement and communication with the peri-urban group. If a 'knowledge map' were to be prepared for plant diseases, the awareness and knowledge of peri-urban landowners would in all likelihood be less influential and the map would be considerably less complex.

Figure 3 : Knowledge map of peri-urban stakeholders, for weeds



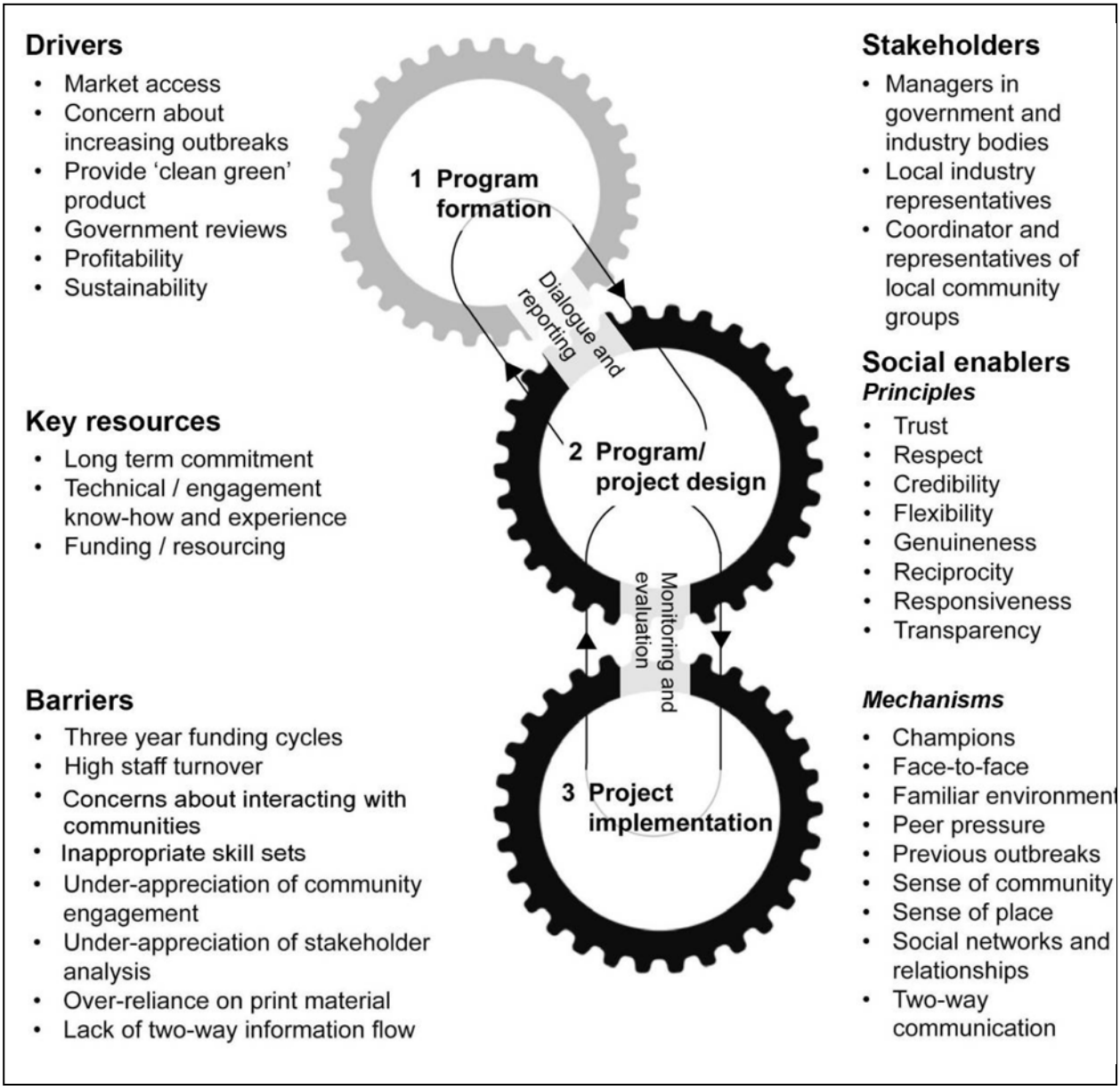
Source: Gilmour *et al.* 2009

6.3.2 Tools

Engagement tools are diverse and their value varies with stakeholder groups and their capacity to be active participants. The capacity of those being asked to participate, requires early, local assessment. In most cases engagement tools are communication tools, but regulatory tools are also effective. Kruger *et al*. (2010) graphically presented general biosecurity engagement as a system of integrated cogs, with drivers, enablers, tools and influences (including barriers and resources). See Figure 4.

Economic information is a tool that shows biosecurity requires investment in return for future benefit, to potential participants. The preparation and delivery of biosecurity information linked to economic impact is a strong engagement tool. While some participants understand the threats to their region, they will not necessarily have appreciation of the economic impact of pest introductions, in terms of lost markets, yield loss or increased costs, increased regulations. Nor will they necessarily appreciate the potential benefits (avoided costs) should the threat be minimised, avoided or eradicated.

Figure 4 : The Engagement Engine



Source: adapted from Kruger *et al*., 2010.

The effective tools of engagement and those that subsequently motivate awareness and participation, vary within and between stakeholder groups. Trust is most important in engaging the culturally- and linguistically-diverse (CALD) community. Government messages are not always well-received; nor are messages delivered by authorities they do not see regularly. The tools used are face-to-face delivery and language-based, e.g. translated documents, signs and regulations, radio programs in ethnic language etc. One-on-one interaction and education of leaders within the ethnic group has been effective in many areas. The delivery of important

information via school-aged children of ethnic community members has also been a successful tool and should be used in all efforts to establish regional biosecurity.

The value of alerts and announcements on regional television, or in regional newspapers and magazines will depend on the audience, message and its urgency. Darwin citizens were effectively engaged in the eradication campaign for grapevine leaf rust via ethnic television, radio and letterbox drops. Both sides of the NT parliament spoke of their support for the campaign which was conducted in the interests of protecting the southern wine industry from an exotic fungus.

Engagement and motivated participation requires on-going reminders and knowledge building. 'Convenience advisories' are notices that command attention. Initially they included posters placed in public restrooms, but increasingly petrol stations, cafes and social clubs where groups congregate, are being used to deliver important regional messages. A tool available primarily to state and local governments is the inclusion of alerts and important information with key paperwork – rates notices, emergency levy invoices etc.

Southwest Biosecurity Queensland regulators provide their community with continuous reminders about red imported fire ants: new restrictions on soil movement, newsletters, posters of the colony and ant appearance, and reminders of its aggressive sting and why its detection benefits all. Similarly for cane toads, engagement and informing stakeholders have been linked. Posters and brochures have been made readily available to transporters who carry nursery and landscape plants from Queensland to other states.

'Good neighbour' pressure is a useful engagement and regional biosecurity tool. A regional approach to the management of potato tuber moth in fresh tomatoes in a region of Queensland was successful. The industry recognised the growing problem despite excessive and unsustainable chemical use. The industry initiated a survey of pest levels, and preceded with an area wide management (AWM) strategy to improve pesticide use, integrated (biological and cultural options) management, scouting effectiveness and response time. Trapping grid findings were published, with high population sites published. They were found to be associated with poor crop residue hygiene. Neighbourly pressure resulted in 'shamed' growers improving their practices, to both the region's and individual's benefit.

Riverina Citrus, based in Griffith NSW has recently announced its intention to establish the Riverina Pest Free Area Management Committee. In partnership with the NSW government, the citrus industry has agreed that a Pest Free Area (for Q-fly) in the Riverina area, is an achievable goal with significant potential market access benefits. In so-doing they have recognised the source of several threats and have sought to engage residential support for the removal of backyard fruit trees to reduce the potential for fruit fly outbreaks.

6.4 Understanding the Threats and their Sources

To understand the threats to a region or community group, one must have basic knowledge of risk assessment and risk management. Risk assessment is the process of identifying potential hazards, and from relevant data and experience, estimating the likelihood of an incursion, the potential magnitude of its consequences, and the factors or degree of uncertainty that influence them. Risk analysis requires decisions and judgments on mitigation options and their likely efficacy, feasibility and impacts.

Identification of regional threats and their sources is an important, necessary step in a biosecurity framework. The threat sources usually are associated with participant or plant/produce movement, regional climatic events, and the vulnerability of the location and land use. The sources may be intermittent and transitory (e.g. seasonal, accidental, batch-related) or on-going; local or external.

When both agriculture and natural systems (environment) are considered, it is rare to find the biosecurity threats, drivers, decisions and outcomes to be the same for each. For example, pests that threaten trade are more important to agriculture, while invasive species (e.g. weeds) may be more important in natural systems. Collaborative approaches, backed up with evidence and shared information, are therefore important in understanding threats and driving forward regional biosecurity.

Threats may be broadly categorised as those that affect human health and welfare, or commerce and economics. The negative impacts may be realised locally, across the entire region or beyond. They may threaten a single commodity or all regional commodities and allied businesses, and the negative effects may be financial, social and/or environmental in nature.

Each region has exposure to biological (phytosanitary), sanitary and/or chemical threats. Their potential impact on production and yields will affect the profitability of growers, but the greater impact may be felt by the entire regional community. The viability of some communities is almost entirely dependent on the agriculture (and processing) of their region, e.g. Tully, Queensland (bananas), Narrabri, NSW (cotton), and as such the entry of a new threat will have significant regional, economic impact.

Most on-farm threats are biological (pests, diseases, weeds), while region-wide threats are usually biological and/or non-biological (abiotic) in nature. The resources available to advance biosecurity (and manage plant pest incursions) are limited. It is therefore necessary to prioritise the threats and required biosecurity measures, to justify resource allocations and to ensure returns on investment in biosecurity, are maximised. The proportional allocations may change at different stages of biosecurity programmes. For example, in planning and pre-incursion stages, resources are needed to characterise the region, for risk assessment of potential threats, and to reduce the likelihood of an incursion. Post-incursion, resources are needed to support measures to reduce the impact of the pest.

6.4.1 Threat Groupings

Biological threats include exotic and endemic pests, diseases and weeds. ‘Exotic’ threats are those not present in Australia and if they were to be found would be the subject of Australian Quarantine and Inspection Service (AQIS), Department of Agriculture, Fisheries and Forestry (DAFF) and Plant Health Australia (PHA) decisions and emergency management.

‘Exotic’ pests are those known not to be (or presumed not to be) present in Australia. In assessing the threat posed by an exotic pest however, consideration should also be given to exotic strains of endemic pests that exhibit chemical resistance that could affect their impact on a regional area. ‘Alert’ endemic pests (‘alert pests’) are those that are present elsewhere in Australia but not in the defined, target region. Pests in the target region that cause on-going problems (e.g. require on-going monitoring; are difficult to manage sustainably; cause market and trade disruption; or quality issues) are referred in this framework as ‘problem endemics’.

Most the high priority exotic threats to Australia’s vegetable industries are insects, vector organisms, and/or nematodes etc. Diseases (with viral, bacterial or fungal causes), food safety contaminants and weeds also cause on-going concern. As such, the focus on threat minimisation cannot be limited to on-farm events. It must permeate all parts of the value chain.

Abiotic threats to a region include non-biological contaminants, chemicals, and environmental events. Abiotic threats, as with biological pests, may cause human, animal, occupational, environmental and/or production problems. Chemical contaminants, for example from copper chrome arsenate (CCA)–treated vineyard posts, are an abiotic threat in areas where their disposal and handling is not well-managed, or where leachate from them enters groundwater. Breaches in animal welfare, protests about genetic-modified organisms (GMOs), ‘ethical’ production and

production styles (halal and kosher) and methods like organic, and bio-dynamic, may also change threat status and the flow of produce from an area.

Chemical spills, releases into waterways, the termination of a chemical registration or the development of resistance to a chemical, or high salt or heavy metal presence in inputs, are abiotic factors which may affect the capacity to manage the growing crop and/or biological threat. Chemical residues are a threat to a region or commodity group that has non-compliant members, a lack of registered crop protection options, or has an influx of new inexperienced or ill-informed growers etc. Similarly, environmental conditions have biosecurity ramifications. Wind-blown rains and flooding have introduced exotic (and alert) pests to previously 'clean' areas, and have damaged crops such that they become more susceptible to previously-benign or manageable organisms.

A region's location can present inherent risk – e.g. areas prone to flooding or cyclones have the added threat of entry of waterborne, soilborne or wind-blown pathogens from another region. Climatic events may also disrupt preventative or eradicative actions. Those productive regions near urban settlements are under increasing pressure from urbanisation, major developments and land use changes as land prices increase.

Input integrity and quality (water, mulch, seed, chemicals, plastic, fertilizers etc.) and the culture of compliance similarly may affect produce or a region's biosecurity. The security of utility and water supplies, as well as the awareness of those who regularly enter private property to test or inspect them, affects biosecurity. Questions have been raised also about the long-term effects of re-cycled water that contains hormones, herbicide and/or pesticide residues.

Superior biosecurity relies on knowledge of the participants, and their capacity to change, and/or implement preparedness and response strategies. Some regions are threatened by a lack of capacity (human and financial), commitment and capability, and leadership. However in most regions, available capacity is unknown and untested, prior to the event of an incursion.

6.4.2 Threat sources and pathways

Movement of people, infested/infected plant material (legal and illegal), green or industrial waste, abandoned sites and feral plants or animals, vehicles/equipment, used substrates (e.g. rock wool, nursery gravel, packaging) or containers, animals, soil, water and air (wind, cyclones, rain etc) are sources of threats, and distribution mechanisms.

Closing pathways is difficult at a regional level, but awareness of potential threats and the time periods during which they present the greatest risk (or when regions are at their most vulnerable), will assist in limiting unintended spread. For example awareness of the potential to spread western flower thrips (WFT) on one's clothing has reduced people movement at random between polyhouses, encouraged coloured clothing to be worn by pickers; encouraged vegetation-free barriers around polyhouses, monitoring using yellow sticky traps, and research into non-host vegetation barriers.

Pathway: Red –imported fire ant

The nursery goods pathway for Red-imported fire ants has been addressed through regulations applied to potted plant soil and mulch, accreditation for businesses growing, transporting, selling plants or stock with roots and soil attached; and for equipment used to move sand, soil, gravel, grass, sod, hay, wood etc.

Pathway: Potato Spindle Tuber Viroid

Potato Spindle Tuber Viroid (PSTVd) has been detected in symptomless *Solanum jasminoides* and *Brugmansi*a spp. and its main transmission is via vegetative propagation. The Netherlands had an outbreak of PSTVd in their greenhouses in the 1980s. Its origin was thought to be pepino seed imported from NZ and Greece.

Australia has had a number of PSTVd outbreaks in greenhouse tomatoes since 2001. In a recent pest risk analysis (PRA) on tomato seed, Biosecurity Australia (now Biosecurity Services group) demonstrated that tomato seed was a pathway for the introduction of this viroid. They presented evidence that showed the viroid could be an external, seedborne contaminant and/or carried within the seed embryo.

New import conditions for tomato seed have been introduced, as announced by the WTO in June 2008 (WTO ref. G/SPS/N/AUS June 2008). All tomato seed imported into Australia is now placed in quarantine. If it is not accompanied by a valid Phytosanitary Certificate with the required additional declarations, it will not be permitted entry into Australia. In practice this delivers improved biosecurity for Australia's potato and tomato industries.

Some high priority *exotic* threats for a range of Australian vegetables are tabled below (Table 4). These are relevant to all production regions. High priority '*alert*' pests for vegetables in South Australia will differ from those identified for example, in Queensland. In most vegetable production regions, perennial crops (e.g. olives, nut and fruit trees) may also be present and non-commercial plantings (esp. in parks, backyards) will be both diverse and extensive. A regional biosecurity plan needs to include some consideration of all threats and their pathways.

The following tables (Tables 4 and 5) are not exhaustive. However they give an indication of the large number and type of pests that must be considered in regional biosecurity planning, in order for technical resource needs, surveillance design focus, and value-adding opportunities, to be identified.

Table 4 : High Priority exotic pests of Australian vegetable regions

Pest	Common name
Achatina fulica	Giant African snail
Acusta despecta	Korean land snail
Bactrocera cucurbitae	Melon fly
Other exotic fruit flies *Bactrocera spp.*	Oriental, Papaya, Philippine
Botrytis squamosa	Onion leaf blight
Candidatus Liberibacter *(and tomato-potato psyllid vector)*	Zebra chip (bacterium + psyllid); Psyllid yellows (psyllid alone)
Cryptophlebia leucotreta	False codling moth
Clavibacter michiganensis subsp. *sepedonicus*	Bacterial Ring rot
Cucumber green mottle mosaic (tobavirus)	Cucumber green mottle.
Delia antiqua	Onion fly (and maggot)
Ditylenchus destructor	Potato rot nematode
Erwinia tracheiphila	Cucurbit bacterial wilt
Fusarium oxysporum f. sp. *lactucae* (strains)	Fusarium wilt of lettuce *(stem wilt and root rot strains)*
Heterodera carotae	Carrot cyst nematode
Exotic leafminers *Liriomyza bryoniae*	Tomato leafminer
Liriomyza huidobrensis	Serpentine (or pea) leafminer
Liriomyza sativae	Vegetable leafminer
Liriomyza trifolii	American serpentine leafminer
Lygus lineolaris	Tarnished plant bug
Leptinotarsa decemlineata	Colorado potato beetle
Pepino Mosaic virus	Pepino mosaic
Phytophthora infestans (A2 mating type)	Late blight

Pest	Common name
Phytophthora capsici	Phytophthora blight
Psila rosae	Carrot rust fly
Tosposviruses and thrip vectors Melon Yellow Spot virus	 Melon Yellow Spot
Tomato chlorotic spot virus	Tomato chlorotic spot
Watermelon silver mottle virus group	Water melon silver mottle, Groundnut bud necrosis
Zucchini lethal chlorosis virus	Zucchini lethal chlorosis
Other hosts	
Varroa destructor; V. jacobsoni	Varroa mites

* Exotic to Australia and relevant to the crop mix in many vegetable growing regions

Table 5 : Alert Pests for vegetables in South Australia

Pest	Common name
Bactrocera tryoni	Queensland fruit fly
Bemisia tabaci (Q biotype) Begomoviruses and whitefly vectors	Silverleaf Whitefly – tomato yellow leaf curl
Capsicum chlorosis virus	Capsicum chlorosis
Ceratitis capitata	Mediterranean fruit fly
Globodera pallida, G. rostochiensis	Potato cyst nematode
Impatiens necrotic spot virus (tospovirus)	Impatiens necrotic spot
Potato spindle tuber viroid	Potato spindle tuber
Puccinia allii	Garlic rust, onion rust
Urocystis cepulae	Onion smut
Thrips palmi	Melon thrips

* Exotic to the NAP but present in Australia, and/or under current regulation.

6.5 Regional activities

As previously discussed regional biosecurity planning requires knowledge of identified threats, their biology and potential sources. From these details regional activities that either promote or mitigate the likely entry or establishment of each pest may be determined.

Day-to-day activities on- and off-farm in an agricultural region affect regional biosecurity. They may compromise or enhance biosecurity directly or indirectly. Consideration of the common activities, cross-industry cropping or livestock cycles, transport routes etc. allow assessment of them as risk-promoting or risk-mitigating. Once identified, alternatives to risk-promoting activities may be offered. Opportunities to integrate or expand risk-minimising activities across a region also need to be identified.

The production of safe, high quality produce and the achievement of regional biosecurity are affected by inherently risky activities and the locations in which they are carried out. It is accepted that those regions with horticultural codes of practice or regulations that control people and produce movement are generally less exposed to new incursions, but biosecurity is dynamic.

As interest in backyard poultry, unusual pets, community markets, medicinal seed sales through internet etc. increase, the importance of backyard and market hygiene also increases. Washing hands, disinfecting equipment, isolating new pets/birds/plants etc, sealing feed containers, and disposing of water and waste away from fresh produce, will increase the chance keeping plants and animals healthy, and produce and human contaminants at bay.

Regions with national borders or state borders have the added benefit of routine inspections by qualified personnel. SA's Plant Health Act 2009, the new guidelines on block clearing, roadblocks, and the fruit fly trapping grid are good examples of efforts to extend biosecurity measures beyond the border. Isolated regions have greater reliance on goodwill and on-farm practices to deliver and maintain biosecurity.

Biosecurity activity must consider the threat at which it is aimed. For example, a pest spread via contaminated fertiliser may be impossible to detect and eradicate before it becomes widespread. Activities to manage such a threat are best focussed on awareness and development of Australian product standards. For other pests that have a fresh food pathway, border control and road blocks might be the best risk-mitigating activity. Surveillance (especially to optimise the chance of early detection) is a risk-mitigating activity warranted for pests with market access or production implications, and costly to eradicate or contain.

In assessing the costs-benefits of biosecurity strategies and measures, it is noted that the benefits often take the form of 'avoided costs'. Risk-mitigating activities are those that reduce the chance of an incursion either directly or indirectly, or influence other characteristics of the region or crop such that the losses associated with an incursion would be limited.

6.5.1 Risk-Promoting Activities

Risk-promoting activities include: sourcing inputs from unfamiliar suppliers; sharing farm equipment; stockpiling exposed green or other (plastic, substrate etc) waste; free release of processing wash water to open street channels; re-using substrates, boxes or pots; allowing run-off of wash water or chemicals into creeks; not harvesting or abandoning production blocks; undertaking major earthworks; using unregistered chemicals or chemicals excessively, loss of registered product availability through resistance development or de-registration; allowing livestock next to production facilities.

Horticultural regions that allow the practices of seed-saving, contract equipment movement from interstate etc. place regions under additional pressure.

6.5.2 Risk-Mitigating Activities

Risk-mitigating practices and facilities include: green waste removal and burial services, on-farm (and commercial) composting, timely pest and disease control, surveillance and management; attention to field hygiene; wastewater containment and treatment; restricted visitor, contractor and equipment movement; wash-down facilities; reporting unusual pests; keeping on-farm records and demanding traceability of planting material, seed, fertiliser etc; responding to Bureau of Meteorology (BOM) advisories when appropriate; purchasing certified planting material; offered reporting incentives (eg free diagnostics); adoption and harmonisation of Interstate Certification Assurances[2] (ICAs) and Import Verification Compliance Arrangement (IVCAs), and Quality Assurance (QA) programmes (e.g. Freshcare, BioSecure*HACCP* and SQF 2000, WQA).

Record-keeping is an important risk-mitigating activity. Traceability is provided by a system of accessible documentation capable of tracking the flow of products and produce through production and value chains. Good record-keeping requires all steps be documented – on-farm, in packing sheds, during transport, in marketplaces. (Suslow, 2009; Fonash, 2006).

[2] ICA is a system of plant health certification based on quality management. The aim of the system is to harmonise the audit and accreditation of nurseries and agri-businesses moving produce throughout Australia with mutual recognition of the assurances accompanying consignments. A business accredited for ICVA must verify that imported plant material received meets all entry requirements.

Industries and operations in which sanitation and hygiene actions are routine, generally have better biosecurity and a culture into which new biosecurity initiatives are more easily introduced. Hygiene underpins many biosecurity measures. Compliance with regulations, standards, codes of practice etc. are expectations in most regions, and these also assist or drive the adoption of new biosecurity measures.

Surveillance involves the searching and testing for evidence of presence (or absence) of pests in general, or a specific pest. Decisions have to be made on where to look, when to look, what to look for, how hard to look, and who is best positioned to be looking. Appropriate surveillance may be on-going (e.g. fruit fly trapping, road blocks) or a sporadic activity. The justification for investment devoted to pre-incursion surveillance, frequently considers the costs of prevention (early detection) relative to cost of presence (and response) – i.e. yield, quality and market losses, the costs of containment and/or eradication. In situations where a pest is very difficult to detect, or when technical support to increase early detection and diagnosis are not available, risk-mitigating surveillance may not be cost effective, and individuals or states will have little incentive to invest in it.

Surveillance may be passive or active. Activities like integrated crop management (ICM), integrated pest management (IPM), and integrated resistance management (IRM) are components of, not substitutes for, biosecurity activities. IPM and biological control require systematic crop monitoring, a capability in identification of pests and beneficial or predatory organisms, and an understanding of the epidemiology of pest populations as they relate to environmental conditions, habitats and hosts. Crop scouts, trained and aware growers and accessible educational resources are necessary for effective and efficient implementation of both IPM and regional biosecurity, and the activities conducted to achieve both are complementary and synergistic.

Some regions have adapted their production systems (i.e. crop rotations, timing of key activities) to minimise the entry or spread of a target pest. The host-free period was an effective biosecurity measure for grapevine leaf rust in Darwin. e.g. removal of *Vitis* spp. material around Darwin allowed the eradication of grapevine leaf rust which is an obligate parasite with a very limited host range.

6.5.3 Roles and Responsibilities in Biosecurity

There are both obligatory and optional roles in biosecurity pre-border, at the border and post-border (Table 6). Regional biosecurity is relevant post-border but its feasibility is greatly influenced by the success of border and pre-border biosecurity measures. This framework is intended to provide guidance for areas wanting to progress regional biosecurity, collaboratively.

The table below indicates some roles of stakeholders pre-border, at the border and post-border.

Table 6 : Biosecurity roles and activities within the plant health continuum

Location	Responsible Parties	Activities
PRE-BORDER	Commonwealth Government	International standards setting (IPPC) – BA, AQIS, DAFF, DFAT
		Pest and Disease intelligence – new and emerging threats; control measures
		Import Risk Analysis
		Pre-Clearance
		Off-Shore Verifications – certification, accreditation
		Off-Shore treatments (Imports)
		Training
		Quarantine policy development; NAQS
		Market Access negotiations

Location	Responsible Parties	Activities
BORDER	Commonwealth Government	AQIS: Quarantine (airports - detector dogs, ports - sentinel hives, container management etc); NAQS
		PEQ Screening
		Export Certification
POST-BORDER	State and Territory Governments, Industry and community stakeholders	Prevention
		Detection and Surveillance
		Emergency Response Preparedness (IBPs, EPPRD)
		Pest Status - evidence collection and management
		Diagnostics & other Specialist Technical Expertise
		R&D; Innovation
		Germplasm Assessments
		Communication & Awareness
		Training & Education
		Regulations – policy development; Plant Health Act 2009, ICAs, IVCAs, codes of practices; Australian standards and specifications
		Information Management

Source: adapted from McMichael, 2008

6.5.4 Activity complexities in a region

Regional complexities that affect the attitude to regional biosecurity or the potential to achieve it, need to be considered. They may not be on-going activities or attitudes unique to the region, but they are factors at a given time, that may disrupt biosecurity efforts. They might include a major event bringing in many people to a sensitive area (e.g. bike tour, or other sporting or cultural event); a major urbanisation project; an influx of new farmers or an ethnic group not familiar with the regional sensitivities; proliferation of U-pick operations and/or non-corporate sales outlets (swap meets, roadside stalls, open markets); changes in major traffic corridors or local services; loss of financial resources or support; or information fatigue in regions prone to threats, e.g. northern Queensland.

6.6 Understanding the Impediments to Regional Biosecurity

There are barriers to advancing regional biosecurity in a timely and cost-effective manner. Each needs specific consideration. Although there will be hurdles unique to each target region, many are common to horticultural regions across Australia. In developing a regional framework for biosecurity, the recognised hurdles need to be ranked, and linked to potential solutions integrated within the framework as activities, roles and responsibilities.

Generally, the hurdles to achieving regional biosecurity may be categorised as resulting from:

- Gaps in knowledge and shared vision
- Unclear economic (or regulatory) imperative
- Lack of collaboration and communication
- Lack of leadership
- Lack of resources

Low level community engagement is a significant impediment to advancing regional biosecurity. Without an engaged community, the chances of early detection and reporting are limited and practices employed in backyards, community markets, roadside stands, community events etc may continue to serve as open pathways threatening peri-urban and rural commercial agriculture.

There is amongst the vegetable industries a general lack of knowledge regarding the obligations of signatories to the Emergency Plant Pest Response Deed (EPPRD). The EPPRD is a mechanism for government and industry to work together, to reduce risks, and share the costs and responsibility of responding to emergency plant pests. To adequately meet their obligations,

signatories have to invest in biosecurity such that they are knowledgeable about their threats, and can minimise their vulnerability to them. As a signatory to the EPPRD, the vegetable industry has a legal obligation to develop and implement comprehensive risk management strategies to maintain plant health, manage exotic incursions, and provide knowledgeable representatives to national decision-making committees. The lack of awareness of these obligations at the grass roots is not unique to vegetable growers, but it is an impediment to both regional and commodity biosecurity, and investment in them.

In rural communities, there is concern about the removal and/or reduction of government support for extension services and funding available for regional development, and research. Staff turnover, and short-term funding cycles, divisions of responsibility in some operations (planning from economic development; tourism from environmental health) cause regions to lose momentum and economies of scale. They become a disincentive to sustained investment by communities, in biosecurity.

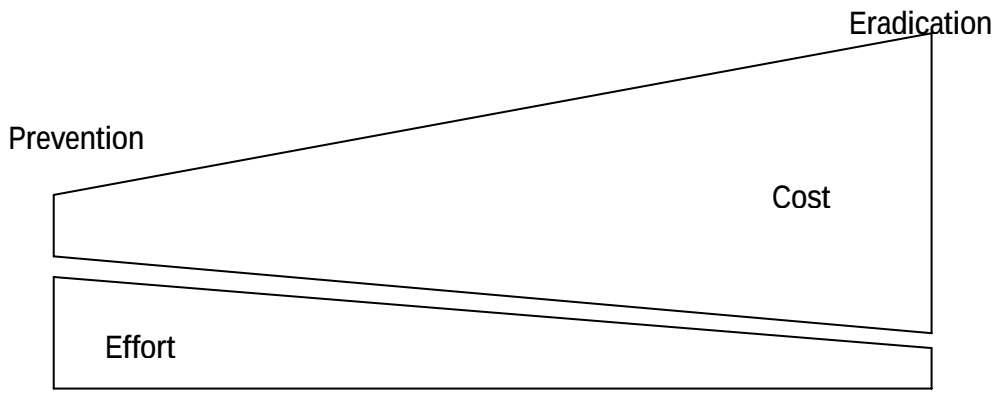
In most areas, the rate of uptake of biosecurity measures reflects regulatory pressure and/or individual perceptions of the costs, benefits and urgency of voluntary active involvement. A community that does not appreciate the link between horticultural activity, and community livelihood and viability, is likely to resist biosecurity measures, or adopt them more slowly than a more aware community. Amongst sophisticated and profitable commodity groups, biosecurity awareness is generally high. Those communities that have experienced direct losses due to the disruptions associated with a pest incursion (e.g. Emerald, Qld with citrus canker), are more likely to appreciate the benefits of community and personal investment in biosecurity.

Other impediments mentioned in previous sections are the absence of clear leadership, low level regional identity and pride, communication networks, co-ordinated surveillance and data collection. Each has the capacity to stall biosecurity activity and progress in vegetable production regions. Regions suffering an economic downturn, a culture of difficult compliance (or non-compliance) and those areas with little dependence on interstate or international trade, will more readily find disincentives for biosecurity involvement.

6.7 Potential Solutions for Biosecurity Impediments

Once the region, threats, impediments and complexities are understood, solutions may be identified. The solutions may be specific or general, new or value-adding to existing activities. This regional biosecurity framework identifies some solutions and incentives. A regional biosecurity plan should include solutions deemed most likely to be effective for the particular region and its participants, e.g. those that provide greatest return for human effort, are easily adopted, and cost-effective (Figure 5).

Figure 5 : Economic Incentive to Invest early in Biosecurity



Source : J. Van der Merwe (Chevron) Global Biosecurity Conference, Brisbane 2010

The acceptance, introduction and implementation of solutions generally require support and collaboration. Although direct financial support from governments can no longer be relied upon post-border, government contributions to biosecurity solutions remain significant and regional biosecurity efforts should be planned and implemented such that government-industry partnerships are maximised.

Governments (particularly Commonwealth and state) are particularly valuable sources of knowledge and 'know how' and their research, publications, fact sheets, awareness material (e.g. guidelines, biosecurity kits), training programmes, codes of practice, ICAs, natural resource management (NRM) boards etc. provide cost-effective bases for the development of targeted regional material and programmes. Industry may tailor these for their particular audience, at little cost. The NRM boards within a region are a respected and valuable resource and their communication networks and work programmes (e.g. weed mapping) can complement and reinforce biosecurity efforts.

Value-added awareness material and education, provides solutions to several impediments. Timely pest specific alerts (as for grape downy mildew) also serve to alert a region, at little cost to the target audience or region. Advisories from the Bureau of Meteorology (BOM) are useful in advising regions of weather conditions that may either promote disease, cause difficulty in managing disease (high winds or rain that could prevent spraying), or provide forewarning of new entries and spread of pests (as occur during cyclones). If these could also be provided to ethnic television and radio stations, the awareness of immediate threats would be greatly increased at little cost to the target audiences.

Surveillance needs to be technically-sound, cost-effective and supported by suitably trained people and/or technology – e.g. traps in effective locations, and suitable to detect more than one pest, checked frequently enough to provide useful data to databases such as the Australian Biosecurity Intelligence network (ABIN) which is an on-line facility through which biosecurity research, surveillance and response interchange may occur, be shared and assessed. For more information visit: www.abin.org.au.

As the adoption of integrated pest management (IPM) and its associated monitoring of beneficials and parasitoids, increases in the region, the surveillance network will necessarily expand and thereby provide opportunity to capture more evidence of pest status. Pest specific training of such professionals by government (at little or now cost) can provide immediate solutions by increasing the number of informed 'first detectors' operating in the field regularly.

The remote sensing for phylloxera undertaken in SA by the Phylloxera and Grape Industry SA (PGIBSA) may also provide a value-adding opportunity. The aerial imagery may assist in identifying ground truthing surveillance sites for other pests in other plantings, e.g. nematodes.

ON-farm surveillance (of crops and surrounding native vegetation, livestock, water sources etc) recorded on standardised templates suitable for input to national data collection software, is critical for biosecurity advancement for several reasons. It assists in overcoming man-power shortages and increases overall awareness; it augments the intensity and scale of government run surveys; and it brings biosecurity to the start of both the production and value chains.

High risk sites warrant focussed surveillance for high priority pests. The state government has identified some pests in this category and they drive the surveillance for them. For example the surveillance for red-imported fire ants in SA has focussed on the areas into which plants from Queensland have been imported. These same sites may be potential entry points for other Queensland pests – cane toads, silverleaf whitefly etc. Knowledge therefore of the potential hosts, sources and pathways of alert pests, can add value to targeted surveillance and increase the chances of early detection.

The government sectors may also provide support in overcoming regional capacity impediments. Government-led surveillance in regions (e.g. for red-imported fire ant, onion smut, fruit flies) may be expanded or extended in negotiation with industry, to provide significant returns at little additional cost to industry or government. For example, increasing trap attractiveness, intensity, and/or reading frequency may increase the data captured for multiple pests. It is known that traps attractive to Q-fly are also attractive to melon fly and perhaps other fruit flies. Recording all findings in traps would add rigour to regional surveillance, and capacity to diagnostic resources. The formulations of new female lures for fruit flies could make the systems more useful on-farm, and in general surveillance.

Sticky traps are useful in detecting flying insects. Yellow traps have proven effective in leafminer fly, whitefly, aphid, fungus gnat surveillance, while blue traps are attractive to some thrips. The positioning (esp. height above foliage) of sticky traps, determines their effectiveness for particular pests. Non-crop indicator plants or sentinel plants may provide surveillance solutions where human resources and physical scouting opportunities are limited. For efficiency they should be monitored at the same time as traps or sticky cards.

In California yellow sticky traps used for detection of glassy-winged sharpshooters (exotic to Australia) have been found to be effective also in attracting Asian Citrus Psyllid (ACP). However, the collection intervals were halved to ensure early detection of ACP (and huanglongbing disease, should the psyllids be infected by the causal bacterium). Recording all findings in traps would add value to regional surveillance, and capacity to diagnostic resources.

If regional biosecurity is to be achieved, financial and in-kind resources are expected today from all biosecurity stakeholders but resources are a biosecurity impediment. Commodity groups and allied industries will need to allocate financial resources to biosecurity. Contributions to high risk areas and high priority threats are likely to deliver high returns. Increasing the contributions for centralised data collation for example, is a practical solution for some pests and regions. If the results of on-farm passive surveillance and active monitoring are not recorded, their biosecurity value is lost. When a central database or repository is supported, the value of data to regional (and national) biosecurity awareness, evidence and preparedness is guaranteed, at little cost to individuals. This is a significant value-adding solution.

Important in overcoming engagement and personnel impediments, is the concept of trust. It is important for biosecurity personnel, whether they be government regulators, researchers, supermarkets or industry leaders, to earn the trust of regional communities and primary producers. Accountability of research and development programmes, extension of results to target audiences, and realistic adoption potential, must be assured before a regional community can be expected to embrace them, or commit their own time and resources.

It is recognised that incentives may be required to overcome engagement impediments amongst some stakeholder groups. The avoidance of future costs and trade disruptions, will not always be sufficient. Potential solutions to this are the provision of more tangible incentives, e.g. an insurance benefit, rebates or subsidies on biosecurity training, signage, biosecurity kits, activity costs and/or supplies, and free diagnostic services.

Reduction in irresponsible activity or counter-productive initiatives in a region may be assisted by imposed regulatory ‘teeth’, e.g. the threat of infringement, publication of non-compliant operations, fines or business closure. Regulatory power proved an effective solution in overcoming the potato tuber moth in an area of regional Queensland. The QDPI granted the power of a government Plant Inspector to regional IPM co-ordinators. On monitoring, the IPM co-ordinators were able to enforce plough-in orders at high tuber moth population sites. The area wide approach, the ‘sticks’ provided by the publication of high pest levels and plough-in orders,

and the enforcement powers, overcame the pest problem and the apathy and poor practices of a minority of growers.

Communication is needed in every biosecurity initiative. Communication impediments generally relate to their reach and relevance, but solutions are found within government and industry networks. Government communication networks and databases of land owners could be utilised more effectively for biosecurity purposes. Local governments can assist with distribution of regional information to the most effective outlets. Information distributed in council areas has the chance to reach casual (volunteer) observers with little understanding of biosecurity and those well-versed in it. Useful outlets include Centrelink, farmers' markets, rural advisory services (including counselling and assistance groups); re-sellers, and the delivery of simple messages via personal invoices (water, emergency services levy or rates notices) are useful in raising both regional awareness and the Council's commitment to the region in terms of sustainability, pride, clean image, traceability and food quality.

The delivery of regional biosecurity alerts and short messages about water, pest, disease and environmental health monitoring etc. can be driven through the LGAs and NRM boards and sub-groups. Industries with grower databases or registers have the potential to be more efficient in communication and response preparedness (e.g. to fire, incursions). If such registers can be formed with little additional cost or loss of privacy, they have the potential to unite a region. NSW has achieved a grape grower registry at little cost by adding value to existing property identification codes (PICs) and an additional question to the Rural Lands Protection Board's (RLPBs) annual returns of land and stock. The development of grower registers and property codes should be driven by the State governments.

Local governments also have the capacity to embed biosecurity considerations into their planning, economic development, tourism and event departments and services. Some services, if integrated will provide greater benefit to the region. For example, investment in facilities and equipment to improve the timeliness of waste collection, or wash-down services, may not only improve regional biosecurity but may also provide an income steam. Considerations of re-vegetation should include biosecurity (e.g. potential to become a site harbouring pests), as well as erosion control. Fines for dumping (and other risk-promoting activities) should reflect the illegality of the action, and also the biosecurity threat.

Biosecurity solutions require collaboration, increased and shared knowledge and resources. Collaboration between industry, LGAs and the state government is essential if biosecurity is to gain momentum in a regional area. All options available for value-adding to existing activities and systems need to be explored. Some are listed below in Table 7.

Examples of awareness material available to regions and stakeholders, are included in Appendix 3.

Table 7 : Potential solutions for biosecurity impediments

Impediment category	Potential solutions
Knowledge and vision	Grow regional pride
	Springboard actions from national, state and regional strategies and standards
	Document the link between horticulture and community economic viability
	Provide training, data packages for new growers/landowners/businesses
	Embed biosecurity in planning, development, operations and actions
	Embed biosecurity in success evaluations
	Determine minimum competencies for stakeholder groups
	Make more visible state and LGA support for biosecurity – training, surveillance, diagnostics, waste removal etc
	Make awareness material unavoidable
	Drive forward grower and property registers
	Target R&D that closes pathways or knowledge gaps

Impediment category	Potential solutions
Regulations and Economic imperative	Demonstrate public good of regional biosecurity - whole community are potential beneficiaries
	Consider power of participant incentives (reduced liability) and disincentives (penalty – polluter pays)
	Provide visible state and LGA support – planning, IDOs, diagnostic services; waste removal etc.
	Link LGA and government support to key outputs and biosecurity achievements
	Determine economics of achieving pest-free area or ALPP status
	Link threats to production costs and market access
	Value add to existing operations – e.g. increase fruit fly trap intensity
	Introduce regulations where needed to change behaviour, in support of industry initiatives
	Provide free diagnostics for suspect threats
	Include biosecurity economics in planning, development, infrastructure assessments. Benefits of irradiation, wash down facilities?
Collaboration - communication	Share ownership of plan region-wide; ensure CALD 'ownership'
	Agree on consistent messages, multiple delivery mechanisms; ethnic languages; translated signs
	Use radio, television, LGA rates, rental contracts, notices, convenience advertising, re-sellers; emergency services announcements; value-add to existing extension activities – newsletters, field days etc.
	Share and value-add to important regional messages and deliveries (rates notices, alerts etc)
	Utilise LGA and state communication networks
	Increase collaborative extension across stakeholders
	Build value-adding opportunities and cross-industry partnerships
	Share resources
Leadership	Establish lead authority - Regional biosecurity committee
	Regional biosecurity committee with effective representation
	Focus on common threats and high priority threats, areas
	Use young ambassadors – through schools, social groups; Regional leaders and identities (as Steve Irwin was for AQIS)
	Make compliance and self-assessment easy and relevant
	Increase regional and industry drivers
	LGA commitment to driving regional pride
Resources	Equitably contributed by and to stakeholders
	Utilise NRM resources and capacity
	Form partnerships for activities and funding
	Establish database and management resource
	Biosecurity-specific funding, e.g. OrdGuard $50,000/yr from State and LGA

6.8 Informed Biosecurity - Priorities

Once a region, stakeholders, and threats are understood, and the activities, impediments and possible solutions have been identified, a region can advance biosecurity operations. In order to prioritise the steps, the stakeholder influences should be documented. From them, and in collaboration with all stakeholders, the complexity and priorities across the region will become apparent. Common threats demand collaborative action, shared resources and investments. An example of an influence framework (to underpin an operational plan) is shown below for CALD primary producers of hydroponic tomatoes (Table 8). Other stakeholder influence frameworks are given for the NAP in Section 9.

Table 8 : Stakeholder (CALD Primary producer) influences

Producer category	Engagement strategy	Drivers	Key actions - engagement
Hydo tomatoes CALD grower	Face-to-face; ethnic radio	Regulations; Government restrictions	Demonstrations, workshops, personal help
	Ethnic newsletter, paper	Supermarkets	Translated awareness material
	Biosecurity officer, extension IDO	Reputation, neighbour	Waste removal service
	Accreditation linked to purchase prices (for inputs)	Prices, cash, economics of crop	Demonstrate link of profit to pests and diseases
	Key messages	Awareness material priority	Training priorities
	Surveillance = evidence; saving money	Simple, clear signs Posters	Chemicals; waste management
	Everyone involved	Radio, Television, videos, DVDs	Trapping, scouting – what to look for, when , how
	Look – report	Biosecurity kits	Economics of pest management
		Outlets - halls, church, cafes, Schools, service groups	
	Key collaborators	Key actions - participation	Key roles/responsibilities
	Biosecurity Officer	Training/accreditation	On-farm surveillance
	Ethnic leaders	Grower registers, property codes	Hygiene; self-audits
	Neighbours, NRM	Lease agreements that include waste management requirements	Reporting
			Records Training self, staff; Warning signs; People movement limits; Planting material records
	Barriers/Limiting factors	Potential Solutions	Success parameters
	Lack of trust	Grower register; property code	No incursions
	Ethnicity – limited understanding	Input costs/access linked to training	Self-audits and recorded data
	Funds -Competition for, cash payments	Biosecurity Officer	Changed practices – e.g. waste, hygiene
	Irregular attendance at meetings		Collaboration

7 CASE STUDY - BIOSECURITY FRAMEWORK FOR THE NAP

7.1 Introduction to the NAP

The Northern Adelaide Plains (NAP) is a larger area than the Virginia horticulture district, which lies within it. For the purpose of this project, we have adopted the approximate boundaries of the study area considered by the Lucas Group's 2007 report "*Development of Horticulture Industries on the Adelaide Plains: A Blueprint for 2030*" (Lucas Group, 2007), hereafter referred to as Blueprint 2030. This document has provided a vision for horticulture on the NAP. The study region included all or part of four local government areas (LGAs): Wakefield Regional Council, District Council of Mallala, Light Regional Council and the City of Playford.

Although there are several towns and peri-urban centres within the NAP, this region has a high proportion (around 80%) of land used for primary production. The Playford area is dominated by horticulture whereas the Wakefield area includes mostly broadacre farming and grazing. The NAP is suited for intensive horticulture because of its suitable soils and Mediterranean climate, adequate water (mains, bore and treated, recycled) supply, reasonable utility infrastructure and workforce availability, adequate transport and shipping facilities nearby and its proximity to the major market of Adelaide.

The region currently accounts for 16.5% of South Australia's horticultural production, excluding wine. According to the 2005-06 Score Card (PIRSA, 2006), NAP horticulture contributed $92.7m farm gate value, and $203.1m wholesale processed value. The Blueprint 2030 suggested there is potential for horticulture on the NAP to double production to $200m Farm Gate Value by 2030, with associated increases in income and employment. Conflicting indications however of the longer term commitment to NAP horticulture have arisen from regional and state authorities, and some growers are reportedly considering other production regions in the south of the state. Major urbanisation projects have been approved for the NAP, and horticultural expertise, and contributions to horticultural services and resources, are reportedly being diminished.

Agriculture on the NAP provides significant employment opportunities. In 2005, the City of Playford estimated there were 1,200 horticultural businesses in the region and that each one employed six people (full-time equivalents). The many food processing and value-adding enterprises on the NAP also provide employment opportunities. The Playford City Council estimated there were 3,000-5,000 employed in agriculture or allied businesses within the region (PIRSA 2006).

The demographic information available on the LGA websites is sourced predominately from the 2006 Census, and it provides insight on employment and the importance of agriculture to the region. For example "Playford Demographics' (from www.playford.sa.gov.au) allows analysis of community profiles for the entire LGA or for specific areas within it. Within one market gardening area of the LGA (Virginia-Waterloo Corner-Buckland Park), 27.5% of residents were employed (in 2006) in agriculture, forestry or fishing. Of this area's residents, 34% were born overseas with the majority speaking Vietnamese at home.

The NAP's vulnerability in terms of current and future biosecurity receives little attention, however regional biosecurity-related risk management will underpin the capacity for effective horticultural growth, justification for horticultural growth, as well as the future profitability and efficiency of existing and new horticultural ventures. Most growth on the NAP is likely to be in increased interstate trade rather than in exports. There is not a significant export focus in this region, but this is not the case for many other vegetable production regions. Imported seed and

planting material, transitory workers and biological and abiotic threats bring a global focus to all production regions even those not focussed on the export of produce.

This framework has been developed primarily with input from horticultural enterprises and participants on the NAP. It is relevant for other vegetable growing regions with peri-urban influences, but its transferability may be greatest across regions with similar risk profiles.

7.2 NAP Characterisation – Bio-geographical and Land Use features

The NAP has diverse land use, including perennial horticulture; annual protected and open field horticulture; nurseries; annual/broadacre grain cropping; animal (livestock, pigs, poultry, alpacas) production and grazing, and other relevant commercial (or entertainment-focussed) activities including horse and dog breeding and racing. It has been estimated there are 30 processors or value-adding enterprises in the region and they process produce grown on the NAP, as well as some potatoes, carrots and onions grown in other parts of SA. Some vegetables and bunch lines are field-packed.

Both conventional and organic production systems are in place on the NAP. The majority of horticultural production on the NAP is greenhouse-grown vegetables (tomatoes, capsicums and cucumbers), and this accounts for 48% of protected vegetable production in Australia. Broad acre vegetables (potatoes, carrots, lettuce, onions, *Brassica* spp.) are also grown on the NAP. Nurseries on the NAP produce some vegetable seedlings, potted colour and landscape plants. Floriculture (especially roses and cut flowers from bulbs) exists, also turf, mushroom, Asian vegetable and melon operations. Perennial horticulture (olives, almonds, wine grapes) are also important in the region.

The region includes little native vegetation but natural resource management is active in relation to water (flood management, erosion, excessive drawing from aquifer), weed control and biodiversity.

7.3 NAP Characterisation – Relevant non-biological features

Three water sources are relied upon in the region – bore, mains, and re-cycled. The Blueprint 2030 estimates that horticulture currently uses around 30 gigalitres (GL) of water, with 18 GL extracted from underground sources and 12 GL of re-cycled water from the Bolivar wastewater treatment plant, via the Virginia Pipeline Scheme. Natural gas is available for heating greenhouses and for some processing operations but current supplies are considered limiting and too localised to allow expansion of horticulture on the NAP. Three phase electricity is available, but expensive.

The state's major Produce Market is 20 minutes north of Adelaide's CBD, within the NAP region. This market receives and distributes produce from around Australia (including from/to the NAP). It has been estimated that 80 SA growers; 50 wholesalers and 1000 individuals use the market everyday. A Sunday market also operates in the area and has fruit and vegetable stalls amongst craft and entertainment stalls.

Many farm and allied industry workers are from non-English speaking backgrounds and therefore efforts to advance biosecurity awareness must specifically accommodate CALD participants. Amongst NAP residents and workers, the Vietnamese, Italian, Greek, Khmer (Cambodian), Turkish and more recently Burmese clusters need specific engagement. Recent initiatives to engage representatives of these groups in business and technical production training and marketing practices, have been well attended. These programmes must link with, or include specific biosecurity measures. The NAP farming community from English-speaking backgrounds is an aging group and that also has implications for awareness efforts and engagement.

It has been reported to us that state extension officers are greatly missed by NAP growers. There is a belief that research and development priorities, services and important messages that relate to biosecurity (e.g. chemical overuse) are now infrequently delivered, inconsistent, not reaching key stakeholder groups, and are not focussed on the challenges and threats that are shared across the region.

The NAP is bordered by two arterial roads. It has a regional airfield and airforce base, regular horse, dog and car events that bring visitors into the area. More recently, large road works have resulted in extensive soil and dust movement.

There are NAP features and facilities that influence or potentially influence (challenge or support) the region's biosecurity.

7.4 NAP Regional Biosecurity - Objectives

Articles and meetings introduced the stakeholder groups to this project and to "biosecurity". Examples of the introductory information are included in Appendix 4.

NAP stakeholders have generally agreed that the primary objectives of a NAP regional biosecurity plan should be:

- Minimisation of incursions of 'alert' pests (present in other vegetable regions but not in SA)
- Minimisation of incursions of 'exotic' pests (not in Australia)
- Cost-effective management of several established pests (e.g. established pests that limit or complicate production and marketing, e.g. Western flower thrip).

Secondary objectives identified were the securing of resources for increased regional support in the form of extension services or a regional biosecurity officer; regional cross-industry co-ordination, communication, and preparedness; recognition of horticulture on NAP as valuable to SA and LGAs.

In brief, NAP stakeholders wish to minimise pests, diseases and weeds that present a threat to plant health in their region, and therefore the regional economy.

Table 9 : NAP biosecurity objectives

Primary Objectives	Secondary Objectives
Minimize 'alert' and 'exotic' incursions	Justified increased resources for biosecurity and related R&D
Cost-effective, cross-industry management of problem endemics	NAP recognised as a valued economic region by LGAs, State – reflected in planning, hort protection, resource allocation
Increase profits	Increased regional pride (as per Barossa, McLaren Vale)
	Engagement with local community and ' lifestyle' residents
	Cross-industry communication, collaboration, shared responsibility

7.5 NAP Biosecurity - Stakeholders

In terms of NAP biosecurity, key stakeholders are the land users and their workforce, allied industry operators and their workforce; community members; the state government and four local government councils.

Governments

The state government is a key participant in the following areas: regulations, administration of the Plant Health Act SA 2009 and active 'public good' surveillance. PIRSA Biosecurity operates in partnership with the Department of Water, Land and Biodiversity Conservation and the Department of Environment and Heritage to manage SA's biosecurity continuum across the landscape. These agencies, NRM boards and groups have primary responsibility for pest animal and plant (weed) control and animal welfare.

The Environmental Protection Agency (EPA) has a lead role in setting some standards for environmental protection, e.g. waste water, burning etc. Several state departments and LGAs have roles in regional planning, water distribution and management, cluster development opportunities, and infrastructure investment. PIRSA drives the state's surveillance for a number of pests and diseases that have public nuisance potential, or export and import implications (with inspections in conjunction with AQIS). Current surveillance is undertaken for fruit fly, Khapra beetle, bacterial wilt and potato cyst nematode (potatoes), onion smut; red-imported fire ants; crown gall and Peach X disease, plum pox (*Prunus* spp.), olive knot and olive lace bug (olives) etc. See National Plant Health Status Report 2010 for full lists, for each state. PIRSA also works with SARDI and other partners to conduct research, education, training and awareness activities. The state government is assisting also with database management.

The four local councils on the NAP are also stakeholders in regional biosecurity. The development plans of LGAs recognise the need for zoned areas devoted to agricultural production (including horticulture); sustainable protection of significant, income-producing regional activities including horticulture; their interface with urban development and enterprises that fit with rural character and lifestyle amenity; and the allocation of resources required to support them. Planning decisions, infrastructure investments and event management guidelines however have rarely revealed if considerations are given to regional biosecurity. Stewardship and natural resource management however are being openly discussed more often.

Primary Producers

Primary producers and other land users are not necessarily land owners on the NAP. Leased land is frequently used in the production of vegetables on the NAP. All land users regardless of the activity conducted on the land (hobby farms, non-commercial users, lifestyle enterprises and sites – tourism, caravan parks, backyards etc) are important stakeholders in regional biosecurity. Amongst the primary producers are those who grow plants (or raise animals) in fixed structures (greenhouses, glasshouses, poultry sheds), semi-permanent structures (shade houses and polyhouses) and those in open-field agriculture (cropping and animal production).

Allied industry

The NAP's allied industry members include business operators and their workforce. The business categories are generally within agricultural supplies or support. Allied personnel include value chain members, consultants and researchers who are regular visitors to the area. The NAP is not a recognised tourist area but being a region bordered by arterial roads, and on the perimeter of urban clusters without buffer, it is a region that has considerable pass-through traffic, retail outlets, truck stops and food outlets. The economic development departments of the LGAs are investigating means to increase tourism on the NAP.

Less easily accessed, but equally important stakeholders are residents and personnel who move in and out of the region – travellers, school staff, those passing through regional airports, and those who visit the area to attend local swap meets, car or trotting events.

7.5.1 NAP Biosecurity Stakeholder Groups

In this framework the stakeholders that have a strong influence on horticulture in the region are noted. Regional biosecurity however demands engagement and participation of all stakeholders.

Table 10 : Biosecurity Stakeholders on the NAP

Stakeholders	Examples
Government authorities	Commonwealth -EPA, DAFF (AQIS, BSG), Research and Development Corporations (RDCs)
	State government - departments and authorities; PIRSA, BiosecuritySA, SARDI, SAWater, NRM boards; Utility policy units, AQIS, TransportSA, NRMs, SA Economic Development board
	Four LGAs and staff; regional development boards, committees, event managers etc.
Peak bodies	Fresh Fruit and Veg Growers; PHA, Ausveg, Potato Growers Association SA; Onions Australia, SA Onions Growers Association; NGIA; GrowSA and other bodies that may at times represent mushroom, turf, lettuce, bunch line, Brassica growers, Almond Board Australia, Australian Olives Association, PGIBSA, WGGA (grapes) ; Horticulture Coalition of SA; Vietnamese Growers Association, Cambodian Growers Association etc.
Allied businesses	Seed companies (e.g. Seminis, Syngenta) Nurseries (Lewis, Virginia, Heynes, Roses) Processors and Packers, e.g. Mondello, Mitolo group, Zerellas, Nicol, Costa, Musolino Marketing, agents, Corporate and non-corporate retail, wholesale: Produce market and swap meet Transporters and storage, e.g. AWB, Harris Contractors, eg contract hedging, harvesters, labour, bin and pallet hire, equipment service Re-sellers and distributors (e.g. Elders, EE Muirs, Landmark) Consultants and researchers (e.g. SARDI, PIRSA, VHC, private, seed companies, NRMs) Crop monitors (Fruit Doctors, Bugs for Bugs) Other value chain members – all food handlers; supermarkets, San Remo, Primo Estate; poultry, abattoirs, Balco hay etc Fertiliser, compost and waste handlers (e.g. Jeffries, Yarmack, Waste Management Pacific, One World) Virginia Irrigation and other equipment agents, suppliers Bolivar water treatment Trainers, education, e.g. VHC; Rural media/journals; Food Forest Other – rural banks, utility operators, pollination services/apiarists
Allied labour	Labour contractors; pickers, budders, harvest crews; crop monitors; inspectors; auditors; contract harvesting; researchers and consultants; produce agents; training providers
Primary producers	All commercial land users – Vegetables (soil, protected, hydro) - onions, carrots, potatoes, lettuce, Brassicas, mushrooms, tomatoes, capsicums, cucumbers, bunch lines; Nurseries – retail/wholesale; flowers, rose stock, ornamentals, seedlings; seed crops. Perennials - Almonds, olives, grapes. Turf. Grains. Livestock – recreational, commercial (birds, cattle, goats, pigs).
Other land owners/users	Lifestyle residents; Sport clubs, equestrian centre, Livestock markets, Mallala off-road hire, dog and trotter racing visitors and venues; caravan parks, Parafield and Edinburgh airports, race tracks, ovals, street landscapes; labour camps; official rest stops on arterial roads etc.
Community	Tourists, visitors, residents; event organisers (Virginia Expo, field days, cars, trotting, dogs; agric exchanges); CALD groups; social groups and service groups (CFS, CWA, Rotary, Kiwanis, Lions etc); schools and staff, hospitality workers, journalists, media managers, Jon Lamb (radio personality)

7.6 NAP Biosecurity – Stakeholder current engagement

In consultation with representatives of the stakeholder groups the range (in extent and intensity) of current biosecurity engagement on the NAP was revealed. Within every commodity group there are some highly aware and technically capable operators and producers, and these people will likely have significant leadership roles in driving forward collaborative biosecurity. While some commodity groups (e.g. almond growers, hydro growers) are aware of the potential threats to their production and livelihoods, and of the importance of hygiene and risk-mitigation, others have a low general awareness of the meaning of 'biosecurity' and how they may influence it. NAP regional biosecurity cannot be achieved without all stakeholders comprehending how their actions influence biosecurity on their own enterprise, those of their neighbours, and throughout the value chain. The fruit fly trapping activity on the NAP has given the region a basic understanding of biological 'threats'. This needs to be built on.

A more definitive means of establishing actual levels of engagement and awareness could have been established via a biosecurity survey, and this option should be considered by a Regional Biosecurity Committee. Incentives to return the completed survey should be provided. An example of such a survey suitable for hobby farmers and primary producers is included in Appendix 5. It has the potential to be extended or made more specific, e.g. with questions derived from biosecurity checklists (examples in Appendix 6) or self-audit templates. Responses to such questionnaires can provide early indications of the prior pest and disease experiences of stakeholders, and their understanding of 'biosecurity'. They may also provide information on current practices and sources of information, and the potential capacity of stakeholders to proactively improve practices, or adopt recommendations with the assistance, e.g. further training, education, regulations, peer pressure etc.

7.6.1 NAP Engagement and Motivation Strategies and Tools

There is no indication of overt resistance to biosecurity advancement on the NAP, but the costs and benefits of participation are not yet clear to most stakeholders. Potential engagement and motivation strategies identified for the NAP stakeholder groups, and are noted in Table 11.

Specific input from the stakeholder groups on the NAP have identified three main engagement and motivation tools for the NAP stakeholders:

- *Prior experience* with a biosecurity incursion,
- Demonstrated *economic benefit* (of participation), and
- *Regulations/enforcement* (to participate).

Personal impact is a key driver on the NAP. Industry support and activity has often been heightened when crops, especially if high in value, are threatened – e.g. industry responded to the Currant lettuce aphid (CLA) threat, and the tomato seed contamination threat ahead of government. Industry also mobilised awareness, cooperation and acceptance of re-cycled Bolivar water in order to ensure supply for the region.

Prior experience with an incursion ("a disaster") is a reactive engagement tool. The NAP, in trying to boost biosecurity before "a disaster", needs to use the experiences of other regions to demonstrate the potential impact an incursion (and quarantines) could have on the NAP horticulture sector, allied enterprises and the community.

Table 11 : Motivating biosecurity engagement on the NAP

Stakeholder group	Engagement and motivation triggers
Government authorities	Meeting on-going obligations (to risk reduce) with more support, and collaboration
	Visible responsiveness - Industry, agri-political pressure; public good
	Economics e.g. increased protection=reduced risk (and future costs); raised lowest common denominator; regulations with industry support; shared costs
	Compliance (risk reduction); regulations - increased with industry support
	Value added support for Fruit fly programme
	Increased regional pride, profile – e.g. support of horticulture, emergency levy funds shared
	Increased roles for and support from NRMs
	Recourse, with industry support, for non-compliers
	Increased communication mechanisms and reach
	Increased facilities – and potential for public-private partnerships

Stakeholder group	Engagement and motivation triggers
Allied business	Economics – reduced liability, profit increase potential
	More visible partner in raising regional profile; client confidence
	Increased training opportunities; recognition of competence, leadership
	Regulations
	Facilities increased – shared costs
	Potential to establish credentials through value chain – information source, compliance, leadership on biosecurity, marketing opportunity (e.g. re-sellers)
	Greater involvement in communication network – can drive some communication; e.g. focus groups
	Competence link to biosecurity knowledge, e.g. for input purchase
Allied labour	Regulations
	Professional standards, training subsidised
	Awareness, knowledge accessible; personal support for adoption; competence, active participation rewarded (accreditation?)
	Communication network including CALD focus
	Central data collection facility
Primary producers Peak bodies	Economics – reduced costs, increased profits, new markets, liability decreased
	Regulations; non-compliance has effective penalties
	Prior experience with new pest, lost chemical, property quarantine
	Regional pride, brand; 'good neighbour' pressure
	Assurance that all stakeholders involved
	Increased resources - funding, facilities, access to inputs etc. linked to biosecurity competence, training, contributions
	More support from government visible – extension/biosecurity officer
	Grower registers, property codes, grower competence measures
	Biosecurity 'score card' – measuring progress
	Re-sellers, trainers fully informed; awareness material accessible
	VHC realigned to grower services– grower register, property codes; professional development competencies
	Leading growers/industry with ear of Minister, LGAs – driving change
	Communication support provided, reinforced biosecurity messages in public announcements, use of ES levy; LGA communication networks
	Free diagnostic services
Other land owners	Regulations; non-compliance penalties
	'Good neighbour' pressure
	Environmental benefit; land value benefit
	Knowledge and 'know how' provided and assistance to adopt
	Low personal cost of participation - economics
Community	Awareness increased
	Clear link of horticulture health to and community economic viability
	Public good and regional pride
	Clear directions and chain of command
	Informed young ambassadors driving action; participation recognised
CALD participants	Regulations; penalties
	Bad prior experiences - residue penalties, high costs of production due to pests

Stakeholder group	Engagement and motivation triggers
	Economics – potential to increase profits, decrease losses/costs
	Information from trusted messenger, e.g. ethnic leader, re-seller, ethnic radio
	Included in leadership groups – e.g. Biosecurity committees
	Simple, first messages - sponsored, translated signs "Stop"; "Clean On-Clean off" ; Six-easy steps to biosecurity
	Training linked to input purchases; competence and professional standards rewarded

The case for NAP *regional* biosecurity rather than *commodity*- or *enterprise-based* biosecurity on the NAP has not been clearly articulated to stakeholders. Both are required, and both start at the grassroots (on-farm, at the business, in the backyard). In reality, no commodity group has the resources or expertise to become 'biosecure' in isolation. Integrated engagement and biosecurity measures are more effective as threats to particular enterprises are often sourced beyond that enterprise, e.g. from the seed source, waste piles of neighbours, hazardous run-off polluting water source, native vegetation or feral plants that harbour virus vectors.

The economic imperative of biosecurity can be highlighted to stakeholders via circulation of the costs and benefits (of pests; of biosecurity initiatives) to individuals, industry and the region. Examples that may be used in awareness material to demonstrate the economic impact of an incursion (e.g. equine influenza), or of a food safety concern, follow. In the On-farm Manual (vegetables) the citrus canker experience is also noted (Appendix 1).

Production cost changes and market access issues that relate to the arrival of a pest can be estimated, and compared with the investment needed to protect a region. Documented trade, production cost, yield and quality effects of a pest will motivate NAP biosecurity participation, especially amongst exporting enterprises and value chains for fresh and semi-processed food.

The delivery mechanisms (both for engagement and action) are important on the NAP. Amongst most NAP stakeholders, personal contact (extension officers, re-seller advice, face-to-face meetings) has been identified as a preferred engagement tool. Personal contact has within it, trust-building capacity. Messages or directives associated with regulators or parties unfamiliar have potential to be met with initial scepticism. NAP rural stakeholders also agreed that NAP biosecurity participation will need regulatory underpinning if it is to be achieved, but neither the State nor LGAs are keen to introduce such regulations, as they need to be policed.

Once engaged, participants on the NAP will adopt more readily, biosecurity initiatives that complement or add value to existing activities. Initiatives of each stakeholder group (including supermarkets, transporters etc.) must complement, not counter, those of others.

Given the importance of the message and the messenger, relationship building is critical to achieving regional, cross-industry engagement and biosecurity.

7.7 NAP Biosecurity - Threats and High Priority Targets

Some regions have unique threats, but in most horticultural production regions like the NAP, pests, diseases and weeds are the main threats to perennial horticulture, broadacre horticulture, and protected horticulture. The mild climate of the NAP allows survival of most weeds, pests and diseases of temperate crops. Heated glasshouses provide a more tropical microclimate that is conducive to the survival of other pests and diseases, e.g. the 'alert' pest silverleaf whitefly could survive in these.

This framework is focussed on the biological organisms that could threaten (or do threaten) vegetable crop health and therefore productivity and quality, on the NAP. The NAP threats have been grouped as *exotic*, *alert* or *(problematic) endemic*. Some of the exotic pests have been formally 'categorised' (by PHA) and the industries expected to cost-share in their eradication should they arrive, are known. The proportion of costs for which each affected industry is responsible, is higher for pests predicted to affect industry, more than the public (e.g. environment or amenity of an area).

7.7.1 NAP Biological Threats – Vegetables

Because of the vegetable crop dominance of the NAP, the following threat tables are focussed on NAP vegetables, both protected (hydroponic and in-soil) and field-grown. However, in framing a regional approach to biosecurity all crops and threats, pathways and other influences must be considered. Significant almond and grapevine plantings exist on the NAP, and some grain crops also, but these crops have Industry Biosecurity Plans and vineyard/orchard/on-farm manuals that highlight their exotic threats in detail.

Tables 12-14 include the main pest threats to the NAP. The NAP On-farm Vegetable Manual includes fact sheets on some (✓).

Table 12 : High Priority exotic pests for NAP commercial horticulture

Fact sheets	Exotic Pest*	Common name	Notes
	Root/bulb/tuber vegetables		
✓	*Psila rosae*	Carrot rust fly	
	Heterodera carotae	Carrot cyst nematode	Attacks carrots but is harboured in other hosts. Spread in infested soil, produce and equipment
✓	*Leptinotarsa decemlineata*	Colorado potato beetle	
✓	*Ditylenchus destructor*	Potato rot nematode	Potatoes,, carrots, garlic, bulbs and corms attacked, esp in cool conditions. High health status planting material is best control
✓	*Candidatus* Liberibacter and *Tomato-potato psyllid (Bactericera cockerelli)*	*Zebra chip*	Vectored by psyllid; 40% losses in protected veg in USA. Strains related: HLB in citrus
✓	*Clavibacter michiganensis* subsp. *sepedonicus*	Potato ring rot	
	Exotic fruit flies	Oriental, Papaya, Philippine	
	Delia antiqua	Onion fly (and maggot)	Only attacks *Allium* spp. (including related ornamentals
	Leafy vegetables		
✓	Exotic leaf miners	Vegetable, American serpentine, Serpentine (pea), and tomato leafminers	
	Fruit vegetables		
	Bactrocera cucurbitae	Melon fly	Beans, cucurbits affected. Sting marks on fruit. Present in Torres St. islands
	Cucumber green mottle mosaic (tobavirus)	Cucumber green mottle	Watermelon, cantaloupe, cucumber. Spread by handling, grafting, from old drop debris; maybe seedborne. Full composting of debris can deactivate virus
	Tospoviruses and thrip vectors	Watermelon silver mottle, groundnut bud necrosis, melon yellow spot, tomato chlorotic spot; zucchini lethal chlorosis	Wide host range for viruses. Several thrip vectors already here.
	Erwinia tracheiphila	Cucurbit bacterial wilt	Hard to control
	Lygus lineolaris	Tarnished plant bug	Vegetables, flowers, fruit , nurseries at risk
	Fusarium oxysporum f. sp. lactucae (exotic strains)	(Stem wilt and root rot exotic strains) of lettuce Fusarium wilt	Long-lived spores survive in soil

✓	Pepino Mosaic virus	Pepino Mosaic virus	Low level seed transmission in tomatoes. Easily spread by contact, grafting and handling. No known insect vector Two strains.
	Phytophthora capsici	Phytophthora blight	Cucurbits, capsicums, tomatoes, others affected
	Phytophthora infestans (A2 mating type)	Late blight	Devastates potatoes, tomatoes when both mating types present. Spread in infected tubers, wind, water; survives in weeds, crop debris
	Nurseries		
	P. omnivorum	Texas root rot	Wide host range. Long survival in soil; concern for nurseries
	Almonds		
	X. fastidiosa and vector	Almond leaf scorch; glassy-winged and other sharpshooter vectors	Almonds, grapes citrus – specific strains. GWSS in Pacific islands.
	Varroa destructor; V. jacobsoni	Varroa mites	May kill bee colonies. Australia one of very few countries without this pest; NZ has it
	Grapes		
	X. fastidiosa and *vector*	Pierce's disease; glassy-winged and other sharpshooter vectors	Disease in USA, vector in Pacific islands and other countries, moved on landscape and ornamental plants
	Other		
	Erwinia amylovora	Fireblight	Apples and pears; Rosaceae ornamentals. Present in NZ and most other countries

* Exotic to Australia and relevant to the crop mix in many vegetable growing regions

Table 13 : Alert Pests for commercial horticulture on the NAP

Fact sheets	Alert Pest*	Common name	Notes
	Root/bulb/tuber Vegetables		
	Globodera pallida, G. rostochiensis	Potato cyst nematode	Present in Victoria
	Urocystis cepulae	Onion smut	Once present on NAP, 15 years eradication surveillance
	Puccinia allii	Garlic rust, onion rust	*Allium* spp.
	Ralstonia solanacearum	Bacterial wilt of potato	Detected once but eradicated from SA
	Fruit vegetables		
✓	Fruit flies - *Ceratitis capitata; Bactrocera tyroni*	Med fly and Q-fly	Q-fly in NT and eastern states Medfly in WA; fruit/veg market access issue
✓	*Bemisia tabaci* (Q biotype) and begomoviruses	Strain of whitefly and Tomato yellow leaf curl	Flowers, veg, nursery, g/h problems. Whitefly present in Nth Aust and NSW; develops resistance quickly. Complexes in SE Asia
✓	*Thrips palmi*	Melon thrips	Vector of viruses
✓	Potato spindle tuber viroid	Potato spindle tuber viroid (PTSVd)	Especially problematic in tomatoes. Pathogen more resistant in WA.
	Tospoviruses *and thrip vectors*	*Capsicum chlorosis*	Found once in 1999. Related to tomato spotted wilt virus; but TSWV resistance in plants is not effective for CC; host range includes capsicum, tomato, calla lily, orchids
	Leafy vegetables		
	Lettuce infectious yellows (Crinivirus)	Lettuce infectious yellows	Virus limited to the phloem and transmitted by *B. tabaci* (B biotype)
	Nurseries		
	Impatiens Necrotic spot virus	Tospovirus	Detected Feb 2010 *on* some veg – worst on ornamentals, but also veg, weeds
	Other – grapes, olives		
	V. vitifoliae = Daktulosphaira vitifoliae	Phylloxera	SA free. Moved in soil, equipment, and grape material. NSW and Victoria have infested areas.
	Ps. savastanoi	Olive knot	Barnea variety very susceptible. Contained in other parts of SA

* Not present on the NAP but present in Australia, and/or under current regulation.

Table 14 : Problem endemic pests on the NAP

	Problem Endemic Pest*	Common name	Hosts
	Vegetables		
✓	*Frankliniella occidentalis* and viruses Tomato spotted wilt virus	Western flower thrips	Capsicum, tomatoes, eggplant, potatoes; market access, yield and fruit quality issue; thrips hard to control
✓	*Nasonovia ribisnigri*	Currant lettuce aphid	More problematic on head lettuce; seed dips effective
		Tobacco Blue mould	Solonaceous vegetables affected; market access restrictions (into Tas)
	Clavibacter michiganensis subsp. *michiganensis*	Bacterial canker	Tomatoes
	Tomato mosaic virus Tobacco mosaic virus	ToMV, TMV	Hygiene issue, survives in crop waste, spread by contact
	Mites	Broad mites; two-spotted mites	
	Nysius vinitor *Nysius clevendensis*	Rutherglen bug Grey cluster bug	Native to parts of Australia; can be a problem in seed crops
	Plutella xylostella	Diamondback moth	Problems for Brassica spp.; also ornamentals
✓	*Trialeurdoes vaporariorum*	Greenhouse Whitefly	In SA since 2006; weed hosts, lettuce, cucurbits, spinach
	Tomato torrado virus	Torrado virus ToTV	Localised; infected tomato transplants, suspected seedborne; some varieties resistant. Weed and protected tomato hosts; G/h whitefly and SLWF vectors; high rate of spread; Origin -Spanish tomatoes.

* Present in the NAP, and of on-going economic concern

Incursion impact -The Equine Influenza (EI)

The peak body's experience (Australian Horse Industry Council)

- Horse emergency contact database – 800 registrants before EI; post EI - over 10,000
- Emails to AHIC office before EI – 140/month avg; Aug 2007-June 2008 over 80,600
- EI infected about 80,000 horses; 10,500 properties spread over 280,000 sq km.
- Eligible costs of the eradication programme were $97.7 million
- Government assistance totaled $350 million.
- Industry losses (including gambling) approx $1.5 billion

Lessons learned

Response capacity:	Early detection is essential Industry awareness needed; active surveillance on-going Wide stakeholder engagement needed Meetings occupy people and time - approx 4,000 hours in consultative committee meetings during EI
Industry data:	Accurate information about the industry is essential – in advance Chain of command needs to be known in advance
Industry resources:	Informed peak body; need to be prepared Not enough Communications network and media management Jurisdiction support needed Informed reps on committees involved in emergency response Biosecurity plans – personal, individual enterprise and industry
Government resources:	Under-staffed for emergencies Whole of government response needed (people, resources, equipment, vehicles, diagnostics, employment contracts etc) Diagnostic support – need reference labs, return result speed, packing, known in advance
Communication:	Need to use whole spectrum (internet, email, phone, radio, television, newspapers)
Consequences:	Distress widespread; personal losses; community disruption and financial impacts; state and national – social, financial

Source: Barry Smith, 2008 (Australian Horse Industry Council)

Food safety Impact and Diagnostic Expertise

The experience of Salmonella by the USA tomato industry

On June 7, 2008 the USA's Food and Drug Administration (FDA) issued a warning to consumers about an outbreak of *Salmonella* Saintpaul that had hospitalized 1329 people in 43 states, since April. Retailers across the US including McDonald's, Burger King, Wal-Mart, supermarkets etc were advised to remove raw plum, round and Roma tomatoes from their shelves, but most removed all tomatoes, and consumers stopped eating tomatoes and fresh tomato products (e.g. salsa).

Media headings like "Florida's tomato industry in complete collapse" did not exaggerate the situation as losses of US $100-500 million in farm gate sales, from the US $ 1.3 billion industry, were believed realistic in the lucrative summer market. The losses were incurred before the FDA, the Centre for Disease Control and Prevention, and state and local health departments had in fact traced the contamination source to tomatoes. It was revealed that the traceability of produce like tomatoes was an inexact exercise, at best. However, on July 17, 2008, the FDA made a new announcement that chillies from Mexico were the likely source and had now been linked to the outbreak. The effects of the outbreak on the tomato industry were multi-layered:

- 252 people were hospitalized as a result of the Salmonella outbreak. The cost of this alone was estimated at US $52 million.
- Massive, negative media coverage on tomatoes. In the months of June-July, 631web pages discussed the incident and after the second FDA announcement, another 445.
- Loss of public confidence in fresh produce, especially American tomatoes. This added to the scepticism that lingered after the 2006 spinach incident.
- The industry could not quickly deliver supply/value chain details to assist traceability investigations. Other vegetables were drawn into the investigations – onions, coriander, and it took FDA weeks to determine the source/s.
- Compensation claims of US $100 million were filed in Florida alone.
- Industry had to shoulder the burden of increasing consumer confidence through lower pricing and promotions of the health benefits of fresh tomatoes.

Source: From McMichael, 2008

7.7.2 NAP abiotic Threats

The abiotic threats identified in the Blueprint 2030 (Lucas Group, 2007) as potentially affecting future growth and expansion of the NAP were water availability, production cost increases, zoning, labour supply and cost, power costs and security of supply, the lack of gas infrastructure, government decisions and public awareness. Some of these may have future biological implications, e.g. handling of green waste and waste water, water quality, pesticide and hormone residues in re-cycled water, chemical resistance, land-clearing, abandonment of production sites, flooding etc.

It is apparent through consultation also that the impending loss of cost-effective chemicals, lack of local specialist expertise on the NAP, changing residue technology and standards (that can be demanded by export markets), the unclear regulation regarding fresh chicken manure, illegal dumping, the handling of treated timber (e.g. posts), irrigation plastic, metals and other materials, are abiotic threats, with potential environmental, social and biological effects on horticultural activity on the NAP.

There are also political concerns, e.g. the long-term commitment of the state and local governments to the region as a horticultural centre; planning decisions, encroaching urbanisation etc. While these also threaten horticulture on the NAP, there are signs of resolve within the political bodies of the region, to improve collaboration and preparedness.

Table 15 : NAP Abiotic threats

Nature of threat	Local example	At risk sectors
Zoning and urban encroachment; planning; low regional identity and pride	Buckland Park and other developments; no clear evidence of government commitment to future of horticulture in region	All horticulture, regional community viability unless a consolidation zone or export zone within NAP is created
Regulatory support minimal	Abandoned sites; waste piles; utility security. LGAs and government less interested in regional regulations, by-laws despite grower interest	Whole region
Waste management – limited infrastructure to underpin biosecurity	Wash water; green waste, persistent waste creating risk	Horticulture - throughout region
Loss of cost effective products; residues; pest and disease costs increasing	Re-registration (dimethoate; fenthion); resistance (Nitofol®); excessive use and some residue issues	Market access issues
Inactive grower groups; minimial cross-region collaboration; CALD groups increasing	Most grower groups only meet if emergency requires; no groups ready to drive change or lobby for additional support as in Riverland	Horticulture across region
Arterial traffic increasing; wind exposure-from northern expressway; airports	Illegal dumping; dust, rubbish; need windbreaks; regional airports; non-corporae outlets	Whole region and regional pride
Loss and cost of human resources – esp. extension staff, skilled labour; specialists	Reduction in services and financial, personnel contributions from Governments, VHC; LGA	Intensive industries; those wanting to drive change; cash-strapped sectors
Water management - supply and quality	Flooding; long-term quality and supply; suitable uses -ice to pack produce?	All horticulture; food safety
Cash economy	Traceability and value chain issues unclear	Whole region. Cash economy can make registers, engagement, action more difficult
Livestock near food crops	Leased land; mixed land use without planning barriers	Consumers; fresh produce safety

7.7.3 NAP Regional Activities

As in every agricultural production area there are practices and activities that present risk, and others that mitigate threats. On the NAP practices range in terms of 'biosecurity' from irresponsible risk-promoting to sophisticated, risk-mitigating practices. Most agricultural and community practices are motivated by economics (profit; avoided costs), convenience, tradition, lack of alternatives etc. rather than by biosecurity. Knowledge of threats, and of common practices in the region will help focus awareness material, and communication and education efforts to areas where practice/behaviour change is most necessary.

Table 16 : Practices on the NAP amongst some stakeholders or commodity groups

Risk-promoting activities	Risk-mitigating (or preparedness) activities
'Stockpiling' green waste; persistent waste; animal manure near fresh produce; uncovered waste allowing pest build-up	Adoption of new Plant Health Act; SA Biosecurity Plan – ICAs, IVCAs, Importer/exporter registers
Excessive chemical use	Good general hygiene practices – footbaths, weed, pest, disease, waste management, disinfection, limits on visitor/vehicle movement
Abandoned production sites; unharvested sites	General and targeted Surveillance - Fruit fly trapping; onion smut RIFA, Olive knot etc (National Plant Health Status Report, 2010)
Unlimited movement between properties	Crop monitoring, sticky cards, barrier crops etc
Shared or contract equipment (some from outside region) used – hedging; harvesting	Contingency plans being developed for high priority pests
Planting material without full traceability – seed, cuttings, bare root perennials; seed saving	Signage displayed - fruit fly and pest posters in sheds; biosecurity at front gate
Waste wash water released to roadside	Plastic removal service
Excessive ground water extraction and environmental degradation	Biodegradable twine and other biosecurity-related research
Re-use of boxes, cartons, pots, trays without disinfestation	Support for grower registers, property codes, professional standards

7.7.4 Changing Risk Profiles on the NAP

The national change in obligations for maintenance of plant health and response preparedness (through EPPRD), is not fully appreciated by many horticultural industries. Few industries have evaluated the relative benefit/costs to them of active biosecurity measures to mitigate threats and the potential economic impact of an incursion on their productivity and surrounding regional communities.

Should responsibility and liability for environmental protection also move toward industry, as predicted, and the parameters of 'pubic good' (and therefore government contributions) move increasingly toward public nuisance pests (and away from commercial agricultural pests), many horticultural industries will be unable to meet their financial obligations.

In most regions, the increased risk relates to movement – of people and produce, more often and over longer distances. However, the NAP is an area not strongly focussed on export, and its changing risk profile seems more closely related to resources. Resources, in terms of available services, expertise and funding, have the potential to significantly affect the biological threat status, and the region's preparedness and response capacity.

There are insufficient State government pathologists and/or entomologists to conduct routine surveillance for exotic, alert or endemic pests, even in economically-important or sensitive production regions like the NAP. The lack of active extension personnel with biosecurity responsibility is a growing threat to the NAP. Private consultants are filling some gaps. Knowledge resources focussed on the region are needed – e.g. NAP versions of PestFacts, CropWatch, and rapid diagnostics.

The increasing demands of supermarkets for non-core assurances (e.g. ethical labour) are costly to producers and agents and as such they potentially distract from the more important activities of biosecurity, and impose additional costs on growers, without being linked to decreased risk or reward.

The changing patterns of trade and the protective practices of some countries in their use of restrictions based on pest status (e.g. Taiwan and WA carrots) suggest that in the future evidence-based support for pest status will not be optional, for any marketplace.

Emerging threats may trigger innovation and opportunities. The loss of export markets (national and international) if dimethoate is removed may increase interest in systems approaches to management and establishment of area freedom or areas of low pest prevalence. The potential of other treatment regimes (i.e. cold treatment or irradiation) have not been explored for many vegetables, but this will change as the threats (or demands) change. The NAP as a regional centre may in the future benefit from the provision of such services and infrastructure investment. Otherwise it may incur significant new costs should the facility be located elsewhere, and its use becomes necessary.

Climate change is a threat of unknown potential and without a timeframe, but it is likely to affect life cycles, distribution, dispersal rates and populations of both pests and plants in the region. The potential biosecurity effects of these changes include changing diagnostic demands, surveillance designs, area freedom status, predator/parasite balance and incursion management.

Table 17 : Potential/predicted trends on the NAP

Trend	Potential biosecurity impact	
	Threat	Benefit
Diagnostic expertise and extension shortages to continue	✓	
Skilled human resources –reduced availability	✓	
Government and LGA commitment to horticulture - unclear	✓?	✓?
Financial contributions from LGA, government hard to secure for horticulture	✓	
Regional infrastructure investments for horticulture - unclear	✓?	✓?
NAP growers drive cross industry collaboration		✓
Pest incursion	✓	
Chemical resistance more widespread	✓	
Urbanisation	✓	
Industry-government collaboration driven by industry		✓
Property codes; grower registrations mandated		✓
Increased grower training – standards for professional development		✓
Low level commitment of Industry funds, and government funds directed to biosecurity	✓	
IPM more acceptable, driven by supermarkets		✓
Peri-urban and rural community increasingly non-English speaking	✓	
Climate change	✓?	
Larger farms, fewer small producers		✓?

7.8 NAP Biosecurity – Existing Impediments

The feasibility of advancing biosecurity over a diverse agriculturally- and culturally-diverse region like the NAP, will depend on the approach taken, i.e. voluntary or enforced, "carrots" or "sticks". There are known barriers to engagement, and variable attitudes about the urgency to advance biosecurity and to invest (time, resources, money) in it.

The impediments relate to stakeholder knowledge, resources, leadership, and communication. For a regional approach to succeed, all stakeholders have to be biosecurity participants, and resources need to be invested where risks are greatest and where prevention/protection efforts deliver tangible benefits.

The following table includes some of the impediments to biosecurity advancement that have been identified on the NAP.

Table 18 : NAP biosecurity – existing impediments

Impediment category	Specific impediments to Biosecurity on the NAP
Knowledge and vision	High level "trigger" not yet presented – e.g. new incursion, region quarantined, lost markets
	Economic importance of horticulture in region not reflected in support or awareness levels
	Little sense of 'community' amongst stakeholder groups
	Nothing linking all industries on the NAP as yet; no shared vision
	'Biosecurity' not widely understood
	Hygiene and best management practices not universally understood or used
	No property codes, growers registers and few land use maps
	Systems in place for incursion management – ad hoc
	Peak bodies not yet driving biosecurity, preparedness, response capacity; or R&D priorities towards gaps
	Lack of "know how" and support to adopt new practices – e.g. 'Area freedom' evaluation, surveillance tools
	Range (from negligible to sophisticated) of understanding of high risk areas or practices
	Market impact of pest status not appreciated – e.g. 'benefit of absence', 'cost of presence' for pests
	Lack of awareness of emerging and alert pests
	Sharing biosecurity information – fear of privacy or trade implications
	Supermarkets drive some practices – not all are aligned with biosecurity, or mindful of local status or conditions

Economic and regulatory imperative	No serious economic trigger apparent to most stakeholders considering biosecurity
	Regulations not yet forcing 'biosecurity' onto investment agenda of all stakeholders
	Economic effect of pest incursions on horticulture, regional community not known by most stakeholders
	Economic viability and its link with plant (animal) health not made
	'Rewards' for active biosecurity participation not apparent to some stakeholder groups
	'Profitability' trigger not yet linked to "biosecurity" or hygiene in most stakeholder minds
	Lack of knowledge of most growers of true costs of production; cost-benefit of good practices, surveillance
	Cash economy and short–term land leases make land, refuse, chemical management, penalties for non-compliance etc. harder to enforce
	Cash-strapped stakeholders have higher priority money demands (land tax, power, water)
	Increasing land values (urban pressure) diverting attention from horticulture and planning for future
	Fear of cost of biosecurity involvement, but unaware of costs of incursion and risky practices
Collaboration and communication	Communication and engagement networks across the community and all stakeholders not functional
	Limited capacity to collaborate without grower registers/property codes and agreed professional standards
	Suitable, simple messages not consistently distributed
	Preferred communication (alerting and reporting) mechanisms, timing and feedback loops, not developed for each stakeholder group
	Lack of collaborative, strategic planning that considers biosecurity
Leadership	Lack of visible leadership and clear mandate for any stakeholder group to drive biosecurity
	Industry leadership can drive biosecurity concept, but needs regulatory underpinnings to implement it
	Potential rewards for improved biosecurity? no indications coming from value chains
	Implicit biosecurity drivers (early detection, market access, residues, food safety) not yet linked strongly to on-farm and value chain practices
	Political support for regional biosecurity needed
Resources	Expertise services and extension personnel not visible in the area
	No obvious investment of state and LGA to horticulture advancement and future on NAP
	LGA services for taxpayers do not yet include biosecurity support- e.g. waste removal, wash-down facilities, signage, biosecurity education etc.
	Expertise not available to support biosecurity knowledge uptake, or implementation, e.g. surveillance
	Growers have not been receiving risk mitigation "know how" presented to them by trusted parties
	'User pays' is a disincentive to reporting
	Training programmes have not yet embedded 'biosecurity'
	No clear access to/provision of funds for extension, assistance, inspections, enforcement
	R&D not yet underpinning biosecurity in the region – diagnostics, surveillance tools, sample packaging

7.9 NAP Biosecurity – Options for overcoming biosecurity barriers

The challenge for the NAP is to develop an integrated biosecurity (and surveillance) system that accommodates a range of diverse plant (and animal) industries, land use and production systems (including urban backyards and natural ecosystems), and allied businesses, over a large area. A regional biosecurity plan for the NAP therefore must have within it the potential to integrate information, policies, activities, and people such that resultant biosecurity is improved, at little extra cost to individuals. It must be made possible for individual business, authority, industry group, and community and on-farm efforts to be co-operative and synergistic, rather than counter-productive, duplicated or wasteful.

In consultation with several commodity groups, local government, NRM members, and researchers on the NAP, and with our knowledge of existing activities, structures and systems in the region, steps towards potential solutions, and opportunities to overcome existing biosecurity barriers, have been identified. As for the impediments, most solutions lie within categories – knowledge, economics, regulatory, collaboration, communication, leadership and resources, as shown in Table 19.

Table 19 : Steps towards overcoming biosecurity impediments on the NAP

Impediment category	Potential solutions and steps towards overcoming biosecurity barriers
Knowledge and vision	Industry becomes driver (through Hort Coalition SA?)- Initial meeting of top representatives of industry (commodity) stakeholders, LGA, State government, allied business. Outline value of hort to region, biosecurity threats, impact on horticulture
	Assess potential political support – Ministerial awareness; regulatory underpinnings for biosecurity initiatives
	Prioritise potential beneficiaries to improved biosecurity; investment capacity and likelihood
	Peak bodies form active NAP groups; meet regularly; strategic agenda; encourage younger generation involvement
	Prepare and circulate business case for investment – (see example of incursion costs - Equine influenza , citrus canker, for growers (industry), allied industry (industry), community (LGA, state government)
	List and circulate key threats; identify common threats across region
	Prioritise initiatives to increase biosecurity capacity; value-add to existing ones – eg surveillance, signage, training, e.g. incursion simulation programmes for NAP participants
	Embed biosecurity into training programs and qualifications, QA etc.
	Standardise record keeping and monitoring templates ; peak bodies linked into national reporting streams – ABIN, NPSRT and BioSIRT[3]
	Inform stakeholders - distribute on-farm manuals, awareness materials, chemical and regulatory updates
	Integrate operational steps and progress goals (regional pride, new markets, fewer chemical residues)
	Introduce accreditation related to professional development and standards
	Mandate property registration and land use identification registers; encourage grower professional development
	Lobby for planning (phytosanitary, infrastructure) consideration of biosecurity – e.g. FSANZ consideration of irradiation as a phytosanitary measure.
Economic and regulatory imperative	Demonstrate economic threat to region from pests and diseases; link with economic incentives e.g. accreditation, free diagnostics for accredited growers etc.
	Identify low-cost investment steps and risk-mitigation practices
	Add value to existing surveillance and activities – economies of effort, scale -more fruit fly traps, recording all results from sticky cards; covering green waste, plastic removal services increased.
	LGAs asked to grow regional pride. Link to visual blight reduction, waste services, export zones, facilities to improve biosecurity, by-law potential support for biosecurity
	Labour agents; re-sellers directing personnel to compulsory training; some responsibility for minimum competency standards; licensing. Springboard from national AgriFood training packages.
	Secure funds from water levies, state emergency levies, fresh produce levies (AusVeg) for targeted biosecurity activities
	Develop state-approved chains of command
Collaboration and communication	High level collaboration started with Minister, state and LGA and industry coalition
	Bring together reps of all stakeholders and form Regional Biosecurity Committee
	Introduce Grower register; property codes/land use register
	Develop and use Community communication strategy – horticulture, media, community, schools
	Make biosecurity awareness unavoidable – use best mechanisms, e.g. paper, radio, signs, penalties
	Ensure CALD focus to engagement efforts, licensing, professional standards deliberations
	Adopt consistent nomenclature for produce and terminology for biosecurity
Impediment category	Potential solutions and steps towards overcoming biosecurity barriers
Leadership	Identify and inform leaders for each stakeholder group
	Form Regional Biosecurity Committee
	Define roles and goals for all participants (See Sections 7 and 8)

[3] Australian Biosecurity Intelligence Network (ABIN) launched its web portal in December 2009 making it an access point for any biosecurity community, to share data and generate intelligence. www.abin.org.au to connect.

National Plant Surveillance Reporting Tool (NPSRT) is a tool that allows state and territory surveillance coordinators across Australia to enter plant pest survey data into a web-enabled database

Biosecurity, Surveillance, Incident Response and Tracing (BioSIRT) is the web-based software developed to manage information and resources in emergency responses. It is funded by all states and the Commonwealth.

Impediment category	Potential solutions and steps towards overcoming biosecurity barriers
Resources	Biosecurity committee formed to include state government (political and practical – R&D etc), LGAs, Vietnamese Growers Association; Cambodian Association, commodity champions, educators, re-sellers and allied industry reps
	Ensure regional Biosecurity Officer; Reference material etc are accessible
	Funding partnerships formed - with clear milestones, timeframes - reflecting needs and benefits
	Ensure technical extension support exists - eg Biosecurity Officer, trained re-sellers etc.
	Provide sponsored signage and biosecurity kits; on-farm manuals; training requirements for professional recognition
	Establish 'biosecurity filters' across region, rather than barriers; regulations to support
	Maximise return on current activity – e.g. surveillance, training, BOM alerts
	Value-add to R&D conducted in the region and beyond

7.9.1 Knowledge and Education steps and solutions

The stakeholders on the NAP need formal introduction to 'biosecurity'. Systems for education, knowledge capture and transfer are needed and the mechanisms to drive their development should be co-ordinated by the Regional Biosecurity Committee. Literature, professional standards, and training requirements need to link biosecurity to the health and safety of food produced in the region, to regional economic viability and sustainability; regional pride (e.g. SA's 'fresh salad bowl' and 'Adelaide's agricultural gateway'), and shared responsibility for it.

Science is the foundation of most food security steps and solutions. Surveillance, testing, diagnostics, policy development, and evaluation require scientific underpinning. Given limited resources and competition for funds, adding biosecurity value to research and development for the region and across stakeholder groups is essential.

7.9.1.1 Biosecurity training and education

There are many resources available already to guide biosecurity awareness and improvement on the NAP. Many are listed in the National Plant Health Status Report, and also in Section 11.

The South Australian government has prepared many documents specifically to advance awareness of biosecurity threats (see Appendix 3). They include information for transport companies, travelling public, farmers, exporters and importers; information on penalties for non-compliance, ICAs and IVCAs; registered chemicals; fact sheets for each pest threat; interpretation and translation services; legislation and standards and a guide to the recent changes in plant health legislation. Peak bodies also have commodity-specific information.

Training requires institutional support (e.g. knowledge extension; accreditation, certification recognition) and accessible networks, a workforce development focus, and specific mentoring where appropriate (e.g. *Training to Grow Your Business* for CALD groups on the NAP).

There is opportunity for the NAP Biosecurity Committee to work with PHA, the state government (e.g. Plant Health Consultative Committee) and training providers to ensure that biosecurity awareness and food safety are incorporated in each programme.

A 'training alliance' could evaluate courses and content. Government and industry partnerships in training priorities, course content and delivery would be beneficial steps toward biosecurity. Chemical use, container and waste management, worker safety, export and import requirements (ICAs and IVCAs), water and irrigation practices etc are common foci of training programs and each has biosecurity relevance.

In 2009, AgriFood Skills Australia established a pilot programme based on whole-of-community approach to the attraction and retention of skilled workforces in regional NSW, at Narrabri. A coalition of regional industries and the NSW government formed successful strategic partnerships to bolster job preparation, improve training packages, and to establish a locally-run management company. Other training package reviews are being undertaken in Agriculture, Horticulture and Conservation and Land Management and should be used as a basis for local training packages.

The education, training and activities associated with IPM and biological control are complementary to initiatives for enhancing biosecurity awareness and the implementation of on-farm and regional biosecurity plans. IPM practitioners and monitors are valuable resources. Their value would be further increased if they were trained to identify key exotic and alert pests, and encouraged to record all pest observations (including absence). There is new opportunity to harmonise existing knowledge on IPM. A national IPM co-ordination team has recently been appointed by HAL. It will have regional foci and the outputs will add great value to the NAP at little additional cost to the NAP stakeholders.

Quality assurance and environmental management systems (EMS) also have components important for biosecurity and their value can be greatly enhanced at little cost, e.g. assessment of the 'safety' and quality of seeds and planting material can be extended to include input safety and quality (chemicals and fertilisers), once standards for them have been established.

Training programmes on pest and disease management, IPM and chemical use have the potential to add to biosecurity on the NAP in several areas: correct usage will minimise potential for residues and resistance build-up; and product choice and timing decisions require knowledge of pest biology (and that of beneficials). IPM strategies used by some growers require crop monitoring, pest population threshold information, and knowledge of the conditions and harbouring sites conducive to parasitoid and natural enemy survival and proliferation. These data are useful additions to regional biosecurity assessments.

The community residents would also benefit from 'casual user' crop protection training. Garden chemical user safety, workplace safety, pest management in schools, chemicals near water courses, the reading of labels, and disposal of containers etc. are important for all residents. The distribution of biosecurity kits (see Fact sheets available for adaptation, in Appendix 7) through courses would be a worthwhile reward for achieving accreditation.

Plant Health Australia (PHA) provides training, with focus on the importance of biosecurity; useful pest specifics, incursion scenarios, and national obligations; on-farm and backyard surveillance and actions; the benefits of early detection and reporting of exotic pests and diseases; other threats, diagnostics and the chain of command for suspect findings.

A review of the role and funding support for the Virginia Horticulture Centre (VHC) is recommended. Such a facility is rare in a horticultural area and its value to the NAP needs to be maximised. It should be the focal point for NAP biosecurity resources, communication and practical activity. The VHC however is under-resourced and mechanisms to secure its future as a key local resource for biosecurity, need to be considered. Services and expertise offered must be aligned with industry needs and have key performance indicators.

Industry must identify its core expectations for grower and community competence (e.g. waste management, chemical use), professional grower standards, preparedness, response capacity and recovery support and ensure that relevant training in each is available. Ensure career paths within horticulture are recognised and in demand and that skills training matches industry and regional needs. The vegetable on-farm biosecurity manual is intended for distribution to all vegetable growers. Regional councils and industries may add specific detail for their region, to this document.

Just as 'safety' has been internalised in business practices (and audits), so too should biosecurity. The NAP Biosecurity Committee may find the CropSafe® model (operating in Victoria in the grains industry), and OrdGuard to be useful programmes, into which specific NAP details could be incorporated, adding biosecurity value to programmes already operating.

CropSafe® is a stream-lined process of observing, sampling, reporting and responding. It is supported by industry, agri-business and Victorian DPI and is dependent on 'informed observers' in the field. There is a network of 100 trained agronomists serving as first detectors and each has received at no charge, specific pest and disease training and diagnostic analyses. A monthly update on disease and pest status is distributed around the network. More information about CropSafe® is available through state grains biosecurity officers, or PHA.

7.9.1.2 Human capacity and capability

It is hoped that that human capacity for biosecurity will be enhanced as the appreciation of threats and legal obligations associated with biosecurity, grow.

There is a case for horticultural/agricultural expertise supported by governments, R&D providers and industry. Increased human capacity on the NAP is needed for daily operations but also for emergency response. Positions like that of NAP Biosecurity Officer, will require greater security of funding (more than 3 years) and resources to equip workforces and industry members with practical biosecurity 'know how'. 'Ethical' labour directives while well-intentioned are a burden and potentially detrimental to reaching long-term, sustainable labour solutions.

Surveillance is a personnel- and time-demanding activity. The surveillance currently undertaken on-farm and by non-government personnel is limited in its extent and rigour by low participation levels, resources and human capabilities. The best solution to this (given the loss of Industry Development Officers [IDOs] and extension staff) is by adding value to existing surveillance, and increasing on-farm surveillance.

Governments are also asked to re-state their commitment to agricultural education in public institutions. It is clear that agricultural education at the tertiary level is wanting and CSIRO and state departments' commitment to maintenance of discipline (diagnostics, pathology, entomology, nematology, epidemiology etc.) and commodity (fruit, vegetable, grapes etc) specialists no longer is assured. Governments have the capacity to compensate through the provision of training for consultants, crop monitors and others who can serve as 'eyes in the field'.

Industry can drive R&D direction (for levy-funded commodities). Since matching funds from the Commonwealth government also support R&D, the government-industry partnership for capacity building already exists and should be built on.

The capabilities of the community stakeholders will be best utilised in surveillance for larger pests, those that cause more obvious symptoms, or have nuisance value – e.g. European wasps, cane toads, ants, snails etc.

Human capabilities for biosecurity rely not only on training and resource availability, but also on practical implementation steps and technology. Technology development is important for surveillance efficiency. New technology for fast diagnostics, mobile phones with satellite and internet mapping (e.g. to log and map trapping and inspection sites for insects), are being developed. Their trialling on the NAP would be valuable. Palm held recorders are being used elsewhere for Plague locust monitoring and could be adapted for use on-farm at little cost.

7.9.1.3 Surveillance – data acquisition and evidence

The more diverse and motivated the stakeholders, the more effective the regional surveillance is likely to be. For a regional approach to biosecurity, emerging and changing threats, terminology, and national requirements must be integrated into standardised surveillance and reporting templates, for on-farm observations, NRM managers and crop monitors, re-sellers etc.

If on-farm passive surveillance and active monitoring were consistently recorded on standardised templates, the results would collectively and significantly advance regional biosecurity, preparedness, and awareness - at little additional cost to individuals. The completeness of record keeping (which serves as 'evidence') throughout the continuum, directly affects the capacity to negotiate market access; the efficiency of threat minimisation and management; the degree of preparedness and efficiency of responses – be they on-farm, at the regional level, or at domestic or international borders.

It is recommended that the NAP add effort and value to existing surveillance initiatives, while also prioritising new surveillance measures that have clear benefits to the participants and the region. A 'Surveillance reference group' would provide useful technical input to the NAP Biosecurity Committee, e.g. defining current surveillance activities, how their value may be expanded, the potential for establishment of "area freedom" (PFA), "areas of low pest prevalence" (ALPP), or "pest-free places of production" (PFPP), how surveys may be implemented, managed and centrally-recorded at little cost to individuals.

There is a significant level of targeted surveillance undertaken formally on the NAP. Most are state government programmes and they are listed in the Vegetable IBP. They are aimed at early detection of exotic pests and alert (e.g. fruit flies, olive mite, olive knot, red imported fire ant) pests. Some surveys are undertaken to confirm eradication e.g. onion smut. Traps that are attractive to Q-fly are also attractive to melon fly and perhaps other non-economic fruit flies so the potential to capture more data from each trap exists.

The fruit fly grid system in South Australia is extensive (3,415 metro sites). Opportunities for horticultural industries on the NAP to add value to this surveillance programme exists, e.g. by increasing the fruit fly trap intensity (and attractiveness to multiple pests) around polyhouses. The tomato, capsicum and cucumber industries may gather sufficient evidence to establish the NAP as a "pest-free area" should incursions affect market access and profitability, for their fresh produce. It has been estimated that the SA Riverland's pest free status (for Mediterranean fruit fly) is worth at least $3-4/box for citrus. The NAP Biosecurity Committee may have reason to ask the state government for a more equitable contribution to regional biosecurity in regions other than the Riverland, so they too may be able to establish pest status recognition.

The requirements or standards (International Standards for Phytosanitary Measures – ISPMs) to establish an area's status are available from DAFF (IPPC link), e.g. ISPM No. 29 (2007) *Recognition of pest free areas and areas of low pest prevalence*; ISPM No. 26 (2006) *Establishment of pest free areas for fruit flies* (Tephritidae); ISPM No. 14 (2002) *The use of integrated measures in a systems approach for pest risk management*; ISPM No. 10 (1999) *Requirements for the establishment of pest free places of production and pest free production sites*; ISPM No. 08 (1998) *Determination of pest status in an area*; ISPM No. 06 (1997) *Guidelines for surveillance*; ISPM No. 04 (1995) *Requirements for the establishment of Pest Free Areas.* A summary of how to establish a pest-free area is included in Appendix 7.

Similar value-adding opportunities exist for the yellow sticky traps and the suction traps in place on the NAP. Should these be adapted (increase trap or card attractiveness) and examined routinely for multiple pests (beyond WFT and Currant lettuce aphid), and combined with BOM data, not only could weather-related flight information be collated, but results could provide information on multiple pests, and early detection for some exotics (e.g. tomato/potato psyllid).

Increased market access, improved crop protection application timing and/or reducing chemical use, would likely occur.

To assist both the development and choice of appropriate surveillance tools and to maximise their value, knowledge of the pest, and local knowledge of the environment, crops, and at-risk sites are needed. Soil sampling for root knot nematode undertaken prior to carrot planting could be equally effective at certain times of the year for early detection of other nematodes of concern, e.g. *M. javanica* survives well in warmer conditions than *M. hapla*. For bacterial pests, areas with overhead irrigation, sandy soil, and/or high winds are likely to be higher risk sites and should be targeted in early detection surveys.

The NAP stakeholders must also maximise their uptake of relevant research undertaken in other regions. NAP can learn from the systems approaches developed (e.g. in Central Burnett region, Qld) for the management of established pests that have multiple hosts and market implications.

The recognition of area wide management (AWM), for light brown apple moth for apples, cherries, stone fruit) and ALPP (for cherries in Young, NSW) has delivered significant market openings to these industries in these regions.

7.9.1.4 Data capture and knowledge management

The value of data repositories will be increased if they are capable of accommodating data from various sources, presented in different ways. Data collected by trained monitors in official programmes, anecdotal data and community programme observations all have biosecurity value.

The inclusion of biosecurity measures into Australian standards, Codes of Practice and Quality Assurance (QA) programs has started and an example is the BioSecure*HACCP* program for the nursery industry. This program would be a useful template for most regions in which nurseries operate and the health status of perennial planting material is considered a biosecurity threat.

The state government has initiated efforts to co-ordinate, standardise and integrate monitoring, and reporting, aligned with the state biosecurity framework, national and international standards. Industry leadership, in partnership with the state, may ensure these efforts result in practical and cost effective data collection and management of biosecurity measures, consistency with regions sharing a similar risk profile, and higher compliance rates.

The collation of recorded data however must be centralised if regional biosecurity is to be functional. State or local governments can assist in this activity, while also protecting privacy. The NAP Biosecurity Officer, can act as a technical filter for diagnostic samples of ‘concern’. Suspect samples can be packed appropriately and submitted to SARDI for free diagnostic service, without grower’s name being revealed.

7.9.2 Economics and Regulatory steps and solutions

It has been clearly stated to us that the NAP will respond to biosecurity initiatives if there is regulatory imperative underpinning them. The value of horticulture on the NAP suggests that both the State and Local governments have justification for consideration of regulatory support in the form of legislation, by-laws or enforcement powers.

The State government contributes at the state borders and post-border, yet at the grass roots level there is little recognition of the state’s significant biosecurity contributions post-border. Growers have reported the removal of government services and extension staff to be a biosecurity impediment and an abrogation of ‘government responsibility’. There is in these comments, evidence that industry is yet to fully acknowledge their post-border responsibilities, and accept that more government funds are unlikely for activities and areas where public good is not demonstrated.

There are also economic imperatives for increased NAP biosecurity but until they are apparent to all stakeholders, broad participation and investment in biosecurity will be harder to secure across the region. As the length of time between an initial entry of a pest and its subsequent reporting and identification increases, the chance of eradication decreases. In simple terms, a current impediment is the low level appreciation that prevention (of most pests) is more cost-effective and reliable, than attempted cure/eradication. To raise biosecurity awareness, funding should be made available for an economic impact study of NAP 'alert' pests and diseases, from other vegetable regions already managing these pests.

Significant value to the NAP (and Regional Biosecurity Committee) will be derived from shared pest interception data (by AQIS and state authorities, road blocks, produce market, incident response committee, NPSRT input; PIRSA records), and exposure of biosecurity-related breaches. These would serve, at little cost, as early warnings and assist in educating and focussing the region and participants on the proximity and pathways of threats. They would also assist with prioritisation of inspection sites, surveillance and resource allocations.

The VHC has reported they received LGA (City of Playford) assistance in purchasing a plastic baler. The used plastic removal service is under-utilised and plastic remains a persistent biosecurity threat on the NAP. The operation of this service needs to be formalised and increased across the region. The potential to re-direct waste (re-cycle, energy recovery, treatment, containment, disposal) into income streams (as per Marion council with green waste), needs to be investigated. LGA contribution of rural waste services would improve hygiene, general biosecurity and sustainability. If regulations dictating waste and crop debris removal in a specified time (post-harvest) cannot be introduced, formal support for coverage of green waste piles needs to be introduced.

LGA economic development groups are encouraged to consider biosecurity in all planning decisions. There are biosecurity ramifications sourced in most land use, zoning, infrastructure and development decisions. The cost-benefits of regional facilities for wash-down (or steam sterilization) of machinery require local consideration because of the value of horticulture to the regional economy.

7.9.2.1 Legislative Support

In some locations and amongst some stakeholder groups, voluntary compliance and 'goodwill biosecurity investment' is unlikely to succeed. There is precedence for local government enforcement of residue removal at the end of a cropping cycle. In some areas of Queensland, tomato crop waste must be removed within two weeks of harvest. If not, a contractor may be brought in to clear the site, with the costs added to the land owner's rates. On the NAP it is the view of many stakeholders that local councils should apply similar 'teeth' to high risk stakeholders and operations, to combat wilful non-compliance or biosecurity complacency.

Enormous state government resources are invested in keeping SA's fruit fly free status. By eradicating occasional peri-urban outbreaks, educating the public, and regulating produce movement, the State contributes greatly to biosecurity awareness. There is potential to increase this by leveraging fruit fly messages to other relevant exotic or alert pests. Public education and communication should include messages about biosecurity and shared responsibility for it.

Industry needs political support and must lobby for it, particularly in the areas of mandated property identification and land use codes; grower registers and competency-based professional development recognition; abandoned sites (also feral trees, roadside vegetation), NAP waste and water management and sharing of interception data. The importer and exporter registers (as under the Plant Health Act 2009) have provided useful information to government and may be a good basis on which to argue government support for registration of all growers. They would greatly assist industry-wide communication, are important for industry preparedness and would underpin immediate actions in the event of an incursion.

7.9.3 Collaboration and Communication steps and solutions

Communication must reach all stakeholders and to achieve this in a cost-effective and reliable manner, resources and mechanisms have to be shared. The NAP needs to investigate the outlets and delivery mechanisms and timetables available to ensure key messages reach target audiences and are unavoidable; messages are consistent and re-enforced often. (See awareness material examples in Appendix 3). The contributions of LGAs to communication should be expanded on the NAP as they have access to all landowners. Their communication databases should be made available for delivery of regional biosecurity alerts, induction manuals, and targeted messages.

Biosecurity communication outlets and avenues include: schools; radio and television; printed literature via NRM and LGA (invoices for rates, emergency services levy), commodity newsletters, service groups like Rotary, road blocks, farmers markets and swap meets, Tourism SA and caravan parks, car hire locations, community events, petrol stations, conveniences, social and sporting clubs, banks etc. Where possible biosecurity alerts need to be delivered as public service announcements, as for fruit fly, downy mildew warning etc. Such announcements must reach ethnic groups also.

For CALD members associated with horticulture, translated DVDs and "how to" videos; translated signage, face-to-face meetings at social gathering spots (church halls, restaurants), and with the Vietnamese Farmers and Khmer-Krom Horticultural Associations, ethnic radio, newspaper and television announcements, articles in Asian Foods newsletters, translated documents (e.g. Plant Health Act 2009, Enviroveg, Freshcare, 'six steps' to biosecurity on–farm), and specific in-person training (e.g. Arris' *Training To Grow Your Business*) are likely to be most successful. Electronic methods, mobile phones, faxed and hard copy mail have not proven useful in some previous emergency situations in other regions (fire, equine influenza eradication campaign). Translation services are available on the NAP and there is opportunity for them to be utilised more broadly with shared funds, especially if they carry a public service message.

Communication efforts must aim to also increase two-way communication on the NAP. Mentoring and trust and inclusion of CALD member representation in mainstream actions/committees, will assist. Closer liaison with supermarket leaders (Coles/Woolworths) regarding biosecurity would provide two-way communication; assure growers that their efforts are continued throughout the value chain and that supermarket demands (e.g. for carton changes, sulphur pad or lid removal etc.) are not introduced or enforced without due consideration of biosecurity.

For the general community, biosecurity information has to be more visual. A calendar campaign that includes pests to watch for according to calendar months has been effective in some areas. Pest sections in gardening notes, the use of familiar radio or television personalities to deliver key messages about threats, and the role and value of community involvement in surveillance, have the potential to raise the profile of biosecurity in the community, e.g. as with Steve Irwin and "Quarantine Matters". Jon Lamb could be engaged to facilitate a strong culture of accountability and biosecurity responsibility within important horticultural regions like the NAP. He could effectively explain regional biosecurity sensitivities, the economics of pest incursions, why residents play an important role in backyard surveillance, and why these sites are often the sites of first detections - disturbed habitats and microclimates created by reticulated watering and a wide range of hosts.

Communication must ensure that all stakeholders are aware of the 'chain of command' if threats or pests of concern are detected. (See next section).

It is the view of most stakeholders, that the collaborative approach to NAP biosecurity has to be driven by industry (and supported by governments). It appears that leading growers (as the Horticulture Coalition of SA [HCSA]) are increasingly prepared to initiate this, form a conduit to

government departments and key political figures (and the Plant Health Consultative Committee).

In terms of collaborative research and development, there is value seen in increasing the interaction of industry with NRM Boards, EPA, Rural Solutions, consultants, and groups that are active in irrigation management, pest and disease monitoring, soil salinity, leaching management and aquifer use, re-vegetation etc. Some food businesses are doing this now. In SA six businesses have committed to implement environmental improvements, in partnership with SA Food Centre, EPA and Innovate SA, and with funding from the "Retooling for Climate Change" grants. 'NAP research forum' would provide further opportunity to share results and funds, review resource allocations, increase collaboration and limit duplication of efforts.

Value needs to be added to the outputs from the NAP weather stations. The Bureau of Meteorology (BOM) and local weather stations provide extensive information on weather events. The circulation of weather event interpretation and warnings is a valuable mechanism in regional biosecurity. On the NAP, some grape growers receive CropWatch and grain growers receive PestFacts (Appendix 8). These electronic alert publications are prepared by SARDI and they regularly interpret weather events and potential (or actual) pest responses. PestFact subscribers are also eligible for free diagnostic services. The biosecurity value of the data underpinning these documents could also be extended to other crops and pests on the NAP. BOM data (from Edinburgh Airforce Base and other weather stations in the vicinity), combined with trapping results (for fruit fly, currant lettuce aphid, WFT etc) could provide important biosecurity information to the nurseries, seed and fresh vegetable producers on the NAP, and indications of resistance management over a wide area. An integrated approach and awareness of the pest threats and practices by nurseries, field and protected vegetable growers for each pest, would result in improved resistance management across the NAP.

7.9.4 Leadership steps and solutions

Industry members have indicated their leadership role. They recognise they must show leadership in raising biosecurity on the NAP. The NAP would greatly benefit from cross-industry biosecurity leadership. It is suggested that the leaders within each of the main commodity groups, local government, and allied business leaders form a NAP Biosecurity Committee. The committee needs to be suitably resourced such that risk mitigation and preparedness, consequences (income, production, market and transport disruption etc; stress); and future funding, can be adequately addressed.

Key steps to be taken are:

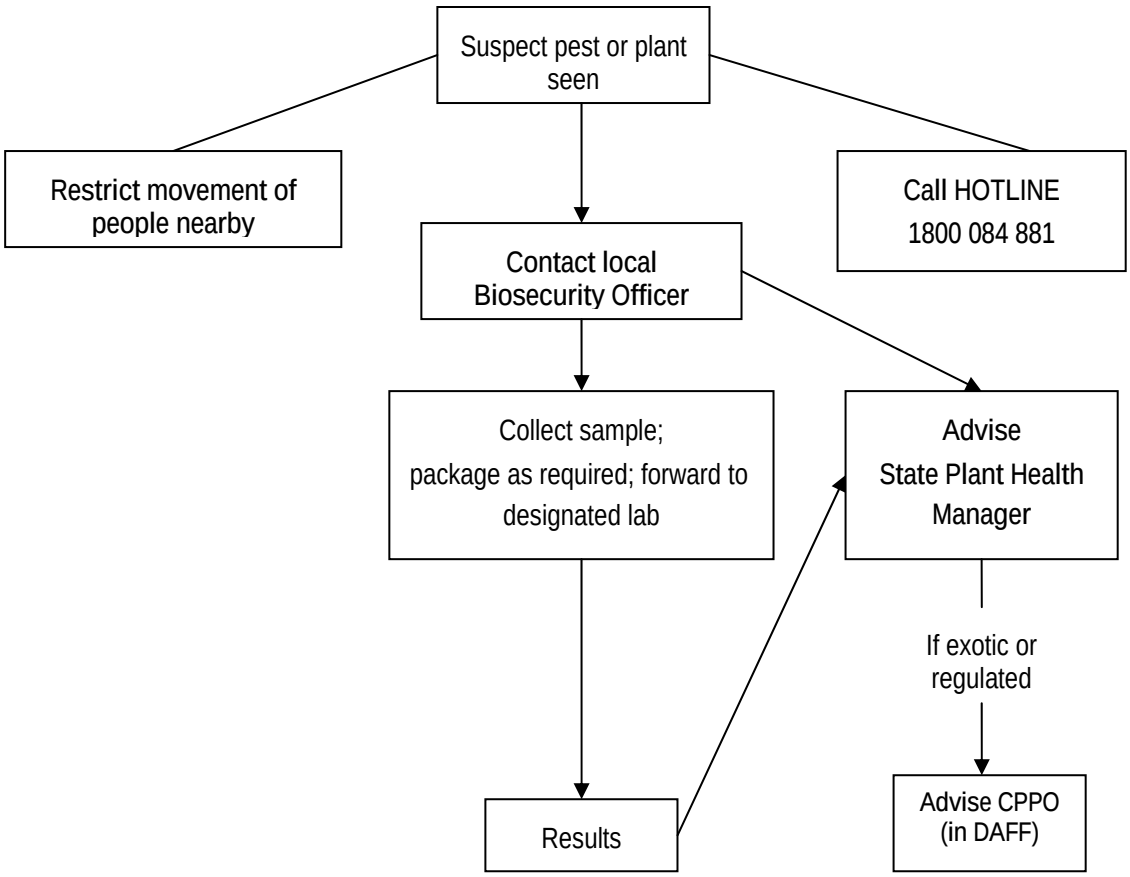
- Meet with key industry, government and LGA members.
- Define role for a NAP Biosecurity Officer. (The funding of a Biosecurity Officer for one year by the State and local governments is recommended, and thereafter by all industries on the NAP).
- Ensure the state Biosecurity Plan encompasses NAP needs and priorities.
- Engage all stakeholders. Identify regional champions (including CALD and community leaders) as spokespeople.
- Engage HAL (AusVeg), local and state government to ensure VHC has in its role, NAP regional biosecurity. Ensure requisite capability and leadership.
- Support initiatives for property identification codes, grower registers, professional standards.

The VHC could be well-placed to play a lead role in the advancement of regional biosecurity on the NAP. This centre has at times had close alignment with the range of horticultural producers

and industries on the NAP; it is centrally located, but requires more secure funding, reporting requirements, and activities aligned with objectives of the region. It is a valuable facility with the potential to fill the void left by state extension officers. A role in leading regional biosecurity while maintaining their activities in training and communication seems to fit within their original charter and an expanded role that re-connects the VHC with on-farm activities would serve the area well.

It is essential for the region to have approved chains of command built into biosecurity activities and measures. Participants in the region must have confidence in each other's ability to address threats responsibly, e.g. how to isolate suspect plantings, report to Biosecurity Officer and State plant health manager, (who will direct sample collections, packaging, sending etc.). The agreed chains require approval at state government levels.

A suggested chain of command for the detection of something unusual on the NAP is:



7.9.5 Resources – steps and solutions

7.9.5.1 Information

The NAP needs ready-access to technical resources and proven delivery systems, including a technically-trained Biosecurity Officer. A comprehensive library at the VHC seems appropriate. NAP stakeholders require lists of available information and specialist services related to biosecurity, how to access them and the authority to distribute information.

The Expertise database prepared and hosted by PHA is a resource useful to those driving the advancement of national and state biosecurity. It is possible to search it by region and by discipline (e.g. plant pathologists, entomologists) and a regional biosecurity committee (and Biosecurity Officer) will need to become familiar with its operation.

In some vegetable production areas where access to experts is physically limited, connection with Remote Microscopy (from CRCNPB and Biosecurity Toolbox) would be valuable. This, and the Virtual Microscopy Laboratory Network (from ABIN) are web-based diagnostic tools that allow experts and non-experts to collaborate and more rapidly identify specimens. The technology requires microscopes connected to web-based digital cameras.

7.9.5.2 Funding

The NAP Biosecurity Committee (and bodies represented on it) will need to justify, and seek commitments for funds from all stakeholders for targeted biosecurity, over the longer term. It will need to prioritise targets but could expect investments equivalent to those provided by industry and governments in the Riverland if 'pest-free status' and market access were identified as high priorities – and had potential for success.

Contributions for NAP biosecurity, from the Emergency Services Levy, appear justified and the mechanism to receive such should be investigated by the region. Its use may best be directed to awareness and response capacity building. There are examples of financial contributions from the Pratt Foundation, Bi$Link National Project, Playford Trust, CRC National Plant Biosecurity; Commonwealth government (e.g. disinfestation data packages through DAFF, EPA), for biosecurity-related activities and research. These need to be explored by industry.

Minister Burke, in March 2010, announced funding for Landcare community-based environmental and sustainable agriculture projects. These should, by definition include biosecurity projects. More than $876,000 has been allocated under the Caring for our Country Community Action Grants program, and in the future it would be prudent for the NAP to actively compete for such funds.

In-kind support is also valuable, e.g. the guidelines developed for disposal of treated timber in the grape industry have been recognised by the local councils in the NAP. The NAP region as a whole has subsequently benefitted from the acceptance of treated posts by the Mallala landfill. Something similar may be developed for other persistent and green waste.

There is potential to receive in-kind contributions via sponsored signage, rebates on purchased and displayed signage, free diagnostics for suspect plant parts (with passage through approved chain of command that includes a technical expert). Some initiatives will have a justified cost. Others may be leveraged in advertising terms, e.g. re-sellers/sponsor name on signage or foot baths; focus group leaders delivering information on company/consultant letterhead, matched voluntary contributions etc.

8 NAP BIOSECURITY – ROLES AND RESPONSIBILITIES

8.1 Roles and Responsibilities

There are several different approaches, levels and locations of regional biosecurity responsibility. Of importance on the NAP, is the coordination of discreet roles into strategies reflective of the diversity in land use (farm and related land use, amenity, natural environment), participant practices and capabilities, and available resources.

The assigned roles and responsibilities should reflect the agreed biosecurity direction and strategies. Region-wide benefits of prevention, detection and preparedness need to be achieved; also, the information capture capacity, improvement evaluation criteria, and on-going support.

The NAP is a post-border location, but it is dependent on the biosecurity achieved at the state borders and national border. Biosecurity roles for NAP stakeholders are suggested below, as part of this framework.

8.1.1 NAP Biosecurity Committee

The NAP Biosecurity Committee will need to evaluate the region's current status, capacity and impediments to biosecurity, in order to define the activities, and determine priorities in the suggested roles and responsibilities.

- Identify and bring together leading stakeholders
- Facilitate the government-industry-community partnership
- Prepare key messages for each stakeholder group; grow 'local knowledge and awareness'
- Prioritise: threats, management alternatives; 'open' pathways, R&D needs, investment needs, leadership, engagement, etc.
- Communicate and engender 'ownership' of programs and initiatives by all stakeholders
- Liaise with state government, local government, and PHA (e.g. on pathway management, diagnostics, surveillance and response planning); encourage legislative or local by-law support
- Confer with State government, DAFF and PHA on international and state alignment of standards and systems
- Prioritise biosecurity action list and investment priorities
- Initiate surveillance in high risk areas
- Determine chain of command for reporting and responding
- Develop incident response plans, containment strategies etc
- Report suspect threats
- Identify and review technical and training support available; competency and technical standards (e.g. suitable courses, staff induction manuals, sponsored signage, biosecurity kits)
- Plan education initiatives; determine necessary annual updates; professional development accreditation levels
- Appoint the NAP Biosecurity Officer with technical and communication skills
- Secure resources and funding support, eg. for regional data packages
- Exert influence on research providers and funders for > 3 year commitment

8.1.2 Stakeholders

Reporting to: the NAP Biosecurity Committee? Biosecurity Officer?

- **Industry/commodity peak bodies**
  - Get the production and value chain stakeholders talking and collaborating; form strategic alliance/s
  - Establish an effective communication network
  - Identify/form functional commodity groups (for each commodity, and linked by production type – e.g. hydro tomatoes)
  - Drive biosecurity internally – with local services and incentives
  - Identify infrastructure needs and potential for shared use and co-investment
  - Set grower professional develop accreditation levels; induction packages for new growers
  - Demonstrate proactive leadership through strategic guidance
  - Engage CALD groups and recognise their communication channels
  - Liaise with NAP Biosecurity Committee re priorities (increased interstate or export trade? cost effective pest control? Quarantine? Stream-lined regulations? Improved on-farm profitability? Regional food security? etc) and capabilities
  - Document expectations for the stakeholder groups
  - Collate key needs and messages
  - Individually and collaboratively prioritise threats
  - Review and prioritise resource needs
  - Consider funding - levy contributions supporting Biosecurity Officer?
  - Identify essential and preferred actions
  - Set timelines and accountability check lists
  - Determine minimum acceptable standards for accreditation, certification, compost, waste disposal etc.
  - Review and distribute commodity pest and disease awareness material; recording and self-audit templates
  - Drive research reviews and R&D priority determinations
  - Build capacity and resilience
  - Ensure chains of command and available resources are clear to everyone
  - Assist farm surveillance focus groups – set progress measures and training targets
  - Value-add to other information services – e.g. BOM, Freschare, PestFacts etc.
  - Maintain an up-to-date grower registry
  - Communicate widely. Lead face-to-face engagement and informing activities; respond to feedback from within group; prepare *Induction Manual for the NAP*
  - Report to NAP Biosecurity Officer and/or NAP Biosecurity Committee

- **Growers/primary producers**
  - Be engaged and guided by industry peak bodies (or acceptable alternatives if these are not sustainable) and NAP Biosecurity Officer
  - Appoint industry leader or champion in each commodity group – as representative in biosecurity discussions. Include industry CALD representative/s also.
  - Co-operate with local peak body to gain efficiencies in biosecurity activities

- Know roles and lines of responsibility, e.g. who to contact if new threats or something unusual are suspected
- Make biosecurity an important component of decision-making (just as 'safety' is)
- Lobby for grower registrations/databases and property identification codes, and other cost-effective initiatives that increase regional biosecurity and preparedness (e.g. response time; traceability; opportunity to contain or eradicate pest should it arrive)
- Lead by example – embrace new biosecurity initiatives and new management tools – e.g. choose high health planting material (and isolate it on arrival), remove volunteers and waste, control vectors and alternative hosts; destroy crop residues; plant native plant barriers that harbour parasitoids, not pests; invest in training etc.
- Do not abandon or leave production sites with active crop residues
- Use warning and biosecurity information signage; footbaths; biosecurity kits etc
- Ensure associated allied industry (fertiliser, seed, transport) etc are aware you expect biosecurity throughout value-chain
- Embrace and invest in available education and skills development in this area; read on-farm Manuals and awareness material; attend recommended training and focus groups
- Inspect crops (and in-coming equipment, plant material) closely and frequently
- Report unusual or suspect pests, diseases, activities
- Use chemicals according to registrations and the law
- Commit and engender 'peer pressure' enthusiasm for biosecurity awareness and on-farm improvement in hygiene, surveillance and recording
- Conduct self-audits; share information and observations
- Provide records of on-farm surveillance to central databases/collators

- **Allied agri-business and labour**
  - Be active in biosecurity and link it to positive regional efforts (eg sponsor signage or biosecurity kits etc)
  - Prioritise preferences for types of awareness material (DVDs, articles, fridge magnets; manuals etc)
  - Inspect all in-coming equipment, plant material
  - Promote the Plant Health Act 2009 through supply and value-chain
  - Identify regional champions and form network
  - Champion, and assist in cross-industry high priority actions, e.g. waste management
  - Sponsor, display and distribute awareness material
  - Supply some biosecurity kit components and other surveillance tools
  - Communicate widely
  - Recognise and embrace CALD members, advisors and leaders
  - Practice good hygiene and biosecurity when visiting properties
  - Determine specific training needs
  - Collaborate with providers for appropriate, cost-effective staff training
  - Add biosecurity to QA and other training if not adequately covered
  - Maintain high level of scientific and technical competence; share knowledge
  - Value-add to licensing – e.g. licensed European wasp removalists trained in surveillance for other pests; beekeepers training in other surveillance
  - Reward staff initiative in biosecurity

- Support practically and financially the regional Biosecurity Officer
- Work closely with growers and industry; and leading community bodies

- **Government authorities**
  - Continue strong border presence and value-add to pest specific surveillance post-border (e.g. minimise entry; optimise detection)
  - Make known the contributions of government (more than compliance) – as evidence of the partnerships
  - Provide case study examples as reminders of need for continuous awareness and improvement
  - Underpin efforts with regulatory powers.
  - Introduce and mandate property identification codes. Ensure trace-back and trace-forward mechanisms are operational.
  - Provide advice to regions on funding prospects
  - Contribute initial financial support for Biosecurity Officer for staged periods leading to industry-funded position within three years
  - Conduct and distribute intelligence, horizon scans for emerging threats, recovery system preparedness and gaps
  - Communicate widely, e.g. share interception data, breaches, pathway change alerts
  - Liaise with NAP Biosecurity Committee on preferred terminology
  - Remain engaged with industry and community – be the top 'enabler' for biosecurity through organisational, institutional and practical leadership
  - Enhance relationship of mutual trust and shared responsibility with regional leaders and industry – consistent services, transparency, personal contact
  - Advise industry and community about on-going surveillance and government biosecurity activities
  - Provide feedback loops and respond to feedback
  - Communicate technical 'know how' to industries, e.g. in systems approaches and strategies that will ultimately meet international obligations; statistically valid sampling
  - Formalise free diagnostics for suspect samples submitted via an informed filter (e.g. Biosecurity Officer); communicate re ABIN
  - Assist with development of protocols for utility operators and workers (who enter multiple properties at times)
  - Mandate biosecurity consideration in regional planning and major infrastructure changes
  - Encourage and assist with innovative trials (that may not attract R&D competitive funds) with potential, broad biosecurity benefits – eg. biodegradable twine for hydroponic producers; resistant varieties; new seed sources; diagnostic tools
  - Contribute funds to ensure diagnostic capacity remains accessible and of the highest level; consider mechanisms to increase other services – epidemiology, taxonomy that are needed to support biosecurity programmes
  - Work on value-adding options: activities, training, awareness material preparation and distribution, shared cost of expanding fruit fly trap intensity
  - Value-add to biosecurity-relevant information available through other departments – e.g. BOM , SARDI, PIRSA, NRM boards, EPA

- Drive forward tighter controls/standards for some risk-promoting activities – e.g. fresh manure use, abandoned sites, off-target effects; investment equity
- Evaluate cost-benefits of 'pest-free' status or 'area of low pest prevalence' for commodities.
- Expand role of NRM boards to include engagement, research and eco-services that enhance biosecurity as a part of environmental health – e.g. native vegetation as it relates to harbouring pests, re-vegetation project.

- **Local government**
  - Help build regional awareness and pride
  - Recognise 'biosecurity' as a lifestyle and livelihood benefit for all land users and residents
  - Make 'responsiveness' and 'attention' given to industry and regional horticulture visible, e.g. support community projects with biosecurity relevance
  - Advocacy, e.g. recognise and promote horticulture (and biosecurity) as economically critical to the region
  - Train new staff in biosecurity awareness, available resources, chains of command
  - Add biosecurity awareness to regional communiqués or notices – e.g. as footnotes or inserts with rates notices; support *Induction Manual for the NAP*
  - Remain independent but support/facilitate cross-regional engagement of all stakeholders, e.g. voluntary codes of practice that incorporate industry standards
  - Value-add, e.g. biosecurity considerations within inspectors/planners roles – greenhouse design, water (run-off, drainage, stormwater), windbreaks, rubbish
  - Expand and drive role for VHC in biosecurity, e.g. promote plastic removal services; consider delivery mechanism and site for green waste
  - Allocate funds annually for building regional biosecurity (consider Voluntary Contribution for matching? e.g. Revegetation by Design)
  - Consider levy for VHC membership with clear terms, service provisions (e.g. training subsidy) and milestones (e.g. document industry standards; prepare voluntary code of practice for the region)
  - Ensure planning decisions involve biosecurity consideration, consultation and feedback, e.g. windbreaks, drainage, stormwater and run-off etc.
  - Integrate biosecurity promoting initiatives/adjustments to on-going council works and programmes – e.g. re waste; weed control and re-vegetation; verge maintenance; removal of feral plants etc.
  - Improve waste removal services and hygiene centres – e.g. wash down facilities
  - Provide regional support via communication network; include biosecurity section in newsletters; provide funding for translation of key messages
  - Ensure range of outlets in region have biosecurity information or signage available – petrol stations, fruit and veg markets; schools; transporters; planning and building operators etc.
  - Find income stream potential through biosecurity initiatives – waste removal and vertical composting; signage sales; irradiation facility; wash-down facilities
  - Actively encourage residents to play their role in monitoring and surveillance of amenity and backyard plantings; consider ban on backyard fruit trees in new developments within 500 m of commercial horticulture

- **General public**
  - Community groups and volunteers: be vocal about regional status and pride
  - Form "Friends of the NAP" (or equivalent, for high risk sites) groups; Neighbourhood Watch etc – each with biosecurity awareness
  - Include biosecurity section and how the community can help - in communiqués (e.g. for farmers' markets, swap meets, major events etc)
  - Look, report – unusual plant appearances or pest populations
  - Schools: teach biosecurity in terms of cost to the community of an incursion; shared responsibility with everyone having important eyes.
  - Convey messages to CALD parents, (esp. via schools and local media)
  - Explain and report effective measures of 'behavioural change' – e.g. no incursions, new markets
  - Recognise 'power of the people' and use it where most beneficial

9 NAP BIOSECURITY – OUTCOMES AND SUCCESS

9.1 Priority outcomes

- Industry and government (State, local) investment in NAP regional biosecurity
- NAP Biosecurity Committee formed, functioning, respected, and active
- NAP leadership in biosecurity recognised – outside the region and within; in government and LGA decisions
- Good governance at all levels; traceability and accountability
- Biosecurity Strategies integrated – across region, across commodities
- Priority target, key message and high priority activity lists agreed
- Biosecurity awareness and communication across region and stakeholders
- Roles and responsibilities of stakeholders allocated, accepted, understood, implemented
- Increased on-farm surveillance and self-audits; improved regional capabilities
- Increased confidence to report, comply
- Improved cost-effective pest management
- No incursions; increased regional biosecurity
- Effective collaboration with national programs e.g. Fruit Fly, ABIN, BioSIRT
- Funded R&D (from vegetable levy) reflecting knowledge gaps, and regional biosecurity priorities

9.2 Progress and success parameters

It is likely each stakeholder group will have different internal success parameters at different times during the development and implementation phases of regional biosecurity advancement. Ultimately a successful regional biosecurity plan will have considered the priorities of each stakeholder group, the necessary and available resources, and undertaken where possible value-adding activities to achieve the outcomes that provide greatest benefit to the region and committed stakeholders. Some success parameters for each group are identified below.

9.2.1 NAP Biosecurity Committee

- Practical and financial investment in biosecurity on the NAP, by all stakeholders
- Biosecurity extension services provided
- No incursions
- Responsibility and assigned roles activated
- Biosecurity (and capacity) improved on-farm and across region
- Communication networks extensive and functional
- Trusted by represented groups
- LGA assistance forth-coming, e.g. in by-laws (or other) if needed
- Recognition as an effective, proactive horticultural region with biosecurity commitment
- Pest status establishment preparation (Area wide management; area of low pest prevalence; pest-free area) if appropriate

9.2.2 NAP Stakeholders

- **Industry/commodity peak bodies**
  - Increased membership engagement
  - CALD participation and two-way communication
  - Industry funds committed to biosecurity
  - Pro-active uptake of training
  - Surveillance designs and actions integrated
  - Increased capacity and capability - biosecurity 'know how'
  - Cross industry communication and collaboration increased
  - No incursions
  - On-farm Manuals distributed
  - Preparedness and response planning commenced
  - Pest-free status or area of low pest prevalence achieved

- **Growers/primary producers**
  - Biosecurity extension services (or Biosecurity Officer) on NAP
  - Monitoring and surveillance confidence
  - Confidence for reporting and chain of command for anything unusual
  - Sustained engagement
  - Reputation improvements – quality, sustainable production and leadership I biosecurity
  - New markets or re-gained markets reflecting pest status

- **Allied agri-business and labour**
  - Increased biosecurity skills, technology and technical competence in biosecurity services
  - CALD groups engaged (re-sellers important)
  - No incursions
  - Service providers include biosecurity in training
  - Biosecurity focussed research and value-adding initiatives

- **Government authorities**
  - Well-informed stakeholders (includes community members)
  - Expanded surveillance capacity and monitored areas on the NAP
  - Increased diagnostic capacity and surveillance technology
  - No incursions
  - Decreased reliance on government to support biosecurity
  - Regional trust, communication and collaboration (and feedback)
  - Increased local biosecurity initiatives (supported by legislation only where necessary, e.g. fines for breaches, PFAs once established; property codes)
- **Local government**
  - 'Community services' include biosecurity investment and action
  - Stakeholder liaison increased and valued

- Assistance only where necessary and in whole of region's benefit
- Regional pride and protection increased
- New facilities (and personnel) supporting regional biosecurity
- Awareness material (not all printed) made readily available
- Cost-effective shared use of communication network and biosecurity tools

- **General public**
  - Regional biosecurity champion (from the community) recognised and active
  - Public understand the potential impact of incursions; why investment of time is justified
  - Confidence in NAP stakeholders to lead biosecurity efforts
  - Community represented on NAP Biosecurity Committee
  - Changed behaviour in-line with biosecurity objectives

10 NAP STAKEHOLDERS - FRAMEWORK MAPS

With the acquired knowledge of the region, the stakeholders, the existing and emerging threats, the activities and drivers for engagement and participation, it has been possible to prepare in part, stakeholder influence 'maps' for NAP stakeholders.

Map comparisons allow the common threats, drivers and actions to be identified. From them, the NAP Biosecurity Committee could identify the common influences (threats, impediments, pathways etc.) and awareness material needed; and the activities that are likely to deliver the best value for effort in reaching desired outcomes.

Table 20 : Authorities – LGAs, State government

Engagement strategies	Engagement drivers	Key actions-engagement
Obligation to all residents	Regional economics	Resources available
Beneficiary and stakeholder, leadership expectations	Income stream potential (waste); shared commitment	Political support for biosecurity
Regional status in comparison with others	Regional reputation – social and economic vitality linked with hort	High level meeting -form Biosecurity Committee
Regional improvement obligations	Visible link to community – public good role	Assurance burden will be shared with industry
Legislation/regulatory power	Equitable use of ES levy, rates	Advocacy
Political power		
Key messages	Awareness material	Training
What the threats are – key enablers of action	Beneficiaries; stakeholder groups; survey	Streamlining services
Regional assistance and industry input linked	Threat lists and potential impact	NRM , planning, events, economics and biosecurity
Everyone benefits – everyone 'in'	Biosecurity gaps - current regulations, industry standards	Threat pathways , public good
NRM has a role; planners to embed biosecurity in decisions	Other stakeholders - support, capacity , capability, resources	People power - management and biosecurity
Key collaborators	Key actions	Key roles/responsibilities
LGA, State and Commonwealth - departments	Shared funding of Biosecurity Officer; review VHC charter	Coordination
Biosecurity Committee	Planning guidelines to include biosecurity consideration	Awareness distribution
Politicians	Value-add to existing activity – surveillance, reporting, communication networks	Diagnostic services
	Review VHC, use of levy funds	Database management
	Provide support and resources	Embed biosecurity into planning
Barriers/limiting factors	Potential solutions	Success parameters
Time, resources poor	Share resources; activity	Cooperation - regional
Communication network limited	Add biosecurity value to rural activities (NRM, surveillance,)	No incursions Risk reduction
At border priority; NAP not priority region	High level engagement in Biosecurity Committee	United community
Expertise shortages	Increase NRM, VHC roles	Shared burden, responsibility
Staff turnover	Free diagnostics	Regional status upgrade – ALPP, PFPP, PFA
Audience complexity	Explain to LGAs the economics of an incursion	Changed behaviour/capacity
Biosecurity not seen in economic development terms	Improve facilities and services – wash-down, waste etc.	Community ownership of regional plan
		Community ownership

Table 21 : Allied Labour – labour groups, agencies, contractors

Engagement strategies	Engagement drivers	Key actions -engagement
Face-to-face; workshops	Component of job description	Liability reduced with engagement
Employment contracts	Job security; profits in business	Training; Biosecurity Officer
Peer pressure	Regulations	Employment – assured, on-going
Regulations	Incentives	Performance criteria; Induction packages
Key message	**Awareness material**	**Training**
Hygiene	Printed; posters	Hygiene; minimum standards set
Threat traceability	Linked to accreditation	General pest identification
Obligation to look and report		Where/how to look
People are pathways		Reporting
Key collaborators	**Key actions- participation**	**Key roles/responsibilities**
Biosecurity Officer; training providers; agency leaders	Compliance training	Good practice on-farm
Funding providers – field boss	Regulations	Reporting poor practices
Commodity peak bodies	Surveillance packages	Documenting on-farm activity
State and local govt	Spot checks on performance	
Barriers/Limiting factors	**Potential solutions**	**Success parameters**
No direct incentives	Job descriptions include biosecurity	Risk reduction
Training not linked to job promotion or security	Provide performance and training links to rewards	Increased skills and awareness
Training programmes expensive, not targeted	Agencies testing knowledge base, skills of labourers; add value to current tests	Communication within and across industries increased
'Bosses' not asking for such skills	Reward biosecurity improvements	Compliance improvements

Table 22 : Primary Producers

Engagement strategies	Engagement drivers	Key actions -engagement
Face-to-face, field days, workshops; Regional Biosecurity Officer	Know how; Previous experience with pest, lost markets;	Biosecurity Officer; local chapter of commodity peak body
Regulations	Regulations	Economics of production
Economics – accreditation benefits, cost of production benefits, few losses etc.	Peers - everyone contributing; reputation; IPM adoption	Market access; demonstrations
	Economics; Markets - Coles/Woolworths	Regulations – waste services
Key messages	**Awareness material priority**	**Training priorities**
Surveillance = evidence; Food safety	Simple, clear signs; BOM + pest facts data etc	Surveillance targets; what to look for, how, when
Look often; know what is normal	Technology training; Biosecurity kits; IPM; chain of command	Self-audits and reporting
Reporting has Regional and individual benefits	DVDs; manuals; posters	General hygiene skills
Investment of time and energy , rather than dollars	Outlets –schools, re-sellers, Newspapers, journal articles	Chemicals, waste management
Key collaborators	**Key actions - participation**	**Key roles/responsibilities**
Local and state government	NAP Biosecurity Committee; Local focus groups ; grower reigsters	On-farm surveillance
Peak industry bodies	Local Biosecurity Officer; Training and accreditation	Signs, footbaths etc; restricted people movement - hygiene
Neighbours, NRM	Scenario of incursion on NAP - cost and disruption demonstrated	Reporting; records to be kept
Biosecurity Officer	New technology	R&D priorities identified
Barriers/Limiting factors	**Potential Solutions**	**Success parameters**
Fear of cost – money and time	Grower and property registers	No incursions; new markets
Lack of support, resources, expertise; competition for funds	Regulations; free diagnostics	Self-audit uptake
No regional pride or rewards for effort; rarely attend meetings	LGA and state resources	Change practices reduced risk, e.g. waste, hygiene
Control alternatives are few	Biosecurity Committee and focus groups	Regional collaboration
No register or active local industry groups	Targeted R&D; add value to activities	More surveillance

Table 23 : Allied Industry – value or production chain member

Engagement strategies	Engagement drivers	Key actions - engagement
Communication	Profit; funding	Evidence opens markets; profits
Regulations	Market reputation; leadership	Food quality reputation
Scenario simulation	Facility upgrades and funding	Support from authorities
Partnerships	Experiences of quarantine; other incursions or food safety issues	Shared costs, responsibility, liability
	Regulations	Prospect of repeat business
Key messages	**Awareness material**	**Training**
Threat pathways throughout chain	Technical targets	Hygiene; cleaning
Incursions, food safety breaches cost millions	Main threats –posters, DVDs	Record keeping – temp, time, handlers, equipment history
Every part of chain involved	Pathway descriptions	Critical control points
Hygiene and records	Interception and breach examples and penalties	Industry standards in Codes of Practice
Key collaborators	**Key actions - participation**	**Key roles/responsibilities**
Industry commodity groups	Technology	Training
LGAs and state govt	Biosecurity embedded in QA	Manifests, reporting templates
Cross commodity – Biosecurity Committee?	Facilities upgrade	Resource sharing
Staff	Value add to existing actions	Record keeping
		Communication
Barriers/Limiting factors	**Potential solutions**	**Success parameters**
Lack of knowledge of role in pathway	Target actions and capacity gaps	Pathway decreased/closed
Lack of funds/organisation	More 'know how' training	Increased compliance
Lack of collaboration with cross industry groups; staff turnover	Regulations	Records increased
Lack of extension resources	Local support increased	Increased reputation, quality
Paperwork onerous	Appropriate penalties	

Table 24 : Other people – Community members; travellers

Engagement strategies	Engagement drivers	Key actions - engagement
Link with regional viability	Sense of community, duty	Trust, respect
Champion	Environment , lifestyle well-being	Shared benefit 'green'
TV/radio - public service	Peer pressure	Sense of responsibility
	Understanding the impact of an incursion	'Know-how'
Key messages	**Awareness material**	**Training**
Valued 'eyes'; regional pride	Posters, school projects	Pests/diseases we don't want
Look for …?.., …?.	Local champion	"Critical spots"
Chain of command – step 1	Outlets – every where	Event planning and threats
Everyone affected – everyone responsible	LGA notices	Specific roles for certain groups
Key collaborators	**Key actions - participation**	**Key roles/responsibilities**
LGA	Awareness material	Awareness talks to service, planning groups
Event, tourist, public place organisers and users	Organised groups with roles	Distribution of printed matter
State government	Casual observers help	LGA share communication and public message networks
Barriers/Limiting factors	**Potential solutions**	**Success parameters**
Human nature "not my job"	Public service messages	Early detections, no incursions
Cost – time and effort	School children; young ambassadors	Regional pride
No obvious enabler; champion	Link region well-being to horticulture	Community collaboration
No clear benefits for region		Communication reaching all stakeholders

11 IMPLEMENTATION SUPPORT

The region requires implementation support from all stakeholders. To get started, there must be a shared vision and broad commitment to it.

There must also be a link to PHA and the Vegetable Industry Biosecurity Plan. The development of a regional operational plan (and review of the IBP) requires the Regional Biosecurity Committee and PHA to work in partnership.

11.1 First 10 steps towards NAP regional biosecurity

1. Industry-driven meeting – with key stakeholder reps and political leaders
2. Prepare information on 'general biosecurity' to inform wider community (of stakeholders)
3. Form strategic alliances within each stakeholder group and between stakeholders.
4. Form the NAP Regional Biosecurity Committee.
5. Establish leadership and chain of command. Develop job description for NAP Biosecurity Officer.
6. Consultation: Stakeholder knowledge: current status and direction, threats, impediments, pathways, engagement priorities etc.
7. Collaborate: Establish the shared priorities, gaps, pathways etc amongst stakeholder groups and high priority steps towards biosecurity
8. Establish communication networks.
9. Consolidate: resources – funding, training, 'political' support
10. Invest: in competence building (action "know-how"), prepare NAP induction Manual; 'support activity' through free data packages, biosecurity kits, training and 'incursion scenario' demonstrations

12 KEY RESOURCES

12.1 Biosecurity authorities / leaders

Australian Horticulture industry news & events, funding opportunities, membership (HAL) http://www.horticulture.com.au

Australian Pesticides and Veterinary Medicines Authority (APVMA) – registrations and maximum residue limits

Bureau of Meteorology (BOM) http://www.bom.gov.au (for **w**eather and climate services, water information etc.)

Bureau Rural Sciences (BRS) Community engagement: anna.carr@brs.gov.au

CRC National Plant Biosecurity

DAFF resources: Biosecurity Engagement Practitioner Network (BEPN)

DAFF resources: *On-farm service providers*; *Biosecurity and workers on your farm*; *Biosecurity for travelling farm workers*

DAFF resources: *Australia's pest and disease Outbreak* website; *Report a new weed, plant pest or disease* DAFF resources: www.farmbiosecurity.com.au

DAFF resources: Biosecurity Services Group and Resources, eg. www.daff.gov.au/biosecurity; *Biosecurity in your State or territory*; *AusBIOSEC – Australia's biosecurity framework*

Domestic Quarantine and Market Access Working Group (DQMAWG) and www.domesticquarantine.org.au (for ICA information)

Exotic Plant Pest Hotline: 1-800-084-881

HAL – Program managers and research committees (IACs)

Mellor, R. (Presentation) A government perspective on risk and return (Biosecurity Services Group)

National Fruit Fly Strategy

National Residue Survey (NRS)

National Surveillance Strategy

National Plant Health Status Report (2010)

Office of Chemical Safety and Environmental Health (OCSEH)

Office of Horticultural Market Access

PaDil –photographic pest library

Pest/industry specific Response Plans – eg. Fruit Fly codes of practice, Phylloxera National Management Protocols; Guidelines for Removing fruit blocks

PIRSA websites: including www.pir.sa.gov.au/ica, www.pir.sa.gov.au/sqs, and http://www.pir.sa.gov.au/plantquarantinestandard

Plant Health Act SA 2009 (and other Acts – phylloxera, citrus, natural resource management)

Plant Health Australia - EPPRD, PLANTPLAN, Industry Biosecurity Plans, *"Are you a risk?"*, signage, *Biosecurity Induction Manual* (eg Bundaberg horticultural farms); hotlines, posters, manuals

SA Biosecurity Strategy (draft - 2009-2014)

SA Food Strategy 2010-2015

SARDI entomology unit – PestFacts (and free diagnostics for subscribers)

SARDI Crop Pathology Unit (free diagnostics for subscribers)

State NRM Plan; NRM Biosecurity Unit

Strategic Plan SA vegetable Industry (2004-2010)

Training providers and courses – skills and training options; national provider organisations.[4]

12.2 Primary Producers

Accreditation and Training - Fertcare, ChemCert (see list above),

Biosecure*HACCP* for nurseries; National Plant Labelling Guidelines

Burfield, T. *Preventing Pests and Pathogens Farm Management Review*

CALD members - Cambodian & Khmer-Krom Horticultural Association SA Inc. (CaKKHA) – newsletters, translations, training and events

DAFF resources: *On-farm service providers*; *Biosecurity and workers on your farm*; *Biosecurity for travelling farm workers*

DAFF resources: *Australia's pest and disease Outbreak* website; *Report a new weed, plant pest or disease*

DAFF resources: www.farmbiosecurity.com.au

DAFF resources: Funding (DAFF- FarmReady) http://www.farmready.gov.au

DAFF resources: tranlations (see Vietnamese listing below)

DQMAWG and www.domesticquarantine.org.au (for ICA information)

Industry (commodity) Biosecurity Plans (PHA)

PHA - On-farm Biosecurity Manuals (almonds, vegetables, grains, citrus, grapes etc); Induction Manual; brochures (e.g. *Are you a risk*?)

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[4]**Avcare** is the largest national organisation representing the ag/vet chemical industry. It includes manufacturers, formulators, distributors etc. Get info at: **www.avcare.org.au**

Agsafe is an independent subsidiary of **Avcare**. Role is to help industry to safely store, handle, transport chemicals through accredited training and safety programmes. Also provides national training and accreditation to those selling or offering advice on ag/vet chemicals. AgSafe also manages ***drum*MUSTER,** a national programme for collecting and recycling empty, cleaned, non-refundable chemical containers. **www.drummuster.com.au**

ChemClear® is a new industry-funded program which aims to provide all chemical users with a safe and easy collection and disposal service. **www.chemclear.com.au**

ChemCert is a national industry training and accreditation programme for chemical users – recognising state regulations and industry QA requirements.. **www.Chemcert.org.au**

The APVMA runs **Adverse Experience Reporting Program** to report unintended or unexpected effects of ag/vet chemicals on animals, plants, people, environments. **Office of Chemical Safety** (Dept Health and Ageing) advises on toxicological issues and worker safety.

Material Safety Data Sheets (MSDS) on chemicals refer to www.pestgenie.com.au

Prepared packages: Agrifoods Skills Council **http://www.agrifoodskills.net.au;** Green-Life Careers; Crop protection resources (eg Stoller, Novartis, Bayer etc); Skills On-line Training Products; Horticultural Consultancy and Communications (Arris)**;** Australian Workforce Development Solutions; Cooperative Venture for Capacity Building Program; FreshCare - Food Safety and Environmental training; National Training and Information Services; New Apprenticeships Training Information Service; Australian Qualifications Framework; National Centre for Vocational Education Research; Australian Training Products Limited; Australian Flexible Learning Framework; EdNA online: Education Network Australia; VETinfoNet: Vocational Education and Training

SARDI diagnostics – Plant and Soil Health; training support

SARDI diagnostics – Pest - http://www.sardi.sa.gov.au/staff_profiles/pests__and__diseases/entomology

Self-assessments and audits: e.g. *Checklist for Assessing and mitigating run-off in greenhouses and Nurseries* (Newman, J. *et al.* UC cooperative extension Ventura County)

South Australian Horticultural industry (Hortex Alliance) www.hortexalliance.com.au

Training providers and material (see foot note 4)

VHC Services and Strategic Plan

Vietnamese and Cambodian translations - fact sheets, climate change, Plant pest and disease: http://www.daff.gov.au (also see CaKKHA above)

12.3 Community and Travellers

DAFF resources: Biosecurity and Farmers markets

DAFF resources: Biosecurity videos

DAFF resources: *On-farm service providers*; *Biosecurity and workers on your farm*; *Biosecurity for travelling farm workers*

PIRSA resources

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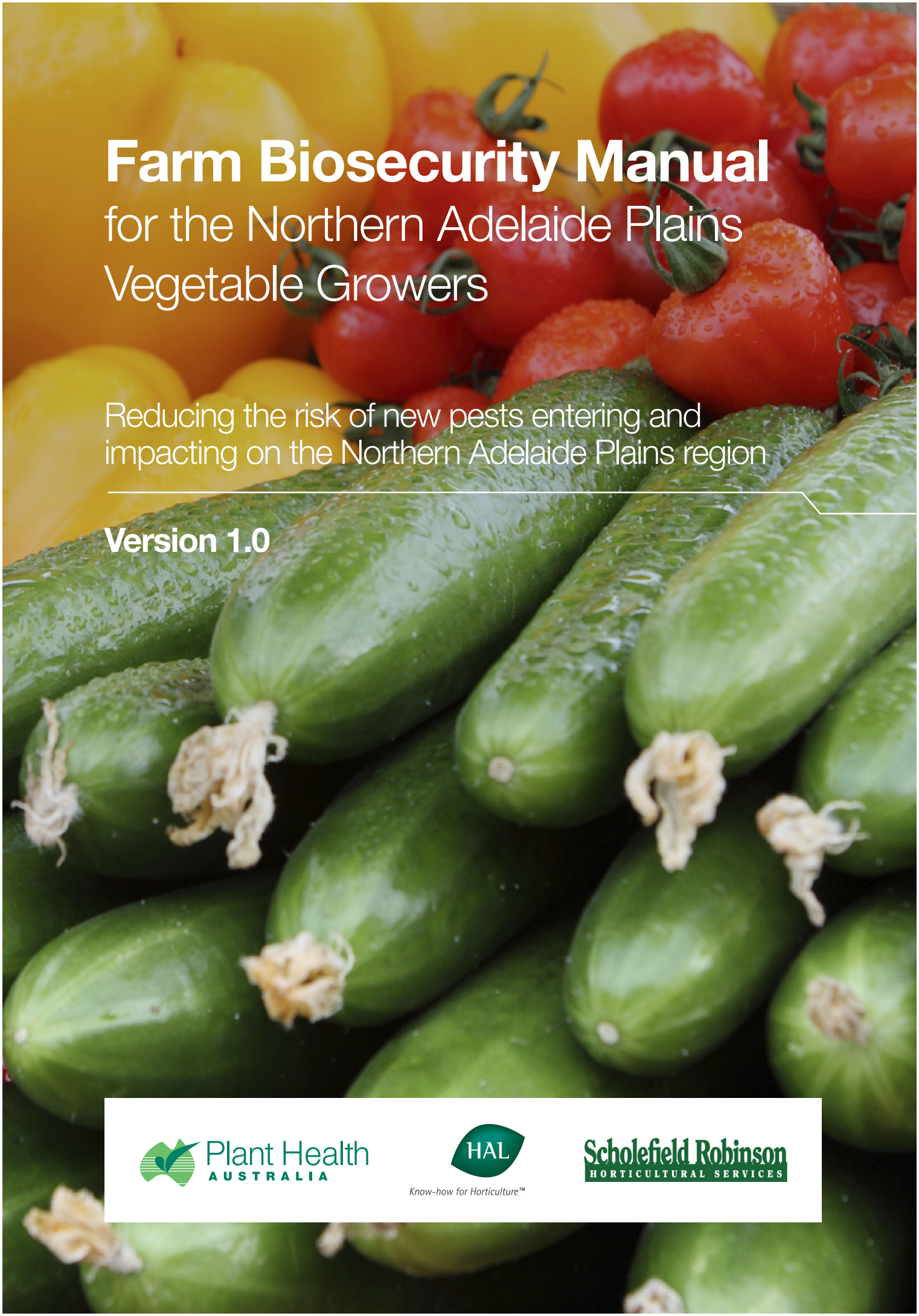
Appendix 1

On Farm Manual



Farm Biosecurity Manual

for the Northern Adelaide Plains Vegetable Growers

Reducing the risk of new pests entering and impacting on the Northern Adelaide Plains region

Version 1.0

Plant Health AUSTRALIA

HAL
Know-how for Horticulture™

Scholefield Robinson
HORTICULTURAL SERVICES

Plant Health Australia (PHA) is the lead national coordinating body for plant health in Australia. PHA works in partnership with industry, governments, researchers and others, providing national coordination to improve biosecurity policy and practice across Australia's plant industries and to build capacity to respond to plant pest emergencies.
www.planthealthaustralia.com.au

The development of this booklet was funded by Horticulture Australia Limited and the Department of Agriculture, Fisheries and Forestry as part of the Engaging in Biosecurity initiative to increase the horticulture sector's capacity to reduce the impact of exotic plant pests.

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An electronic copy of this manual is available from the website listed above.

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Table of contents

Six easy ways to protect your farm

You have an important role to play in protecting your farm and the entire vegetable industry from biosecurity threats.

Here are six simple things you can do to reduce the threat of new pests entering and establishing on your farm. Don't put your livelihood at risk by neglecting farm biosecurity.

1. Be aware of biosecurity threats

Make sure you, your farm workers and contractors are familiar with the most important vegetable pest threats. Conduct a biosecurity induction session on your farm to explain hygiene practices for workers, equipment and vehicles.

2. Use quality, pest-free propagation material from known sources

Ensure all propagation material (seed, transplants, tubers, corms, bulbs, rhizomes, etc.) and farm inputs are fully tested and pest free. Keep records (batch numbers, source) and retain a sample of your farm inputs.

3. Keep it clean

Practicing good sanitation and hygiene will help prevent the entry and movement of pests onto your property. Workers, visitors, vehicles and equipment can spread pests, so make sure they are decontaminated before they enter and leave your farm.

4. Check your crop

Monitor your crops frequently. Knowing the usual crop appearance will help you recognise new or unusual pests or plant symptoms. Keep written and photographic records of all unusual observations. Constant vigilance is vital for early detection of any exotic plant pest threat.

5. Abide by the law

Support and be aware of laws and regulations established to protect the vegetable industry and your horticultural region.

6. Report anything unusual

If you suspect a new pest – **report it immediately.**

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881

Biosecurity overview

This manual is designed to assist you in protecting your vegetable farm and the vegetable industry from new and invasive pests. By implementing the recommended measures in your day-to-day operations, you will enhance your biosecurity and that of your region, while minimising productivity losses and unnecessary costs.

What is biosecurity?

Biosecurity is a set of measures that can be put in place at the national, regional or farm level to protect against the introduction and spread of new pests, and to effectively deal with them should they arrive.

Australia is currently free from many of the pests that are affecting plant production overseas. Maintaining freedom from these pests through effective biosecurity measures is essential for the future profitability of Australian horticulture. In addition, 'area freedom' from a number of localised, endemic pests, is vital to the prosperity of the vegetable industries.

Early detection and immediate reporting increases the chance of an effective eradication of a new pest.

Farm biosecurity is a set of management practices and activities that are carried out on-farm to protect a property from the entry and spread of pests. Farm biosecurity is essential for protecting livelihoods and it is the responsibility of every person working or visiting the farm.

The farm biosecurity measures in this manual will protect properties from pests exotic to the region and minimise the impact of those already established. Farm biosecurity should be supported throughout the region and the activities outlined here are applicable to all properties that you visit.

Hive biosecurity is also important to some vegetable production regions. Be on the lookout for any unusual bee behaviour or the presence of new bees, as these can negatively impact on vegetable production in the long term. More information is provided on page XX.

The definition of a **pest** used in this manual covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that are injurious to plants or plant products. **Exotic pests** are those not currently present in Australia. **Endemic** (or established) **pests** are those present within Australia.

Regional biosecurity

Biosecurity implementation at the regional level supports the measures implemented on your property. Consider starting or contributing to biosecurity meetings in your region, to coordinate and promote regional biosecurity, which will reduce the threats to all properties.

At a regional level, potential biosecurity threats may originate from neighbouring farms (operating or abandoned), nurseries, other commercial plantings, native vegetation or amenity plantings. Movement of vegetable products within the region, such as when travelling to markets or swap meets, also increases biosecurity risks.

Reducing risks at the regional level can be achieved through activities such as raising awareness of key threats to the area, identifying and documenting the locations of vegetable production, providing guidance on the appropriate protocols to follow when moving produce within the region and engaging the local

council. Councils are not only integral to facilitating biosecurity planning, but they also have roles in the management of some risk areas (such as roadside weeds and plantings, water courses and regional events).

Within a region, every agricultural business will be financially affected in the event of an incursion and the response to it. The impact might be in lost production, restrictions on market access, compliance costs, quarantined produce or forced crop destruction.

Implementation of farm biosecurity underpins regional biosecurity, which in turn underpins national biosecurity. Promotion of biosecurity at the regional level is enhanced through broad engagement of the community, understanding the region, the source and nature of threats, and having knowledge of the expertise and resources available to the region. This is supported by a commitment from everyone to implement biosecurity measures, carry out surveillance and report suspect pests.

If farm measures are supported by community-based measures, a regional framework for biosecurity can be coordinated, and is achievable.

Pests

High priority exotic pests

Exotic pests are not currently present in Australia. However, the pests listed here have the potential to enter and become established in vegetable production regions. In addition, each of these pests would have a high economic impact on vegetable production if they were to become established. Implementation of biosecurity measures is required to minimise the risk of this occurring.

For a complete list of exotic pests that could impact on the vegetable industry refer to Vegetable Industry Biosecurity Plan, available from **www.phau.com.au/biosecurity/vegetables**.

Carrot rust fly	
• Fly – *Psila rosae* • Found in Europe, Canada, USA, New Zealand • Attacks carrots, parsnips, celery and parsley • Adult fly (6-8 mm in length) has a black body, red head and yellow wings • Damage caused by larvae, which are up to 1 cm in length and have a white-yellow cylindrical body without a distinctive head • Plant symptoms include irregular brown channels under the root surface, root deformation, leaf discolouration, reduction in plant growth and occasionally plant death • Larvae spread in soil and infested produce	EPPO (R. Collier, Warick HRI) 
Exotic leafminers	
• Flies – *Liriomyza* spp., including the American serpentine, Tomato, Pea and Vegetable leafminers • Found in most vegetable producing countries worldwide • Attack a wide range of vegetable crops • Leafminers are small flies whose larvae feed internally on plants • Feeding punctures can be seen as white speckles on leaves • Mining scars, which can be easily seen on leaves or stems, range from straight to serpentine, depending on the species • Larvae can be spread in infested plant material	Merle Shepard, Gerald R.Carner, and P.A.C Ooi, Bugwood.org 

Bacterial ring rot	
• Bacteria – *Clavibacter michiganensis* subsp. *sepedonicus* • Found throughout Europe, Asia and North America • Infects tomato, eggplant and potato • Lower leaves show the first symptoms of wilting and discolouration of interveinal regions, and these progress up the stem • Primary potato tuber symptom is a discolouration of vascular tissue, visible as a yellow to brown ring when cut, which will ooze a creamy material • Freshly cut stems of infected plants also exude a white ooze • Spread with infected plant material	Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org 
Colorado potato beetle	
• Beetle – *Leptinotarsa decemlineata* • Found throughout Europe, Asia and Central and North America • Attacks eggplant, capsicums, tomatoes and potato • Adult beetles are about 1 cm in length and larvae are bright red with a black head when young, changing to an orange colour before pupation • Both adults and larvae feed on leaves and stems, leaving sticky black excrement • Leaf defoliation is the most obvious symptom • Adults can fly up to 160 km but can also be spread with plant material or on farm machinery	David Cappaert, Michigan State University, Bugwood.org 

Remain observant for anything unusual on your farm. If a pest is found that is not normally present on your farm, it may be new not only to your farm, but to the region, state or even Australia.

EXOTIC PLANT PEST HOTLINE
1800 084 881

Priority alert pests for the Northern Adelaide Plains

Alert pests are those present in Australia, but have not yet become established on the Northern Adelaide Plains (NAP). If any of these pests are detected in the region, they should be reported immediately to ensure vegetable production in the area is not negatively affected by their establishment.

Queensland fruit fly and Mediterranean fruit fly	
• Fly – *Bactrocera tyroni* (Queensland fruit fly; Qfly) and *Ceratitis capitata* (Mediterranean fruit fly; Med-fly) • Qfly is found in Eastern Australia and Med-fly is found in Western Australia • Maggots found in fresh fruit and vegetables may be that of Qfly or Med-fly • Qfly (top image) is wasp like, red-brown with yellow marks and is about 8 mm long • Med-fly (bottom image) is 3-5 mm long, light brown with mottled wings that have distinct brown bands extending to the wing tips • After laying eggs in the fruit, some necrosis may be visible around the puncture mark. This may be followed by decomposition of the fruit	G. T. O'Loughlin, Department of Agriculture, Bugwood.org  Florida Department of Agriculture and Consumer Services, Bugwood.org 
Melon thrips	
• Thrips – *Thrips palmi* • Attacks a wide range of vegetable species • Adults (about 1 mm in length) are pale yellow but with numerous dark hairs on the body • Infested leaves become white or brown, then crinkle and die • Leaves and terminal shoots become stunted • Fruit may also show scars and deformities • Heavily infested fields can display a bronze colour • Can act as a vector for viruses	J. Guyot, INRA, Pointe-à-Pitre, Bugwood.org 

Potato spindle tuber viroid (PSTVd)	
• Viroid – *Potato spindle tuber viroid* (*Pospiviroid*) • Primary hosts are tomato, potato and avocado • PSTVd symptoms can be confused with other virus and viroid infections • Mild strains show no or minor symptoms • Severe strains induce leaves to curl downwards and become spindly with a rough surface and darken in colour • Tubers become small, spindly and elongated, and may have growth cracks • Spread can occur through seed, tubers or mechanical transmission	Plant Protection Service Archive, Bugwood.org 

Priority endemic pests

Pests in this category are present in Australia and on the NAP. They are pests causing on-going problems on the NAP and are expensive or difficult to manage. The presence of these pests has forced specific monitoring and scouting, as they affect both the quality and yield of vegetables. Monitoring for the presence and levels of these pests will allow for the most effective management procedures to be put in place.

Western flower thrips	
• Thrips – *Frankliniella occidentalis* • Attacks a very wide range of vegetable and ornamental hosts • Insects are tiny (less than 2 mm long) and yellow to brown in colour • Can transmit a range of tospoviruses, including Tomato spotted wilt virus, which reduces tomato, capsicum, and eggplant quality and yield • Symptoms of infestation vary depending on the host • Fruit may become distorted or split • Thrip feeding symptoms include silvering, malformation and feeding scars • Spread by people movement, wind and on infested plant material	P.M.J. Ramakers, Applied Plant Research , Bugwood.org 

Currant-lettuce aphid	
• Aphid – *Nasonovia ribisnigri* • Mainly attacks currants (*Ribes* spp.) and lettuce • Adults (2-3 mm in length) have long legs and a spindle-shaped body that is green on *Ribes* spp. hosts, but can vary on other hosts • Aphid infestation results in leaf curl symptoms, dead hearts in head lettuce, and some stunting of plants • Fancy lettuce and leaf lettuce develop few symptoms • Honeydew production can result in sooty mould growth • Spread by wind or with infested plant material	Whitney Cranshaw, Colorado State University, Bugwood.org 
Greenhouse whitefly	
• Bug – *Trialeurodes vaporariorum* • Main crops attacked are ornamentals, cotton and vegetables, especially transplants and seedlings of greenhouse vegetables • Nymphs or 'crawlers' range from pale green to brown and resemble scale insects • Adults (1.5 mm long) resemble tiny moths, with pale yellow wings that are held flat • Key impact of infestation is the production of honeydew, which encourages the development of sooty mould • Heavy infestations can result in leaf wilting and failure to set seed • Spread on infested plant material, on people and by wind	W. Billen, Pflanzenbeschaustelle, Weil am Rhein, Bugwood.org 

Pest surveillance

Pest surveillance, or crop monitoring, involves looking for, recording and managing plant pests. It can be incorporated into existing Integrated Pest Management (IPM) practices, quality assurance programs, or as a component of best management practices.

Pest surveillance is important because:

- Early detection of new pests improves the chance of eradication or effective management, minimising the impact of the pest.
- Surveillance information helps maintain access to markets, domestic and international.

- More effective endemic pest management can be achieved by understanding pest populations through surveillance, and optimal treatment times.

All pest (exotic and established) surveillance activities carried out on your property should be recorded. These records can be used in the response to a pest outbreak and provide support to industry surveillance activities. An example of a pest surveillance datasheet is included in this manual on page XX.

Case study: Western flower thrips

The arrival and establishment of Western flower thrips (WFT) in Australia in the 1990s provides an example of the impact new pests can have on Australian horticulture. Following its detection in Western Australia, WFT spread throughout Australia within four years, with only small areas of the country remaining free of the pest.

WFT is a vector for Tomato spotted wilt virus (TSWV). Although other vectors were present before the arrival of WFT, this thrip is a more efficient vector with a wider host range. WFT presence has increased the impact of this virus. WFT are difficult to control with chemicals due to their ability to develop insecticide resistance. A regional approach to integrated resistance management appears warranted in some areas.

Increased attention to management, greenhouse and glasshouse design, and movement of farm workers has been required to limit WFT impact on production. Monitoring programs, more chemical applications and rotations of them, modifications to IPM programs and the planting of cultivars that develop less severe symptoms have occurred in response to WFT's arrival.

The implementation of good biosecurity measures in the vegetable industry will reduce the threat of more exotic pests establishing and minimise any increases in pest control costs to growers and the industry.

Report suspect pests

Early detection and reporting of new pests may prevent or minimise long-term damage, the quarantine period applied, and the effects on your farm, the region and the vegetable industry as a whole.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in your state or territory who will:

- Collect information about what you have seen.
- Arrange for a sample to be collected or to be sent to a specified diagnostic facility.
- Provide further information about the most appropriate precautions to be followed.

In some states, the Exotic Plant Pest Hotline operates only during business hours. Outside these hours, leave your full contact information and a brief description of the issue and your call will be followed up as soon as possible. Every report will be checked out and treated confidentially.

If you have found a suspected exotic plant pest, the following general precautions should be taken:

- Mark the location of the pest detection.

- Do not touch, move or transport affected plant material.
- Wash hands, clothes and footwear that have been in contact with affected plant material or soil.
- Do not allow movement of people and equipment near the affected area.
- Follow the directions provided by the Exotic Plant Pest Hotline or by the state or territory government.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

The Emergency Plant Pest Response Deed and the vegetable industry

The Emergency Plant Pest Response Deed (EPPRD) is a formal, legally binding document between Plant Health Australia, Australian and state/territory governments and plant industry signatories. As a signatory to the EPPRD, AUSVEG, the national peak body for the vegetable industry, has a seat at the decision making table and also contributes to funding if an approved Response Plan is implemented to eradicate an Emergency Plant Pest.

Under the EPPRD, AUSVEG members have a responsibility to report suspect pests. The earlier a new pest is detected, the greater the chance an eradication response will be mounted and the more likely it will be successful.

Within an approved Response Plan, grower reimbursement payments (Owner Reimbursement Costs) are included for direct costs incurred as a result of eradication of a pest incursion.

Case study: Citrus canker eradication

Citrus canker is an exotic bacterial pest of citrus trees that causes canker development and lesions on leaves, stems and fruit. Yield is severely reduced on plants infected with the bacterium. Citrus canker was detected in Queensland in 2004, resulting in restrictions in trade and an eradication operation removing all citrus trees in the area. Australia was declared free of Citrus canker in 2009.

Even though the outbreak was localised to the Emerald region, the eradication of Citrus canker from Australia cost over $26 million. When combined with the loss of trade due to restrictions during the eradication timeframe, the Citrus canker introduction had a severe negative impact on the Australian citrus industry.

Product management

Planting material and farm inputs

Planting material (including seeds and seedlings) and other farm inputs (such as growing substrates, pesticides, fertilisers, mulches and nutrient mixes) have the potential to carry pests or contaminants onto your farm. Plant material infected with pests such as fungi, bacteria and viruses may look healthy to the naked eye.

When purchasing planting material and farm inputs:

- Purchase only from reputable suppliers, preferably ones that are certified, who take biosecurity, hygiene, health testing and record keeping seriously.
- Check planting material thoroughly for evidence of pests or unusual symptoms. Isolate new plant material from production areas.
- Maintain a record of all planting material and farm inputs brought onto the property.
- Request and retain documentation in relation to planting material and farm inputs – source, testing regimes and import details.

Reduce the risk of pest infestations or contamination of planting material and other farm inputs by storing them appropriately. For example, mulches and fresh manure, composts and fertilisers should be stored on impermeable surfaces away from production areas.

Record the use, movement, testing and storage of all planting material and farm inputs that are used on your property.

Waste products

Maintaining good farm hygiene can minimise cross-contamination and pest population build-up. Waste generated through cropping and harvesting practices must be disposed of appropriately to reduce the biosecurity risk.

Green waste (e.g. fresh mulch, green crop debris, slashed weeds) can be beneficial if treated correctly. However, careful and timely management is required to reduce the risk of outbreaks of unwanted pests.

Appropriate disposal mechanisms for plant waste include total removal, deep burial (away from production areas), burning (where restrictions permit) or hot composting. Waste should be disposed of immediately and undertaken in combination with an effective monitoring/pest management program. If immediate removal is not possible, the waste should be contained separately to production areas and covered.

Ensure that no soil, plant material or insects are left adhering to vehicles, bins or other equipment (including hand tools) that are used on farm.

Biosecurity and Quality Assurance

If your farm, seed or transplant provider is accredited (i.e. maintains a Quality Assured scheme such as ISO 9000, SQF 2000, NIASA, Freshcare or Woolworths Quality Assurance Scheme), it is likely that some fundamental techniques of biosecurity best practice are already being applied.

Ensure that the schemes, requirements and records are in accordance with your farm scheme and expectations for traceability. Your records, together with service provider records should allow full traceability (e.g. the ability to trace-back plant material on your farm to its source, including all seed and planting material, health testing specifics and authenticity records) and provide evidence of the surveillance and pest management practices undertaken on your property.

Auditable Quality Assurance schemes and achievement of membership to them, is beneficial in terms of biosecurity, market access, meeting specifications and customer expectations of food quality and food safety.

Case study: Biosecurity opening a new market

As a direct result of growers and the industry implementing and recording good biosecurity and farm hygiene measures, Tasmanian cherries have appeared in fruit bowls in South Korea for the first time. South Korean government officials visited Tasmanian cherry orchards and packing houses, assessed the pest risk of fruit, and concluded the cherries were biosecure. As a result cherries from Tasmania are now exported to South Korea without prior fumigation.

The new market in South Korea is expected to boost Tasmania's cherry production by about 75% over a three year period, demonstrating that biosecurity has been a good investment for Tasmanian cherry growers.

Hive biosecurity

Vegetable crops including cucumber, peas, pumpkin and zucchini benefit from pollination by honey bees. To ensure the vegetable industry continues to benefit from honey bees, the risk of new pest introductions should be minimised through the implementation of good hive biosecurity measures.

There are a number of bee and hive pests that are currently not in Australia, with the highest threat posed by Varroa mite. These pests could have serious impacts on the honey bee and pollination-dependent industries if they were to become established. Many of these pests are prevalent in neighbouring countries.

Work with your hive providers to implement good hive biosecurity measures, including monitoring for unusual bee behaviour, minimising contact with the hives and cleaning equipment and hives before moving between properties.

If you see any unusual signs or pests in your bees call the Emergency Animal Disease Watch Hotline (1800 675 888) or the Exotic Plant pest Hotline (1800 084 881).

Farmers markets

Farmers markets provide a great opportunity to sell products directly to the consumer. Commercial growers from around the region and non-commercial backyard producers gather at these markets with their produce, and this provides a mechanism for the spread of pests.

To maintain these markets as positives for the industry, the following basic practices should be followed:

- Don’t share equipment or mix other growers’ produce with yours – keep them separate
- Ensure all produce sold is fresh, healthy and of high quality
- Remove all soil and adhering plant material from produce before sale
- Keep an eye out for any signs of pests – and report them immediately if spotted
- Disinfect all equipment on arrival back at your property
- Do not bring back unsold produce to your farm – you risk introducing new pests onto your property

People and biosecurity

Biosecurity signs

Well designed signage informs visitors that biosecurity on your farm is a focus and that they share responsibility for maintaining it. The signs serve to alert people to the potential impact of their visit. Signs also demonstrate your commitment to farm hygiene, safety and auditable systems.

Biosecurity signage should be placed at the main gate, other entrances, visitor parking areas and wash-down facilities, and where appropriate, include translations into the relevant languages.

Biosecurity signs should direct visitors to contact the owner/farm manager to formally register their presence before entering any production areas. The sign should include important contact details, such as the home telephone number, mobile number and/or two-way channel.

Contact Plant Health Australia for further information on obtaining biosecurity signs for your property.

Managing people movement

People moving between home and farms, nurseries and other horticultural sites (including market places, food stalls, etc.) can spread pests on vehicles, equipment, boots and clothing. Even hair and watchbands can carry fungal spores and bacteria. The most obvious risks are pests carried in soil and plant material.

Implementing the following measures will reduce the threat associated with people movement.

- Maintain a visitor register (example on page 25), that records visitor arrivals, departures and purpose. This is a safety and biosecurity measure.
- Brief all workers (including casual workers), contractors and visitors on your farm biosecurity measures.
- Employee and visitor footwear and clothing must be free of soil and plant material before entering or leaving the farm.
- Provide scrubbing brushes, footbaths, boot covers, rubber boots and protective clothing such as disposable overalls, for people entering or leaving your farm, or moving from contaminated to clean areas of the property.
- Display biosecurity awareness material in staff rooms, trimming and packing sheds, rest rooms. Keep the messages simple and effective.

Casual workers and tourists

Casual workers and travellers (e.g. backpackers, retirees, etc.) are often employed to assist with farm activities that bring them in contact with the crop. This includes planting, trimming, weeding, harvesting, picking and packing.

While their contribution is highly valued, they are a particular biosecurity threat because they move from farm-to-farm and region-to-region. They can potentially carry and spread pests between and around farms on their clothing, footwear, gloves, car tyres and personal equipment (e.g. knives).

Before entering production areas or packing sheds, make sure casual workers are well briefed on biosecurity measures at your property, have changed or washed their clothes and boots, and all tools and equipment are cleaned and disinfected.

Overseas travellers

People returning from overseas are a threat to regional and farm biosecurity, especially if they have visited farms, nurseries, or markets where plant material or produce was sold.

Several vegetable specimens carrying pests have been intercepted at the Australian border and overseas travellers have unknowingly brought in pests in the past. Air travel means exotic plant pests are only a few hours away.

To protect your farm from exotic (overseas) pests, ensure that all people who have recently returned from overseas have cleaned their boots and clothes before entering your property.

Equipment and vehicles

Movement of vehicles and machinery

Vehicles and farm equipment such as sprayers, tractors and hand tools can carry pests and weed seeds around and between farms, in adhering soil, sap and plant material. Ensure vehicles and equipment are cleaned before moving between areas of the farm or moving between properties.

Inspecting and cleaning machinery is more time and cost effective than managing a new pest.

Farms open to the public (e.g. U-Pick businesses) and those open to growers (e.g. for field days, equipment demonstrations, etc.) have a heightened risk and designated parking areas away from production sites are important.

Measures to reduce the risk of pest entry on equipment and vehicles include:

- Use a dedicated farm vehicle to carry visitors around your farm.
- Keep vehicle movement to a minimum in production areas and stick to regular pathways.
- Keep farm vehicles clean by clearing the vehicle floor of soil, weed seeds and insects, especially after visiting other properties.
- Vehicles and equipment should be cleaned in a designated wash-down area before entering your property. This process should be repeated before leaving the property.
- Ensure all vehicles and equipment, including contractors, delivery trucks and earth moving equipment, are clean and follow your farm wash-down procedures.
- Regularly clean all tools and equipment used on your farm, preferably with an antiseptic or bleach solution.
- Keep a vehicle log to trace movement between properties.
- Carry a biosecurity kit in each vehicle.

A basic biosecurity kit includes:

- Stiff brushes
- Broom for cleaning inside of vehicle
- Scraper for removing dirt from boots and tyres
- Plastic footbath for disinfecting boots and hand equipment
- Disinfectant solutions and spray bottles
- Personal safety gear – gloves, overall and boot covers

- Sealable plastic bags for sample collection
- Soap and at least five litres of water

Wash-down facilities

A wash-down facility allows farm employees, contractors and visitors to clean their vehicle and equipment (including hand tools) in an easily managed area where waste water is contained. This will ensure that plant material, insects and soil is not moved on to or out of your farm.

Aim to have a wash-down area that:

- Is readily accessible and located between the driveway and farm roads.
- Is isolated from production areas.
- Has access to power and high-pressure water.
- Has a sealed (concrete or bitumen) or packed gravel surface.
- Does not drain into a waterway or production areas.
- Have a sump or collection area for easy inspection and waste management.

For additional protection, an added detergent-based degreaser or disinfectant (for example, Septone Truckwash®, Castrol Farmcleanse® or Virkon®) may be appropriate. For best results, seek advice from re-sellers on the best product, and remove as much soil and plant material as possible from the equipment before using the disinfectant.

The wash-down area may be the same as that used for chemical wash-down of vehicles and equipment. If so, all occupational health and safety issues associated with chemical wash-down areas must be taken into account.

Designated parking areas

A well sign-posted designated parking area should be provided for all visitors to your property. Dedicated farm vehicles should then be used for transport of visitors around your property.

The designated parking area should be located away from production areas. A biosecurity sign in the parking area will remind visitors of the importance of biosecurity and farm hygiene on the property.

Designated parking areas serve to contain the entry of new pests to an area away from production sites. It also allows for the inspection of tyres, equipment, floor mats and boots for soil and plant material which may carry new pests.

Do not allow the movement of on-farm machinery through the parking area.

Greenhouse facilities

Greenhouse, glasshouse and shade house facilities are commonly used in the production of vegetable seedlings and crops. The use of these facilities presents specific biosecurity threats, particularly due to the

ideal breeding environment for many pests, close plantings, physical contact between plants and workers, and the green waste generated.

If you have greenhouse or glasshouse facilities on your farm, the following measures should be implemented:

- Regularly monitor and control pests to ensure isolated populations do not spread throughout your farm.
- Pest monitoring should include the entire greenhouse structure, including gutters and covers.
- More than one pesticide should be used to limit the potential for the development of resistant insects.
- All waste material should be regularly removed and disposed of appropriately.
- Maintain weed-free or non-host vegetative barriers around the facilities.
- Always visit or work in houses with clean and young crops before entering contaminated, infested or older crops.

Summary

Pests (page XX)	• Crop monitoring should be carried out and recorded to reduce the risk of new pests establishing, maintain access to markets and provide information for better pest control. • If you suspect a new pest or see unusual symptoms on the crops: o Report it immediately to the Exotic Plant Pest Hotline on 1800 084 881. o Restrict movement of people and equipment in the area. o Wash clothes and skin in contact with affected crops, produce or equipment. • Be aware of key vegetable industry pest threats.
Product management (page XX)	• Planting material and farm inputs can carry pests onto your farm. • Ensure planting material is from a reputable supplier and retain all documentation. • Dispose of waste and by-products appropriately, away from production areas. • Be aware that hive biosecurity measures impact on your farm and crops. • Implement a Quality Assurance scheme on-farm.
People and biosecurity (page XX)	• Biosecurity signs should be placed at the main gate and other entrances to the property and strategically around the facilities. • Use a visitor register to track people movement. • Ensure all visitors have cleaned their vehicles, clothing and equipment before entering the property. • Provide cleaning equipment for visitors and employees.
Equipment and vehicles (page XX)	• Provide a wash-down facility on-farm, or identify an available wash-down facility in your region. • Do not allow entry to contractors, visitors and employees who do not clean their vehicles and equipment. • Provide a designated parking area away from production areas.

Useful contacts

Plant Health Australia

Phone 02 6215 7700
Email **biosecurity@phau.com.au**
Website **www.planthealthaustralia.com.au**

Scholefield Robinson Horticultural Services

Phone 08 8373 2488
Email **srhs@srhs.com.au**
Website **www.srhs.com.au**

AUSVEG

Phone 03 9544 8098
Email **info@ausveg.com.au**
Website **www.ausveg.com.au**

Farm Biosecurity

Phone 02 6215 7700
Email **info@farmbiosecurity.com.au**
Website **www.farmbiosecurity.com.au**

Government

Australian Department of Agriculture, Fisheries and Forestry (DAFF)
Phone 02 6272 3933
Website **www.daff.gov.au**

South Australia – Department of Primary Industries and Resources

Phone 08 8226 0222
Website **www.pir.sa.gov.au**

Visitor register

Please enter your details to assist us with our on-farm biosecurity records

Date	Time on property		Name	Reason for visit	Vehicle registration and mobile phone	Blocks/greenhouses visited	Location/date of last contact with commercial vegetables or seed production sites
	Arrival	Departure					

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Pest surveillance data sheet

Farm:

Scout:

Date:

		Endemic pests				Exotic pests			
Block/greenhouse	**No. sites**	**Pest 1**	**Pest 2**	**Pest 3**	**Pest 4**	**Pest 1**	**Pest 2**	**Other pests found**	**Comments**

[NB] Estimated infestation level of endemic and exotic pest presence/absence to be scored (e.g. zero/low/med/high or % plants/blocks affected)

Pests targeted by surveillance must be named before surveillance initiated (for both endemic and exotic pests)

Fact sheets

Carrot rust fly

What is Carrot rust fly?

Carrot rust fly (*Psila rosae*) is primarily a pest of carrots, but it also affects parsnip, celery and parsley. The larvae channel into the roots of host plants, where feeding activities impact on plant vigour and tap root quality. Under ideal conditions, the Carrot rust fly can have up to three generations per year.

What does it look like?

The mature fly has a black body, reddish head, yellow legs and transparent wings. These flies are about 8 mm in length and can be spotted on the leaf surfaces of host plants.

The larvae are 8-10 mm long and white or yellowish in colour. They have a pair of prominent black feeding hooks at the front end. Pupae are shiny brown and about 5 mm in length.

What can it be confused with?

The small fly may be hard to distinguish from other fly pests in the field and the Carrot rust fly damage can be confused with nutritional deficiencies or water stress. However, host symptoms in combination with the presence of flies or larvae should be reported.

What should I look for?

Host plant symptoms are the easiest way to detect the presence of the Carrot rust fly.

Seedlings can be killed or injured by larvae feeding on tap roots. Look for gaps in the crop, but also yellowing and reddening of the leaves. In more mature carrots, the larvae attack the tap roots and create channels, distorting them and making the crop unfit for market.

How does it spread?

The pest can be spread as larvae in bulbs, tubers, corms or rhizomes, and also by the transportation of pupae in infested soil. The adult fly is a weak flier and is not a significant spread risk.

Where is it now?

Carrot rust fly is widespread in Europe, Canada, USA and New Zealand.

How can I protect my farm from Carrot rust fly?

Check your farm frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the vegetable industry so you can tell if you see something different.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Images

File name	Caption	Acknowledgement	

File name	Caption	Acknowledgement	
CRF1	The small fly has a black body with transparent wings	EPPO (Rosemary Collier, Warwick HRI)	
CRF2	Distorted carrots with deep channelling as a result of larval feeding	EPPO (Rosemary Collier, Warwick HRI)	
CRF3	The cylindrical larvae of the Carrot rust fly	EPPO (Rosemary Collier, Warwick HRI)	
CRF4	Larvae feed on tap roots, resulting in unsaleable products	Whitney Cranshaw, Colorado State University, Bugwood.org	
CRF5	The adult fly is about 8 mm in length	EPPO (Rosemary Collier, Warwick HRI)	
CRF6	The white to yellow larvae can grow up to 10 mm in length.	Rasbak	

Exotic leaf miners

What are leafminers?

There are over 300 species of leafminers worldwide. However, only four are considered serious horticultural pests:

- American serpentine leafminer (*Liriomyza trifolii*)
- Vegetable leafminer (*L. sativae*)
- Tomato leafminer (*L. bryoniae*)
- Pea leafminer *(L. huidobrensis*)

Leafminers quickly establish in most crops and are particularly a problem in protected cropping systems. Plants can be affected during all growth stages.

All *Liriomyza* species are leaf-mining flies. Leaf damage occurs through puncture wounds from adult feeding and egg deposition, and the larvae tunnel, or mine, within the leaf tissue. The damage can reduce the photosynthetic capacity of the plants.

The host range for each species is large:

- *L. bryoniae* - many vegetables, mainly tomatoes
- *L. huidobrensis* - 15 plant families, key pest of potato
- *L. sativae* - 40 hosts in 10 plant families, including Cucurbitaceae, Fabaceae and Solanaceae
- *L. trifolii* - 28 plant families, key pest of Asteraceae

What do they look like?

Adult flies are small, yellow and black, with variations in colour allowing the species to be distinguished. Although female adults are larger and more robust than males, their small size still limits field identification.

The larval stages are not usually seen as they remain inside the leaf tissue. However, the mines are easily spotted and are evidence of larvae presence.

What can they be confused with?

There are a number of other leafminer species already present in Australia, but these do not impact on horticultural production.

What should I look for?

Stippled foliage (as upper leaf cells are destroyed), white or greenish-white mines (lines) and blotches on leaves indicate the presence of leafminers.

Fungal infection may also occur, as the feeding damage increases susceptibility to secondary infections.

How does it spread?

The insects spread by flying within the crop. Long distance transport is likely to occur through the movement of infested plants, plant tops, soil or packaging.

Where are they now?

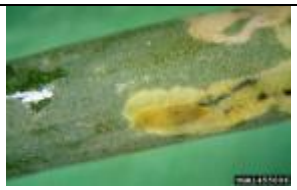
Each of these exotic leafminers have different distributions, however they are all widespread throughout vegetable producing countries worldwide, with the exception of Australia.

How can I protect my farm from Leafminers?

Check your farm frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the vegetable industry so you can tell if you see something different.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Images

File name	**Caption**	**Acknowledgement**	
ELM1	Pea leafminer *(L. huidobrensis)* mining damage	Merle Shepard, Gerald R. Carner and P. A. C. Ooi, Bugwood.org	
ELM2	Black and yellow markings of the American serpentine leafminer (*L. trifolii*) adult fly	Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org	
ELM3	Tomato leafminer (*L. bryoniae*) mining damage	Plant Protection Service Archive, Bugwood.org	
ELM4	Vegetable leafminer (*L. sativae*) larvae visible at the end of a mine in onion leaf	Whitney Cranshaw, Colorado State University, Bugwood.org	
ELM5	Leaf mining damaged in pea pods caused by the vegetable leafminer (*L. sativae*) larvae	Whitney Cranshaw, Colorado State University, Bugwood.org	

File name	Caption	Acknowledgement	
ELM6	Mining damage to a chrysanthemum leaf caused by the American serpentine leafminer (*L. trifolii*)	Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org	

Bacterial ring rot

What is Bacterial ring rot?

Bacterial ring rot (*Clavibacter michiganensis* pv. *sepedonicus*) is one of the most feared diseases of the potato industry, particularly for seed producers. The pathogen can spread quickly through a crop or property, which usually results in serious losses.

What does it look like?

Symptoms include wilting and yellowing of the leaf, and markings which later turn brown and appear 'burned'. In the later stages of the disease, lower leaves and stems may die and leaf margins become brittle.

Tubers rot from the inside, initially in the vascular ring of the tuber. Infected tubers exude a creamy, odourless bacterial exudate in cheese-like ribbons when squeezed and tuber skins can crack under heavy infection levels.

What can it be confused with?

Bacterial ring rot can be confused with potato brown rot caused by *Ralstonia solanacearum* which is already present in Australia. If you are unsure, have it checked out by an expert.

What should I look for?

Symptoms rarely develop quickly and infections usually remain latent for long periods. Watch out for wilting and yellowing of above ground plant parts and frequently dig developing tubers to check for symptoms.

How does it spread?

Bacterial ring rot is usually transmitted in infected tubers and micro-propagated plantlets. The bacteria can survive in soil (usually in association with unharvested tubers) and on volunteers and plant debris.

The bacteria can also survive for several years on contaminated equipment. It can survive in water for more than a month and can be transmitted through wash water.

Where is it now?

Bacterial ring rot is currently found in Europe, North America, Asia, North Africa, Mexico and Venezuela.

How can I protect my farm from Bacterial ring rot?

Source seed tubers and plant material only from clean, accredited suppliers. Keep equipment clean and remove plant debris from growing sites.

Check your farm frequently, especially in the heat of the day, for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the vegetable industry so you can tell if you see something different.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Images

File name	Caption	Acknowledgement	
BRR1	Tubers initially rot from the inside	William M. Brown Jr., Bugwood.org	
BRR2	Rotten tubers exude a creamy white bacterial ooze	Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org	
BRR3	Above-ground symptoms include wilting and yellowing of leaves	J.D. Janse, Plant Protection Service, Bugwood.org	
BRR4	Rotting and discolouration of the vascular ring caused by Bacterial ring rot	Dr Solke H. De Boer, Canadian Food Inspection Agency	
BRR5	Tuber skins may crack under high disease intensity	Larry L. Strand, University of California Statewide IPM Program	
BRR6	At later stages leaves turn brown and appear burned	William M. Brown Jr., Bugwood.org	

Colorado potato beetle

What is Colorado potato beetle?

The Colorado potato beetle (*Leptinotarsa decemlineata*) is a serious and persistent pest in temperate regions. In countries where it is established, it is both difficult and expensive to control, and insecticide resistance is a major issue.

The preferred host plants are potatoes, eggplant, capsicums and tomatoes. Adult beetles and larvae feed on stems, leaves and growing tips, and they produce a sticky black excrement.

What does it look like?

Adult beetles are about 1 cm in length and visible to the naked eye. They have five dark line markings on each wing cover, with a yellow to red underlying colour. They are found on stems and leaves, externally on fruit or tubers and sometimes in produce packed from infested fields.

The larvae are also brightly-coloured and grow to 15 mm in length. Initially they are bright red with a black head and legs, but this changes to a pale orange before pupation.

What can it be confused with?

There are no beetles with a similar morphology native to Australia.

Defoliation and leaf tatter caused by the Colorado potato beetle is similar to the damage caused by other insects, but the black sticky deposits help confirm the Colorado potato beetle is present.

What should I look for?

Leaf defoliation caused by Colorado beetle feeding is the most obvious sign of the pests' presence during in field inspections. Shake potato plants and observe the ground around them for beetles. Larvae and adults can been seen easily on young plants. Also check nearby Solanaceous weeds.

How does it spread?

The adults can fly short distances within a host crop and have been known to travel up to 160 km when assisted by strong winds.

The larvae and adults can be transported as 'hitch-hikers' on plant material, produce, machinery and packaging.

Where is it now?

Colorado potato beetle is widespread throughout Europe, Asia, Mexico and in the western USA. It has been eradicated from the UK and is contained within regions of Canada.

How can I protect my farm from Colorado potato beetle?

Do not plant tubers from unknown sources. Check your farm frequently for the presence of new pests and unusual symptoms. Make sure you are familiar with common pests of the vegetable industry so you can tell if you see something different.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Images

File name	Caption	Acknowledgement	
CPB1	Adult beetles have distinctive dark lines on wing covers	David Cappaert, Michigan State University, Bugwood.org	
CPB2	Defoliation damage caused by Colorado potato beetle feeding	USDA APHIS PPQ Archive, Bugwood.org	
CPB3	The larvae is brightly coloured and has two rows of dark spots along each side	David Cappaert, Michigan State University, Bugwood.org	
CPB4	The brightly coloured Colorado potato beetle eggs are laid in clumps in leaf surfaces	David Cappaert, Michigan State University, Bugwood.org	
CPB5	Beetles are yellow to red with dark markings and segmented antennae	David Cappaert, Michigan State University, Bugwood.org	
CPB6	Cream coloured pupae of the Colorado potato beetle	Whitney Cranshaw, Colorado State University, Bugwood.org	

Queensland and Mediterranean fruit flies

What are they?

Mediterranean fruit fly (*Ceratitis capitata*; MedFly) is one of the world's most destructive agricultural pests, and the Queensland fruit fly (*Bactrocera tryoni*; Qfly) is also considered a very serious pest of a wide variety of fruit and vegetables. The presence of these flies in production regions has severe consequences on trade, both locally and internationally.

Both QFly and MedFly have short life cycles in warmer weather. Each has egg, larval (maggots), pupa (in soil) and adult fly stages. The larval stage is the most damaging as they feed within fruit or vegetable tissue. Secondary infections with fungi cause rot and decay around wounds. 'Stinging' sites (where eggs are laid) may also provide entry points for secondary organisms.

It is the falling of infested fruit/vegetables to soil that allows the life cycle of the flies to be continued as the pupation occurs in soil.

What do they look like?

MedFly is 3-5 mm long, has a light brown body with mottled wings. The wings have distinctive brown bands extending to the tips. Larvae are creamy-white and about 7-8 mm long. The life cycle in warmer conditions is completed in about a month.

QFly is wasp-like and about 7-8 mm long, reddish brown, with yellow markings. Larvae are cream-white, legless, and they develop in three stages. They reach 9 mm in length. QFly prefers warm-hot and humid conditions for development.

What can they be confused with?

The damage symptoms of Medfly and Qfly will aid in distinguishing them from other endemic fruit fly species.

What should I look for?

Infested fruit and vegetables may show "sting" marks, indicative of egg-laying. Maggots found within any produce may indicate the presence of these fruit flies.

How do they spread?

These flies are spread through the movement of maggot-infested produce. There should be no produce or green waste movement from known infested zones to fruit fly-free zones. The adult flies can also fly short distances.

Where are they now?

Medfly is a pest in most of the world, including Western Australia. QFly is native to Australia, but it is not present in South Australia, Western Australia or Tasmania.

How can I protect my farm from MedFly and QFly?

Dispose of rotten produce appropriately. Do not move any produce out of fruit fly infested areas. Early detections of fruit fly can be monitored using lure traps.

South Australia is a declared Fruit Fly Exclusion Zone. If an Medfly or Qfly is suspected, contact PIRSA through the Exotic Plant Pest Hotline.

Images

File name	Caption	Acknowledgement	
MFF1	The adult Medfly is light brown and about 3-5 mm in length	Scott Bauer, USDA Agricultural Research Service, Bugwood.org	
QFF1	Qfly adult laying eggs through fruit surface, which results in 'stinging sites' and allows the entry of pathogens	G.T. O'Loughlin, Department of Agriculture, Bugwood.org	
MFF2	Medfly larvae feed in fruit and vegetables causing severe damage	Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org	
MFF3	Medfly pupae, which develop in the soil following infested fruit falling from the tree	Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org	
MFF4	Medfly wings have distinctive brown bands	Pest and Diseases Image Library, Bugwood.org	
QFF1	Qfly adults are 7-8 mm long and wasp-like in appearance	K. Walker, Pest and Diseases Image Library	

Melon thrips

What are Melon Thrips?

Melon thrips (*Thrips palmi*) attack a wide variety of crops including beans, capsicum, cucumbers, eggplant, melons, pumpkin, squash and zucchini. Weed hosts include plants from the Cucurbitaceae and Solanaceae families. This pest is also known to be a potential virus vector.

What do they look like?

Adult melon thrips are about 1.5 mm in length and are a yellow-orange colour. The adults have feather-like wings with black hairs along the fringe, which resembles a black line down the body of the thrip. Juveniles (nymphs) are smaller, paler in colour and wingless.

Melon thrips are found most often on the underside of leaves, in flowers and on fruit.

What can they be confused with?

Melon thrips can be confused with other thrips species and are likely to be distinguished by a lack of response to current insecticides. If normal insect controls do not work, have the pest checked out by an expert.

What should I look for?

Infested plants will show an overall stunting. Leaf feeding of the thrips results in a silvery effect becoming present on the surface. Under high infestation levels there is a bronzing of the leaves and they later crinkle and die.

Fruit on infested plants are reduced in quality, normally through the development of scar tissue on the surface.

How do they spread?

Thrips can be spread as hitch-hikers on machinery, clothes and plant material.

The movement of certain produce from infested zones to ‘clean’ zones requires fumigation. Produce from the Northern Territory must be inspected by quarantine staff prior to entry into South Australia.

Where is it now?

Melon thrips originated in Malaysia and Indonesia and have now spread to south-east Asia, Japan, Papua New Guinea, North America, the Caribbean islands, South America and Europe. In Australia, they are present in Darwin and South-East Queensland.

How can I protect my farm from Melon thrips?

Regular monitoring for melon thrips following after transplanting material increases the chances of detecting an infestation early. Report any thrips infestations that do not respond to commonly used controls, both chemical and biological.

Images

File name	Caption	Acknowledgement	
MT1	Melon thrips usually reside on the underside of leaves	Edith Smith, Shady Oak Butterfly Farm	
MT2	Heavy infestations cause leaf bronzing	J. Guyot, INRA, Pointe-à-Pitre, Bugwood.org	
MT3	Adult Melon thrips are a yellow-orange colour and just over 1 mm in length	Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org	
MT4	Fruit infested with Melon thrips can show scarring	J. Guyot, INRA, Pointe-à-Pitre, Bugwood.org	
MT5	Adult Melon thrips have feather-like wings with black hair along the fringe	Plant Protection Service Archive, Bugwood.org	
MT6	Affected leaves appear silvery as Melon thrips kill the leaf surface cells	R. Mau, University of Hawaii	

Potato spindle tuber viroid

What is Potato Spindle Tuber Viroid?

Potato spindle tuber viroid (*Pospiviroid*; PSTVd) is a pathogen that poses a threat to potato, tomato and eggplant crops in Australia.

Symptom development is dependent on the strain of the viroid in conjunction with the host species and stage of development. In potatoes, severe PSTVd strains have caused losses of up to 65% in tuber number and size. In tomatoes, losses of 40-50% in yield have been reported.

What does it look like?

Infected tubers have pointed ends, giving them a spindle shape with a round cross-section. Infected tubers are also often smaller than healthy ones.

Above ground symptoms of PSTVd infection of potato include a reduction in leaf size, thin stems which develop in a more upright manner, and an increase in the length of the internodes (stem regions between the leaves). These symptoms are usually only present under high infection levels.

Infection of tomato causes the foliage to become mottled, and yellow or purple, and the plants are stunted. Fruit produced from these plants is smaller, misshapen and will fail to ripen.

Symptoms can be mild for at first but will become more severe with each successive generation.

What can it be confused with?

PSTVd symptoms can be confused with nutrient deficiency or toxicity, spray damage, insect damage or plant viruses.

What should I look for?

Above ground symptoms of leaf distortion and discolouration, together with modified growth patterns are normally only detected under heavy infection levels. Observation of the deformed potato tubers when harvested is the most likely method of detecting this pathogen.

How does it spread?

Mechanical transmission of the viroid, for example by machinery, people, tools and clothing that has been in contact with infected plants, is the most likely method of spread.

Where is it now?

The disease is present in Asia, Africa, North America, South America, Europe, and New Zealand.

PSTVd has been reported in tomatoes in the Northern Territory, Western Australia and New South Wales and in potatoes in Victoria, New South Wales and South Australia. In each instance, eradication has been undertaken and has generally been successful. However, the viroid appears more persistent in Western Australia.

How can I protect my farm from Potato Spindle Tuber Viroid?

Farm hygiene is crucial in minimising the risk of PSTVd introduction through mechanical transmission. Only use planting material from reliable sources and ensure there is traceability on all seed supplies purchased.

Images

File name	Caption	Acknowledgement	
PSTVd1	In tomatoes the virus causes severe yellowing of leaves	Central Science Laboratory, Harpenden Archive, British Crown, Bugwood.org	
PSTVd2	In potatoes the smaller leaves and thinner stems of infected plants (middle plant) are difficult to distinguish from healthy plants (left and right)	R.P. Singh, Bugwood.org	
PSTVd3	Infected tubers (right) are typically smaller than healthy tubers (left) and pointed at the ends	Plant Protection Service Archive, Bugwood.org	
PSTVd4	PSTVd infection reduces the size and yield of potato tubers	European and Mediterranean Plant Protection Organization Archive, Bugwood.org	
PSTVd5	Potato tubers showing symptoms of infection with PSTVd	William M. Brown Jr., Bugwood.org	
PSTVd6	Reduced size and elongated shape of infected potato tubers	Dr. Weidemann, Biologische Bundesanstalt für Land- und Forstwirtschaft, Bugwood.org	

Western flower thrips

What are Western flower thrips?

Western flower thrips (WFT; *Franklinella occidentalis*) were introduced to Australia in the 1990s and have since impacted on vegetable production. They can attack a variety of field crops, but generally cause greater damage to greenhouse crops.

WFT is an efficient vector of Tomato spotted wilt virus (TSWV) and is harder to control than other thrips species in Australia.

What do they look like?

WFT are small flying insects (1-2 mm in length), which are yellow to brown in colour. Adults have tiny, narrow wings carried over their back. Nymphs are similar in shape, pale yellow-orange, wingless and smaller than adults.

Eggs are laid in slits in leaves and growing points. Nymphs and adults feed in flowers and growing tips.

What can they be confused with?

Due to their small size, thrips species cannot be distinguished with the naked eye. In particular, WFT cannot be easily distinguished from plague, tomato or onion thrips.

What should I look for?

Detection of WFT usually occurs through trapping the insects or detecting plant symptoms, and not by direct observation of the insects.

Infested crops can be damaged directly through feeding, which leads to leaf discolouration, deformed new growth and buds, spotty foliage. However, the transmission of TSWV causes the greatest impact on vegetable crops. TSWV produces distinct symptoms in some hosts, such as ringspots, patterns, distortion of fruit and some leaf spots.

Look for TSWV symptom and thrips hotspots. Check population levels on yellow sticky traps and make routine examinations of leaves, flowers and fruit.

How does it spread?

Spread occurs primarily with infested plant material or contaminated equipment. Short distance movement can occur through WFT flight, especially when assisted by wind.

Where is it now?

WFT is native to North America but has now spread to most European countries, Japan, Kenya, South Africa, Hawaii, Costa Rica, Colombia, New Zealand and Australia.

How can I protect my farm from Western flower thrips?

Ensuring plant material is clean and appropriately disposing of crop debris will reduce the risk of WFT and TSWV impacting on your farm. Where possible, source planting material raised in a WFT and TSWV free area.

Maintaining high levels of farm hygiene, controlling weeds and using mesh and double door entries to greenhouses minimises the threats posed by these pests.

Monitor all crops routinely for the presence of pests and use yellow sticky traps where possible.

Images

File name	Caption	Acknowledgement	
WFT1	WTF are yellow or brown in colour with bodies 1-2 mm long	P.M.J. Ramakers, Applied Plant Research , Bugwood.org	
WFT2	Leaf symptoms of Tomato spotted wilt virus, transmitted by WFT	David B. Langston, University of Georgia, Bugwood.org	
WFT3	Spotted foliage caused by WFT has a coarser pattern (left) than damage caused by *Thrips tabaci* (right)	P.M.J. Ramakers, Applied Plant Research , Bugwood.org	
WFT4	Eggs are laid in slits in the leaves	P.M.J. Ramakers, Applied Plant Research , Bugwood.org	
WFT5	Feeding on leaves can lead to leaf discolouration	Whitney Cranshaw, Colorado State University, Bugwood.org	
WFT6	Eggs laid directly in fruit reduce produce quality	Whitney Cranshaw, Colorado State University, Bugwood.org	

Currant-lettuce aphid

What is Currant-lettuce aphid?

Currant-lettuce aphid (CLA; *Nasonovia ribisnigri*), also known as lettuce aphid, is a serious pest of lettuce, endive and chicory.

This pest attacks host plants at all stages of development and is primarily a problem due to the colonisation of the inner leaves (and hearts of lettuce) renders the product unmarketable. Due to this colonisation habit, CLA does not impact on fancy lettuce to the same extent as traditional lettuce varieties.

CLA is also known to transmit Cucumber mosaic virus and Lettuce mosaic virus.

What does it look like?

Adults (2-3 mm in length) have long legs and a spindle-shaped body, and may be present in either a winged or wingless form. Colouration of CLA is dependent on the host plant species, ranging from yellow to green, through to pink to red.

What can it be confused with?

In the field, CLA is difficult to distinguish from other *Nasonovia* species. Be observant of the pest response to control programs.

What should I look for?

Colonies of CLA may be visible on infested plants. However, CLA prefers to feed while hidden in the centre of host plants (particularly lettuces), and are generally found on the underside of leaves.

Affected lettuce leaf symptoms include leaf curling, stunting, blistering and abnormal colouring. Under heavy insect loads, lettuce hearts fail to form or die. Sticky honeydew can also be seen in leaves leading to sooty mould growth.

How does it spread?

Movement of winged adults in wind currents over relatively wide areas is the predominant means of dispersal for CLA. Movement can also occur with infested plant material.

Where is it now?

CLA is found in Europe, North America, South America, New Zealand and all states of Australia.

How can I protect my farm from Currant-lettuce aphid?

Maintain good farm hygiene practices to reduce the risk of introducing the aphid onto your property or into greenhouses. Once CLA is introduced it is difficult to eradicate.

Control volunteer lettuce/chicory plants and wild hosts (e.g. speedwall, prickly lettuce) on your property and plough in of heavily infested lettuce crops as soon as possible.

If CLA becomes established on your farm, the pest can be managed through integrated pest management schemes and the use of resistant varieties. Chemical control is difficult due to the location of the aphid on plant material.

Images

File name	Caption	Acknowledgement	
CLA1	A wingless adult currant-lettuce aphid	Whitney Cranshaw, Colorado State University, Bugwood.org	
CLA2	The winged adult has narrow dark bands on the abdomen	Whitney Cranshaw, Colorado State University, Bugwood.org	
CLA3	A colony of aphids at varying growth stages infest the underside of a leaf	Whitney Cranshaw, Colorado State University, Bugwood.org	
CLA4	CLA colouration is dependent on the host plant	Stephen Ausmus	
CLA5	Light banding is present on the legs, antennae and body of the aphid	Whitney Cranshaw, Colorado State University, Bugwood.org	
CLA6	Leaf distortion of lettuce caused by CLA infestation	Whitney Cranshaw, Colorado State University, Bugwood.org	

Greenhouse whitefly

What is Greenhouse whitefly?

Greenhouse whiteflies (*Trialeurodes vaporariorum*) are a serious pest of most greenhouse vegetables and many ornamentals. These pests are able to complete their life cycle and feed on the underside of host plant leaves.

Both the adult and immature life cycle stages feed on the host plants sap. The immature nymphs are the most damaging and their feeding can cause yellowing and mottling of leaves. Honeydew excreted by the feeding insects promotes sooty mould growth.

What does it look like?

The mobile juvenile instars are white to pale yellow and resemble scale insects. The juveniles become immobile and develop distinctive red eyes. At maturity, adults are small (about 1.5 mm long), white and moth-like in appearance.

What can it be confused with?

Greenhouse whitefly is very similar in appearance to the Ash whitefly and Silverleaf whitefly, but the latter prefers a hotter climate.

What should I look for?

Look for whitefly populations, which may include adults, larvae, nymphs and eggs, on the undersides of leaves. Infested plants usually become yellow (chlorotic) and they lose vigour with leaves dropping prematurely.

The presence of honeydew and the development of sooty mould on leaves is an indication of feeding activity.

How does it spread?

Whiteflies are spread with infested plant material and attached to people and equipment. Greenhouse whiteflies are not strong fliers and will not spread large distances without assistance.

Where is it now?

Greenhouse whitefly is widespread in the southern states of Australia and it continues to cause problems in protected horticulture and nursery operations.

How can I protect my farm from Greenhouse whitefly?

Monitor for the presence of Greenhouse whiteflies through the use of yellow sticky traps. Regular inspections of plant material, particularly the undersides of leaves, will also increase the chances of detecting populations early.

Maintain good farm hygiene measures, including checking clothing for the presence of whiteflies, and where appropriate changing them, before entering clean greenhouse and farm areas. Dispose of crop residues and waste appropriately, and remove volunteers and weeds prior to planting, to limit the breeding environments for this pest.

Images

File name	Caption	Acknowledgement	
GWF1	Adult insects are white and around 1.5 mm in length	David Cappaert, Michigan State University, Bugwood.org	
GWF2	Nymphs (depicted alongside an adult) are yellow/white with red eyes	W. Billen, Pflanzenbeschaustelle, Weil am Rhein, Bugwood.org	
GWF3	Adults and nymphs are typically found on the underside of leaves	Peter Bryant, University of California	
GWF4	Pupa on the underside of a leaf	Peter Bryant, University of California	
GWF5	Pupae cuticles often remain on the underside of leaves after the departure of the young nymphs	Peter Bryant, University of California	
GWF6	Multiple life cycle stages can be found on an infested leaf	Whitney Cranshaw, Colorado State University, Bugwood.org	

PEPINO MOSAIC VIRUS

Pepino Mosaic Virus (Potexvirus)

What is Pepino Mosaic?

It is a viral disease primarily of greenhouse tomatoes. Infected pepino, weeds and other tomatoes have also been found.

What does it look like?

The symptoms of PepMV may be transitory and vary in different tomato varieties and conditions. The symptoms are more easily seen in low light, cool conditions (e.g. autumn, winter). They are often more serious when infection is early. The Peru strain shows no symptoms in tomatoes.

Symptoms of the European strain can appear within three weeks of infection and they may include distorted leaves, stunted apical leaf clusters, some flower abortion. The leaves become puckered and spindly, spotted (yellow or dark) and the calyx and stems can show brown streaks.

Infected fruit develops a marbled appearance and often ripens irregularly. The ecnomic impact is on quality rather than yield.

What can it be confused with?

Some of the leaf symptoms resemble hormonal herbicide damage. The spots on lower and young leaves may be confused with other chemical, scorch or disease symptoms.

What should I look for?

The virus is related to Tomato Mosaic virus (ToMV) but PepMV spreads faster. Nurseries raising transplants need to check plants regularly from emergence. Note particularly if the symptoms are within specific seed batches.

Suspicious seedlings need to be removed and disposed of carefully.

How does it spread?

This virus is very easily spread by contaminated hands, equipment, shoes and tools. It can also be spread through grafting and hand pollination. The virus may survive in dry plant mater and in leachate from crops.

Low level seed contamination has been confirmed for the European strain, and is the likely cause of long distance spread. Clean seed is essential.

Where is it now?

The first reports of PepMV were from Peru. The European and South American strains differ. PepMV is now present in most European countries, Canada, and in several USA states.

How can I protect my farm from Pepino Mosaic virus?

Clean transplants and seed are essential. Worker hygiene, crop debris removal and destruction, and cleaning of structures at the end of each crop, are very important. Keep records of seed sources and early crop development.

POTATO CYST NEMATODE

Globodera rostochiensis and G. pallida

What are Potato cyst nematodes?

Potato Cyst Nematodes (PCN) are serious pests wherever they are found. They attack members of the Solanaceae family, especially potatoes, but also eggplant, tomatoes and weeds like nightshade. They can have devastating effects, especially on yields (size and number of tubers), if not controlled.

The cysts can survive in the soil without a host. Each cyst may contain up to 400 eggs. Eggs usually hatch within 7-10 years, but they (and cysts) can remain dormant in the soil for up to 30 years. Eggs will hatch when there are potato root exudates in the soil.

What do they look like?

The nematode itself is hard to see with the naked eye as it is less than 1mm in length. The cysts are 0.5mm and can be seen on the roots of infested plants with a hand lens, particularly at the time of flowering. The cysts are white or yellow when they first form and turn into a tan brown colour once matured.

What can they be confused with?

In the field PCN may be confused with other nematodes, nutrient deficiency or water stress.

What should I look for?

Plants infested with PCN may become stunted in growth, wilt, and develop small, yellow leaves.

In the field, look for uneven, patchy growth of plants. Where heavy infestations occur infested plants will be nutrient deficient and often unresponsive to fertiliser additions.

How do they spread?

PCN is a soilborne pest that is spread by the movement of eggs and cysts in infested soil, or in infested plant material. Locally PCN can be spread by sharing farming machinery or even boots.

Where are they now?

The nematode occurs mainly in temperate regions, and is in most potato growing regions around the world. Wherever it occurs, it is subject to stringent quarantine and/or regulatory procedures.

It was introduced to Europe from South America in the mid-1880s. *G. rostochiensis* was first discovered in Australia in 1986 in Western Australia. In 1991 it was found in Victoria in market garden potatoes, and there have been other detections since. Only one strain of *G. rostochiensis* (Ro1) has been detected in Australia.

How can I protect my farm from Potato cyst nematodes?

Only buy potato 'seed' from certified sellers in non-infested areas.

Focus on hygiene and avoid movement of soil and equipment onto your farm. Ensure equipment, shoes etc. are thoroughly cleaned before entry onto your property.

Crop rotation can be effective with non-host crops and resistant potato varieties.

Chemical control is expensive and is only effective during a short period of the nematode lifecycle (after the eggs have hatched).

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

POTATO ROT NEMATODE
(Potato tuber nematode)

Ditylenchus destructor

What is the potato rot nematode?

This nematode is soilborne in temperate regions. It prefers moist and cooler conditions than some other nematodes in the same genus. Field losses may be up to 40%.

It is particularly damaging to root crops, especially potatoes, carrots, sweet potato, peanuts, garlic, and ornamental bulbs/corms/rhizomes (eg. dahlia, iris, tulip, gladioli). It survives in many weeds and may also survive in stored, infested tubers and bulbs, thereby adding to field losses.

Chemical control is expensive and nematodes are very difficult to eradicate. Clean planting material is essential.

What does it look like?

The nematode cannot be easily seen but on removing the below-ground plant parts its damage is usually evident as dry, mealy, wrinkled tubers or roots.

The infested plant parts are often sunken due to enzymes released by the nematodes. These cause cell collapse which is often followed by further disintegration due to secondary invaders.

What can it be confused with?

Top symptoms are not a reliable means of detecting this nematode's presence. Often it is found late in a season or at harvest, when subterranean plant parts are found to be rotted.

What should I look for?

Inspect all in-coming plant material for any sign of soft areas (in cloves, bulbs, tubers). If there is doubt, do not plant the material. For some bulbs, hot-water treatment may be effective.

During the growing season, look for areas in the field that do not look vigorous. Dig up developing plants throughout the season, and inspect them carefully.

How does it spread?

The nematodes are spread in infested plant material or soil. Weeds and volunteers allow in-field survival and reproduction even in the absence of a crop. The nematodes are also capable of long term survival on soil fungi.

Where is it now?

This nematode is present in many parts of Europe and Asia and in localised areas of the United States, South America and South Africa.

How can I protect my farm from Potato Rot nematodes?

Do not plant material that is from a nematode-infested area. Check all in-coming planting material and harvested fresh produce. Isolate storage of each until a full inspection has been carried out.

Do not allow entry of used equipment or returning travellers to your farm, if they have been present in a nematode-infested region.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

SILVERLEAF WHITEFLY (Q-biotype)

Bemisia tabaci

What is the Q-biotype of SLWF?

This is a new biotype of the silverleaf whitefly (SLWF). More common strains have been the B-biotype.

SLWF can efficiently transmit viruses not found present in Australia, making it a serious threat. There is added risk associated with the Q-biotype, because it has quickly developed resistance to a range of insecticides, making control very difficult.

The preferred feeding sites for both are vegetables (over 500 plant species) including zucchini, pumpkin, squash, melons, cucumbers, tomatoes, eggplants, potato, Brassicas, and sweet potato. Non vegetable hosts include many weeds, ornamentals, and cotton.

Once present, containment or eradication of this pest is unlikely. Integrated pest management is an option. The parasitoid wasp *Eretmocerus hayatii*, has been somewhat effective against field infestations, and *Encarsia formosa* has provided assistance in protected cropping systems.

SLWF can transmit viruses, including Australian tomato leaf curl virus (ATLCV) and yellow leaf curl virus (YLCV).

What does it look like?

The biotypes of SLWF cannot be distinguished visually. SLWF is similar to all whiteflies.

What can it be confused with?

Because the life cycles and host range of the silverleaf whiteflies are similar, the biotypes will be confused at the farm level. The damage they cause and the difficulty in controlling them, as well as molecular tests, are used to distinguish them.

What should I look for?

The Q-biotype does not cause the same physiological changes (colour changes, silver leaves, irregular ripening) in infested plants as the B biotype. The Q-biotype causes damage through its feeding, copious honeydew production, and the resultant sooty mould.

If high whitefly populations are noted and difficult to control, seek identification of the biotype present.

How does it spread?

Silverleaf whiteflies are capable of short flights. Their longer distance spread is wind-assisted. Long distance spread across countries has resulted from the movement of infested ornamental plants and vegetable seedlings.

The appearance of new viruses to areas, have been associated with the movement of SLWF.

Where is it now?

Silverleaf whiteflies are in every continent except Antarctica.

The Q-biotype has become a problem in Europe, the Middle East and China.

Only recently (2008/09), has its presence in Australia been confirmed. It has been found in vegetable crops in Queensland and northern NSW.

How can I protect my farm from the Q-biotype of SLWF?

Avoid early season applications of broad spectrum insecticides. Rotate insecticide groups and avoid repeated use of any insecticide.

Monitor white fly presence and report any difficulties with their control.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Zebra chip

What is Zebra chip disease?

'*Ca* Liberibacter' is a recently-recognised bacterial pathogen. It may be introduced to host plants during feeding by the tomato-potato psyllid (TPP), *Bactericera cockerelli*.

Neither this vector nor the bacterium is believed to be present in Australia. Both are recent arrivals and problems in New Zealand on potatoes. The psyllid alone also causes problems in potatoes and tomatoes, capsicums and other Solanaceous plants. It is difficult to control.

A phytoplasma (bacteria-like organism) may also be part of the disease complex but its role is unclear.

What does it look like?

The bacterium cannot be seen but it causes symptoms in potatoes, tomatoes, capsicums, tamarillo, and Solanaceous weeds. In potatoes it may cause leaf yellowing, zigzag stems, leaf curl, stunting and some wilt. Inside the infected tubers dark streaks or flecks in the medullary rays (central part) are visible. These darken on cooking, thereby making this a serious disease in chipping, fresh market and French fry varieties. In seed and ware crops it is also a problem because yields decline, proliferation of aerial tubers may occur and tuber eyes may be killed.

The vector lays eggs, feeds as nymphs and adults on host crops. The TPP lays yellow, oval-shaped eggs on short stalks amongst leaf hairs. The nymphs feed on the underside of leaves, injecting toxic saliva and the bacterium as they do. Adults have clear wings and are about 3 mm in length. They change colour from light yellow on emergence to grey/black. Mature adults have white stripes across abdomen.

What can it be confused with?

Adult TPP may be confused with other psyllids or small cicadas. Nymphs may be confused with small scale insects but under a microscope the TPP nymphs have a ring of spines around their perimeter. Until nymphs get wing buds they may also be confused with whitefly nymphs.

The disease top symptoms may be confused with 'purple top', a phytoplasma caused disease of potatoes. Top symptoms of Fusarium wilt may also look similar to zebra chip. The leaf yellowing symptoms of "Psyllid yellows" are also similar and TPP is associated but it cuases symptoms despite not carrying the bacterium. Tuber symptoms are diagnostic for zebra chip.

What should I look for?

Early flights of psyllids can be detected with yellow sticky traps placed at plant height a few rows in from the edge of plantings. Other evidence of the psyllid presence is 'psyllid sugar'. These are small, white waxy beads of excess sap excreted by the insects on the leaves.

No potato (or tomato) cultivars appear to be immune or resistant to this disease. Disease symptoms are most obvious in the tubers but foliar symptoms in scattered plants or small clusters, vascular browning of stems and stolons, and enlarged lenticels in tubers, may allow earlier detection.

How does it spread?

Ca Liberibacter is spread by the feeding of psyllid vectors. It does not spread on clothing or due to handling, but grafting experiments have demonstrated the bacterium can be moved from tomatoes to potatoes and vice versa.

While the disease complex is not often a problem in seed crops, low level seed transmission has been shown. It is therefore a disease that certification programmes need to consider.

The psyllids are potentially moved on Solanaceous and Brassica plant material. Adults are strong fliers and they may also be moved by wind. Presence in a greenhouse crop would allow overwintering of both the psyllid and bacterium.

Where is it now?

The psyllid and the bacterium are present in New Zealand and in parts of USA and in Central America.

How can I protect my farm from Zebra chip?

Ca. Liberibacter cannot be controlled by chemicals so management of this disease requires control of the psyllid vector. Clean seed tubers and removal of weed and volunteer hosts are very important.

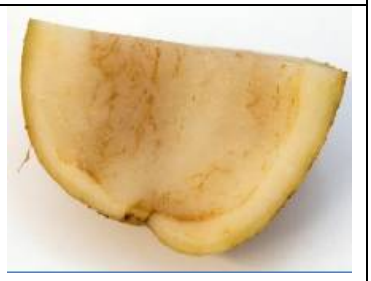
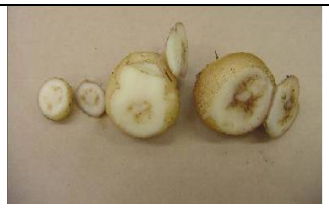
Since the vector is not yet present in Australia, it is important to remain alert. Insecticides need careful management because of the development of resistance by the psyllids to certain modes of action. Understanding life stages and population changes would assist with timing insecticide sprays. Avoiding planting during expected peaks is sensible. Yellow sticky traps near perimeter of fields, end of rows and in the headlands are essential. Additional scouting would be required if the psyllid became established.

Protected crops in insect-proof structures are at reduced risk but all reject produce and waste piles, volunteers, alternative hosts and weeds create a potential habitat for the insect and reservoir of the bacterium.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.

Images

File name	Caption	Acknowledgement	Image
ZC1	Symptoms in cooked potatoes. *Left* – infected with zebra chip; *Right* – no Zebra chip.	Henne, D., Workneh, F. and C. Rush. Texas AgriLife Research, Amarilla, Texas, USA.	
ZC2	Symptoms in uncooked tubers. *Left* – no Zebra chip infection; *Right* – Zebra chip in freshly cut infected tuber showing dark medullary rays.		

File name	Caption	Acknowledgement	Image
ZC3	Psyllid nymph with fringe.	Plant Health and Environment laboratory, IDC, MAFBNZ (New Zealand).	
ZC4	Adult tomato/potato psyllid	Gary Secor, North Dakota State University, Fargo ND, USA.	
ZC5	Uncooked tuber with darken medullary rays		
ZC6	Range of darkening visible throughout the uncooked tubers.		

Appendix 2

Biosecurity Engagement Strategies

Australian Government

Bureau of Rural Sciences

Biosecurity engagement guidelines: practical advice for involving communities

Heleen Kruger, Nyree Stenekes, Rachel Clarke and Anna Carr

March 2010

Appendix 4: Engagement tools used in biosecurity engagement

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Engagement method: face-to-face contact						
Individual consultation/ interaction—occurs when engagers meet with individuals for example on-farm visits by technical experts	• regarded as the best method for conveying a message for all audiences • allows people to feel connected and valued • provides an opportunity for Q&A	• very resource intensive • difficult to engage all relevant stakeholders groups	Growers General public	• the messenger is trusted/credible • used to engage critical, clearly identified stakeholders for a specific purpose	Any stage	Listen Involve Partner Mobilise & Empower
Shed meetings—used to communicate with growers about a specific issue. Sometimes chaired by a 'shed captain' usually the shed owner	• good for developing initial understanding/ engagement around an issue • facilitates two-way communication between growers, DPI, others • opportunity for growers to lead discussions and ask questions • comfortable, informal environment for growers where they feel supported and able to speak up • allows face-to-face contact with a large group at once • helps develop trust between growers and technical staff or industry • a shed captain may help growers to develop leadership skills • opportunity for peer learning	• time intensive for time- poor growers • new growers might find intimidating • not everyone will have access • might not be ideal for presenter i.e. no PowerPoint	Most growers	• meetings are led by growers • meetings are issue specific e.g. an outbreak • meeting times are decided by growers – i.e. not during harvest, planting • shed captains are neutral • catering is provided to add a social element • technical staff are present/available but not directing the meeting • key points are made available to others after the meeting • remove barriers that could cause uneasiness, i.e. DPI uniforms	Implementation Design	Listen Involve Partner Mobilise & Empower

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Information stand/ van—portable tool used to convey a certain message at an event	• can be effectively combined with other engagement tools – i.e. pamphlets, booklets, videos, • could become recognisable by the community	• puts the onus of interest / involvement on the public • info centre staff may have to deal with frustrated and angry people	Growers General public	• located at an appropriate audience specific venue i.e. travelling trailer with fruit fly roadblock • staff have support from other agencies to refer difficult cases to	Implementation	Inform
Field days—(including on-farm demonstrations) can be held to visually demonstrate a practice or problem	• growers are generally comfortable and relaxed on-farm • provides an interactive learning experience, growers usually prefer a hands-on experience • opportunity for farmers to learn from each other or develop leadership by volunteering to host a trial • opportunity for general community to learn about food production	• time consuming to organise • sometimes have poor attendance rates	Growers General public	• are held at times convenient to growers • growers are consulted in organising of the field day to see if it will be relevant/interesting	Any time	Inform Listen
Industry conferences—most horticulture industries hold annual and bi-annual conferences or symposiums	• effective for dispersing information to a large number of growers • provides opportunities for two way communication around issues of interest	• growers will pick and choose what interests them—some messages may not be a high priority • smaller growers may not be able to afford to attend	Growers Industry representatives Government	• the biosecurity presentations are delivered by champions for the cause	Any time	Inform
Information centres—found in most towns and a valuable conduit for providing information to tourists on biosecurity matters	• can be effectively combined with other engagement tools—i.e. pamphlets, booklets, videos • generally well used by tourists • tourists appreciate having a fact sheet or brochure explained	• puts the onus of interest/involvement on the public to enquire • can be time consuming for info centre staff to explain	Tourists	• there is a pest specific message i.e. fruit fly • staff have received training around the pest • used in conjunction with other tools i.e. to explain a poster or pamphlet	Implementation	Inform

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Engagement method—telecommunications and internet						
Phone (personal calls)— effective where an individual face-to-face meeting is impossible, e.g. between growers and technical staff	• best alternative to face-to-face contact • enables two way individual interaction and feedback • opportunity for Q&A	• time consuming • may result in lost time depending on availability of receivers	Growers General community	• the caller is known to the audience and credible	Any time	Listen Involve
Phone (text messaging)— beginning to be used by engagers for some purposes i.e. reminders	• quick and easy for communicator • likely to be read by recipient • fairly cheap	• limited to how much information a text can convey • patchy mobile coverage in rural areas and message may be lost	All with access to a mobile	• best for people with established relationships • a reminder about an event or point recipients to another info source	Any time	Inform
Phone (1800 numbers)— available for reporting of suspected plant pest and disease incursions	• provides reporter with opportunity to be heard • may enable two-way learning	• recipients of message may not provide follow up leading to disengagement	All	• person answering the phone reports back to source • person answering the phone is trained in pest and disease identification	Implementation Monitoring and evaluation	Listen
Faxes—utilised more in the past, and are still preferred by many growers	• relatively quick and easy for communicator • more personal than an email or pamphlett thus more likely to be read • quicker to access than email • lower incidence of faxes means more likely to be read • cheaper and faster than posting a letter	• many people don't have fax machines • viewed as cumbersome tool by some messengers	Growers	• work well with clearly identified target audience • used to provide updates • used as an invitation • no more than two pages • best as follow-up tool, rather than initial contact	Implementation	Inform

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Email—emerging as a tool, but is not widely/ frequently used in rural areas yet	• quick and easy for use by messenger • preferred to fax by some large/young growers that may not have fax	• easily ignored • many growers do not have/check regularly • considered a poor way of inviting people to events	Young or technologically literate growers	• individually addressed • accompanied by a text/phone call to alert recipient	Formation Design	Inform Listen
Internet—a preferred biosecurity tool/ information repository of engagers such as technical officers and IDOs. Includes YouTube, videos and audios that can be accessed online	• good resource for engaged parties seeking more information	• information seekers must already be engaged around the topic • access to internet is limited/slow in many rural areas	Young/ technologically literate growers	• used in conjunction with other tools i.e. a newsletter that refers to a website for more information	Implementation	Inform
Engagement method—printed materials						
On-farm manuals—farm glove box guides, manuals usually provide explanations of pests and visuals for identification	• can become an invaluable tool for growers • reasonably quick and cheap to produce	• easy to ignore • use determined by quality/relevance to farmer • information may date	Growers Farmers	• is small (glovebox size) and weatherproof • should be trialled by growers before printing • contains contact details for follow up • has good colour photos and diagrams • provides for addition of new information i.e. weed decks • is appropriate for target audiences	Implementation	Inform

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Posters—informative posters, such as shed posters, information stand posters	• good for growers using itinerant workers • good for farm workers with limited English language skills	• can be quite expensive to develop and distribute • will need occasional updating • may be ignored by some	Farm workers General public	• has large, clear, colour graphics/diagrams • has minimal text • is placed in a prominent location for easy/frequent viewing e.g. near lunch area • is explained initially by the farmer/other messenger	Implementation	Inform
Newsletters/ bulletins—newsletters are used by many messengers i.e. industry groups, technical officers, consultants	• some newsletters are widely read by growers e.g. macadamia nut association newsletter • growers feel it is valuable if paid for by their levies	• easily ignored • sometimes produced on tight budgets which affects document quality	Growers Technical officers	• paper newsletters more popular • audience specific i.e. industry newsletters widely read	Any time	Inform
Calenders—informative multi-page posters that can alert growers to different activities in different months	• good reminder for growers	• currently not available widely	Growers Farm managers	• industry specific	Implementation	
Fact sheets—available in many regions for different pests and disease	• can be a useful tool for identification of pest/disease • reduce wastage by allowing information seekers to take what they want	• one-pagers often get lost or damaged over time • often duplicate information available elsewhere for no real gain	Growers Community	• can be connected to form a booklet • are used in an outbreak situation • uncluttered and without too much technical information	Implementation	Inform

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Pamphlets—informative pamphlets on pest, disease or practices	• can help reinforce messages to pre-sensitised audiences • can promote new understanding of an issue if accompanied by a personal explanation • can be made widely available • relatively cheap to produce and distribute	• easily ignored • mail outs considered virtually useless • can waste paper/resources	General community Growers	• colour photos, clear graphics, maps and minimal text • target audience has been considered • topic is already a priority • linked to an activity i.e. fruit fly inspections • linked to a local area • supported by media or other awareness raising activities • provided with an explanation i.e. information centres, stands • mail outs/letter box drops are avoided unless linked to an activity • distributed in a small community • uncluttered and without too much technical information	Implementation	
Community newsletters—In addition to agriculture specific newsletters, some community groups, such as Neighbourhood Watch and other groups may include biosecurity information upon request	• exposure to different audiences • targets segments of the community that are interested in serving the community	• audience may not be interested	Community groups	• flag a specific issue likely to be of interest to the broader community • eye-catching heading and includes locally specific examples and photographs • contains contact details for follow up	Design Implementation	Inform

Tools and processes	Advantages	Disadvantages	Most appropriate audience	Factors contributing to success/ appropriate use	Most likely engagement stage	Engagement type
Engagement approach—media						
Newspapers—local and farmer targeted such as The Weekly Times and The Land	• wide readership of local papers • wide readership of agricultural papers such as The Weekly Times	• issue must be considered 'newsworthy' by paper • media sometimes gets facts wrong	All	• issue has pre-existing profile • is linked to an activity	Implementation	Inform
Radio—local radio, ABC for news stories or advertisements	• good way of communicating with busy growers/farm workers • local newspapers generally widely read by community	• issue must be considered newsworthy' by journalists • not all people listen to the same station	All	• used to provide updates/reminders	Implementation	Inform
Television—mainly used for advertisements, news will occasionally cover an event	• access to a wide audience • cheap on an access per person basis • good for promotion of good news stories	• hard to make it audience specific • may be of considerable cost for little benefit • not all people watch the same channels	All	• use in high profile issues i.e. Tully Black Sigatoka outbreak profiled Landline	Implementation	Inform

Appendix 3

General Biosecurity Awareness Material

Australian Government
Department of Agriculture, Fisheries and Forestry

vital information
for small rural landholders

farmbiosecurity
Partnering for better practice
Jim McGrath and Thea McNaught-Reynolds

Spotted anything unusual?

What is biosecurity?

EXOTIC PLANT PEST HOTLINE
1800 084 881

EMERGENCY ANIMAL DISEASE WATCH HOTLINE
1800 675 888

Spotted anything unusual?

Biosecurity - so simple it could make me cry!
The use of analogies in understanding biosecurity concepts

Biosecurity is an integrated multi-layered concept that includes detection, risk analysis, categorisation, spread and management.

In general, biosecurity is not well understood by the public. Using analogies in biosecurity risk communication may help the wider community to comprehend these concepts.

How to deliver Emergency Plant Pests (EPP) concepts?

Biosecurity — The onion analogy

Order form

Plant Pest Investigation
with
Lily and Sam

CRC PLANTbiosecurity

Footwear as a biosecurity threat
Defining the hazards and possible solutions

Introduction

Materials and Methods

Results

farmbiosecurity

secure your farm
secure your future
www.farmbiosecurity.com.au

Australian Government
Department of Agriculture, Fisheries and Forestry

Don't put this farm at risk!

You can stop agricultural pests and diseases spreading

Plant pests, diseases and weed seeds can easily spread from one property to another on **clothing, shoes, equipment** and **vehicles**.

You can do your part to stop the spread of agricultural pests and diseases by doing these simple things.

Wash mud, soil, seeds and plant material from your vehicle before entering another property.

Clean and disinfect any equipment (such as pruning shears) in between use on different properties with soapy water and then disinfectant.

Check your shoes, clothing, hair and hats for any seeds or plant material. Pay special attention to your shoes as they can easily carry contaminated soil and seeds.

Only park in designated visitor areas or well away from cropping or plantation areas.

***Report* to the homestead or the farm's office**. Do not enter cropping or plantation areas without permission.

Report any plant pest or disease symptom that you think may be unusual to the farm manager or owner immediately.

Exotic Plant Pest Hotline **1800 084 881**
For more information visit **www.daff.gov.au/biosecurity** and **www.farmbiosecurity.com.au**

Biosecurity measures help protect our economy, environment and people's health from pests and disease.

DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY


YOU MAY BE TRAFFICKING FRUIT FLY TO THE RIVERLAND.
KEEP YOUR RECEIPT
Fruit and fruiting vegetables including tomatoes, capsicums, chillies and eggplant MUST NOT BE TAKEN into the RIVERLAND of South Australia unless purchased in South Australia and accompanied by an itemised receipt.
ON THE SPOT FINES AND PENALTIES APPLY
Call the Fruit Fly Hotline 1300 666 010
QUARANTINE MATTERS
www.pir.sa.gov.au/fruitfly
If you bring them in you're risking more than just a heavy fine.
Don't risk a $2,500 fine
IS IT A CANE TOAD? OR YOUR LOAD
Call the Fruit Fly
1300 666
vital information
for plant producers
YOU MAY BE TRAFFICKING FRUIT FLY. STOP.
INCREASED ON THE SPOT FINES
RIVERLAND FIELD DAYS
Official Program
September 16th & 17th, 2009
vital information
for travelling farm workers
STOP AT OUR ROADBLOCKS.
STOP AT OUR QUARANTINE BINS.
STOP AT OUR BORDERS.
Fly FAQ
Where can I get more information?
Pest Free & Proud
For a Greater Sunraysia
Protecting our Industries from Fruit Fly
Maltese
Hares il-Ġid u l-Propjeta tiegħek
Protect Your Assets by Preventing a Major Animal or Plant Disease on Your Farm
Traveller's Guide to Australian Interstate Quarantine
Check what you're carrying. Penalties apply.
Quarantine Domestic

Appendix 4

Regional Awareness of Biosecurity Objectives

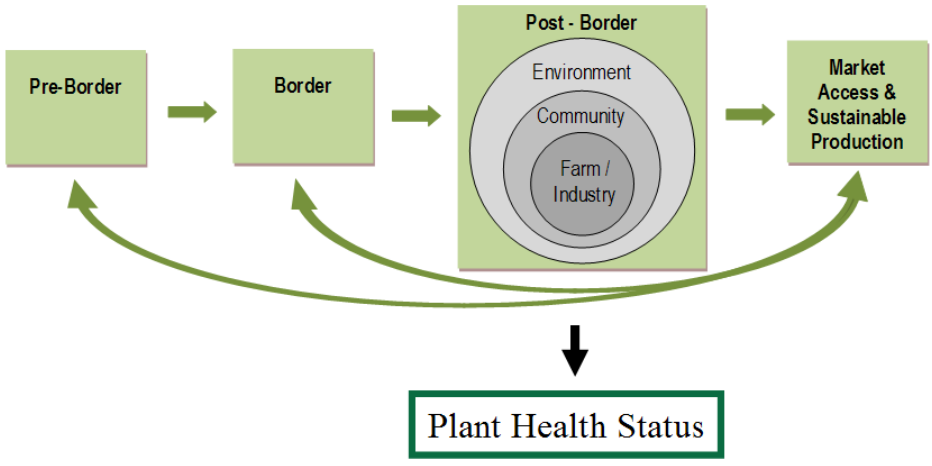
Biosecurity in the vegetable industries

'Plant **'biosecurity**' refers generally to the minimisation of biological threats to the environment, lifestyles and livelihoods. The threats include high priority plant pests with the potential to reduce commercial, amenity and native plant health and quality, and the environments in which they grow. It its broadest sense biosecurity also encompasses chemical and regulatory effects on food safety, plant movement, and public health.

The challenges of biosecurity and quarantine are global in nature, local in effect and a shared responsibility pre-border to post-border. In practice, the vegetable, seed and nursery industries (like all horticultural industries) must today, identify the nature, source and pathways of their threats, and assume roles in risk minimisation, as indicated in the national plant health biosecurity continuum (Figure 1).

The responsibility for biosecurity management is today shared between governments, communities, industries and individuals. The successful Commonwealth quarantine systems of the past are now challenged by changing domestic and global conditions, and the realisation that external threats to our production regions and food quality, may potentially reach us in less than 24 hours, and have immediate social, economic and/or environmental effects. Several recent reviews have discussed the changing quarantine environment and challenges arising from the increasing volumes and movement distances of people, plant material, animals, and produce (Beale *et al*., 2008; Cullinan, 2008; McMichael, 2008).

Figure 1 : Plant Health Continuum



Source: DAFF, 2008 (OCPPO Pers. comm.)

Biosecurity preparedness starts *pre-border* with the acquisition of intelligence through specific surveillance, auditing and accreditation of facilities supplying plant material, and sentinel operations (eg. hives). At the *border*, biosecurity is managed primarily through post-entry inspections, testing and treatments, but there is also surveillance along Australia's northern coastline. *Post-border* biosecurity management is dependent on the regulatory framework of the states, awareness and actions of growers, industry-allied personnel and the wider community. Within the continuum, the most significant biosecurity gaps exist post-border.

International **market access** negotiations today are underpinned by science-based evidence that demonstrates 'area freedom' (eg. '*known not to occur'*) or 'low pest prevalence' etc. As such, appropriately implemented and documented on-farm and regional surveillance, and systems approaches for biosecurity management, are critical to any industry attempting to gain, maintain or re-gain market access. **Surveillance** requires a focussed, collaborative industry and government effort to ensure the structure and co-ordination are internationally acceptable and locally achievable. Growers and nurserymen will soon be relied upon to document pest status (presence *AND* absence) from on-farm inspections, trapping and monitoring. Industry support will also be needed to receive and collate on-farm data. The National Plant Surveillance Reporting Tool (NPSRT) database has been designed to accommodate surveillance data from multiple sources, and thereby serve as a national plant health data repository and resource. Another benefit of regular surveillance is the increased potential for **early detection** of an incursion. Incursions detected early, have a greater chance of being contained to a level at which eradication is a feasible control option.

Plant Health Australia (PHA) is assisting member industries with biosecurity planning and preparedness, through the development of Industry Biosecurity Plans, contingency plans for specific pests; coordinated development of diagnostic protocols and surveillance strategies. The IBPs alone however are insufficient for industries and state governments to prioritise preparedness efforts (eg. co-ordination, funding, human resources, training etc).

A recent review of the biosecurity gaps in the vegetable industry (McMichael, 2008) is relevant to all the vegetable industries and the seed production and nursery sectors. The review discussed threats and their pathways and the gaps that exist at the border and post-border for most inputs – seed, planting material, chemicals, fertilisers etc.

The costs to industry of being ill-prepared or unaware of biosecurity issues, are significant. The historical lack of co-ordinated pest surveillance, and documentation of systems control for certain pests, have proven costly to some fruit and vegetable industries recently in terms of market access. Equine influenza and citrus canker were extremely costly incursions. Neither industry nor government has the capability or resources to enhance biosecurity in any plant industry or region, in isolation. It is therefore strongly recommended that similar plant industries (e.g. perennial horticulture; protected horticulture) and those within a region, collaborate to identify investment needs and priorities, research gaps, surveillance strategies, training and awareness material needs, and to address the problems of specialist expertise shortages (e.g. pathologists, entomologists), data capture and sharing mechanisms. Local government involvement is highly recommended as planning decisions may directly affect a region's biosecurity.

Horticulture Australia and Ausveg are currently funding the development of a step-wise guide for vegetable industries such that frameworks for regional biosecurity will include local authority, community, horticulture, and allied industry collaboration and a sharing of resources; roles for participants – active and passive, and means to engage them; and suggested biosecurity measures that are cost-effective and will deliver enhanced biosecurity across the range of land uses and business enterprises, in a region. The case study area is the northern Adelaide Plains. Contact Prue McMichael, at prue@srhs.com.au, for further details.

While biosecurity is but one of many major challenges faced by horticultural producers today, it is one that will affect all future markets and produce movement. As such, it should be a high priority in industry and regional planning.

Dr. Prue McMichael
Scholefield Robinson Horticultural Services
Principal Consultant/Plant pathologist

References

Beale, R., Fairbrother, J., Inglis, A., and D. Trebeck. 2008. *One Biosecurity: a working partnership*. Report of the Quarantine and Biosecurity Review Panel, to the Australian Government. 244 pp.

Callinan, I. 2008. *Equine Influenza: the August 2007 outbreak in Australia*. Report of the Equine Influenza Inquiry, Canberra.

McMichael, P.A. 2008. *Vegetable Biosecurity and Gap Analysis*. Final Report VG07087 Horticulture Australia Ltd. 130 pp.

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Input biosecurity in horticulture and agriculture

Biosecurity refers generally to the minimisation of biological threats to the environment, lifestyles and livelihoods. Plant and animal threats include high priority pests with the potential to reduce commercial, amenity and native plant/animal health and quality, and the environments in which they develop. It the broadest sense 'commodity biosecurity' and 'regional biosecurity' encompass inputs also – chemicals, fertilisers, compost and regulatory effects on food safety, produce movement, and public health.

The challenges of biosecurity and quarantine are global in nature, local in effect and a shared responsibility pre-border to post-border. The responsibility for biosecurity management is today shared between governments, communities, industries and individuals. Within the plant health continuum, the most significant biosecurity gaps exist post-border. In practice, our agricultural and horticultural industries (e.g. tree, vine, vegetable, seed and nursery industries) must today, identify the nature, source and pathways of their threats, and assume roles in risk minimisation that start on-farm. At the regional level, local government involvement is highly recommended as planning decisions may directly affect a region's biosecurity.

As signatories to the Emergency Plant Pest Response Deed (EPPRD), many horticultural industries also have a legal obligation to develop and implement comprehensive risk management strategies to maintain plant health, manage exotic incursions, and provide knowledgeable representatives to national decision-making committees.

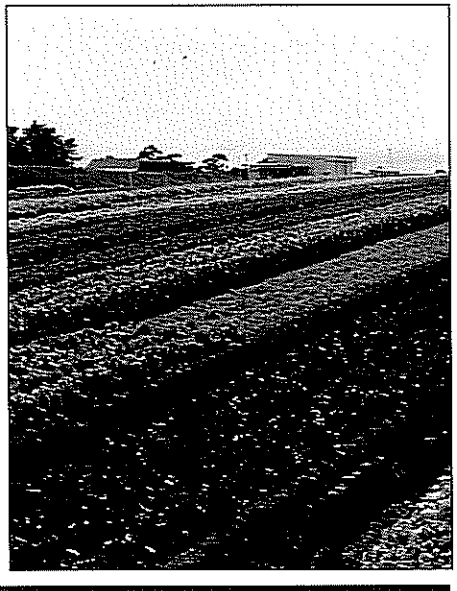
Fresh produce is routinely exposed to chemicals and soil amendments of different types, including fertilisers and compost. The quality of such inputs is of importance to all commodity groups, producers and regions. As waste disposal from all sources (i.e. health care, industrial and domestic industry, water treatment bi-products etc) presents new challenges, down-line users of composts and fertilisers need assurance that systems are in place to detect contaminants that are potentially detrimental to food and human safety, the environment, and trade sustainability. While breaches in Australia are rare, there are examples internationally of contamination and substitution of such inputs, and miss-use.

In South Australia, the control of industrial waste is housed in the Department of the Environment, Water, Heritage and the Arts, but only to the point at which the 'waste' becomes 'beneficial' e.g. as fertiliser. Responsibility for ensuring fertiliser and compost quality lies initially, with the manufacturers and importers. The biosecurity and environmental risk management issues related to commercial handlers (storage), transporters and spreaders of each, are incorporated into the Fertcare programme. National awareness of fertiliser quality indicators and Australian standards is needed. The uptake of FERTCARE® and a registration programme that allows traceability of fertiliser, mulch and compost, are recommended.

The FERTCARE® programme is a fertiliser industry initiative developed by the Australian Fertiliser Services Association (AFSA) and the Fertiliser Industry Federation of Australia (FIFA). The programme provides competency-based training to all participants in the fertiliser and soil ameliorants supply chain about their responsibilities. This education programme has been developed within the Australian Qualifications Framework and is delivered by registered training organisations.

While biosecurity is but one of many major challenges faced by producers of horticultural and agricultural products today, it is one that will affect all future markets, production costs, and produce movement. As such, it should be a high priority in industry and regional planning.

Dr. Prue McMichael
Scholefield Robinson Horticultural Services
Principal Consultant/Plant pathologist



AFSA STATE CONFERENCE DATES 2010

Tasmania 2nd July, Victoria 8th-9th July, NSW 15th-16th July,
SA 23rd-24th July

The next **Australian Fertiliser Industry Conference**, a joint effort between FIFA and AFSA, which will include the AFSA – AGM, will be held from **August 23-26 2010** on the Gold Coast, Queensland, Australia. More details on the program will be distributed by email and registration will open in March 2010. If you are on the email list you would have received notice of the conference already. If not simply send an email to fertilizer@fifa.asn.au with subscribe in the subject line, you will then receive all future updates.

The conference will address a range of policy issues affecting the industry including in the areas of environment, climate change, food safety, and quarantine. There will be discussion of agronomy and application technology, market trends and the value of fertilizer in food security. There will also be ample opportunity for informal and commercial meetings.

Who should attend?

- Senior and mid level managers of Australian fertilizer companies involved in manufacture, import, distribution and sale of fertilizers.

Overseas supply chain partners of Australian fertilizer companies.

- Policy makers in the Australian and State Governments with an interest in fertiliser.

Biosecurity and Regional Framework Meeting, Monday 9th November 2009

Presented by Dr Prue McMichael

1. BIOSECURITY - What is it?

- Protection of livelihoods and lifestyles that may be compromised by pests – environment, people, economy
- Pest = pathogen, weed, pest, contaminant?

2. BIOSECURITY - Who needs it?

- Individuals and communities
- Regions
- Governments – Local, State, Commonwealth

3. BIOSECURITY – Why? Why now?

- "Shared responsibility" - continuum
- Legal obligation – the DEED
- Human behaviour
- Globalisation

4. BIOSECURITY – Components?

- Engagement and awareness
- Risk analysis
- Implemented measures – hygiene, preparedness
- Surveillance
- Recording
- Reporting
- Response capacity and capability

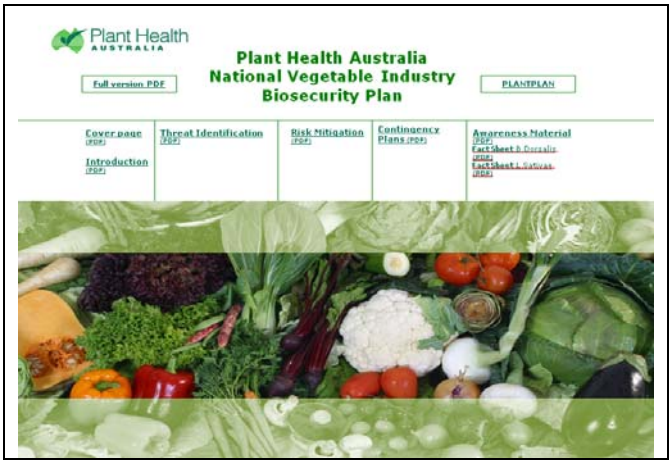
5. BIOSECURITY- Benefits

- Market access
- Evidence →Area status
- Early detection
- Traceability
- Harmonisation
- Collaboration and shared resources
- Consistent messages
- Effective management

6. BIOSECURITY – Costs?

Environmental, economic, human health compromises

- Increased surveillance, reporting, recording
- Loss of benefits, through
  - Incursions
  - Quarantine
  - Lost market access
  - Yield losses, ⇧ production costs
  - Supply chain costs



7. REGIONAL FRAMEWORK – Why the NAP?

- Crop mix; agriculture and horticulture
- Perennial, annual
- Protected; in-field; nurseries
- Organic. conventional
- Seed and vegetative propagation
- Allied industries
- Produce market
- Swap meet
- Arterial roads
- Peri-urban, urban
- Casual labour
- Ethnic diversity
- Existing surveillance

8. REGIONAL FRAMEWORK - Project components

- Region vs on-farm
- Pest threats - High priority, Alert, Endemic
- Threat sources
- Participants
- Drivers
- Resources
- Challenges

9. REGIONAL FRAMEWORK – Participation

- Stakeholders – active
- Community – passive, active
- Cross-industry
- Cross business
- Cross-government agency and levels
- **Industry reference group**

10. REGIONAL FRAMEWORK – Outputs? Outcomes?

- Engagement strategies
- Communication – format? Message type and targets?
- Regional collaboration
- Value-adding opportunities
- R&D focus
- Resources increased, shared
- Human capacity building strategy
- Success parameters identified

Comments can be faxed to:
Dr Prue McMichael
Scholefield Robinson Horticultural Services Pty Ltd
Fax: (08) 8373 2442

Name (Optional): _____

Company Name: _____

Contact Details: _____

_____

_____

REGIONAL BIOSECURITY

BACKGROUND: **Biosecurity** refers to the protection of **lifestyles, livelihoods** and the **environment**. Simply put, improved **regional biosecurity** should in a practical sense involve the whole of the community and provide greater protection against the introduction of exotic and unwanted pests, diseases, food safety contaminants, and weeds. In its broadest sense regional biosecurity must also consider the security of **inputs** (water, chemicals, fertilisers, compost, seed etc), **waste**, and the effects of weather events, planning decisions etc.

As signatories to the Emergency Plant Pest Response Deed (EPPRD), most horticultural industries now have a legal obligation to develop and implement comprehensive risk management strategies to maintain plant health, manage exotic incursions, and provide knowledgeable representatives to national decision-making committees.

BIOSECURITY on the NAP: Scholefield Robinson and Horticulture Australia are working on a **biosecurity framework –** a series of considerations and steps that might be needed in order to advance biosecurity within a region. We are using the NAP as the case study region, and it was chosen because it is a complex area – peri-urban; mixed agriculture - perennial, annual, protected horticulture; non-commercial and commercial livestock/birds; major produce market and non-corporate outlets (markets, swap meets, roadside stands), diverse allied industries (compost, transport, re-sellers, researchers and consultants etc); ethnic diversity; permanent and transitory labour etc.

The **steps** that underpin a regional plan include: **stakeholder identification** (primary producers, peak industry bodies, the general community, state and local government, allied industry, allied labour etc.); **engagement** strategies and key messages for each group; **threat** identification and their sources; **on-farm** and **community capacity** (e.g. incentive and capability for monitoring/surveillance, recognising threats, recording observations etc.); identification of **threat-promoting** and -**minimising activities**; **awareness** and **information** gaps, biosecurity **impediments/barriers** and **solutions;** development of a **communication network** cross-commodity, cross-region etc.

Prue McMichael has met with several commodity groups and authorities interested in the NAP in relation to the above considerations. She has received feedback on threats, their sources, perceived risk-promoting activities, views about how biosecurity could be improved and the roles various groups might undertake. A few are noted below:

1) Sources of your major biosecurity threats?

Examples: waste and lack of cost-effective removal services; re-using containers/pallets etc; feral trees/abandoned orchards; casual labour/visitors; illegal planting material; lack of knowledge of threats and risky practices; lack of help/expertise provided; non-compliance; practices of other commodity/supplier groups; residents or backyard gardens; water - flooding, major soil movement; lack of regional communication; local government decisions/planning etc.

2) What will motivate NAP stakeholders to engage in biosecurity advancement?

Examples: the experience of a disaster (like phylloxera, or loss of important chemical due to resistance); loss of markets because of new pest (quarantined zone); cost of production going too high because of pest controls needed; government or local government regulations (waste removal, clearing abandoned crop sites etc); food safety problem (Salmonella or E.coli in local produce); enforced accreditation linked to local government help/services; a cross-industry regional biosecurity committee; cost-effective monitoring being made available; free diagnostic services for unusual pests; more regional communication that ensures everyone has to be involved and doing their bit; prospect of new markets or lower costs of production with 'pest-free status'.

Appendix 5

Regional Survey

Biosecurity: Plant Pests and Diseases

(Adapted from ACERA, Gilmour *et al* 2009)

As a region we are committed to improving the Biosecurity of the NAP. We need to determine your understanding of biosecurity and how it affects your farm, business, livelihood and our region. We would appreciate if you would complete the following survey as your responses are critical to the progress of this study.

Completion of this survey is expected to take about 20 to 30 minutes. Please tick the appropriate responses or provide a brief answer on the space provided. You may omit any question you prefer not to answer. All information you provide will be considered confidential and all results of this study will be presented as a group with no individual participants being identified.

Please return the completed questionnaire in the self-addressed, reply paid envelope by ???. If you have any questions about this study, or would like additional information, please contact …..

Background information

1. Age: ☐ 15-24 years ☐ 25-54 years ☐ 55-64 years ☐ 65 years and over

2. Household composition at your property:
   Number of adults who have left school (including children) _____
   Number of children of school age _____
   Number of children below school age _____

3. Stakeholder Group
   ☐ Commercial Grower ☐ Allied Agri-Business ☐ Non-commercial grower
   ☐ Community ☐ Agri-labour

4. Is English your first language?
   ☐ Yes ☐ No If 'No', what is your first language _____

5. Do any of the adults in the household have off-farm employment?
   ☐ Yes ☐ No If yes, how many hours per week? _____
   If yes, which industries? _____

6. On average over the last five years, what proportion of your household income has been derived from your property?
   ☐ 0 ☐ less than 10% ☐ 10-50% ☐ 51-80% ☐ 81-100%

7. Tenure details:
   ☐ Property owned ☐ Property rented / leased ☐ Polyhouse / Glasshouse leased

8. Permanent or part-time residency on the NAP:
   ☐ Permanent ☐ Weekender ☐ Absentee owner (less than 4 visits a year)
   ☐ Other Please specify days per year _____

9. Have you previously lived elsewhere on a rural property?

☐ Yes ☐ No If yes, where? _____

Main activity? _____

10. Have you always lived in the NAP local government area? ☐ Yes ☐ No

If **no**, why did you move to this area? *(Please tick those that apply)*

☐ Rural lifestyle ☐ Rural pursuits ☐ Affordability

☐ Proximity to work ☐ Natural values ☐ Other _____

11. What is the nature of the properties that adjoin yours?

☐ Small landholdings (less than 30ha) ☐ Large landholdings (greater than 30ha)

☐ Small and large landholdings ☐ Agribusiness

☐ Residential ☐ Unsure

Activity on your property

12. Do you have any animals on your property? ☐ Yes ☐ No

If yes, what animals do you have?

☐ Sheep ☐ Alpacas ☐ Horses ☐ Dogs ☐ Cats ☐ Goats

☐ Cattle ☐ Poultry ☐ Pigs ☐ Other_____

For what purpose ***(Please tick those that apply)***

☐ Commercial ☐ Recreation ☐ Lawnmowers ☐ Pets ☐ Personal consumption

13. Do you grow crops on your property? ☐ Yes ☐ No

If yes, what? _____

_____

For what purpose? ***(Please tick those that apply)***

☐ Personal Consumption ☐ Commercial Sale ☐ Non-Commercial Sale

☐ Swap meets, Markets ☐ Other_____

14. Do you grow vegetables and/or fruit on your property? ☐ Yes ☐ No

If yes, what? _____

_____

For what purpose? ***(Please tick those that apply)***

☐ Personal consumption ☐ Commercial sale ☐ On-site processing

☐ Other _____

15. Do you grow seedlings on you property? ☐ Yes ☐ No

16. Do you grow flowers on you property? ☐ Yes ☐ No

Biosecurity

17. How familiar are you with the term biosecurity?
☐ Not familiar ☐ Somewhat familiar ☐ Very familiar

18. What do you understand the term "Biosecurity" to mean?

_____

_____

_____

_____

19. Is biosecurity relevant to you?
☐ Not relevant ☐ Some relevance ☐ Very relevant ☐ Don't know

20. What do you think are the main factors that contribute to pest and disease spread in this region? ***(Please tick the appropriate response for each threat)***

	No impact	**Some impact**	**Significant impact**
Erosion, Soil Managment	☐	☐	☐
Wind	☐	☐	☐
Water	☐	☐	☐
Native and non-native vermin / animals / birds coming onto properties	☐	☐	☐
Bringing other plant material and feed from other areas onto properties	☐	☐	☐
Equipment and machinery moving between properties	☐	☐	☐
Other people's land management practices	☐	☐	☐
Movement of people	☐	☐	☐
Quarantine practices at distant borders	☐	☐	☐
Knowledge to recognise disease / pest symptoms	☐	☐	☐
Knowledge to recognise weeds	☐	☐	☐
Awareness of impact of the spread of pests and diseases	☐	☐	☐
Resources available to growers	☐	☐	☐
Lack of support	☐	☐	☐
Other _____	☐	☐	☐
_____	☐	☐	☐

21. List up to 5 pests, diseases or weeds that you believe are significant in this district or could become significant?

_____

_____

_____

_____

_____

22. List up to 5 pests, diseases or weeds that you have experienced personally

_____

_____

_____

_____

_____

23. If you saw a weed, pest or disease on your property that you could not identify, what do you do? ***(Please tick those that apply)***

☐ Nothing ☐ Ask a friend /neighbour ☐ Search for information myself

☐ Ask a consultant ☐ Ask VHC ☐ Other_____

24. What are your top 3 reasons for managing weeds on your land? ***(Please rank from 1 to 3 in order of importance)***

_____ Animal health _____ Crop protection _____ More costly if not done early on

_____ Maintain land value _____ Good land management _____ Aesthetics

_____ Compliance _____ Responsibility to neighbours

_____ Other *(please specify)* _____

25. What steps do <u>you</u> take to keep your land free from pests and diseases? ***(Please tick the appropriate responses)***

	Never	**Sometimes**	**Always**	**Not Applicable**
Remove volunteers and feral plants	☐	☐	☐	☐
Call Local Government authority about roadside weeds, waste water, and run-off.	☐	☐	☐	☐
Make visitors check in at office	☐	☐	☐	☐
Cleaning machinery and equipment	☐	☐	☐	☐
Cleaning vehicles going between places	☐	☐	☐	☐
Cleaning shoes and clothing	☐	☐	☐	☐
Getting plant material from trustworthy sources	☐	☐	☐	☐
Do not share equipment	☐	☐	☐	☐
Keep records	☐	☐	☐	☐
Monitoring (for weeds, pests & diseases)	☐	☐	☐	☐
Spraying chemicals	☐	☐	☐	☐
Restricting (to the extent possible) the entry of pest animals	☐	☐	☐	☐
Covering or burying green waste	☐	☐	☐	☐
Pay for removal of green waste	☐	☐	☐	☐
Other *(please specify)* _____	☐	☐	☐	☐
_____	☐	☐	☐	☐

Any other comments about any of the above: _____

_____

26. What are your main land/crop management concerns?

_____

_____

_____

27. Which groups or organisations do you feel are best able to drive/ motivate biosecurity progress in this district?

_____

_____

_____

Networks, travel patterns and communication

28. Please list all the local and regional networks that you are involved with (e.g. attend meetings, events, receive newsletters):

Work related	
Specialist animal/plant groups	
Research / extension	
Recreational/sporting	
Children's activities	
Social (e.g. bridge club, craft group)	
Community service groups (e.g. Rural Fire Service, CWA)	
Environmental groups	
Other	

29. Do you have regular access to reliable internet services?

☐ Yes ☐ No

If yes, how often do you access information related to land or crop management?

☐ Not at all ☐ Only for high attention issues

☐ Regularly ☐ Whenever I have an issue on which I need information

30. Do you access any of these websites or entities for information on weeds and animal/crop diseases? ***(Please tick those that apply)***

☐ DAFF, *www.daff.gov.au*

☐ Primary Industries and Resources South Australia (PIRSA), *www.pir.sa.gov.au*

☐ Virginia Horticulture Centre (VHC), *www.virginiahc.com.au*

☐ Local Council

☐ Specialist crop association websites

☐ Plant Health Australia (PHA), *www.planthealthaustralia.com.au*

☐ Horticulture Australia (HAL), *www.horticulture.com.au*

☐ Peak Bodies for vegetables, potatoes, onions etc.

☐ Other (please specify) _____

31. What newspapers do you read regularly?

☐ Advertiser ☐ The Australian ☐ The Land ☐ The South Australian Grower

☐ Stock Journal ☐ Ripe ☐ None ☐ Other_____

32. What radio stations do you listen to regularly?

☐ ABC Local ☐ Radio National ☐ None

☐ Other Local _____

33. What special interest (farming, plants etc) magazines/newsletters do you read regularly?

_____

_____

_____

_____

_____

34. Have you received information about pests, weeds or animal diseases in the past two years?

☐ Yes ☐ No ☐ Unsure

If yes, where from?

_____

_____

_____

_____

35. What is your preferred method of receiving regulatory (or 'high attention') information: (eg publications, brochures, inserts in magazines, inserts in council notices, flyers from re-sellers, R&D report, face-to-face meetings, etc)

_____

_____

_____

36. Other comments:

_____

_____

_____

_____

_____

_____

Thank you for taking the time to fill out this survey.

Appendix 6

Biosecurity Checklists

On-farm Biosecurity and Surveillance Considerations

Category	Components	Examples	Purpose – comments
Site Choice	Topography	Drainage, influence of animals, septic tanks locations	Prevent/avoid contamination
	Crop history	Rotations; pre-plant populations (nematodes, fungi etc)	Avoid infested sites
Site	Signage	Property code	Useful in management of incursions
Water	Drainage	Patterns. Note positions of livestock/wild, septic tanks, stock piles manure, crops	Prevent contamination
	Irrigation	Quality of source	
	Chemical applications		Potable water- for any crop/vegetable contact Prevent spread of persistent pests or pathogens
	Cooling		
	Post-harvest washing	Water quality; sanitizers, chlorine concentration (and pH); contact time	
	Re-cycled water	Single return system only	
	Dust settling sprays		
	Wheel dips	Water change schedule	Avoid introduction of pest
Inputs	Planting material	Choice of Seed, vegetative material	Traceability; health,, early contaminant ID, good supplier
	Chemicals	Permits, labels; storage security, batch no.	Traceability; safety, efficacy; legal use
	Manure, compost, bees	Specifications of aging, supplier details and records, batch numbers; storage	Traceability; avoid non-compliant lots; contamination
Hygiene	Field workers	Facilities available, signs	Food safety
	Packing shed	Sanitation; reporting illness/wounds; separate eating areas	Food safety
	Facilities	Sanitation foot baths, hand washing, visitor register	Worker and food safety
	Clothing	Appropriate; clean changes – coveralls, gloves	Worker and food safety
	Equipment	Restrict movement and access; cleaning and inspection regime	Preventing spread & introduction
Waste disposal	Crop debris	Removal methods & location (away from crops)	Avoid point source contamination
	Chemical waste	Storage; removal	Avoid accidents; contamination
	Equipment-used crates etc	Inspection, storage, removal	
Crops / Pests	Surrounding vegetation; weeds	Other crops, neighbouring crop age	Surveillance: presence, absence, distribution, management; detections of harboured pests/pathogens
	Visual checks; inspections	Appearance, distribution of symptoms	Surveillance – adding to the network; early detection preparedness
	Trapping/monitoring	Frequency, trap locations, results interpretation	
	Sampling	Soil, water testing, diagnostics; GPS locations	Early detections; reveal management options
	Abandoned plantings	Destroy unpicked crops.	
Personnel	Staff	Education -biosecurity training; resources and contacts (eg posters; diagnostic, commodity specialists)	Increasing awareness of food safety and biosecurity. Increase management capacity and response preparedness
	Visitors	Entry sign-in; signage around property, facility	Preventing introductions of pest/pathogens
Record keeping	Batch numbers, labels; supplier details	Seeds, planting material, chemicals, suppliers details	Traceability
	Key dates	Irrigations, treatments, planting, symptom development; weather events	Preparedness; traceability; management options
	Photos; GPS details	Symptoms, distributions	
	Weather	Major events	Preparedness
	Inspections/monitoring/QA scheme	All pests – presence, absence, distribution, timing	Preparedness; surveillance to support area freedom determinations

Source: McMichael , 2008

Summary Check List

Pests	• Crop monitoring should be carried out and recorded to reduce the risk of new pests establishing, maintain access to markets and provide information for better pest control.
	• If you suspect a new pest or see unusual symptoms on the crops:
	  o Report it immediately to the Exotic Plant Pest Hotline on 1800 084 881.
	  o Restrict movement of people and equipment in the area.
	  o Wash clothes and skin in contact with affected crops, produce or equipment.
	• Be aware of key vegetable industry pest threats.

Product management	• Planting material and farm inputs can carry pests onto your farm. • Ensure planting material is from a reputable supplier and retains all documentation. • Dispose of waste and by-products appropriately, away from production areas. • Implement a Quality Assurance scheme on-farm. • Be aware that hive biosecurity measures impact on your farm and crops.
People and biosecurity	• Biosecurity signs should be placed at the main gate and any other entrances to the property. • Use a visitor register to track people movement. • Ensure all visitors have cleaned their vehicles, clothing and equipment before entering the property. • Provide cleaning equipment for visitors and employees
Equipment and vehicles	• Provide a wash-down facility on-farm, or identify an available wash-down facility in your region. • Do not allow entry to contractors, visitors and employees who do not clean their vehicles and equipment. • Provide a designated parking area away from production areas.

Induction and farm biosecurity risk checklist

Name: _____ Date: _____

Pests	
Who do you report suspect pests to?	Name:
	Contact number:

Product management	
Crop waste is disposed of	Location:
	How:
Packing shed waste is disposed of	Location:
	How:

Cleaning and disinfecting equipment, tools and machinery			
Equipment to be disinfested with, and the frequency	Hot soapy water		
	Equipment	By whom	How often
	Bleach		
	Equipment	By whom	How often
	Methylated spirits		
	Equipment	By whom	How often
	Other specified products:		

People, vehicle and equipment movement	
Parking area	Location:
Wash-down area	Location:
	Equipment/vehicles to be cleaned:
	Cleaning products available:
On-farm equipment, clothing and tools	Available items:
	Location:
Footbaths	Location:
	When to use:
Farm-specific biosecurity measures	

Additional copies of this checklist can be downloaded from **www.phau.com.au/biosecurity/vegetables.**

On-farm biosecurity checklist

On-farm/property name:

Date of biosecurity check:

Recommended practices	Yes	No	Comments
Pests - general			
Commercial crops and neighbouring vegetation are regularly inspected for pests			
On-farm staff know how and where to report pests			
On-farm staff are familiar with the high priority and alert pest threats for your region's vegetable industries			
Active pest surveillance is regularly conducted			
Multiple surveillance methods used – eg. visual inspections, netting, yellow cards			
Survey activities and results are recorded, even when nothing is found			
Inspections and pest control records are accessible and available			
Waste (water, plant debris etc) exposure is minimised			
Vermin are controlled in/around processing/packing area			
Product management			
Propagation material (seed, transplants, cuttings) is free from pests – visually and by documented testing			
Planting material is 'certified' or has defined health status			
Records of planting material and its source maintained			
Planting material without complete documentation not accepted on property			
Staff have specific knowledge of symptoms of vegetable pests spread via seed and other propagation material			
Effective monitoring/pest management program maintained			
No soil, plant material or insects left on equipment or in bins			
Vegetables loaded and unloaded on paved or sealed pad away from production areas			
Plant waste and packing shed waste disposed of away from production areas and irrigation sources			
Off-site unsold produce is not returned to the production site			
Produce tracking and complaint response system is in place			
*** For protected crops**			
Multi-faceted surveillance methods used – yellow cards, baits, pheromone traps, symptom inspections			
Seed and transplants free from pests – visually and by documented testing			
Clean substrate is sourced from approved suppliers only			

Recommended practices	Yes	No	Comments
Growing media batches meet specifications and are tested pre-plant			
New twine is used for each new crop in greenhouses			
Overlapping crops are not raised in same nursery facility (eg greenhouse)			
Insect screens are installed at openings and in vents			
Staff know symptoms of vegetable pests spread via seed and other propagation material			
Smoking is not allowed in greenhouses, around fresh produce or near chemical storage areas.			
Secateurs and hand tools are disinfected using a bleach solution between rows/glasshouses etc.			
Used plastic (production tarps, and handlers' gloves etc) is disposed of effectively			
Plumbing has back-flow prevention devices			
*** for Seed**			
Seed is 'certified' or has defined health status			
Transplant production nursery is BioSecure *HACCP* certified			
Staff know symptoms of vegetable pests spread via seed/transplants			
Import conditions, testing, place of production and export known and recorded			
Sample of seed retained and stored appropriately			
Cleaning, sanitising and maintenance records are available			
People movement			
Biosecurity signs are located at main entrances			
Visitors sign a Visitor Register on arrival			
Visitors, clothing, footwear and tools are free of loose soil or plant matter before entering or leaving the farm			
All people recently returned from overseas have clean footwear and clothes before entering the farm			
Footbaths and scrubbing brushes provided for visitors and staff moving from contaminated to clean areas of the farm			
On-farm vehicles used to transport visitors around the property			
On-farm staff aware of biosecurity procedures in place			
Personal hygiene policies are documented and displayed			
U-pick visitors are confined to one block with direct access ??			
Equipment and vehicles			
Designated parking area for non-farm vehicles			
Cleaning and wash-down facilities, preferably on a concrete pad, provided for people, machinery and equipment			
High pressure water or air available for use to remove plant material and soil from equipment and machinery			
Sump installed in wash-down facility to catch unwanted weeds and stop run-off			

Recommended practices	Yes	No	Comments
On-farm vehicles kept clean by regularly clearing the vehicle floor of soil, weed seeds and insects			
Vehicle movement kept to a minimum in production areas			
Borrowed and second-hand machinery and equipment is cleaned of all plant material and soil before use			
Secateurs and hand tools are disinfected between rows/cultivars			
Cleaning, sanitising and maintenance records are accessible and available for inspection			
Movement (personnel and equipment) between mulch/compost and produce (harvest/processing) is controlled to prevent contamination			
Waste (plastic etc) is disposed of effectively			
Machinery is cleaned before being moved off property			
Pallets, boxes, lugs, trays, pots are used only for produce			
Pallets, boxes, lugs, trays, pots are not re-used? Re-used after authorised cleaning/sanitation standard?			
Transport vehicles are inspected for dirt, debris before loading			
For Other specific inputs			
*** Water**			
Water is regularly tested for microbial and chemical contaminants			
Water supplies are secure			
Backflow devices are present			
Used drip line is disposed of away from fresh produce			
*** Chemicals**			
Chemical storage areas are secure and dry			
Batch numbers are recorded			
Chemicals are not stored outside original, labelled container.			
Empty containers are disposed of as required			
*** Fertiliser**			
Fertilisers are acquired from reputable suppliers			
Fertiliser product and application meets industry standards			
Source is known and traceable			
*** Compost and mulch**			
Deliveries include origin and source material documentation			
Storage is isolated to minimise cross-contamination			
Seepage from stockpiles is contained			

Seed and transplant producer and provider checklist

The following checklist is specifically relevant to your planting material providers. Discuss these points with your seed company sales representative and nurserymen providing transplants. To reduce the risk of introducing new pests to your farm, keep the responses and documentation associated with every seed lot and every transplant batch.

Seed producer name:

Nursery name:

Date of propagation material purchase:

Propagation material purchased:

Batch/reference number:

Retained batch sample location:

Recommended practices	Yes	No	Comments
Pests			
Nursery is NIASA accredited**? BioSecure *HACCP*** accredited*			
Transporters are approved			
Nursery/seed company documentation allows traceability			
Nursery/seed company staff familiar with general biosecurity practices			
Nursery/seed company staff familiar with exotic and endemic threats of vegetables			
Specific testing (pests, timeframe) is documented			
Test results are documented and auditable			
Pest threat posters displayed			
Staff know how and where to report pests			
Unlabelled material or that of unknown/undocumented origin, is not accepted as planting material			
An effective monitoring/pest management program maintained and recorded in 'spray diary' or similar			
Active surveillance is formally conducted – inspections, sticky cards, traps etc.			
Survey activities are recorded, even when nothing is found			
Product management			
Biosecurity/authorised person at nursery is known			
Seed source and production location has been identified			
Seed health and germination test results have been provided			
Propagation material is free from pests			

Certified 'seed' is physically separated from non-certified plant material			
Supplier is approved member of NGIA and using NIASA or Biosecure *HACCP*			
Register of plant material by import/accession number and date of importation maintained			
Register of planting material and its specific source maintained			
Planting location (bench, greenhouse, rows etc) documented			
In-coming and out-going plant materials are isolated			
Staff are familiar with symptoms of vegetable pests transmissible in 'seed' (see list)			
Pots and bins are not re-used or regularly and thoroughly sanitised			
Plant debris and trimmings are disposed of appropriately			
Water disinfestation and sanitation schedules and results documented			
Staff understand laws governing declaration and introduction of plant material			
People movement			
Biosecurity signs with contact details located at main entrance			
All visitors enter details into Visitor Register before moving about property			
All visitor and staff clothing, footwear and tools are free of loose soil or plant matter before entering and leaving the nursery			
All people recently returned from overseas are checked to ensure they have clean footwear and clothing before entering nursery			
Footbaths and scrubbing brushes are provided			
Staff trained in biosecurity measures and threats			
Staff understand neighbouring enterprises and their activities			
Equipment and vehicles			
Designated parking area provided for visiting vehicles and contractor equipment			
Paved, sealed or compacted walkways through the nursery propagation areas			
Suitable cleaning and wash-down facilities for in-field propagators			
Effective water treatment, recycling and run-off containment			
Livestock are isolated from irrigation water sources			
Vehicle and people movement minimised in production areas			
Borrowed and second-hand machinery and equipment is cleaned of all plant material and soil before entering production areas			
Hand tools are regularly disinfected (with bleach solution)			

* **BioSecure *HACCP*** is the on-farm biosecurity program for production nurseries in Australia. If your nursery has this qualification they are highly likely to be following best practices for container and/or in-ground production. The integrity of the business' biosecurity records and preparedness is auditable and should be assured.

Appendix 7

Factsheets for Manual and Biosecurity Practitioners Biosecurity Kit

Biosecurity and Food safety

Consumers rightly expect their fresh produce to be safe for eating. At every step in the production chain and supply chain there are threats to that safety, and some horticultural industries have been crippled by contamination of human health concern (e.g. *E. coli*, Salmonella). The sources of such contamination have usually been biological and from poor hygiene and handling practices, or inputs like water (contaminated via excrement of vermin or birds, fresh manure, or biosolids). Vegetables packed in the field present the highest risk for consumers, especially where the potential for direct produce contact with soil, recycled or animal-contaminated water, or unhealthy workers, exists. Providing good hygiene facilities and training for workers and keeping animals off-farm and away from water sources, can assist. Environmental damage may also result from inputs used incorrectly.

Chemicals are an important input with potential human safety implications – both for produce consumers and chemical users. In addition to ensuring responsible chemical use, (e.g. 'spray diary' for each consignment of vegetables; residue testing), chemical waste removal must also be responsible in order to protect farms and the wider environment. On rare occasion heavy metals and chemical sabotage have also been implicated in some human health issues.

Produce traceability from seed to the saleable product (fresh, dried, frozen), is the mechanism that allows effective investigation of produce not meeting food safety standards, and for minimisation of the economic and human health impacts of unsafe produce. FreshTest Australia and the National Residue Survey are programs aimed at ensuring food safety through appropriate testing. FreshCare™ is the horticulture industry-owned, not-for-profit, on-farm assurance program. It is based on codes of practices and training support materials. Your industry's involvement in these schemes strengthens your industry's biosecurity and food safety.

There are important check lists regarding input quality. Each grower has some capacity to assess the likely quality of the inputs allowed onto the farm. Knowing the credentials of your suppliers, the industry standards to which they adhere, and the traceability of their products will guide growers toward the best inputs, and providers of them. Effective biosecurity minimises the opportunities for unintentional contamination, and intentional damage (sabotage).

Bee and hive threats

The Australian honey bee industry currently faces several key biosecurity threats. The highest threat is considered to be Varroa mite (*V. destructor* and *V. jacobsoni*), which is carried on Asian and European honey bees in countries to the immediate north (Papua New Guinea) and east of Australia (New Zealand). More information can be found in the fact sheet included in this manual. The Asian honey bee is capable of not only carrying the Varroa mite but is also a very aggressive competitor.

Varroa mites feed on both adult and broodbees, weakening them and spreading bee pathogens within the colony. Infestation ultimately results in deformed bees, early death of individual bees and slow death of the honey bee colony unless control measures are applied.

Other threats include:

- Tracheal mite: Infestations result in sick bees that do not work as hard or live as long as healthy bees. The mite spreads from bee to bee, hive to hive and is difficult to detect.
- *Tropilaelaps clarae* mite: This parasite causes brood death or shortened life span for any bees that survive to adulthood.
- The application of biosecurity measures also addresses pests already established in Australia, such as the Small hive beetle, American foulbrood and the European foulbrood of honey bees.

Increasing hive biosecurity

Beekeepers should:

- Check the health of any bees purchased (get a vendor declaration to define the health status).
- Consider hive placement, and what pests might be at a new location.
- Specifically check for Varroa mite, Tracheal mite and Asian honey bee.
- Position hives to limit the transfer of pests from hive to hive.
- Consider the stress placed on bees that are regularly moved.
- Avoid placing hives in proximity of rubbish tips or where birds are fed honey.
- Avoid the placement of hives near abandoned hives or abandoned farms.
- Avoid the contact of livestock with the hives.
- Regularly inspect bees for unusual behaviour.
- Isolate captured swarms for six months to ensure their health and that they are free from pests.

Vegetable producers utilising pollination services and beekeepers should:

- Ensure all on-farm and hive equipment has been cleaned between uses.
- Wash and disinfect hands when moving between hives.
- Ensure boots and clothing are free from plant material, soil, insects and other pests before entering and leaving farms or handling hives.
- Minimise the number of people that visit the hives.
- Prevent vehicles from driving in close proximity of the hives.
- Secure honey stores and equipment so robbing bees cannot gain access.
- Report anything unusual to the Emergency Animal Disease Watch Hotline on 1800 675 888.

BIOSECURITY AND FARMERS' MARKETS

(adapted from DAFF documents within: www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity)

Farmers produce markets provide a great opportunity for farmers to sell their agricultural products direct to the consumer and, in turn, consumers enjoy being able to buy fresh produce direct from the farm.

With farmers markets rapidly growing in Australia it must be acknowledged that these gatherings could potentially be a vehicle for the spread of animal and plant pests and diseases.

Australian farms currently enjoy freedom from major pests and disease, so good biosecurity practices are essential in maintaining this health status. In addition to standard biosecurity practices, participants at farmers' markets should also adopt the following biosecurity measures.

At the farmers' market

- Don't share equipment with other stall holders without ensuring it is clean and free of soil and contaminants. Disinfect containers and equipment as necessary.
- Don't put other stall holders' products in with yours, keep them separate.
- Ensure the produce you sell is fresh and of high quality.
- Brush or wash fruit and vegetables to remove soil before selling.
- Always practice good personal hygiene and cleanliness at your stall as disease can be carried on clothing, footwear and skin.

Food safety and your obligations

Food licencing requirements vary from state to state. Farmers' market organisers work with local government to ensure all stall holders meet their selling obligations and licencing requirements. Talk to your farmers' market organiser if you require further information.

When you get home

- Disinfect your equipment with household disinfectant.
- Keep an eye out for, and immediately report any signs of animal or plant disease.
- Make sure new animals are isolated from others initially.
- Do not bring back unsold produce to your farm where possible. It may have been exposed to other pests/diseases.

Bird pests and diseases

- Where possible use new egg cartons when selling eggs as pre-used cartons can help spread disease. If you use pre-used cartons, keep them away from birds and always wash your hands after handling the cartons before handling your birds.
- Always practice good personal hygiene when handling meat and eggs.

BIOSECURITY FOR ON-FARM SERVICE PROVIDERS

This information is also available in the following format:
Biosecurity guidelines when entering farms or animal facilities PDF [84kb]
Guidelines for visits to farms or animal facilities during an animal disease outbreak PDF [80kb]
(adapted from DAFF documents within: www.daff.gov.au/animal-plant-health/pests-diseases-weeds/biosecurity)

Biosecurity guidelines when entering farms or animal facilities

Biosecurity is everyone's responsibility. Good biosecurity protects businesses and jobs in primary production and related industries such as eco-tourism, hospitality and travel.

Utility workers, contractors, volunteers and community support providers (and anyone else visiting properties) need to be aware of basic biosecurity measures. Even if a disease cannot infect humans, people can still transfer disease to livestock without realising.

These guidelines apply when visiting farms or animal facilities such as saleyards, stables, kennels, abattoirs and catteries. If followed they will help minimise the risk of spreading infectious diseases such as equine influenza and foot and mouth disease.

What's the risk?

People - can carry disease-causing organisms - clothes, shoes, hands and even nasal passages can harbour organisms.

Vehicles - tyres and the undercarriage of a vehicle can pick up dirt or manure which contains disease causing organisms.

Equipment - can carry disease to livestock. This is even more likely if it is equipment used regularly on or near animals.

What you need to know

- Avoid all unnecessary contact with livestock.
- Consider boots, shoes, work clothes and overalls - do they need to be cleaned or changed?
- Wash hands after contact with any farm animal, including working dogs and pets.
- As vehicles are hard to clean, park your vehicles away from places that are trafficked by animals, such as sheds, livestock thoroughfares and paddocks. Where possible leave vehicles at gate to property.
- Avoid moving soil (including on your boots) from property to property.
- Check that equipment used with stock is properly cleaned and disinfected.
- Keep informed - know about disease issues in your district and observe all biosecurity measures in place.

- If you spot unexpected or unusual signs of disease, abnormal behaviour or unexpected deaths in animals, act immediately. Call a veterinarian, local government animal health authority or the Emergency Animal Disease Watch Hotline on **1800 675 888**.

Guidelines for visits to farms or animal facilities during an animal disease outbreak

- During the outbreak of an emergency animal disease biosecurity measures are essential to help stop its spread.
- People, vehicles, equipment and clothing can transport infectious animal diseases. Anyone who has contact with infected animals or their environment can transfer infection.
- The guidelines below are for visitors (e.g. visits by utility providers, service providers, contractors, or community support providers) who attend properties or animal facilities during an animal disease outbreak.
- Animal facilities include places such as saleyards, stables, kennels, abattoirs and catteries.
- Visitors must follow all the guidelines below to help contain the disease.

Is your visit necessary?

- Check if the visit is necessary. Only essential vehicles/visitors should enter farms or animal facilities.
- Use other methods of communication with property owners, for example, phoning for meter readings.

Before you enter a property

- Contact the property owner.
- Plan your vehicle and personal decontamination. If the property owner advises that suitable disinfection equipment is not present on the property, bring disinfectant, water, bucket, towel and scrubbing brush. Also, bring a change of clothes and a sealable laundry bag.

When you enter a property

- Where possible, leave your vehicle at the front gate or away from animals.
- Drive or walk on driveways or hard surfaces where possible.
- Go directly in and out of the property.
- Do not physically go near any animals. Keep away from animal products such as manure, urine, feathers or hair, equipment and bedding.

Procedures to follow during visits

- Do not come into direct contact with animals, their products, equipment or housing.
- No special procedures are required for visitors who only use sealed paths or roads and have no contact with animals or people in direct contact with animals.
- More decontamination is required if a visit involves direct or close contact with animals or people with close contact, or driving across roads or paddocks.

Leaving a property

- If a vehicle enters a property, cleaning is required if it gets mud or manure over its surface.
- If you come into direct contact with an animal, full personal decontamination (below) is required. You should avoid contact with other animals for 24 hours.

Personal decontamination

- After coming into direct contact with an animal, wash all exposed skin with soap and water, and disinfect footwear. Change clothes, including hat and footwear before handling healthy animals.
- Launder clothes in hot water and laundry detergent.
- Even if you haven't come into direct contact with animals, wash your hands with soap and water, and clean and disinfect footwear. A change of clothes is not required if you did not come in contact with animals.

Decontaminating vehicles

- Clean and wash vehicles thoroughly with water to remove all matter. Wash wheels and wheel arches (and undercarriage) thoroughly with detergent and water.
- Drivers should ensure that they clean inside their cabin (including seat, steering wheel, door and door handle) and change their clothes and shoes. Place the dirty clothes and shoes in a plastic bag and perform personal decontamination of these items.

SPRAY DRIFT

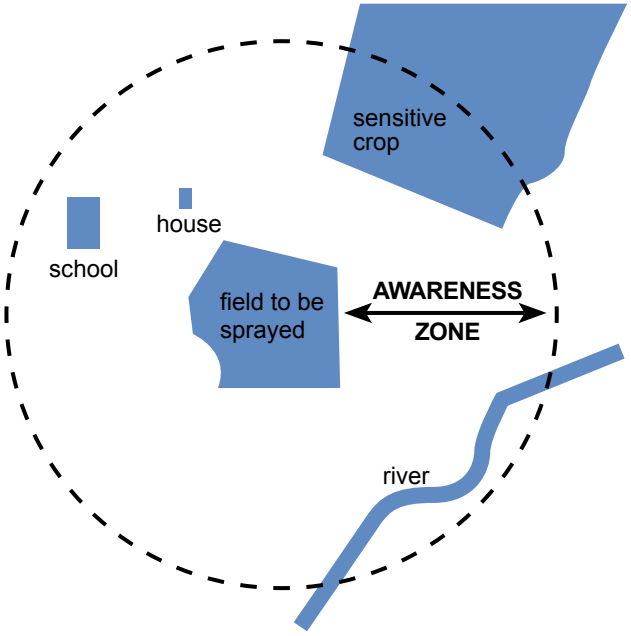
Spraying this season?

Be aware - take care this summer

Spray drift costs YOU directly in money and can impact on everyone in the community

Doing the job right will protect you and your business from:

- Causing off-target crop damage
- Losing your own non target crops and pastures
- Wasting time and money on poor applications
- Damaging community relationships
- Visiting the lawyers
- Losing potential access to particular chemicals
- Causing resistant weed development
- Harming the environment



Useful Resources

APVMA – Registered Labels, 2,4-D Information, Minor Use Permits, Spray Drift Website
www.apvma.gov.au/index.asp

NSW Dept. of Environment, Climate Change and Water 'Chemicals and Pesticides'
www.environment.nsw.gov.au/pesticides/index.htm

NSW Training Requirements
www.environment.nsw.gov.au/pesticides/training.htm

Decision Support
www.syngenta.com.au/start.aspx
www.spraywisedecisions.com.au/
www.pestgenie.com.au/

Crop Consultants Australia Inc.
www.cropconsultants.com.au/home.html

Neighbour Notification
www.nswfarmers.org.au/policy_committees/ag_chemicals
www.cottonaustralia.com.au/toolkit/resources/Pre-Season_Neighbour_Agreement.pdf

Pesticide Application Risk Management Plan
www.cottonaustralia.com.au

Record Keeping - General
www.environment.nsw.gov.au/pesticides/pestrecords.htm
www.dpi.nsw.gov.au/agriculture/farm
www.environment.nsw.gov.au/resources/pesticides/pesticidesrkform.pdf

Rig selection, Nozzle Information, Spray Quality, Calibration
http://www.dpi.nsw.gov.au/agriculture/farm/chemicals/general/spray-sense-leaflet-series

Reducing Herbicide Drift
www.grdc.com.au/director/events/factsheets - Spray Drift Factsheet
www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/publications/factsheets/spray-drift
www2.dpi.qld.gov.au/extra/pdf/fieldcrops/sprayright2005.pdf

Susceptible Crop Awareness Map
www.cottonmap.com.au/

Weather
www.bom.gov.au/silo/
www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf

This guide has been jointly developed by the Australian Pesticides & Veterinary Medicines Authority ('APVMA'), Cotton Australia, the NSW Department of Environment, Climate Change and Water ('DECCW'), and NSW Farmers' Association.

NSW Farmers Association
Growing the Business of Farming

Australian Government
Australian Pesticides and Veterinary Medicines Authority

Department of Environment, Climate Change and Water NSW

COTTON AUSTRALIA

Safety Tips to Avoid Drift

Best Management Practices

TYPES OF DRIFT

Droplet Drift

Droplet drift is the airborne movement of liquid pesticide droplets away from the target.

Vapour Drift

Vapour drift is the airborne movement of vaporised pesticides from sprayed areas.

Before you Spray

- **Product Selection** – Have you identified your weeds correctly? Have you spoken to a specialist about the best product for your current situation? Summer weed control requirements can change rapidly!
- **The Label** – Have you read the label for this application?
- **Training** – Do you have the appropriate training and is it up to date?
- **Risk Assessment** – Do you know the locations of nearby susceptible crops and sensitive sites? These can include cotton, grapevines, orchards, tomatoes, pulse grains, legumes, oilseeds, cereals and or fodder crops, livestock, bee hives, aquaculture, organic farms, homesteads, gardens, schools, public areas, conservation areas, heritage areas, national parks, and water sources including wetlands.
- **Weather** – Suitable weather conditions for spraying is extremely important. Aim for mild temperature (less than 27°C), higher humidity, and a consistent light wind (between 3 and 15 km per hour) at the application site, blowing away from areas of risk. Spraying phenoxy herbicides in stable conditions (i.e. zero wind) increases the risk of the occurrence of off-target impacts, in any direction (see the Bureau of Meteorology 'Weather for Pesticide Spraying' Guide www.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf).
- **Neighbour notification** – Have you spoken to your neighbours before spraying? This can help avoid chemical trespass and minimise misunderstandings or unnecessary conflicts.
- **Rig preparation** – Is your rig set up for spraying group I Phenoxy herbicides for summer i.e. coarse to very-coarse nozzles (see APVMA's spray drift website: www.apvma.gov.au/users/spray_drift.shtml).

Copyright Commonwealth of Australia

While you are Spraying

MONITOR:

- **The Weather** – Has the wind speed or direction, air temperature, or relative humidity changed at the site while you have been spraying? Don't assume that it can't change within quite a short period. We recommend using portable handheld weather monitoring units. Also, don't assume that night time is a better time to spray - herbicides will drift during stable weather conditions which are more likely to occur at night.
- **The Rig** – During the job the rig should be regularly calibrated and nozzle outputs checked.
- **The Operator** – The spray applicator is responsible for the efficient and safe operation of equipment, in order to get the best weed control job whilst not causing off-target damage. For example, are you travelling at an appropriate speed for your application? Are you aware of the increased risk of drift whilst turning?

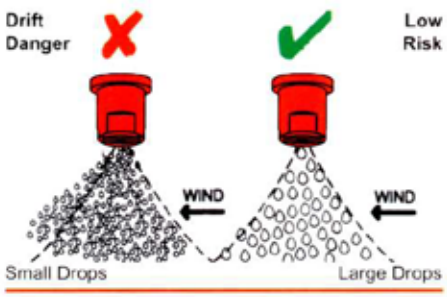


Diagram courtesy of PIRSA

After Spraying

Records – Ensure your chemical application records have been completed according to NSW Pesticide Regulation 2009.

Updated NSW Pesticides Regulation

Did you know that an updated NSW Pesticides Regulation came into effect on 1 September 2009, which increased the fines for some offences?

The two main fine changes to note are:

- The penalty notice for failing to make a record of pesticide use, has been increased to $750 for individuals and $1500 for corporations, in line with comparable offences under NSW environment protection legislation.
- The penalty notice for making a false or misleading statement, including false or misleading information in a record, has been increased to $750 for individuals and $1500 for corporations, also in line with comparable offences under NSW environment protection legislation.

Pesticides Regulation 2009 is available on the NSW Government legislation website **www.legislation.nsw.gov.au**

GUIDELINES FOR IRRIGATORS CLEARING FRUIT BLOCKS

DROUGHT RESPONSE SOUTH AUSTRALIA

A must read before clearing irrigation blocks

This information outlines elements to consider and appropriate contacts that may assist irrigators in clearing their blocks as a component of a replanting program or exiting from irrigation.

Introduction

As an irrigator, you need to be aware of:

- Responsibilities and options when disposing of environmentally hazardous posts and irrigation infrastructure;
- Management and disposal of plantings;
- Options to reduce the length of time soil is exposed to the risk of erosion; and
- Managing potential pest and weed problems.

These guidelines will particularly assist those irrigators taking up the Commonwealth "Small Block Irrigators Exit Package". Under this arrangement, the removal of permanent plantings and other production related infrastructure is a condition of the package. A grant of up to $20,000 is available for removal of plantings and infrastructure.

For information on the Irrigators Exit Package, contact Centrelink on 1800 050 015.

These guidelines may also be of assistance to irrigators removing land from or rehabilitating land for irrigation.

Removal and disposal of above ground infrastructure

The appropriate removal and disposal of copper/chrome/arsenic (CCA) or green perma-pine, and creosote posts, poly-pipe and trellis wire requires specific attention and the following provides irrigators links to the relevant contacts able to provide detailed information of legal obligations and requirements.

Block clearing will produce a number of different wastes such as:

- Treated timber;
- Organics (green waste);
- Irrigation plastics; and
- Metal and other materials.

These wastes and materials will need to be separated for **recovery, reuse and recycling** where possible. Materials that are not suitable for recovery or recycling must be disposed of appropriately. There are waste or recycling depots in the Riverland, run by the Loxton and Waikerie, the Berri and Barmera and Mid Murray Council District Councils, which are licensed to receive plastics, metals and green waste.

Treated timber (for example fence posts) must be dealt with carefully due to the potential impacts of improper disposal. Treated timbers that cannot be reused or salvaged can be stockpiled on site for a short time in accord with the Environment Protection Agency (EPA) guidelines for stockpile management www.epa.sa.gov.au/pdfs/guidelines_stockpile.pdf .**The EPA has also recently given approval for the disposal of treated timbers at the Inkerman landfill in the district Council of Mallala. This landfill is currently the only landfill able to accept treated timbers for disposal**.

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Government of South Australia

Issued Jan 2010

CCA, creosote posts and poly pipe must be kept separate from bulldozed vines and other above ground infrastructure. CCA and creosote posts must not be burnt.

The EPA will not endorse burning permits for burning of treated timbers due to the generation of toxic gases and the release of the copper, chrome and arsenic into the environment.

CCA and creosote treated timbers will not be accepted at composting sites and should not be added to mulch due to the risk of harm to the environment.

For information on disposal of CCA and creosote treated posts please contact EPA on (08) 8204 2000.

For information on the disposal of poly pipe, hard waste, contact your Local Council.

Landholders are reminded that wherever possible it is better to REUSE or offer to others for reuse, rather than dispose of redundant infrastructure in landfill.

Removal and disposal of perennial vegetation

Once treated posts, trellis wire and poly pipe have been removed, vines can be bulldozed and heaped up for burning.

Before burning vines or trees please contact the local council for advice on when to burn and other safety requirements.

For information on the burning of removed plantings, contact your Local Council.

Loxton Waikerie	**08 8584 8000**	**council@loxtonwaikerie.sa.gov.au**
Renmark Paringa	**08 8580 3000**	**council@renmarkparinga.sa.gov.au**
Berri Barmera	**08 8582 1922**	**bbc@berribarmera.sa.gov.au**

After clearance land management

Landholders have a responsibility to maintain land condition and avoid pollution under Section 25 of the EPA Act 1993.

Land stabilisation is of high importance and it is recommended that landholders factor in the establishment of either annual or perennial vegetation to stabilise their land as part of the overall cost associated with effecting land transition.

Importantly this may necessitate several workings to clear old roots and to create a suitable tilth which will support sowing.

Following clearing and levelling, the land can be prepared for the establishment of vegetation such as cereal rye, triticale or barley. These crop types will provide suitable ground cover and have the potential to produce some financial returns while assisting in the management of weeds.

Longer-term options may be further use of annuals or possibly the establishment of perennials such as lucerne or native vegetation.

For information on land management, contact Bernadette Lawson or Jeremy Nelson:

Bernadette Lawson,
Team Leader Land Management.
South Australian Murray Darling Basin, Natural Resource Management Board,
Murray Bridge
Ph: 08 8532 1432
bernadette.lawson@samdbnrm.sa.gov.au

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After clearance land management *cont.*

Jeremy Nelson
Land & Water Management Planning Coordinator
South Australian Murray Darling Basin, Natural Resource Management Board,
Berri
Mob: 0429 845 216
jeremy.nelson@samdbnrm.sa.gov.au

For information on the River Murray Forests Project contact:

Damien Pearce
Project Manager: River Murray Forest Project
Department of Water, Land and Biodiversity Conservation
Ph: (08) 8303 9354
Mob: 0427 604 206
pearce.damien@saugov.sa.gov.au

Pest plant and animal management

Following land clearance there is likely to be significant influx of proclaimed and other invasive weeds with the added likelihood of pest animal incursions onto sites.

Longer term control of annual weeds and other pest incursions will need to be factored into ongoing land management costs post land clearance. Recommendations of the Natural Resources Management Act 2004 should be considered in conjunction with a pest plant and animal control strategy to achieve the most cost effective method(s) of ensuring that cleared land does not significantly degrade under pressure from invasive plant species.

For further information on controlling pest plant and animals please contact your local NRM officer.

Contact: **Roger Kelly**
Animal and Plant Control Operations
South Australian Murray Darling Basin, Natural Resources Management Board
Ph: (08) 8582 4477

CONTROL OF CONTAMINANTS AND PROHIBITED SUBSTANCES IN FERTILIZERS

DENIS HAMILTON.
Biosecurity, Department of Primary Industries and Fisheries,
80 Ann St, Brisbane, Queensland 4000 AUSTRALIA

June Feature

Toxic waste bound for crops

UNTREATED toxic waste bound for Australian fertiliser manufacturers was intercepted by the Federal Department of the Environment last month.

The discovery has highlighted the lack of national regulation for Australia's fertiliser industry.

A spokesperson from the department said the shipment from China contained an industrial residue that if treated correctly and subjected to chemical processes, could produce clean zinc sulphate.

The spokesperson said the untreated shipments posed the biggest threat to industry.

Federal Environment Minister Dr David Kemp said the lack

"Where toxic wastes are reprocessed for use in agriculture, there is a clear need for tight regulation. The current system appears to fail growers and consumers.

"Given that pesticide manufacturers are closely regulated and growers are increasingly required to assure the safety of their produce, an unregulated fertiliser industry seems out of step," she said.

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39 — SUNDAY, TELEGRAPH, JUNE 14, 1992 — 39

Metal waste 'shipped to Aust as fertiliser'

A FEDERAL grand jury indicted four companies and three executives yesterday for allegedly getting rid of heavy-metal hazardous waste by mixing it with fertiliser and shipping it to Australia and Bangladesh.

The indictment said that Stoller Inc's Charleston County plant shipped 3000 tonnes of fertiliser contaminated with lead and cadmium overseas, Federal Attorney John Simmons said.

Investigators allege that Gaston Copper Recycling Corp of Gaston, South Carolina, shipped 1000 tonnes of dust from its

fertiliser, the jury was told.

Authorities allege that the defendants arranged to get rid of the hazardous waste instead of paying for a hazardous waste firm to recycle it or safely dispose of it.

The material arrived at the plant last October in pellet form and was ground and processed.

The fertiliser was then sent to Australia and Bangladesh.

ABSTRACT

A national working group was established to develop standards for contaminants in fertilizer in Australia after press reports in 2002 about contaminated industrial waste in fertilizer.

Repeal of fertilizer registration in 1995 had inadvertently removed safeguards against the disposal of industrial waste as fertilizer, where the driving economic force is the disposal cost.

The project will identify prohibited substances (the negative list) not to be included in fertilizers, e.g. waste asbestos, and permitted contaminants (the positive list) and their recommended guideline limits. Guiding principles include: contaminant levels in fertilizers and their annual loading per unit area should be as low as reasonably achievable (ALARA principle); and fertilizers should not be treated as vehicles for waste disposal.

Australia's agricultural and pastoral lands are valuable assets to be protected against contamination, but conversion of waste or by-product materials to genuine fertilizers should not be precluded.

The project aim is to have: a list of prohibited substances, a list of contaminants and guideline limits and transparent evaluation procedures.

1 INTRODUCTION

Industrial wastes are being recycled as fertilizer ingredients. Unfortunately, they sometimes contain persistent and toxic contaminants that accumulate in the soil and may enter crops and food-producing animals.

In Australia, State fertilizer legislation has generally been aimed at the manufacture, sale and use of fertilizers intended to improve the nutrient status or the condition of the soil. The legislation generally has not been framed to control the disposal of industrial waste under the guise of fertilizer, where the driving economic force is the disposal cost of wastes.

In 2002, it became a public issue with press reports about imported wastes containing high levels of cadmium and lead being brought into Australia for use as fertilizer. A Fertilizer Working Group was established to recommend a national approach to the control of contaminants in fertilizers.

2

FERTILIZER REGISTRATION (before 1995)

- The composition and label of each product were examined and approved before it might be offered for sale.
- Products offered for sale were sampled and analysed for comparison with their declared composition.
- Fertilizer standards for maximum permitted concentrations of lead, cadmium and mercury were based on their occurrence in raw materials.

AFTER REPEAL OF FERTILIZER REGISTRATION (after 1995)

- A product may be offered for sale if it meets the labelling requirements, complies with fertilizer standards and, like other goods, satisfies consumer protection legislation.
- Products offered for sale are no longer routinely sampled and analysed.
- No additional standards.

3 BENEFICIAL PRODUCTS FROM INDUSTRIAL AND MINING WASTES

Fertilizers (and soil conditioners) are ideal targets for recycling and reusing wastes.

1. Content of plant nutrients (N, P, K, Ca, Mg, S …) or trace elements (Zn, Cu, Se, B, Mo …..) can be used as evidence that the material supports plant nutrition.
2. Physical properties or neutralizing capacity can be used as evidence that the material is a soil conditioner.
3. Fertilizers are used in large quantities.
4. There are no standards for maximum content of most contaminants.
5. The end user cannot easily observe that the product contains contaminants.
6. While it is described as a waste it is regulated. When it becomes a beneficial product it generally is not.
7. The high costs of waste disposal provide an incentive to convert the waste to a beneficial product that can be sold.
8. Recycling is seen as an environmentally responsible action in reducing the load on land fill capacity.

4 THE PROPOSALS

1. Some wastes (**prohibited substances**) should not be allowed as fertilizer ingredients, e.g. asbestos waste and radioactive wastes.
2. Use the **concentration comparison** approach for initial screening. The concentration of a contaminant in a fertilizer is acceptable if it is no higher than the existing concentration in the soil (dry weight or ash weight).
3. Use the **critical load model*** for contaminants that require further investigation. For sustainability, the time to reach the critical concentration must be a long time – suggested 70-100 years. The results should be acceptable loadings or acceptable concentrations for permitted contaminants.
4. **Priority production systems** for study:

Horticulture	Viticulture
Sugar cane	Cereals
Dairy	Aquaculture
Beef and sheep	

5. **Priority contaminants** for investigation: F, Ni, Hg, Pb, Cu, As, B, Se, Zn, Cr (note that Cd has already been investigated), POPs, radioactive material, and contaminants related to individual waste types such as sewage sludge, red mud and municipal solid waste.

* A critical load model is a dynamic mass balance model aimed at a critical soil concentration based, for example, on ecological health.

5 CONCLUSIONS

The aim is for the project to provide:

1. **A list of substances that are prohibited ingredients in fertilizers.**
2. **A list of contaminants permitted in fertilizers and their guideline limits in various fertilizers or their maximum permitted annual loading rates per unit area.**
3. **Transparent evaluation procedures, evaluations and data requirements.**

Acknowledgement

The background information collected and the ideas suggested by the Fertilizer Working Group of the Australian Product Safety and Integrity Committee are gratefully acknowledged.

Pests can ruin an industry – and its market access

Phylloxera

The root aphid that attacks grapevine roots is more damaging to market opportunity and grape material movement than it is on the vine itself. A single sighting of phylloxera will close markets, quarantine the vineyard and area around it, and instantly increase a grower's costs. Phylloxera is impossible to eradicate and once found, delivers economic hardship over a long period to the infested vineyard and to those nearby.

Extensive awareness efforts have raised knowledge of the pest and the means by which it is moved. National Phylloxera Management Protocols include the means by which an area is to be surveyed to demonstrate area freedom, and maintained in this state. These have been adopted across southern Australia and many areas are considered phylloxera free.

There are also processes describing how an area is to be surveyed, should phylloxera be found (delimiting survey). The economic impact of phylloxera results not only from the restricted movement of equipment, people, soil and grape products within and from a phylloxera-infested zone, but also from enforced vine removal, loss of productivity, survey and monitoring activities on neighbouring properties, signage, traceability investigations. Surveillance by any detection method is costly as indicated in the following table. The costs associated with incursion management are greater than those associated with incursion avoidance and area protection (regional biosecurity).

Surveillance

The establishment of pest free areas (PFA) is required to support trade. PFA surveys may be undertaken to demonstrate freedom from a pest thought never to have been present; or they may be undertaken to provide assurance that a particular pest has been eradicated, if once present. The requirement of area freedom is based on IPPC guidelines (ISPMs) that state that area freedom is an area (officially defined country, part of a country or all or parts of several countries) free from and without pests (or a specific pest) in numbers or quantities that can be detected by the application of phytosanitary procedures.

Delimiting survey - detection costs (4 hectares per day)

Survey technique	Frequency	Approx cost per ha
Ground survey	3rd row, 5th panel 37 per ha	$110
Emergence traps	25 per ha	$150
DNA probe	25 per ha	$325

Western Flower thrips

It is thought that this pest arrived in Australia on cut flowers from Columbia. They spread and established easily in most regions, within four years, Today only the NT and parts of Tasmania claim to be free of WFT and they may reject produce from infested areas..

WFT has been more troublesome and costly than other endemic thrips because of its capacity to efficiently transmit tomato spotted wilt virus (TSWV) to a large number of crops and weeds, including tomatoes and capsicums. The virus was already present in Australia, but the arrival of this new vector saw its impact increase significantly. WFT also has the propensity to develop resistance to chemicals and as such has been expensive and difficult to control.

Fire ants

Red-imported Fire Ants were considered until 2001 to be exotic to Australia. However they were detected in Brisbane in 2001. These lifestyle pests affect the social, economic and environmental well-being of infested areas. The National Fire Ant Eradication Program is currently implemented by the Queensland government, with funding from all states/territories and the federal government. Up to this time, the cost of the program, treatment and containment, and on-going surveillance is $210 million.

The Citrus Canker incursion

Citrus canker is an exotic bacterial pest of citrus. It causes lesions on leaves, stems and fruit and cankers. Yield is severely reduced on plants infected with this bacterium. Citrus canker was detected in Queensland in 2004 and as a result trade was restricted and an eradication campaign commenced. It required the removal of all citrus trees in the region around Emerald. Even though the outbreak was localised the effects of the incursions were widespread, and the cost of the eradication was estimated at $26 million.

New market access – Biosecurity yielding a new market

(Source: AQIS Bulletin Jan-March 2010)

Tasmanian cherries have appeared in fruit bowls in South Korea for the first time as Australian growers shipped the first-ever consignments to the Land of the Morning Calm in February. After conducting an assessment and inspecting the Tasmanian cherry orchards and packing houses, Korean government officials were convinced of the low pest risk of the product and decided that the fruit didn't have to be fumigated before export.

The new market in South Korea will help boost Tasmania's cherry production which was around 4000 tonnes in 2008–09 and is expected to reach 7000 tonnes by 2011-2012.

Bee Biosecurity
April 2010

PARIS — The huge die off of bees worldwide, a major threat to crops depending on the honey-making insects for pollination, is not due to any one single factor, the World Organisation for Animal Health (OIE) said Wednesday.

Parasites, viral and bacterial infections, pesticides, and poor nutrition resulting from the impact of human activities on the environment have all played a role in the decline, the OIE said.

At normal times, bee communities naturally lose around five percent of their numbers. But the syndrome known as colony collapse disorder (CDD) causes a third-half -- sometimes even 90 percent -- of the insects to be wiped out. In the United States, government figures released last month showed a 29 percent drop in beehives in 2009, coming on the heels of declines of 36 and 32 percent in 2008 and 2007. The mysterious decline of bee populations in the United States, Europe, Japan and elsewhere in recent years threatens agricultural production worth tens of billions.

The global review conducted by OIE experts concluded that "irresponsible use" of pesticides may damage bee health by increasing their susceptibility to different diseases. Inadequate "biosecurity" -- especially protecting against invasive species -- and climate change also likely play a role, the experts said.

"Resources to establish increased surveillance and registration processes, inspection, diagnoses and research capacity are missing in many countries and regions of the world," Wolfgang Ritter, chair the expert panel said.

Earlier research has shown that different bee parasites are active in different parts of the world. Culprits already identified include a blood-sucking mite called Varroa and a single-celled fungal parasite called *Nosema cerenae* that causes bee dysentery. More recently a new pathogen, *Varroa jacobsoni*, has attacked *Apis mellifera* in Oceania, and now presents a new threat to beekeeping globally. In Europe, a recent intruder -- the Asian hornet, *Vespa velutina* lurks near hives and captures honey bees in mid-flight, devouring them.

Another suspect is poor nutrition. Native vegetation removal, along with spreading suburbs, are thought to be depriving bees of a decent diet. Vallat called for more research and adherence to OIE guidelines on biosecurity in trade of bees between countries, a major cause of global contamination.

Government and industry investment in preparedness

New $5m five-year FMD preparedness program
Stock Journal April 12, 2010

Australia's livestock industries and the Federal Government are investing in a new five-year $5 million research program to address vulnerabilities in Australia's readiness to control Foot and Mouth Disease.

The beef and dairy cattle, sheep, goat and pig industries and MLA's Donor Company are investing $2m in funding over the first two years of the program which will be managed by Animal Health Australia with the research carried out by CSIRO scientists from the Australian Animal Health Laboratory.

MLA managing director David Palmer said the initiative aims to better prepare the Australian industry to respond effectively to an outbreak of FMD and thereby minimise disruptions to trade and impacts on the community.

"Markets around the world have stringent and unwavering laws on their food imports and in the event of Australia contracting FMD, we would be locked out of all trade with our customers," he said. "Economic losses would be devastating – in the order of $4m a day according to estimates by the Australian Productivity Commission. "In addition, community concerns will demand better use of technology to minimise any livestock destruction as the main source of control in such an event.

"Vaccines, animal traceability, improved modelling and the use of sophisticated diagnostics underpin an effective and efficient response to FMD. This project will deliver the necessary science on vaccination as a preferable FMD control strategy, and develop the necessary protocols.

Diagostics and their importance to industry
(Source: From McMichael, 2008)

On June 7, 2008 the US Food and Drug Administration (FDA) issued a warning to consumers about an outbreak of *Salmonella* Saintpaul that had hospitalized 1329 people in 43 states, since April. Retailers across the US including McDonald's, Burger King, Wal-Mart, supermarkets etc were advised to remove raw plum, round and Roma tomatoes from their shelves and food, but most removed all tomatoes, and consumers stopped eating tomatoes and fresh tomato products (eg. salsa).

Media headings like "Florida's tomato industry in complete collapse" did not exaggerate the situation as losses of US $100-500 million in farm gate sales, from the US $ 1.3 billion industry, were realistic in the lucrative summer market. The losses however were incurred before the FDA, the Centre for Disease Control and Prevention, and state and local health departments had in fact traced the contamination source to tomatoes. On July 17, 2008, the FDA made a new announcement that chillies from Mexico were the likely source and had now been linked to the outbreak. It was revealed that the traceability of produce like tomatoes was an inexact exercise, at best.

The effects of the outbreak on the tomato industry are multi-layered:

- 252 people were hospitalized as a result of the Salmonella outbreak. The cost of this alone was estimated at US $52 million
- Massive, negative media coverage on tomatoes. In the months of June-July, 631web pages discussed the incident and after the second FDA announcement, another 445.
- Loss of public confidence in fresh produce, especially American tomatoes. This added to the skepticism that lingered after the 2006 spinach incident.
- The industry could not quickly deliver supply chain details to assist traceability investigations. Other vegetables were drawn into the investigations – onions, coriander, and it took FDA weeks to determine the source/s.
- Compensation claims of US $100 million have been filed in Florida alone.
- Industry will shoulder the burden of increasing consumer confidence through lower pricing and promotions of the health benefits of fresh tomatoes.

What the government is doing about diagnostic expertise

(Source: AQIS Bulletin Jan-March 2010)

Australia's plant biosecurity systems heavily rely on highly trained and skilled diagnosticians. Diagnosticians develop their skills over many years working in the field, studying and identifying countless pests and diseases that have the potential to devastate Australia's plants and agriculture industries. As with many specialist scientific fields, the number of experts is declining.

To combat the decline, the Biosecurity Services Group (BSG) is working with state and territory governments and industry to develop a unique mentoring and learning program that increases the skills of diagnosticians and ensures their knowledge and experience isn't lost.

The Advance Diagnostics Development Program is a collection of two-year courses run by world-leading experts in nominated fields. Up to three candidates who have demonstrated their skills in the specialised diagnostic field are invited to participate in each of the courses in the program. The program so far has covered five fields: aphids; bee diseases; bee diagnostics; *Xanthomonas* (plant bacteria) spp.; and dermestids (Khapra beetles and related beetles). Two more are planned for this year: nematodes (round worms) and Hyphomycetes (fungi). This program, funded under an Australian government election commitment to protect Australian horticulture, is part of a broader goal of BSG to work in partnership with other governments and industry to secure the health of Australia's plant industries.

Weeds - assessment of the relative biosecurity threat

(Source: AQIS Bulletin Jan-March 2010)

Introduced plants can cause serious problems for the Australian environment. In agriculture alone, weeds are estimated to cost Australian farmers close to $4 billion each year in lost production and control.

To help prevent the introduction of plants that have the potential to become weeds, the Biosecurity Services Group (BSG) assesses all proposed plant imports using an internationally-recognised scientific system. The weed risk assessment system poses a series of questions about the plant, including its climate preferences, weed status, undesirable traits, reproduction method, dispersal mechanisms and persistence attributes. From this information, BSG plant scientists can determine if the plant has the potential to threaten Australia's environment, and agricultural industries.

In Australia, exotic plant species vastly outnumber native plant species. Of the 26,000 introduced plant species, 2800 have naturalised in their new environment and about 280 are now proclaimed as noxious weeds. About 300 plants are assessed each year, and of these about 55 per cent are accepted into Australia, 25 per cent are rejected and the remainder require further evaluation.

Food safety – Camplylobacter and poultry biosecurity

Souce: Tim Covino Aril 2010 from Farmers Weekly (UK)

Whole of chain approach needed

Campylobacter is a bacterium that lives in the avian gut, as it thrives at a temperature of 42 degrees. Generally, it does not cause disease in the birds themselves, but if it is ingested by humans it can lead to severe diarrhoea and stomach cramps, which can last for up to two weeks.

Campylobacter is the number-one cause of food-borne disease in the UK. Just in England and Wales we estimate that there are about 300,000 cases a year out of about 1m instances of food poisoning. Of these, about 15,000 result in hospitalisation and there are even about 80 deaths. It is also estimated that 60-80% of campylobacter food poisoning is related to chicken.

A recent report by the European Food Safety Authority showed that, in the UK, some 75% of broiler flocks are infected with campylobacter. It also showed that 86% of carcasses had the bacteria immediately post-slaughter, while our samples have found it in 65% of chicken meat at retail.

In the EU member states, there is a wide range of incidence levels. The lowest were found in the Scandinavian countries, where fewer than 10% of flocks have campylobacter. The EU average is over 70% and in Ireland it is more than 90%.

Management of the problem requires a multi-tiered approach involving everyone in the supply chain. New Zealand, for example, has cut the level of campylobacteriosis in the human population by two-thirds in just three years.

At the Farm level: The biggest single thing is to tighten bio-security. The Scandinavians in particular have shown how maximum biosecurity and minimum contact with the birds pays dividends. Campylobacter is not found in chicks; it only appears after about three to four weeks, so it must be brought in from outside. In Scandinavia the farms all have separate changing areas. Nobody goes into a poultry shed in the same clothes they came to work in. And in Iceland, we heard that they put up nets to keep flies and midges out during the summer months.

Outdoor systems are more prone to campylobacter than indoor systems due to environmental contamination. For example, in France about 77% of the flocks are contaminated, but in the free range and organic sector, it is close to 100%. The type of campylobacter found in outdoor flocks (*Campylobacter coli*) causes much less human disease than that found in indoor flocks (*Campylobacter jejuni*).

In the supply chain: Slaughterhouses have to improve their performance too, especially in the evisceration area which is where campylobacter gets from inside the bird to the outside. In New Zealand and the USA they use anti-microbial washes to treat the meat, but this is not allowed within the EU. EU can only use potable water or steam, though we are looking at naturally occurring substances, such as citric or lactic acid.

Retailers also have a role. They should adopt leak-proof packaging more fully. The problem is not so much people eating undercooked chicken, as it is cross-contamination of things like salads and vegetables through contact with the bacterium. Adopting modified atmosphere packaging - for example by increasing CO2 levels - could help.

Canada to Strengthen Food Safety and Biosecurity Systems

Source: Government of Canada ; 26th April 2010

The Governments of Canada and British Columbia are working together to help producers and processors maintain the health of their businesses by strengthening their traceability and biosecurity systems.

"Our Government is working with the provinces and industry to create a strong national traceability system that will help producers and processors minimize risks, strengthen their businesses and continue to deliver their top-quality, safe food to consumers at home and around the world. B.C. is already a leader in biosecurity measures, and having these systems in place builds consumer confidence. It also positions our agri-food industry to be competitive in both the domestic and international marketplace."

The British Columbia and federal governments will put up $3.5 million to back an **on-farm biosecurity program** and to support **traceability** at the farm and processor levels. B.C. Agriculture Minister Steve Thomson and Vancouver-area MP Andrew Saxton announced the funding Friday in Burnaby, including $2.04 million for the Enterprise Infrastructure Traceability (EIT) program and $1.5 million for the provincial ag ministry's biosecurity program. EIT is meant to help producers, food processors and "agri-food businesses" buy and install traceability infrastructure and systems to track products "from receiving to shipping."

Ongoing efforts to implement food safety, traceability and biosecurity measures are important for achieving a safe food supply into the future and will greatly improve the Provinces protection of animal, plant and human health.

Completed projects include B.C.'s $14.5-million, high-security containment Level 3 laboratory in Abbotsford and a Foreign Animal Disease Emergency Support plan (FADES) that has been developed to enhance B.C.'s response to occurrences of significant disease events.

Traceability initiative

- $2.04 million for the Enterprise Infrastructure Traceability (EIT) to help producers, farmers, food processors and agri-food businesses with costs to purchase and install **traceability** infrastructure/systems to track products from receiving to shipping. The program consists of animal (product) identification, premises identification and movements recording. This funding will help proactive management of food-borne risks along the agri-food chain.

On-farm biosecurity initiative

- $1.5 million will be allocated to the biosecurity program, which will help producers continue to improve their **on-farm biosecurity** procedures such as wearing site-specific clothing and disinfecting farm equipment.

Community Awareness initiative

- '*Discover Agriculture in the City*' is a three-day event, open to the public, designed to build awareness among urban British Columbians about the contributions farmers make to the economy, the environment and to the health of Canadians, as well as some of the innovative uses of Canadian agricultural products.

What is biosecurity?

Biosecurity is a set of measures that are put in place at the national, regional or farm level to protect against the introduction and spread of new pests (insects, diseases and weeds). Biosecurity measures aim to deal with pests should they arise, and minimise the impact of pests already established.

Farm biosecurity measures reduce the risk of new pests entering a property and are essential for protecting livelihoods. Farm Biosecurity is the responsibility of every person working on or visiting the farm.

Regional biosecurity protects Bundaberg's fruit and vegetable growers from the impacts of new pests. With your help we are minimising the risks to their livelihoods, your jobs and the region's economy.

Early detection and immediate reporting increases the chance of an effective eradication or rapid management of a new pest.

PHA10-019

Have you spotted anything unusual?

Early detection and a rapid response to new pests can minimise the long-term impact to farms, the region and to the industry.

If you see any unusual pests or plant symptoms, call the Exotic Plant Pest Hotline

EXOTIC PLANT PEST HOTLINE
1800 084 881

Further information

Bundaberg Fruit and Vegetable Growers Cooperative – **www.bfvg.com.au**
Farm Biosecurity – **www.farmbiosecurity.com.au**
Plant Health Australia – **www.phau.com.au**
Queensland Department of Employment, Economic Development and Innovation – **www.deedi.qld.gov.au**

Are you a risk?

Could you be at risk of bringing new plant pests and diseases to the Bundaberg region?

Bundaberg Fruit & Vegetable Growers

Plant Health AUSTRALIA

What are the risks?

New and potentially damaging pests can be spread through a number of ways. This brochure outlines simple measures to reduce these risks.

Your cooperation and assistance in minimising the spread of pests is appreciated and will help protect the productivity of the Bundaberg region.

Fresh produce import

All fruit and vegetables have the potential to carry undetected pests. Buying locally and not transporting produce between farms and regions is the best protection.

Plant material

Whether attached to your vehicle or in a bunch of flowers, plant material can carry pests. Make sure your vehicle and clothing are clean. Dispose of any plant material before entering or moving within the region.

Cars, shoes, camping and farm equipment

Anything from cars, trucks and farm machinery through to camping equipment and clothing can carry pests. Ensure your clothes and belongings are clean and you have washed your vehicle at a wash-down facility to stop the spread of pests.

Check with the regional council and National Resource Management body for the location of a regional wash-down facility.






Backpackers, contractors and transport companies

Backpackers, workers, contractors and transport companies provide a valuable service to the Bundaberg fruit and vegetable industry. However, workers also need to be aware of potential biosecurity threats. Ensuring that clothes, shoes, equipment and vehicles are clean will reduce these risks.

Pets and fish tanks

Wash your pets before moving them between regions to stop the spread of pests on their coat. Take care when cleaning fish tanks, as any fish, turtles or exotic plants can easily establish if they reach local waterways.

Ballast water and bilge tanks

Water carried in the bilge as ballast on boats and yachts can transport marine pests and weeds. These can impact on production and the quality of the local water supply. Check the local requirements for emptying bilge water in regional waterways.






Six easy ways to protect your vegetable farm

You have an important role to play in protecting your farm and the vegetable industry from biosecurity threats.

Here are six simple things you can do to reduce the threat of new pests entering and establishing on your farm.

1. Be aware of biosecurity threats

Make sure you and your farm workers are familiar with the most important exotic and endemic vegetable pests.

2. Use high health status, pest-free seed and propagation material from reputable sources

Ensure all propagation material (seed, transplants, tubers, corms, bulbs, rhizomes etc) and farm inputs (chemicals, compost, mulch) are fully tested and pest free. Keep records (batch numbers, source) and retain a sample of your farm inputs.

3. Keep it clean

Good sanitation and hygiene is essential. They will help prevent the entry and movement of pests onto your property. Workers, visitors, vehicles and equipment can spread pests so make sure they are decontaminated before they enter and leave your farm.

4. Check your crop

Monitor your crops frequently. Knowing the usual appearance of them will help you recognise new or unusual events and pests. Keep records of all unusual observations.

5. Report anything unusual

If you suspect a new pest – **report it immediately.** Early reporting gives the best chance for eradication or containment.

6. Abide by the law

Support and be aware of laws and regulations established to protect the vegetable industry and your horticultural region.

If you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881

EXOTIC PLANT PEST HOTLINE
1800 084 881

Biosecurity Kit Content

The content of the kits can be purchased at Bunnings, Big W and Protector Safety Supply for approximately $125. This price does not include disposable overalls.

Administration	o 45 litre Storage box o Folder o Sample Sheets
General Cleaning	o Spray Bottles (2) o Steri Klen o Farm cleanse solution o 5 Litre water container o Wash bucket / Footbath
Vehicle Hygiene	o Car sponge o Heavy duty scrubbing brush o Window squeeggee
Personal Hygiene	o Boot brush o Cloth gloves o Disposable gloves (10) o Safety goggles o Cleaning Soap o Hearing protection (10) o Boot coveralls o Disposable overalls
Optional Equipment	o Secateurs o Orange safety vest o Pencil o Garbage bags o Flagging tape o Zip lock bags o Zip ties o sample bottles and bags

Source :Dept AgWA Post-border biosecurity

Contact for enquiries on farm biosecurity:

Colin Hanbury
Coordinator - HortGuard
email: chanbury@agric.wa.gov.au

Appendix 8

Value Added Awareness Material

Issue No. 12 Nov 19th, 2009

Coordinators:
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CONTENTS

Lookout for summer pests

Crops have been maturing quickly in many districts with the recent burst of warm to hot summer weather. These conditions favour the development of certain 'true' bug (Hemiptera) and moth (Lepidoptera) species, which can occasionally become problematic in southern Australia:

Rutherglen bugs

Rutherglen bugs (*Nysius vinitor*) are prevalent during spring and summer and can sometimes cause problems when they migrate into crops from weedy areas or pastures that are drying off. They attack a wide range of weeds and crops including canola, sunflowers, safflower, sorghum, wheat, linseed and lucerne. Feeding damage from their piercing and sucking mouthparts includes wilting of young foliage and damage to developing seed, as they are able to penetrate pods. Moisture-stressed plants are often worst affected. Heavy infestations in sunflowers during budding can cause wilting and head distortion, while infestations in canola during grain fill can reduce yield, oil content and quality. Adults can also be a grain contaminant. Adults are 4 mm long, grey-brown in colour with clear wings folded flat on their back. They are narrow-bodied with prominent dark eyes, and are highly mobile. Nymphs look quite different from adults; they are wingless, dark red in colour and have a 'swollen' pear-shaped body.

Often, targeted or border spraying affected areas is sufficient to control numbers, however chemical control can be difficult when high numbers are present. This highly mobile species can readily re-invade a treated area,

resulting in the need for a repeat spray. Sometimes buffer-spraying the source of invasion (such as nearby pastures and weedy areas) can be worthwhile.

Green mirids

Green mirids (*Creontiades dilutus*) attack many field crops including lucerne, sunflower, safflower, cotton and pulses. They feed preferentially on the growing points of plants which causes wilting, delayed maturity and reduced yield. Adults are yellowish-green in colour, approximately 7 mm long with long legs and antennae, and have clear wings folded flat on their back. Nymphs are typically light green in colour and can sometimes be misidentified as aphid nymphs. Both adults and nymphs are highly mobile and will run or fly off quickly when disturbed.

For more information on these 'true' bugs, refer to Crop Insects, the Ute Guide (pp. 65-69) and Plant bugs - NSW DPI (pdf).

Weed web moth

Weed web moth (*Achyra affinitalis*) is a sporadic pest that can build up to large numbers where there has been an abundance of green plant material (pastures and broadleaf weeds) over spring and summer. Larvae of this and other closely related species (within the family Pyralidae) cause damage to broadleaf crops such as canola and lupins, and also weeds. They leave silken webbing at ground level amongst dead and living plant material, and larvae can be found concealed between leaf surfaces glued together by silken web and chewed plant material. Larvae grow up to 15mm long, are slender and grey-green to pale brown in colour with a dark head. Older larvae often have a dark stripe down the middle of the back and three rows of small dark spots on the sides, and they wriggle violently when disturbed.

In South Australia, weed web moth has been recorded on Eyre Peninsula, in the mid north and the upper south east, usually damaging lucerne or annual medics. Little is known about the biology of this sporadic pest. Control difficulties have occurred in the past because this pest requires higher rates of insecticides than are commonly used against cutworm and pasture webworm. For more information, refer to Crop Insects, the Ute guide (pp. 30-31) and Weed web moth - Qld DPI.

Planning for next season

Many growers will now be focusing on this season's harvest; however, it is not too early to start thinking about next season. Cultural practices can have a significant impact on insect populations in field crops, and a number of basic steps over the summer and pre-sowing period can help increase the chances of a successful start to the next growing season.

Remember that summer weeds provide a 'green bridge' for many pests (such as aphids, mites, snails, diamondback moth and other lepidopteran pests) to survive on over the hot summer months. These over-summering populations give rise to new generations the following autumn, which can then move into emerging crops and cause damage. Controlling summer weeds removes available habitat and food supply for many pests, which can reduce their survival and hence the potential for local sources of infestation next year.

Identify paddocks at higher risk of pest pressure and carefully monitor them in the autumn prior to sowing susceptible crops. Some risk factors might include:

- High pest pressure this season, or a history of recurring or resident pests such as cockchafers (Scarabaeidae) and false and true wireworms (Tenebrionidae and Elateridae).
- Crops intended to be sown following a pasture phase, or adjacent to long term pastures.
- Areas containing or adjacent to high weed populations which may harbour pests.
- Crops intended to be sown which are particularly susceptible to seedling damage (such as canola).
- Significant pest numbers detected during autumn monitoring of paddocks prior to sowing.

Monitoring techniques could include pitfall traps and shelter traps (for ground-dwelling or nocturnal feeders), germinating seed baits, and digging in the soil to detect soil-dwelling larvae. Remember to sample a number of representative areas within the paddock. If pests are detected which are likely to cause significant damage at emergence, consider the use of seed dressings or rotating with a less susceptible crop.

Insect diagnostics and online reporting form

**Please note the diagnostic service will continue to be available over the summer.*

SARDI Entomology Unit offers a **FREE insect diagnostic service for PestFacts subscribers**. For identification, please send at least 2 undamaged specimens in a non-crushable container along with some food (host material). Also please provide collection date, district, host-plant, description of damage caused and contact details.

Specimens can be forwarded to:
Kym Perry
Entomology Unit SARDI
GPO Box 397, Adelaide 5001

PestFacts relies on valuable field observations of pest occurrences. Your contributions make your newsletter more informative and helpful for the management of invertebrate pests. Please provide regular information on your observations and pest occurrences using the **online NIPI observational reporting form** or contact a coordinator directly.

Crop diseases diagnostics

SARDI, Field Crop Pathology Unit offers a range of diagnostic services refer to: SARDI Crop pathology diagnostic services. Crop watch is an electronic newsletter service provided by SARDI. If you would like to receive Crop Watch please send your email address to Jon Lamb, Jon Lamb Communications jlcom@chariot.net.au titled “Crop Watch request”.

Useful links

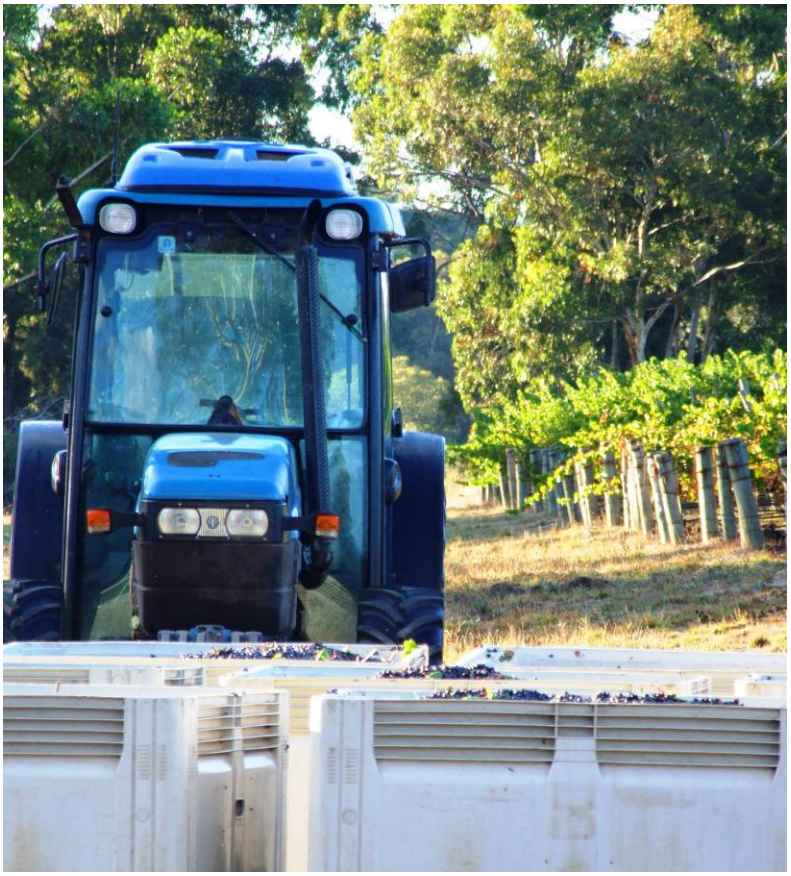
SARDI Fact Sheets
Farm Biosecurity - free newsletter and website
Previous PestFacts issues

PestFacts *is a FREE service providing updates throughout the growing season on an "as-needed" basis of the latest information on invertebrate pests in broad acre crops in South Australia and western Victoria. It is supported by GRDC's National Invertebrate Pest Initiative (NIPI). All information is sent by email to subscribers. Please email a coordinator to be placed on the circulation list. Your support and feedback are essential to the success of PestFacts.*

CropWatch

HARVEST EL 38

Harvest update



This message from Adelaide Hills CropWatch was compiled for the week ending **Friday, March 19th 2010** and will be updated prior to April 2nd.

More Pest and Disease information is available at www.adelaidehillswine.blogspot.com

Above: Pinot Noir harvested this week for table wine has been yielding well in the 3.5 to 5 tonne to the acre range and have reached flavor ripeness around 13.5° Baume aided by the ideal daytime ripening weather.

The white varieties are all but harvested. Some Riesling and Chardonnay blocks remain in small quantities.

Merlot and Shiraz and are progressing rapidly and picking of those varieties should begin in earnest over the coming week. Reported "top-end" Baume's are around the low 13's to 14.5 for both Merlot and Shiraz.

The first Merlot on a CropWatch vineyard was harvested on Sunday night. Cabernet is 10-14 days away from picking in many cases.

Dry weather has limited Botrytis.

Fruit condition looks good despite some bunch Botrytis being triggered by last weekend's rain.

Botrytis levels remain low. Where some bunch infection was triggered it appears to be naturally drying out as infected berries dry, raisin and drop out of bunches.

Rainfall overnight on the 18th/ 19th of March may cause some flair up of bunch rot.

LBAM and Vine Moth caterpillars.

Light Brown Apple Moth levels are low. Most of the LBAM currently seen in the vineyard are now pupating in cocoons and will soon leave bunches, as adult moths, which will lay eggs in other host plants. By Overwintering on other plants LBAM survives from season to season.

Vine moth caterpillar levels are low to moderate in the field, but are very noticeable in picking bins.

Weed growth.

The rain last weekend has caused some regrowth some of the perennial grasses and encouraged the growth of *capeweed*.