

**B3 Annual Report**

DAJ Teulon

**2016–17**



**Adding Value to New Zealand's Biosecurity  
System through Research**



**B3**

**Science Solutions for  
BETTER BORDER BIOSECURITY**  
[www.b3nz.org](http://www.b3nz.org)

## **B3's vision**

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... a world-leading source of science-based solutions for plant border biosecurity challenge by 2017, supporting and protecting the competitiveness of export industries and unique terrestrial ecosystems ...

## **B3's strategic priority**

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Adding value to New Zealand's Biosecurity System through research

## **B3's critical objective areas**

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Leadership and Influence  
Performance  
Uptake  
Capability  
Investment

## **B3's research themes**

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Risk Assessment  
Pathway Risk Management  
Diagnostics  
Surveillance  
Eradication and Response

## **B3's partners**

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The Ministry for Primary Industries (MPI)  
The Department of Conservation (DOC)  
The New Zealand Forest Owners' Association (FOA)  
The Environmental Protection Authority (EPA) (observer status)  
Horticulture New Zealand (observer status) (representing the horticulture/cropping sectors)  
Dairy New Zealand (observer status) (representing the pastoral sector)  
The New Zealand Institute for Plant & Food Research Limited (PFR)  
AgResearch (AGR)  
Scion  
Landcare Research (LCR)  
Bio-Protection Research Centre (BPRC)

## About Better Border Biosecurity (B3)

**Background.** B3 acts as the pre-eminent research provider for science-based plant border biosecurity solutions in New Zealand and provides a single point access to the New Zealand science system for plant biosecurity research. It has evolved from largely isolated and sector-based initiatives within the productive sector CRIs (pre 2003), through to the Foundation for Research Science and Technology (FRST)-funded 'Improved Biosecurity' programme (2003–05). A step change followed with the large Ministry for Science and Innovation (MSI)-contracted Outcome Based Investment (OBI) B3 programme (2005–11), to the current collaboration resourced primarily through Crown Research Institute Core (SSIF) funding.

**Scope.** The breadth of research carried out within B3 encompasses threats to the pastoral, horticultural, arable and forestry productive sectors and natural ecosystems, especially cross-sectoral issues where plant pests and diseases do not respect the productive and natural system boundaries. Weeds were confirmed to be within the scope of B3 in 2014-15.

**Partners.** All partners work towards a commonly developed and agreed-to Strategic Plan and a Business Plan, underpinned by a Collaboration Agreement. The current members of B3 include:

Science providers: Plant & Food Research, AgResearch, Scion, Landcare Research and the Plant Bio-Protection Research Centre hosted by Lincoln University.

End-users: Ministry for Primary Industries, Department of Conservation, and Forest Owners' Association. The Environmental Protection Authority, Horticulture New Zealand (representing the horticultural and cropping sectors) and Dairy New Zealand (representing the pastoral sector) have observer status.

B3 is aligned to the New Zealand Biological Heritage National Science Challenge ([www.biologicalheritage.nz/](http://www.biologicalheritage.nz/)).

**Governance.** The Collaboration Council (CC), led by an independent Chair and consisting of senior managers from the members listed above, plus the Director, meets quarterly to provide a governance role for B3 and to provide a link between the executive arms of the members' organisations and the operational science programme.

**Operational.** The Director leads a group of five Theme Leaders (plus Landcare Research representative), who are also representatives for the research providers. They provide operational leadership to the Project Leaders who make up the B3 science programme. The Theme Leaders are strongly influenced by Theme Representatives from the stakeholders, who provide input at the twice-yearly Science Partnership Forum (SPF) as well as at a range of formal and informal meetings throughout the year. A central tenet of B3 is that the government operational agencies, MPI and DOC, and more recently industry, create the value from B3's science and technology through their co-investment in the form of research uptake and application at the border. A corollary of this design is the need for frequent and effective communication among the various parties.

Staff are managed by their own organisations, with some advice from the B3 leadership, which has no direct line-control.

**Essential documents.** The Statements of Corporate Intent (SCI) for each of the member CRIs identify biosecurity as core to their research investments. The B3 Strategic Plan (2010/11 to 2016/17) outlines the key drivers, critical objectives, scope, and aspirations for the research conducted within B3. A new B3 Strategic Plan was developed in 2016. The Collaboration Agreement outlines how the members intend to interact with one another to enable B3 to function. The Business Plan outlines the planned activities for a given year and the Annual Report provides an account of what was achieved. The Hosting Agreement with PFR provides the resources for the Collaboration's leadership and coordination.

**Reporting.** Monthly Theme Leader reports (to the Director), a monthly Director's report (to the CC), and an Annual Report are placed on the B3 internal internet site ([www.b3nz.org](http://www.b3nz.org)) and are made available to the CRIs for their internal reporting requirements.

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## From the Director

2016-17 has seen several important changes to B3 and the broader biosecurity scene in New Zealand.

B3 undertook a process for **Operational Refresh**, based on its new 2016 Strategy, which instigated the establishment of a whole new suite of fit-for-purpose plant border biosecurity projects starting in July 2017 (page 9).

**Biosecurity 2025** - a new national paradigm for biosecurity endeavour was launched in Government House in July 2016. B3 members have been fully engaged at various fora and working groups to ensure the success of this critical and highly aspirational undertaking (page 5).

The **Government Industry Agreement** (GIA) for Biosecurity Readiness and Response continued to grow with nine industry sectors signed by June 2017. Reflecting this, B3 has continued to grow its partnerships with industry in such areas as pest and disease surveillance for forestry, pre-emptive biocontrol for horticulture and risk assessment for pastoral agriculture, while not neglecting biosecurity risks to the environment such as myrtle rust (page 6).

New Zealand's **Biological Heritage National Science Challenge** (NSC) continues to grow from strength to strength. B3, which is fully aligned to this NSC, continues to seek synergies in its governance, operations and science research to maximise biosecurity outcomes across New Zealand's productive and natural systems (page 8).

June 2017 also saw the conclusion of the 15 **Achievement Measures** set in 2010. Thirteen of these were completed with an extensive list of additional achievements accomplished as well (page 2). 2016-17 also had the highest number of manuscripts published in B3's 14 year history.

B3 drives research under five themes – (i) risk assessment, (ii) pathway risk management, (iii) diagnostics, (iv) surveillance and (v) eradication & response (page 10). Each of these themes involves teams comprising people from science and end-user organisations. These themes contribute to five critical objectives of B3 (page 23), and the projects within each theme are strongly informed by the end-user organisations. Cross-theme approaches, for example border biosecurity initiatives for Brown marmorated stink bug and *Phytophthora*, are being linked across themes by designated organism leaders.

In the following pages you will find outstanding examples of B3's contributions to science, policy, operations, system co-ordination and leadership and capability development for New Zealand's border biosecurity system.

B3 continues to provide a responsive, adaptable, innovative and integrated science platform with a clear mission and scope well understood by its end-users.



**David AJ Teulon** PhD, FNZIAHS  
Director, Better Border Biosecurity

12 December 2017



### B3'S ACCOMPLISHMENTS

June 2017 brings about the conclusion of the Achievement Measures set in 2010 and provides an opportunity to review B3's successes. The following is a list of some of the more outstanding accomplishments of B3 over the last 5 years:

#### Specific outcomes

- **Elevated preparedness for brown marmorated stink bug.** Through the invitation of key international experts to NZ meetings and a strategic approach targeting the whole biosecurity continuum, B3 has raised the risk profile of this destructive insect for both industry and government.
- **Expertise underpins EPA's decisions on new organisms.** Unique NZ science capability, found within B3 on non-target impacts of predators and parasitoids, has informed community deliberations on the introduction and release of these exotic biological control agents into the environment.
- **Tools informing the risk of establishment.** A suite of climate matching software tools has been developed and partly incorporated into MPI's Emerging Risk System. These provide high resolution climate suitability maps for the rapid assessment of the likelihood for alien plant pests and diseases to establish in NZ including their expected distribution.
- **Shaping international biosecurity policy.** B3 science, quantifying the risks, benefits and costs of potential mitigation measures for 'hitchhiker pests', was presented in support of a proposed international sea container standard at the International Plant Protection Convention (IPPC), Commission on Phytosanitary Measures meeting in April 2016 in Rome.
- **Biogeochemical technology provides key information for responses.** As a world first for biosecurity, isotope and trace element signatures can provide critical evidence of the origin of a fruit fly or BMSB incursion; importantly whether they are already established here or whether they have just crossed NZ's border.
- **New technique to identify if an organism is pathogenic.** A novel molecular assay is being applied to differentiate between pathogenic and non-pathogenic organisms to further define the risk of exotic microbes at the border, even in the absence of a species name.
- **Refining NZ's fruit fly surveillance system.** New biological knowledge and new technologies have been appropriated to update NZ's critical fruit fly surveillance programme to ensure greater protection of our important horticultural crops and their market access – a key outcome for the Fruit Fly Council under the GIA.
- **World first butterfly eradication.** Scientific expertise from B3 helped drive the world-first eradication of the invasive great white butterfly. Data analysis and modelling provided to DOC enabled them to target control efforts at the right places at the right times thereby significantly increasing the likelihood of success and reducing the timeframe of the response.
- **Innovative spot spraying technology.** Novel aerial spot spraying approaches have been developed and used effectively in several eradication programmes. These reduce off-target application through spray drift, thus providing an essential tool for invasive species management in urban and semi-urban environments.

#### General outcomes

- **New knowledge advancing border biosecurity science.** An average of 28 peer reviewed publications per year in a range of journals targeting pragmatic applications for biosecurity practitioners as well as the international science community.

- **Technical expertise underpins government and industry operations.** B3 has provided a one-stop-shop of expertise to underpin NZ border biosecurity operational activities. B3's scientists have provided indispensable informal and formal advice (e.g. on TAGs, industry advisory groups) across the biosecurity continuum on many occasions.
- **Developing the new generation of biosecurity competency.** As the border biosecurity challenge increases year on year, quality educated recruits will be required to advance innovative biosecurity solutions. B3 scientists are at the forefront of this endeavour having initiated programmes, supervised/co-supervised 15 PhD students in the last 5 years.
- **National leadership for border biosecurity science.** Through B3 Conferences, B3 hui, B3 Science Partnership Fora, a multitude of targeted workshops and hui, plus key contributions to the Biological Heritage NSC and Biosecurity 2025, B3 provides a leading national role to progress a collaborative and integrated approach for the development of innovative science solutions.
- **A network to the international biosecurity community.** International connectivity is an essential part of an effective plant biosecurity system to ensure access to the latest knowledge, technology and capability. Through their extensive international collaborations B3 researchers provide an important network of biosecurity practitioners throughout the world.



B3 has played a significant role in highlighting the biosecurity risk of myrtle rust both before and during the autumn 2017 incursion

## THE MYRTLE RUST INCURSION AND RESPONSE

B3, with its collaborators, has been particularly active both before and during the recent and ongoing myrtle rust incursion. Myrtle rust, caused by the fungal pathogen *Austropuccinia psidii*, was first found in NZ in March (Raoul Island) and April (North Island) 2017. It is a debilitating disease of plants within the Myrtaceae and is a serious threat to some of NZ's best-known native plants, such as the iconic pōhutukawa, rātā, kānuka and mānuka as well as many lesser-known species, such as swamp maire and ramarama. Exotic plants such as *Eucalyptus* species and feijoa are also at risk. Once myrtle rust became established in Australia in 2010, many considered that it was inevitable that it would make its way to NZ. B3 has contributed in the following ways:

### Biosecurity research

- Assessed the use of sentinel plants for risk assessment, undertook climate matching to assess likely distribution, assisted MPI in the development of a new molecular diagnostic tool
- Explored the biosecurity risk of myrtle rust to Māori and especially taonga plant species
- Planned and sought additional research funding from a range of sources prior to the incursion
- Supported the development a substantial and successful MBIE Catalyst research programme
- Adapted the focus of a number of B3 'refreshed' projects (i.e. risk assessment, surveillance tools, engagement with iwi) to include myrtle rust as a model organism

### Consciousness-raising

- Hosted a keynote speaker from Australia at the B3 Conference 2014
- Prompted engagement with Māori on myrtle rust as a biosecurity threat at the B3 hui in 2015
- Presented the risk of myrtle rust at NZ conferences to raise the awareness of this disease nationally
- Organised a workshop with MPI/PBCRC in December 2016 (60 attendees) attended by DOC team that subsequently found myrtle rust on Raoul Island

### Operational support

- Participated on the MPI Myrtle Rust Technical Advisory Group (TAG)
- Reassigned B3 FTE's to increase field support for MPI/DOC during the incursion

### Strategic support

- Co-organised a science workshop with PFR (15 May 2017) (50 attendees) to generate greater co-ordination and focus on potential myrtle rust research across the NZ science community. The major conclusions were passed to MPI to develop a national myrtle rust research programme
- Provided the Myrtle Rust Strategic Science Advisory Group (SSAG) with a description of past and current research myrtle rust projects to identify research gaps for future funding
- Cemented strategic links with Australia (esp. PHA) through the MBIE Catalyst programme
- Supported the development of research programmes for long term management

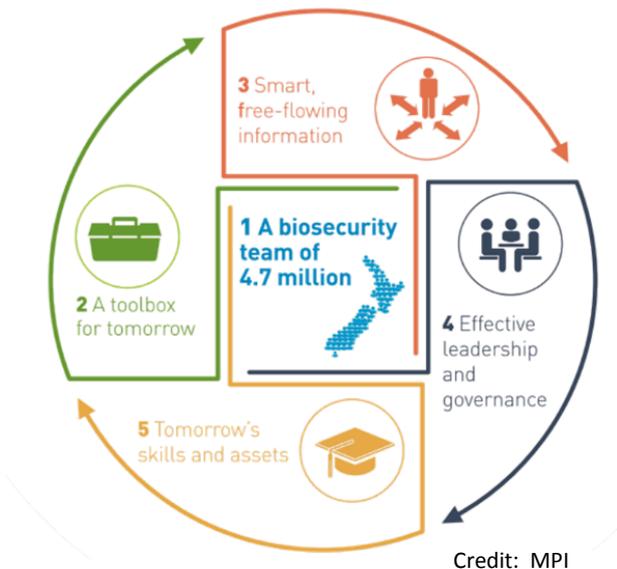
### Key references:

- Baskarathevan J, Taylor RK, Ho W, McDougal RL, Shivas RG, Alexander BJR. 2016. Real-Time PCR Assays for the Detection of *Puccinia psidii*. *Plant Disease* 100: (3) 617-624.
- Narouei Khandan H. 2014. Ensemble models to assess the risk of exotic plant pathogens in a changing climate. PhD Thesis, Lincoln University.
- Teulon DAJ, Alipia TT, Ropata HT, Green JM, Viljanen-Rollinson SLH, Cromey MG, Arthur K, MacDiarmid RM, Waipara MW, Marsh AT. 2015. The threat of myrtle rust to Māori taonga plant species in New Zealand. *NZ Plant Protection* 68: 66–75.

## A NATIONAL STRATEGY INITIATIVE - BIOSECURITY 2025

The Government has set five strategic priorities for New Zealand's biosecurity activities over the next 8 years, which include: a national team approach, a toolbox for tomorrow, free-flowing information, effective leadership and governance, and tomorrow's skills and assets.

B3 has enthusiastically supported Biosecurity 2025 (see Teulon & Goldson 2016) incorporating the strategic priorities in its Strategy and building its new science programme around them (see page 9).



A number of B3 researchers were active participants in the Biosecurity 2025 consultation workshops in August and September 2016 and the B3 Director provided a written submission on the Biosecurity 2025 Discussion Document in September 2016.

Many B3 researchers attended the Biosecurity Forum in November 2016 where Minister for Primary Industries Nathan Guy released the new Biosecurity 2025 Direction Statement. Steve Pawson was an invited speaker at the main Forum and David Teulon presented a 'think piece' at a workshop the following day.

B3 continues to be fully engaged with Biosecurity 2025 where opportunities arise and late in 2016-17 this has included the involvement of key B3 personnel on working groups to develop the Strategic Directions (SDs) including:

- SD1 (A Biosecurity Team of 4.7 m): Alby March (PFR), Melanie Mark Shadbolt (BPRC), Richard Palmer (Hort NZ)
- SD2 (A Toolbox for Tomorrow): Steve Pawson (Scion), David Teulon (B3)
- SD3 (Smart Free-flowing Information): Richard Palmer (Hort NZ), John Kean (AGR)
- SD4 (Effective Leadership and Governance): Melanie Mark Shadbolt (BPRC)
- SD5 (Tomorrow's Skills and Assets): Bevan Weir (LCR)

These working groups will be particularly active in 2017-18.

### Key reference:

Teulon DAJ, Goldson SL. 2016. Future-proofing New Zealand's border biosecurity system – the role of Biosecurity 2025. *The Journal* 20 (3): 8-11. September 2016. <http://b3nz.org/news/future-proofing-new-zealand%E2%80%99s-border-biosecurity-system-%E2%80%93-role-biosecurity-2025>

## PLANT BORDER BIOSECURITY RESEARCH LINKS WITH INDUSTRY

With the exception of the forestry sector, which has a long history in plant border biosecurity, industry interest in B3 is a relatively recent phenomenon, and has largely followed industry participation in the Government Industry Agreement (GIA) for Readiness and Response. The developing GIA for shared decision making and costs for biosecurity readiness and response is becoming a cornerstone of New Zealand's biosecurity system.

In 2016-17 the forestry sector, represented by Forest Owners Association, the pastoral sector – represented by Dairy NZ, and the horticulture and cropping sectors – represented by Horticulture NZ, were active members of B3.

While there is an expectation of increased activity over time, B3 is now working extensively with industry to maximise plant border biosecurity outcomes for New Zealand in the following ways:

### Strategic interactions

B3 plans with Industry to optimise research priorities

- Industry representation on the B3 Collaboration Council
- B3 expertise on industry biosecurity groups (e.g. KVH Biosecurity Steering Group)
- Industry participation in the B3 Operational Refresh

### Meetings/workshops

B3 joins with Industry to share knowledge and brain storm solutions

- Continued B3 participation at the FOA/MPI annual workshop
- Participation in other industry meetings (e.g. GIA Biosecurity Forum, Sheep & Beef workshop)
- Industry biosecurity managers attending and presenting at the B3 Science Partnership Forum (SPF) and B3 workshops (e.g. fruit fly, BMSB, myrtle rust, technology, weeds)
- NZ US Invasive Species Workshop and associated visits by international experts

### GIA activities

B3 works with Industry and MPI to implement the GIA

- Fruit Fly Council and Technical Working Group: A desk-top review of the science underpinning the current fruit fly surveillance system and membership of an international panel to review the whole system
- BMSB Council: Research to support a pre-emptive approach to biological control with the Samurai wasp and participation in the Samurai Wasp Steering Group
- Forest Health Surveillance: B3 researchers have been closely involved in the leadership and development of the new Forest Health Surveillance System

### Industry projects

Increasingly B3 undertakes Industry contracted research

- Dairy NZ: Weed and pest lists for biosecurity risks of pasture
- FOA: Risk maps for entry & establishment of forestry pests and diseases
- Kiwi Vine Health (KVH): Chinese language publications on BMSB impact on kiwifruit
- Kiwi Vine Health (KVH): Diagnostics of *Pectobacterium carotovorum* subsp. *actinidiae*
- NZ Wine: metabarcoding to profile multiple pathogens in grape trunk diseases
- Tomatoes NZ: survey design to determine presence/absence of predator species

### B3 Operational Refresh

B3 targets Industry priorities with Industry co-funding

- Pasture Pest Risk Analysis
- Imaging technology for biosecurity inspection of imported seed lots
- Biosecurity excellence in port communities
- Eradication toolkit and readiness



At the signing of the BMSB Operational Agreement in August 2017, Barry O'Neil (KVH CEO) (second from left) emphasised the importance of past B3 activity to prepare NZ for BMSB.

## B3 SUPPORTS THE MISSION OF THE NZ BIOLOGICAL HERITAGE NSC

The National Science Challenges (NSCs) were designed to develop a more strategic approach to the government's science investment by targeting a series of goals, which, if achieved, would have major and enduring benefits for New Zealand. The NZ's Biological Heritage NSC's (NZBH) mission is to reverse the decline of New Zealand's biological heritage, through a national partnership to deliver a step change in research innovation, globally leading technologies, and community and sector action. B3's CRI partners have aligned their SSIF investment in B3 to NZBH from its inception in December 2014. Since then B3 has been working closely with this Challenge to cultivate synergies to fulfil both the objectives of B3 and the NZBH. This has been achieved by:

- Integration of the NZBH Intermediate Outcomes into the new B3 Strategy
- Direct alignment of B3 and NZBH projects where interactions provide significant synergies in research activity and cross-learning such as:
  - An integrated platform for biosecurity through eDNA sequencing
  - Maori responses to biosecurity incursions
  - Susceptibility of taonga plants to myrtle rust
- A joint approach to support important biosecurity initiatives such as the Port of Tauranga Biosecurity Operational Excellence, and the MBIE funded Biosecurity Toolkit for the Urban Environment research programme
- Regular meetings between the Directors of B3, NZBH as well as the BioProtection Research Centre
- Combined meetings with end-users, such as MPI, to align national biosecurity goals
- Joint development of the Biosecurity 2025 Session at the NZBH Conference in 2017

NZBH and B3 provide a shared and synergistic vision to deliver biosecurity outcomes for New Zealand: NZBH provides high level leadership across the broader biosecurity spectrum linking biosecurity and biodiversity outcomes while B3 provides a single point of access for niche science solutions focussed on plant border biosecurity.



Panel members at the Biosecurity 2025 session at the NZBH Conference

## A REFRESHED B3 RESEARCH PROGRAMME

### **B3's Refreshed Scientific Programme - 2017**

A major refresh of B3 research was undertaken between August 2016 and June 2017 building upon the numerous achievements of B3 over the last 10 years. The refresh was based on the new B3 Strategy (developed in 2016) and stakeholder's priorities, and consisted of a two stage process of project Concepts and followed by the development of Full Proposals. Seminars on the process were given at Auckland (MARC & Tamaki), Lincoln, Te Puke, and Rotorua in September 2016. Despite other key meetings being interrupted by earthquakes, fog and biosecurity incursions, a strong suite of research projects targeting significant biosecurity outcomes was developed.

Principles of co-innovation with stakeholders were paramount throughout the process from Concept initiation through to the signoff of targeted outcomes including a specially designed Project Planning Tool targeting tangible biosecurity outcomes. Critical review and selection of Project Concepts and Full Proposals was overseen by a Science Advisory Group (SAG). The SAG was selected from within each of the B3 partner organisations with reference to their ability to reflect on scientific rigour and stretch, their seniority within their respective organisations and their independence from the research groups. The SAG included Richard Newcomb (PFR), Alison Popay (AGR), Lindsay Bulman (Scion), Dan Tomkins (LCR), Travis Glare (BPRC), Ian Ferguson (MPI), Chris Green (DOC) and Russell Dale (FOA). Projects were assessed with respect to (1) B3 strategy, (2) science quality, (3) ability to deliver and (4) likelihood of biosecurity outcome.

The SAG also considered a range of balance factors including the breath of organisms targeted (i.e. invertebrates, pathogens and weeds), productive and natural plant systems, new science capability and leadership, new science approaches, high and low risk science, and social and cultural engagement. The SAG provided a recommendation for a new suite of research projects to the B3 Collaboration Council (CC) in June 2017. Their recommendation was largely accepted by the CC.

The Operational Refresh resulted in a 10% increase in investment from the B3 CRI partners with 28 new projects spanning the border biosecurity continuum of risk assessment (both intentional and unintentional introductions), pathway risk management, diagnostics, surveillance and eradication and response.

Several new areas of research have been initiated including projects targeting biosecurity outcomes related to tourism, engagement with iwi and weed incursions. New capability, new research teams, new research approaches and new collaborations, including those outside the current B3 partners, have also been embraced. At least 10 graduate students are included in projects to strengthen future capability requirements for New Zealand's biosecurity system. Time-lines for projects now include completion dates for 2, 3, 4 and 5 years providing much greater flexibility for future changes in priorities.

B3 is aligned to the NZ Biological Heritage National Science Challenge (NZBH) with several B3 projects exploring synergies with NZBH projects. Similarly, opportunities to integrate further with the members of Government Industry Agreement (GIA) for Readiness and Response was established.

## B3 Theme Outcomes – A Selection

This section highlights a selection of the value created by B3 science for its stakeholders across its five themes.

### THEME 1. RISK ASSESSMENT

**Aim:** *To develop and deliver improved methodologies for identifying hazards, assessing risk, predicting impacts and ascertaining where in the system mitigation measures are best targeted*

**Theme Leader:** Barbara Barratt

**Theme Representatives:** Jo Berry (MPI), Helen Harman (MPI), Chris Green (DOC), Clark Ehlers (EPA), Russell Dale (FOA)

**Project Leaders:** Lisa Jamieson, Sue Worner, Craig Phillips, Nigel Bell, John Charles, Toni Withers, Barbara Barratt

**From the Theme Leader.** Researchers, in close collaboration with MPI, have developed a generic systems model to evaluate risk and to target interventions across import pathways for imported produce. This allows likelihood of entry, establishment and spread to be assessed, and will advise resource allocation and surveillance. For risk analysts, risk grouping tools for pest risk assessments continued to be refined such as the analysis of traits of successful invaders, and an on-line climate matching tool. Also a climate suitability model (CLIMENZ) has been developed which is a quick and easy way to generate climate suitability maps. *Phytophthora* has been identified as a major threat to productive and natural ecosystems, and a review of global invasion risk has been completed for publication. Research in natural ecosystems on a potential threat to native grass species (a damaging invasive pasture grass pest) was found to pose little risk to native grasses, supporting previous findings with exotic species in natural ecosystems and providing MPI with further published evidence of this for pest risk assessments. B3 is a member of IPSN (International Plant Sentinel Network) which can provide information and pest forecasting to support research on new threats; a network of possible collaborators in China, has been established this year. A novel approach to assessing biosafety of potential new natural enemies in advance of the arrival of a pest ‘pre-emptive biosafety assessment’ was prompted by the threat from high risk pests such as myrtle rust, GWSS, BMSB, SWD. Also research to develop a tool (PRONTI) to assist EPA applicants to objectively select non-target species which are likely to be at highest risk from a proposed BCA for quarantine host range testing.

#### A pre-emptive biocontrol strategy for the Brown Marmorated Stink Bug

A variety of research is being undertaken to prevent the establishment of brown marmorated stink bug (BMSB) in NZ and to reduce its impact if it does establish. One of the strategies being developed by B3 and USDA researchers, in close partnership with industry and government, is a novel pre-emptive approach to biological control. This entails getting everything in place for the introduction of the tiny Samurai wasp, a biological control agent for BMSB, before BMSB establishes in New Zealand.

The Samurai wasp, which originates from Asia, is considered to be the most promising natural enemy for BMSB and is likely to provide an important means for controlling this pest. B3 researchers, with Brian Patrick, have been scouring NZ's countryside for the few but rare native and indigenous stink bugs and then examining the impact of the Samurai wasp on them in quarantine. B3 researchers have provided input into a cost/benefit analysis and risk assessment and have assisted in consultation with Māori and other key stakeholders. It is planned that this information will become part of an application to the Environmental Protection Authority (EPA) for release of the Samurai wasp in NZ.



Searching for native stink bugs in Central Otago

**Key report:** Charles et al. 2016. Pre-emptive assessment of the biosafety of a classical biocontrol agent: Responses of *Trissolcus japonicus* to New Zealand's native Pentatomidae prior to the arrival of BMSB. In: International Congress of Entomology, Orlando, Florida, USA. DOI: 10.1603/ICE.2016.110850.

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### The Electrical Penetration Graph (EPG) an effective tool for biosecurity

The EPG technique has been developed for analysing, quantifying, and comparing the feeding behaviours of both phloem and xylem sap-sucking insects. This B3 research explored the potential application of EPG for biosecurity incursion response decision making. Assessment of biosecurity decision points and case studies has shown that there is potential to use EPG to differentiate between the plant hosts, suspect hosts and non-hosts of sucking insects to assist in biosecurity response decision making. In related PFR SSIF funded research, the EPG technique is being used to understand the effectiveness of the meadow spittle bug, and other potential New Zealand vectors, as a vector for the destructive *Xylella* plant pathogen which has not yet been found in New Zealand.

**Key publication:** Sandanayaka et al. 2017. Potential use of electrical penetration graph (EPG) technology for biosecurity incursion response decision making. *NZ Plant Protection* 70: 1-15.

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### PRONTI ready for trial in EPA applications

A computer-based tool called PRONTI (Priority Ranking Of Non-Target Invertebrates) has been developed and tested by B3 researchers to aid in the selection of non-target species (NTS) for pre-release testing with entomophagous (insect eating) biological control agents. Compared to other approaches, PRONTI can rank hundreds of NTS simultaneously and provide a body of information that can be used to both understand each NTS' ranking and to justify more objectively the selection of NTS for pre-release testing. EPA have indicated that they would be interested to see how PRONTI performs if used as part of their application process for approving the introduction of biocontrol agents into New Zealand.

**Key publication:** Todd et al. 2016. A comparison of methods for selecting non-target species for risk assessment of the biological control agent *Cotesia urabae*. *BioControl* 62 (1): 39-52. DOI 10.1007/s10526-016-9770-z

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## Plant biosecurity risks of pastoral systems

In close association with DairyNZ, a new B3 project assessing the biosecurity risks to pasture (NZ's largest 'crop') has been initiated. The goal is to produce prioritised lists of weeds and invertebrate pests that are biosecurity risks to pasture. Two workshops involving industry biosecurity managers and researchers have been undertaken. Thirty seven insect species not present in NZ, but likely to feed on ryegrass or clover, received risk scores which indicate they are worthy of consideration for additional risk assessment such as examining their potential NZ distributions and impacts. Such 'plant' risk assessments compliment the traditional focus on the important animal biosecurity diseases such as foot and mouth. *"This project is of high importance to DairyNZ as its outputs will support, and inform GIA activities and help to prioritise DairyNZ's wider investment in biosecurity readiness, response and R&D"* said Dave Hodges (DairyNZ).

**Key report:** Phillips CB, Orre-Gordon S. 2017. Pasture insects hazard identification: Report to DairyNZ', AgResearch Document No. 6457, 31 May 2017, 31pp.

**Contact:** Craig.Phillips@agresearch.co.nz

## CLIMENZ: a new tool for risk analysis



Potential distribution of myrtle rust

This website tool includes access to a climate suitability model that allows users to generate high resolution maps for the projected climate suitability of specific taxa in NZ under current and future climates. CLIMENZ is accessed from the B3 website (<http://b3.net.nz/climenz>) and is intended as a tool for use by risk analysts and surveillance managers in central and local government agencies and for industry biosecurity managers. For example a map of the potential distribution of myrtle rust in NZ was quickly developed using CLIMENZ and was used by MPI in the response to the incursion of this potentially devastating pathogen. The CLIMENZ website also includes a database of many published models for biosecurity risk organisms covering of concern to NZ (216 economically important taxa), such as the Brown marmorated stink bug and the Russian wheat aphid, where authorised users can generate distribution maps for NZ. Rory McLellan noted that *"This would be a great tool to have use of within MPI when planning future surveillance work as well as planning delimiting surveys for newly intercepted exotic species"*.

**Key publication:** Kriticos et al. 2017. The potential global distribution of the brown marmorated stink bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae): A critical threat to plant biosecurity. Journal of Pest Science. doi:10.1007/s10340-017-0869-5.

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## B3 recommits to the International Plant Sentinel Network (IPSN)

IPSN links botanic gardens and arboreta, national biosecurity institutions and plant health scientists from around the world to identify potential plant pests and diseases before or at the border, thereby acting as an early warning system (<https://www.bgci.org/plant-conservation/ipsn/>). Recent funding obtained through Euphresco has enabled IPSN to continue its activities for a further 3 years and B3 joined the newly funded project in 2017 (B3 was previously a member of the IPSN International



International Plant  
Sentinel Network

Advisory Group). B3 is exploring with MPI, DOC and botanical gardens in Auckland, Wellington, Christchurch and Dunedin, how it might best utilise IPSN to increase our assessment of biosecurity risk through understanding the impact of pests and diseases to NZ's valued plant species in foreign gardens. Emerging collaborations with the Institute of Plant Protection, Chinese Agricultural Academy of Science (pastoral pests) and Plant Health Australia (myrtle rust) are helping us to maximise these linkages.

**Contact:** Mark.McNeil@agresearch.co.nz

### **New capability for biosecurity risk assessment**

Four new PhD graduates (one still to be examined) have provided a noteworthy finale to Prof Sue Worner's career after her retirement in 2017. Audrey Lustig, Marona Rovira Capdevila, Mariona Roige and Ursula Torres have been part of a vigorous group carrying out quantitative biosecurity risk assessment research in association with B3 including a series of workshops with members of the SAFARIS project (USDA/APHIS, CIPM University of North Carolina), an activity funded through the NZ-US Invasive Species Working Group. These recent graduates have developed an impressive body of knowledge through the publication of their theses, in peer reviewed journals, blogs, and websites. All four are following a range of different opportunities in biosecurity in NZ and internationally.



**PHD SUPERVISION**

**Key publication:** <https://bprc-ecoinformatics.github.io>

**Contact:** Karen.Armstrong@lincoln.ac.nz

## THEME 2. PATHWAY RISK MANAGEMENT

**Aim:** To develop and deliver 'fit for purpose' tools and methodologies for reducing risks along importation pathways

**Theme Leader:** Ecki Brockerhoff

**Theme Representatives:** Shane Olsen (MPI), Chris Denny (MPI), Chris Green (DOC), Clark Ehlers (EPA), Russell Dale (FOA)

**Project Leaders:** Lisa Jamieson, Mark McNeill, Craig Phillips, Ecki Brockerhoff

**From the Theme Leader.** As the final year of the term of the first incarnation of B3, the 2016-17 year's focus was on completing work in the three ongoing projects. Most of the research investment in this theme was on the development and uptake of treatments for fresh produce, in collaboration with authorities and producers in Samoa, New Caledonia and New Zealand. High-pressure washing and hot-water treatment of produce were successfully developed as alternatives to fumigation within a systems approach, and these methods are ready for adoption or have already been adopted in several Pacific Island countries. As a result there has already been a reduction in MeBr fumigation of fresh produce from this region. Another focus involved the development of detection and sampling tools for pathway risk management, including a review that is nearing completion. Considerable progress has been achieved in the characterisation of volatile organic compounds emitted by brown marmorated stink bug, including the identification of a previously unknown compound that shows promise for use in detection tools. Proof of concept has been achieved regarding the use of acoustic detection tools for the detection of species such as bark beetles imported with wooden items. Two PhD and two MSc projects have been completed.

### Exploring BMSB surrogates to improve border treatments

The brown marmorated stink bug (BMSB) is not found in New Zealand and we are trying hard to keep it that way. As BMSB is increasingly found in a range of imported commodities (e.g. vehicles) at the border, there is an urgent requirement to optimise effective border treatments. The green vegetable bug (GVB), which is closely related and similar in size to BMSB and, most importantly, present in New Zealand, is being explored by B3 researchers as a BMSB surrogate. With funding from MPI and support from the USDA through the NZ US Invasive Species Working Group, preliminary research indicated that GVB may be a useful rapid and cost-effective alternative to test a range of treatments for BMSB including those that are more environmentally acceptable than the current methyl bromide treatments.



BMSB & GVB

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### B3 supports biosecurity operations in Antarctica



The pristine Antarctic environment may be under greater threat from biosecurity contamination as a result of climate change. Antarctica NZ has contacted B3 to help it understand how to mitigate biosecurity risk associated with the transport of material to the continent on equipment, containers and cargo as well as from soil on footwear between sites in Antarctica. Discussions are underway as to the development of a joint project. Antarctica NZ Environmental Advisor Rebecca Roper-Gee spoke at the recent NZ-US Invasive Species Workshop in Auckland.

**Key publication** (work of relevance): McNeill et al. 2017. Defining the biosecurity risk posed by transported soil: Effects of storage time and environmental exposure on survival of soil biota. *NeoBiota* 32: 65–88 (2017), doi: 10.3897/neobiota.32.9784.

**Contact:** Mark.McNeil@agresearch.co.nz

### B3 contributes to international Task Force on biological invasions in forests

Under the patronage of the International Union of Forest Research Organizations (IUFRO), B3 members and collaborators were part of an international and interdisciplinary Task Force to share, discuss, integrate and develop more comprehensive approaches to managing biological invasions in forests (<https://www.iufro.org/science/task-forces/biological-invasions/>). Outcomes targeted stakeholders at the local level (e.g., management of forests for resistance to invasions), national level (e.g., risk assessment, surveillance and eradication), and international levels (e.g., international agreements on phytosanitary measures). Contributions from a workshop held in West Virginia, USA, in July 2016 were published in a special issue of *Biological Invasions* with 24 papers on a range of taxa and biosecurity measures. This included an invited 'Elton Review' on 'Biological invasions in forest ecosystems' and a review of the 'Ecology of forest insect invasions'.



**Key publication:** Liebhold et al. *Biological Invasions*. Volume 19. Issue 11. Special Issue. <https://link.springer.com/journal/10530/19/11/page/1>

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## THEME 3. DIAGNOSTICS

**Aim:** To investigate and deliver fast, cost-effective, robust and accurate diagnostic methods and tools to enable informed biosecurity decisions

**Theme Leader:** Karen Armstrong

**Theme Representatives:** Robert Taylor (MPI), Disna Gunawardana (MPI), Chris Green (DOC), Clark Ehlers (EPA), Russell Dale (FOA)

**Project Leaders:** Simon Bulman, Andrew Pitman, Karen Armstrong

**From the Theme Leader.** State of the art technologies can be a blessing and a curse. PHEL will clearly benefit from the next generation sequencing (NGS) technology that underpinned delivery of an effective, biologically-informed, tool to determine risk and support regulatory decisions. The simple pathogenicity test, derived from comparative pseudomonad genomics, is set for imminent PEQ implementation and establishes a formula for research going forward to generate the same for other high-risk bacterial groups. This year, by refocussing on the momentum of an industry grape vine programme and closer alliance to LCR's taxonomically validated sequence collection, progress to reduce the divide between easy data generation and confounding interpretation has been made. While the proof of principle to determine natal origin has been substantiated again this year, for BMSB, uptake was stymied by a contemporary technology that is as-yet not cheap, rapid or sensitive enough and must be the focus for future research effort.

### Diagnostic keys using morphology are still an essential biosecurity tool

Identification of pests of biosecurity concern using morphological characteristics is sometimes mandated in international agreements and essential in the absence of modern molecular laboratories and/or comprehensive DNA databases. They are very powerful when used in conjunction with molecular diagnostics. Capability from B3 and its national and international collaborators has helped to develop morphological keys for three high risk insect groups (as identified by MPI). Such keys provide a more widely accessible means of identification for biosecurity practitioners in NZ and offshore as well as for amateur entomologists and sometimes the general public, and are essential tools for border biosecurity. These keys include:



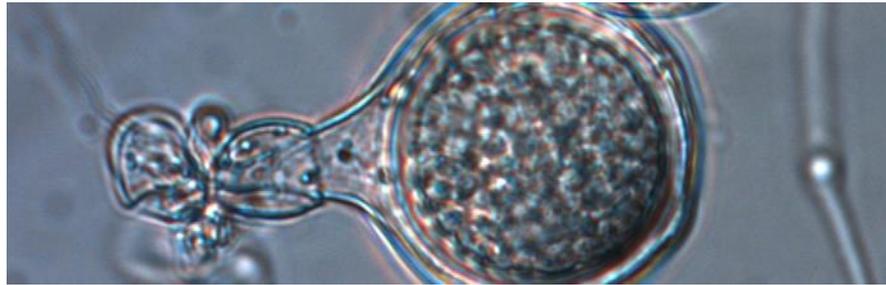
Credit: Anne Hastings, CSIRO

- Larivière et al. 2016. Identification keys to New Zealand Pentatomidae (Insecta: Hemiptera) and surveillance tool for biosecurity. [www.landcareresearch.co.nz/pentatomidae](http://www.landcareresearch.co.nz/pentatomidae).
- Mound et al. 2017. *Thysanoptera Aotearoa* – Thrips of New Zealand. Lucidcentral.org, Identic Pty Ltd, Queensland, Australia. [http://keys.lucidcentral.org/keys/v3/nz\\_thrips/](http://keys.lucidcentral.org/keys/v3/nz_thrips/).
- Zhao et al. 2017. First record of the root knot nematode, *Meloidogyne minor* in New Zealand with description, sequencing information and key to known species of *Meloidogyne* in New Zealand. *Zootaxa* 4231 (2): 203–218. <http://dx.doi.org/10.11646/zootaxa.4231.2.4>.

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## Accelerating collation and use of taxonomic metadata

Large specimen collection and DNA sequence reference databases are mainstay diagnostic tools, but the disparate sources can be unwieldy to use. This has been considerably improved by the LCR



team through two avenues. Firstly, the International Collection of Microorganisms from Plants (ICMP) and the NZ Fungal and Plant Disease Database (PDD) databases have become a one-stop-shop, clearly linking to external genetic and literature sources and enabling more efficient species diagnosis (see [https://scd.landcareresearch.co.nz/Specimen/ICMP\\_18884](https://scd.landcareresearch.co.nz/Specimen/ICMP_18884)). Secondly, making the ever growing crop of DNA sequence data available by-and-to anyone is facilitated with a simple software plug designed to aid importation of meta-data associated with the organisms sequenced (<https://datastore.landcareresearch.co.nz/dataset/geneious-plugin-metadata-importer>). Metadata Importer adds to the powerful suite of molecular and NGS analysis tools on the Geneious platform.

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## NGS-enabled biosecurity tools for government and industry

Several notable examples of end user uptake from the NGS-related (Next Generation Sequencing) science developed within B3 have become evident.

- A diagnostic test that distinguishes between pathogenic and non-pathogenic *Pseudomonas* strains is expected to be routinely implemented by MPI/PEQ operations as part of their general surveillance in late 2017
- A multi-taxa NGS approach has been extensively applied to detect grapevine trunk disease pathogens in an allied NZ Wine industry vineyard ecology project
- An evaluation of a published diagnostic test for *Pectobacterium carotovorum* subsp. *actinidiae* for recommendations for its potential use with *Actinidia* seed imports were reported to KVH.



Sampling kiwifruit vines

### Key publications:

Barrero et al. 2017. An internet-based bioinformatics toolkit for plant biosecurity diagnosis and surveillance of viruses and viroids. *BMC Bioinformatics* 18: 26. <http://doi.org/10.1186/s12859-016-1428-4>

Visnovsky et al. 2017. Draft genome sequences of *Pectobacterium carotovorum* subsp. *actinidiae* ICMP 19971 and ICMP 19972, two strains isolated from *Actinidia chinensis* with symptoms of summer canker in South Korea. *Genome Announc* 5:e00104-17. <https://doi.org/10.1128/genomeA.00104-17>.

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## Biogeochemical technology supports BMSB response

As a world first for biosecurity, B3-developed stable isotope data, along with other corroborative evidence, was used to successfully determine that a single BMSB female found post-border was of

northern hemisphere origin and not established in NZ. Such information is critical to a biosecurity response and in this case raised the level of evidence necessary to avert the need for a significant response.

**Key publication:** Holder et al. 2017. Brown marmorated stink bug (BMSB) T17-490: Stable isotope analysis for geographic origins.” Report to Ministry for Primary Industries. 14 March 2017.

**Contact:** Karen.Armstrong@lincoln.ac.nz

### ***Phytophthora pluvialis*, red needle cast disease – industry abreast of student research**

Engaging students in research for biosecurity is a key opportunity to develop relevant underpinning skills. To then give this visibility to the appropriate end users is of considerable long-term value. Simren Brar has captured the attention of PF Olsen who assist forest owners to produce and protect high quality forests. The outcomes of her study, to understand the genetic diversity and population structure of the pathogen, are a set of molecular markers for monitoring, knowledge that separate introductions to NZ were likely responsible for the current disease epidemiology, and that the narrow diversity means susceptibility or resistance testing of *Pinus radiata* to red needle cast can be done using a small number of *P. pluvialis* isolates. This indicates the latest technology available to forest owners and reinforces the vigilance necessary to avoid introduction of new pathogen isolates from overseas.



Simren Brar inspecting pine seedlings for *Phytophthora* symptoms

**Key publication:** Dale et al. 2016. Summary of *Phytophthora pluvialis* population findings in New Zealand. *Wood Matters*. <https://nz.pfolsen.com/market-info-news/wood-matters/2016/november/summary-of-phytophthora-pluvialis-population-findings-in-new-zealand/> (PF Olsen web-based report).

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## THEME 4. SURVEILLANCE

**Aim:** To deliver knowledge, strategies and tools for determining presence or absence of invasive pests of plants

**Theme Leader:** John Kean

**Theme Representatives:** Paul Stevens (MPI), Rory MacLellan (MPI), Chris Green (DOC), Clark Ehlers (EPA), Russell Dale (FOA)

**Project Leaders:** Max Suckling, Scott Hardwick, Suvi Viljanen-Rollinson, John Kean

**From the Theme Leader.** This year marked the wrap-up of current projects and preparation of new surveillance research ideas for the refreshed B3 portfolio. Previous work in this theme culminated in MPI revising its fruit fly trapping system and in the announcement that great white butterfly has officially been eradicated from Nelson. Recommended changes to the Forest Health Surveillance System are being trialled in three regions in preparation for a national roll-out next year. The pathogen surveillance review was completed, and there has been significant progress in reviewing and coordinating fruit fly surveillance knowledge with Australia and NZ's new Fruit Fly Council. Parts of the SITplus cofunded work on improved attractants for Queensland fruit fly will carry over into a new B3 project together with further development and testing of automated traps. This will complement the new project on low power wide area networks for use in biosecurity. Such tools may eventually be trialled in the new project focusing on improving biosecurity in port environs, including the community of workers and residents associated with the port.

### Australasian experts come together to tackle fruit fly

In September 2016, B3 and PFR hosted scientists and biosecurity operatives from Australia's PBCRC and SITplus for a week of workshops, meetings and tours. A fruit fly workshop, held in conjunction the recently formed NZ Fruit Fly Council – a collaboration under the GIA - reviewed past and current research on invasive fruit flies and identified priorities for future research and supported the development of the NZ Fruit Fly Strategy. Topics included surveillance, detection and trapping, risk assessment, and management methods such as Sterile Insect Technique (SIT) and lure and kill treatments. It's rare to have such a varied group of research, government and industry representatives from both sides of the Tasman at the same meeting, and the workshops provided a positive platform for discussion and information sharing. By coordinating the scientific trans-Tasman efforts we can help develop applied solutions for dealing with this important pest and preventing its establishment in New Zealand. Barry O'Neil (FF Council Chair) was reported as saying that "it was 'one of the best workshops he had attended'".



**Key report:** <http://www.plantandfood.co.nz/page/news/media-release/story/staying-on-top-of-the-fruit-fly-threat/>

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### Forest biosecurity surveillance revised

The national Forest Health Surveillance System (FHSS) aims for early detection of any pest or disease incursions in forest trees. B3 has been working with FOA, MPI, SPS Biosecurity and Melbourne-based Bayesian Intelligence to revise and improve the FHSS. The new analytical approach predicts the areas of greatest risk according to pathways of entry, and optimally allocates a range of surveillance tools across NZ according to their local efficacy and costs. The results suggest greater emphasis should be

placed on urban and peri-urban areas for detecting forestry pests and diseases. The recommendations are being piloted in south Auckland, the Taupo area and Southland with the intent to roll out the new FHSS nationwide in January 2018.

**Key output:** Meurisse et al. 2017. Early detection of forest invaders in New Zealand: optimising surveillance effort based on spatially-explicit modelling of high-risk pathways. 11th Meeting of the International Pest Risk Research Group, 29 August – 1 September 2017 in Ottawa, Canada.

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### B3 surveillance expertise called on for recent incursions

Each new biosecurity incursion requires a robust sampling programme to delineate an organism's distribution and to accurately identify when it has been eradicated. MPI has used B3 expertise and sample plans during their surveillance activities for a number of current or recent incursions including:

- myrtle rust in Taranaki
- pea bruchid (weevil) in the Wairarapa
- spiked awl snail, with its vectored pathogen, in Auckland.



Sweep netting for the pea bruchid

In addition, the new NZ Fruit Fly Council commissioned B3 to review the science underpinning NZ's current fruit fly surveillance system. The Council has appointed the main author to lead an international panel to review potential improvements in the fruit fly trapping programme.

**Key publication:** Kean JM 2017. Summary of research underpinning New Zealand's National Fruit Fly Surveillance programme. AgResearch client report no 6451 for Ministry for Primary Industries.13 pp.

**Contact:** John.Kean@agresearch.co.nz

### Resources redirected towards myrtle rust incursion

The potentially devastating myrtle rust plant pathogen was first detected on the NZ mainland in April 2017 (see page 4) and B3 resources were rapidly reprioritised to support the MPI response. Several B3 CRI members volunteered qualified staff to support on-the-ground surveillance teams where their plant pathology expertise was very welcome. Additionally, during the early stages of the myrtle rust incursion when there was some uncertainty about the distribution of myrtle rust in New Zealand an anticipatory treatment protocol was developed to assist in the potential management of elite plant germplasm if it was found to be within an area infected with myrtle rust.



B3 pathologist Beccy Ganley surveying for myrtle rust

**Key output:** Falloon R. 2017. Fungicide management of myrtle rust on native New Zealand plants in germplasm collections. Unpublished Plant & Food Research report.

**Contact:** Rebecca.Ganley@scionresearch.com

## THEME 5. ERADICATION AND RESPONSE

**Aim:** To increase preparedness for responses by providing knowledge, strategies and tools to support robust decision-making

**Theme Leader:** Jessica Dohmen-Vereijssen

**Theme Representatives:** George Gill (MPI), Rory MacLellan (MPI), Chris Green (DOC), Clark Ehlers (EPA), Russell Dale (FOA)

**Project Leaders:** Max Suckling, Grant Smith, Jessica Dohmen-Vereijssen, Tara Strand

**From the Theme Leader.** This year, several researchers were actively involved in biosecurity responses, underlining the skills and expertise present within B3. A major achievement was the successful eradication of great white butterfly from NZ, to which B3 researchers made major contributions through research and technical advice on surveillance and eradication. Positive interim results were obtained from the PFR-led pilot eradication of codling moth in Hawke's Bay which is based on the principles of area wide control and eradication developed within B3. Project leaders, end-users, theme reps and leaders collaborated intensively on getting new proposals signed off for the B3 Operational Refresh. Two major milestones were achieved; Lloyd Stringer's Queensland fruit fly manuscript was accepted for publication and Grant Smith's GERDA manuscript on plant pathogen eradications was published.

### Eradication of the great white butterfly now official

The great white butterfly was formally declared eradicated from Nelson in November 2016. As reported in last year's Annual Report, B3's work made an important contribution to the success of this, the world's first eradication of a pest butterfly. As such this event was reported in New Scientist ([www.newscientist.com/article/2114573](http://www.newscientist.com/article/2114573)). The pest, first seen in Nelson in 2010, posed a significant threat to NZ's native and cultivated brassica plant species. It prompted the major eradication effort led by the DOC, and B3 partners provided expertise to guide the effort.



The DOC GWB response team

**Key output:** Phillips et al. 2016. *Pieris brassicae* (great white butterfly) eradication Annual Report 2015/16. DOC, Wellington. 16 p.

**Contact:** [craig.phillips@agresearch.co.nz](mailto:craig.phillips@agresearch.co.nz)

### SIT: A new tool for eradicating the brown marmorated stink bug?

The brown marmorated stink bug (BMSB) continues to test our border controls and if they are breached NZ will require new tools for eradication. The sterile insect technique (SIT) has proved useful for the border management of a number of insect pests (but so far not Hemiptera such as BMSB) and B3 researchers are investigating whether SIT can be used for BMSB, supported by researchers from the USDA and by the NZ US Invasive Species Working Group. Preliminary research on BMSB males is promising. However it is early days and more work will be needed on the comparative fitness of irradiated insects and logistics, such as mass rearing or field collection, in order to determine the feasibility of the approach.

**Key publication:** Welsh et al. 2017. Irradiation biology of male brown marmorated stink bugs: is there scope for the sterile insect technique? *Int. J. Radiat. Biol.* 93(12):1357-1363. DOI 10.1080/09553002.2017.1388547.

**Contact:** [Max.Suckling@plantandfood.co.nz](mailto:Max.Suckling@plantandfood.co.nz)

## Expert advice sort in operational responses

An important contribution of B3 to NZ's biosecurity system is the scientific expertise it provides to underpin operational activities. In the last year B3 researchers were invited to participate in the following areas:

- Myrtle rust incursion: Beccy Ganley and David Teulon were part of the Technical Advisory Group. Beccy was also an authorised Team Leader as part of the surveillance programme in the Bay of Plenty.
- Pea weevil (brucid) response: David Teulon (as an observer) was part of the Technical Advisory Group. John Kean provided technical advice on the deployment of trap crops to detect remnant populations and to prove local freedom. Max Suckling's team explored new lures.
- Brown marmorated stink bug biocontrol. John Charles, Gonzalo Avila and David Teulon were part of the industry/government Samurai Wasp Steering Group.
- Isotope technology provided good supporting evidence of probable northern hemisphere origin for a post-border BMSB incursion.

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## Supporting the Western Australia response to Tomato Potato Psyllid

NZ knowledge of the tomato potato psyllid (TPP) and the pathogen it transmits (*Candidatus Liberibacter solanacearum* or CLso) was quickly sort out by Australian biosecurity authorities after the discovery of TPP in Perth in February 2017. B3 researchers swiftly provided relevant publications, reports and expertise on the biology, diagnostics and surveillance of both species as well as working with the incursion response team at DAFWA on insect biology, behaviour and identification, crop and non-crop host plants, symptomology, insect management, and scouting. Sonya Broughton (DAFWA) stated that *"having access to NZ capability was invaluable in providing update to data knowledge of the pest and in sharing lessons learnt from NZ's experiences with managing TPP"*.



Emily Glass (DAFWA), Callum Fletcher (AUSVEG), Jessica Dohmen-Vereijssen (B3) & Darryl Hardie (DAFWA) discussing the TPP Biosecurity Alert

**Key publication:** Teulon DAJ, Hill MG. 2015. Responding to the establishment of new pests and diseases: What can be learnt from tomato potato psyllid and *Candidatus Liberibacter solanacearum* in New Zealand? NZ Plant Protection 68: 76-84.

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## B3 Highlights by Critical Objective Area

The current (2010-17) B3 strategy is based on five critical objectives. Noteworthy examples of B3's activities in these areas are highlighted here.

### 1. LEADERSHIP and INFLUENCE

B3 is providing strong scientific leadership for its stakeholders across the border biosecurity spectrum by introducing a diverse range of international experts, by creating a variety of forums enabling information exchange, and by working with key collaborators to bring new concepts of science-based solutions to NZ to enhance our world-leading plant border biosecurity system.

#### Biosecurity Forum

Several B3 members attended the GIA Biosecurity 2025 Forum and Workshop (22-23 November 2016) in Auckland. Steve Pawson spoke in the main programme (on new technologies) and James Buwalda (on governance) and David Teulon (on new technologies) each provided a think-piece for the workshops.

#### B3 Science Partnership Fora (SPFs)

Two SPFs were organised. The first was held at Lincoln (20 October 2016) and was the first time that a concerted effort was made to invite the industry partners from the horticulture/cropping and pastoral sectors. Consequently, this was probably the largest SPF ever, with about 70 participants. Interest from stakeholders was evident throughout the meeting.

The second half of the SPF focussed on research being carried out on the brown marmorated stink bug (BMSB) in B3 and elsewhere, and provided industry and government with a perspective of the current breadth of research activity. The SPF was followed immediately by a meeting of the Samurai Wasp Steering Group.

Veronica Herrera (Director MPI) noted: *...the SPF was a very successful day. It was clear that in many areas there has been great work and there is true partnership spirit between the different agencies working together*.

The second SPF (30 March 2017) was abandoned due to fog at Wellington airport. This was very unfortunate as it was to be the 'kick-off' for project engagement as part of the Operational Refresh.

#### Biological Heritage NSC Conference

The inaugural Biological Heritage NSC conference was held from 8-11 May 2017. The first day included a session highlighting Biosecurity 2025, and was co-organised with B3. It included speakers from industry, government and science. The feedback from the conference was very positive and it reflected the growing integration of B3 and BHNSC objectives.

- Invited participants: Sandy Liebhold (USDA FS) (plenary), Roger Smith (MPI), Barry O'Neil (KVH), Mark Whitworth (POT), Phil Cassey (U Adelaide). Chaired by Jen Scoular (NZ Avacodos)

#### Formal submissions

B3 was involved in formal submissions for several important policy documents pertinent to plant border biosecurity including:

- Conservation and Environment Science Roadmap (September 2016)
  - Support for the Royal Society of NZ submission
  - A separate written submission from the B3 Director and Theme Leaders on
- Biosecurity 2025 Discussion Document (September 2016)

- A written submission from the B3 Director and Theme Leaders
- Primary Sector Roadmap (April 2017)
  - A written submission from the B3 Director and Theme Leaders

### National and international biosecurity meetings/workshops

B3 led or played a key role in organising a number of activities throughout the year to provide updates, dialogue and direction on plant border biosecurity science and its implementation.

#### End-user focused meetings:

- Fruit Fly Workshop (13-15 September 2016, Auckland) held in conjunction with the NZ Fruit Fly Council to assist in the development of future research priorities in the context of GIA. Hosted by B3/PFR/PBCRC.
  - Invited Australian participants (funded by PBCRC): Darryl Barbour (PHA), Michael Robinson (PBCRC), Phil Taylor (MAQ), Mark Schutze (QUT), Paul Cunningham (QUT), Will Zacharin (BSA/SITPlus), Nancy Schellhorn (CSIRO)
- Myrtle Rust Workshop (6-7 December 2016, Wellington). Hosted by MPI/B3/PBCRC. Attended by ca. 60 with representatives from government (MPI, DOC, Regional Councils including botanical gardens), industry (Apiculture NZ, Comvita), public interest (Project Crimson), iwi and research (CRIs, Universities, PBCRC) and included two Australian myrtle rust experts. The workshop highlighted the potential impact of myrtle rust on NZ plant systems and the concern of the many stakeholders present.
  - Invited international participants: Geoff Pegg (QDAF), Bob Mackinson (PBCRC), Lisa Keith (USDA), Dean Paini (CSIRO)
- Weeds Workshop (12 December 2016, Wellington) attended by Regional Councils, FAR and Beef & Lamb. This resulted in a Weeds Research Concept being submitted for the B3 Operational Refresh.
- Pasture Weed Biosecurity Risks Workshop (21 September 2016, Wellington) with DairyNZ.
- Pasture Pests Biosecurity Risks Workshop (30 October 2016, Wellington) with Dairy NZ.
- PRONTI Workshop (21 October 2016, Wellington) with EPA and DOC.

#### Science focused meetings

- Pest Risk Analysis Meeting (25-28 July 2016, Lincoln). To progress a review and recommendations for the management and communication of uncertainty in pest risk analysis and modelling, using case studies for Mediterranean fruitfly and gypsy moth.
  - Key participant: Yu Takeuchi (USDA, APHIS, NCU, CIPM)
- Biosecurity Science and Technology Workshop (19 October 2016, Tamaki), hosted by B3 and University of Auckland and sponsored by MPI. Ca. 35 participants from a range of disciplines to identify new strategies, tools and teams to deliver a step-change for NZ biosecurity. The workshop was led by Prof Jacqueline Beggs (UoA).
  - Key participants: Ian Ferguson (MPI), Shaun Hendy (Te Pūnaha Matatini), Nick Waipara (Te Tira Whakamātaki)
- Myrtle Rust Workshop (15 May 2017, Christchurch). This science-focused workshop was attended by about 50 researchers from B3, BHNSC, Te Tira Whakamātaki, five CRIs, MPI, DOC, two botanical gardens, and two Universities to brain-storm science solutions with which to mitigate the impact of myrtle rust.
- Preventing Invasions of Forest Insects and Pathogens (24-27 October 2016, Beijing). A session at the IUFRO Regional Congress for Asia and Oceania was organised by Ecki Brockerhoff.



Phil Hulme, Karen Armstrong, Beccy Ganley, and Bevan Weir discussing options for myrtle rust research

## International Linkages

Effective border biosecurity requires strategic and tactical international collaborations to maximise. B3 and its partners continue to build and extend their connections to key biosecurity institutions throughout the world in critical areas.

### International

- International Atomic Energy Agency (IAEA). Ongoing collaboration through the IAEA has underpinned the concepts of area wide control and eradication for the codling moth programme in Hawke's Bay and potentially for BMSB eradication.

### Australia

- Plant Biosecurity CRC. PFR and BPRC are members of the PBCRC and are involved in a range of projects. PFR hosted the PBCRC Board in NZ in September 2016.
- Centre for Fruit Fly Biosecurity Innovation, Macquarie University. As a member of this Centre PFR has established electroantennogram facilities in Sydney and intends to support the co-supervision on 4 fruit fly relevant PhDs.
- SITplus. PFR is a participant in this Queensland fruit fly research consortium, including HIAL, CSIRO, NSW DPI, SARDI and Macquarie University, that is targeting fruit fly detection and management
- Centre of Excellence for Biosecurity Risk Analysis (CEBRA), Melbourne University. Scion is working with MPI on a project assessing the effectiveness of NZ's biosecurity system.

### Pacific

- MAF Samoa Nu'u Research Station and Atele Packhouse. Developing high pressure washing and hot water treatments.
- Institut Agronomique Néo-Calédonien (IAC). Testing new Queensland fruit fly surveillance and eradication technologies.

### America

- NZ US Invasive Species Working Group. This was reported on in some depth last year. There were two unsuccessful attempts at organising a NZ US Invasive Species workshop (which finally took place in Auckland in August 2017). Several productive interactions with US research institutions were made during the year

(esp. Sterile Insect Technique, biological control and treatments – all for BMSB) including the hosting and co-supervision of 2 PhD students at the USDA Appalachian fruit research station.

- US Department of Homeland Security (DHS). This collaboration includes a joint PhD project on acoustic detection within pathways with Stevens Institute of Technology. DHS Program Managers, Charlotte Sullivan and Kesia Hamilton visited NZ in December 2016 to discuss research plans. B3 members attended and presented at the MBIE / DHS bilateral meeting in March 2017 in Wellington.

#### **Europe**

- International Plant Sentinel Network (IPSN). B3 (through AGR) joined this Euphresco funded project with aligned B3 research.

#### **Asia**

- Institute of Plant Protection, Chinese Academy of Agricultural Science. Both AGR and PFR were both actively engaging with researchers to develop collaborations in plant biosecurity.
- Sunchon National University, Korea. Collaboration for fruit fly and brown marmorated electrophysiology research.

## 2. PERFORMANCE

B3's stakeholders can be confident in B3's scientific performance, based on the measure of peer review through publications in high impact and fit-for-purpose scientific journals, its plenary and other invited presentations at respected scientific meetings, and the individual achievements of its scientists reflecting the recognition by peers.

### Research Projects

B3 had 22 high-performing research projects in 2016–17, providing outputs and outcomes for science and end-users. A summary of some of these projects, their impacts and the value created for NZ's biosecurity system is outlined for each theme above. Some metrics of B3's research in the last year include:

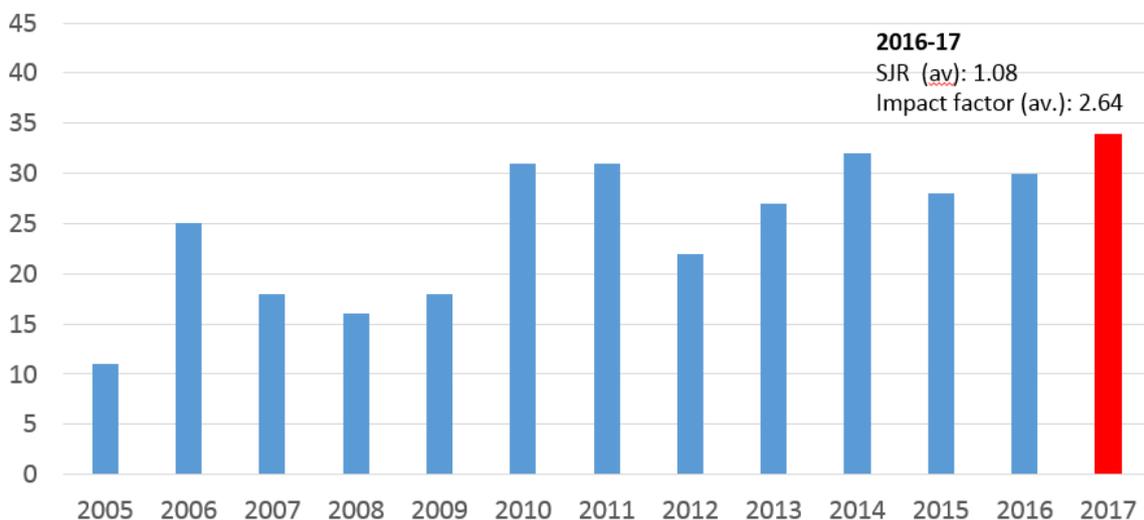
- 34 peer-reviewed articles in national or international journals, a record for B3
- 12 invited presentations at significant national or international meetings
- 14 reports for stakeholders or end-users

### Scientific Output

B3 is first and foremost a research collaboration, creating knowledge for NZ's plant border biosecurity system. No other entity has this essential research scope or responsibility so that publication of scientific endeavour is an unashamedly strong focus for B3.

In 2016-17, B3 researchers published a record number of peer reviewed articles (34) in international and national journals, reflecting the completion of target milestones in June 2017 but despite decreasing investment because of inflation pressures.

Number of peer-reviewed publications per year from the B3 collaboration since 2005



Some publications of note include:

Two publications in **Frontiers of Plant Science**. With an Impact Factor of 4.3, this journal is the 1st most cited Plant Sciences journal in the world (<https://www.frontiersin.org/journals/plant-science#>).

- Barratt et al. 2016. Is the invasive species *Listronotus bonariensis* (Kuschel) (Coleoptera: Curculionidae) (Argentine stem weevil) a threat to New Zealand natural grassland ecosystems? *Frontiers in Plant Science* doi:10.3389/fpls.2016.01091.
- Goldson et al. 2016. Invertebrate biosecurity challenges in high productivity grassland: the New Zealand example. *Frontiers in Plant Science* 7: 1-8 doi:10.3389/fpls.2016.01670.

One publication in **Methods in Ecology and Evolution**. This journal is ranked #1 (ecological modelling) by SciMargo Journal Rank (SMJ) (Impact Factor: 5.7). The first author was a B3 aligned PhD student.

- Roigé et al. 2016. Cluster validity and uncertainty assessment for self-organizing maps pest profile analysis. *Methods in Ecology and Evolution* 8: 349-357. doi: 10.1111/2041-210X.12669.

Two publications in **Scientific Reports - Nature**. This journal is ranked #5 (multidisciplinary), behind *Nature*, *Science* and *PNAS*, by SciMargo Journal Rank (SMJ) (Impact Factor: 4.3). The first author for one of these publications was a B3 aligned PhD student.

- El-Sayed et al. 2016. Caterpillar-induced plant volatiles attract conspecific adults in nature. *Scientific Reports – Nature* 6: 37555. DOI: 10.1038/srep37555.
- Stringer et al. 2017. Thigmotaxis mediates trail odour disruption. *Scientific Reports – Nature* 7: 1670. doi:10.1038/s41598-017-01958-z.

One publication in the **Journal of Applied Ecology**. This journal is ranked in the top 10 (ecology) by SciMargo Journal Rank (SMJ) (Impact Factor: 5.3).

- Liebhold et al. 2017. Depletion of heterogeneous source species pools predicts future invasion rates. *Journal of Applied Ecology* 54 (6): 1968–1977. doi: 10.1111/1365-2664.12895.

Sandy Liebhold (USDA FS), Ecki Brockerhoff (B3/Scion) and Martin Nunez (CONICET-Universidad Nacional del Comahue, Bariloche, Argentina) published a special issue of *Biological Invasions on 'Biological invasions of forests'* with about 24 papers on a range of taxa and biosecurity measures. Most of the papers are available online at <https://link.springer.com/journal/10530/onlineFirst/page/1>.

B3 science is also regularly published in 'fit-for-purpose' journals and directly in reports to stakeholders, providing an outlet for some of the research carried out within B3, and making the research accessible particularly to industry and government agencies. Often the rankings of these journals do not provide any indication of the value that this research accrues to B3 stakeholders.

## Individual Achievements

- **Kerry Everett** received the 2017 NZ Avocado Service to the Industry Award for her work on avocado diseases and especially for diagnostic markers for avocado scab that restored avocado exports.
- **AgResearch's Clover Root Weevil Biocontrol Team** won both the 2016 AgResearch Technology Prize for achievement of an outstanding scientific output contributing to sector outputs
- **Mark McNeil** was a Foreign Expert as part of the 'Overseas High-level Talents Programme' administered by the Chinese government.
- **Aimee Harper** received a Margaret Hogg-Stec award from PFR to visited USDA ARS Beltsville for cooperative research on brown marmorated stink bug.

### 3. UPTAKE

The value created by B3 science for its stakeholders is clearly exemplified across its five themes as described in this and previous Annual Reports. B3-developed tools are being used in risk assessment; B3 technology and knowledge is being used for pathway risk management; new approaches for diagnostics are being tested by B3 for adaption by stakeholders; and B3 science capability, expertise and ingenuity are contributing to better design of pest and disease surveillance systems and eradication programmes for MPI and DOC.

#### Formal Interactions

B3 must work in close partnership with its stakeholders and end-users who will provide the ultimate vehicle for implementation of the research outputs. As part of this process, B3 needs to communicate clearly to its end-users what it does. The activities below form the basis for this process, but there are many more.

Activity	Primary audience
Written publications in scientific journals Presentations at science conferences/workshops	NZ and international scientists and end-users
B3 Annual Report B3 CEOs' meeting Collaboration Council (4 p.a.) B3 Science Partnership Forum (SPF) (2 p.a.) B3 conference (every second year) B3 website – external (incl. web stories) B3 website – internal B3 Theme Leader meetings (monthly) B3 Project workshops (as needed) B3 Theme meetings (Theme/Project Leaders) Reports commissioned by end-users @B3Director (Twitter)	CEOs of B3 partners and other interested parties CEOs of B3 partners Senior Managers of B3 partners All B3 end-user partners NZ biosecurity community NZ biosecurity community All B3 partners B3 science partners B3 partner end-users B3 partner end-user Theme Reps B3 partner end-users The wider biosecurity community
FOA/MPI Forest Biosecurity Workshop PFR/horticulture/cropping sector workshops	Forestry sector Horticulture/cropping sectors
Presentations at end-user meetings (e.g. MPI/FOA Biosecurity workshop) Technical Advisory Groups (TAPS) Sector Biosecurity Steering Groups	B3 partner end-users MPI/DOC Various sector end-users
B3 hui and other hui	Iwi

#### Technical advice to end-users

While new knowledge is the basis for B3 activity, technical advice provided to B3 end-user partners is also of paramount importance. Such activity in 2016–17 included:

- A range of activities associated with the myrtle rust incursion and response (see p. 9)
- Fruit Fly Council and Technical Working Group: A desk-top review of the science underpinning the current fruit fly surveillance system and membership of an international panel to review the whole system
- BMSB Council: Advise to support a pre-emptive approach to biological control with the Samurai wasp and participation in the Samurai Wasp Steering Group
- Forest Health Surveillance: Leadership and development of the new Forest Health Surveillance System
- Input into industry research such as:

- Dairy NZ: Weed and pests lists for biosecurity risks of pasture
- FOA: Risk maps for entry & establishment of forestry pests and diseases
- KVH: Chinese language publications on BMSB impact on kiwifruit
- KVH: Diagnostics of *Pectobacterium carotovorum* subsp. *actinidiae*
- NZ Wine: metabarcoding to profile multiple pathogens in grape trunk diseases
- Tomatoes NZ: survey design to determine presence/absence of predator species

### Technical Advisory Groups

B3 researchers provided a range of scientific and technical support to MPI for the following invasive species:

- Myrtle rust. Beccy Ganley (as a member) and David Teulon (as an observer) were part of the Technical Advisory Group.
- Pea weevil (brucid). David Teulon (as an observer) was part of the Technical Advisory Group.
- Brown marmorated stink bug. John Charles, Gonzalo Avila and David Teulon were part of the Samurai wasp Steering Group.

### Science Advisory Groups

- David Teulon and Lindsay Bulman are on the BioProtection Research Centre's Science Leadership Group
- David Teulon and Barbara Barratt are on the Characterising Land Biota research programme Advisory Group
- David Teulon, Beccy Ganley and Suvi Viljanen are on the KVH/Zespri Biosecurity Steering Group
- Max Suckling is on the Technical Advisory Committee for SITplus
- Mark McNeil is the B3 representative for the International Plant Sentinel Network

### Co-innovation, Research, Technology & Innovation Practice

B3 continues to explore more effective ways to increase opportunities for engagement, uptake and application of its research including:

- Concepts of co-innovation were followed through the B3 Operational Refresh such as the specially designed Project Planning Template that targeted tangible biosecurity outcomes.
- Exploring new ways of engagement between scientists and end-users by incorporating ideas from AGR's Adoption and Practice Change programme for one B3 project.
- Utilising MPI's Research, Technology & Innovation Practice process for accelerating the development of new technology for some B3 projects.

## Māori Engagement

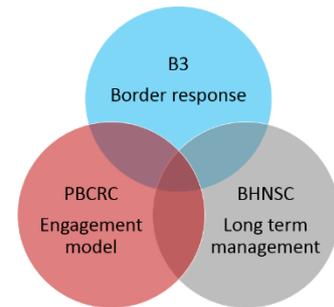
B3 continues to expand its engagement with iwi within the research programme.

As part of the B3 Operational Refresh, and for the first time in B3, a project focussing on plant border biosecurity issues specific to Māori has been funded. The project titled: **Māori responses to biosecurity incursions including Cultural License to Operate; using Myrtle Rust as the case study**, is led by Alby Marsh and aims to advance the cultural imperatives of Māori for biosecurity responses by:

- Establishing relevant Māori networks for the dissemination of biosecurity related information.
- Engaging active Māori participation in biosecurity activities through a tailored response plan appropriate for all levels of Māori society.
- Developing response plans to improve future engagement based on learnings from the recent myrtle rust incursion.

This B3 project links closely with two related projects funded from elsewhere and provides important synergies:

- Korero mai – Let’s Talk. Ma! Engagement for resilience in indigenous communities. Funded by PBCRC.
- Whakawāteatea riha rāwaho: Māori solutions to biosecurity threats and incursions to taonga species. Funded by BHNSC.



Other activities that provided a greater engagement with iwi in plant border biosecurity were:

- A Wanaga (28 April 2017, Auckland) organised by Te Tira Whakamātaki to discuss the Samurai Wasp/BMSB pre-emptive biocontrol initiative.
- A myrtle rust focussed hui (17 May 2017, Kerikeri) organised by Te Tira Whakamātaki. This was a very informative meeting and highlighted a number of iwi concerns that are likely to impact on future B3 activity including:
  - An expectation that Mana Whenua are part of the engagement process in a biosecurity response at all levels.
  - Iwi’s interpretations/understandings with respect to a biosecurity response, including kaitiaki (guardianship). These have developed over 1000 yrs and need to be considered in a response to reflect a genuine partnership.
  - Iwi expect (young) Māori biosecurity scientists to be included in a biosecurity response as a priority
  - Iwi have strong views on ownership of taonga/fauna which has important implications for activities and protocols surrounding ‘seed banking’
- A hui with Ngāti Manuhiri (January 2017, Auckland) attended by Graham Walker and his team on biological control and biosafety.



## 4. CAPABILITY

The maintenance and growth of plant border biosecurity capability and expertise within NZ is a high priority for B3.

### Primary and secondary schools

Building awareness of topics of importance to Māori, such as biosecurity, often starts at the marae, but many recently urbanised Māori have no link to their now local marae so may not receive the information. School students are often an effective way to share knowledge in these populations.

In association with the Futureintech programme, PFR Research Associate Hone Ropata is teaching school-aged students about biosecurity, with a particular focus on schools and after-school programmes in areas of Auckland with a high Māori and Pasifika population. Over the past year, Hone has built a relationship with teachers at eight schools, including primary and secondary, visiting each school on multiple occasions to talk to students across the age range. He has also been a regular visitor to the Māori Science Academy, a project mentor for the Manukau Beautification Charitable Trust's Tiaki initiative, and a scientist guide at the Auckland BioBlitz.



Hone Ropata takes biosecurity into the classroom

During his visits, Hone talks about the importance of biosecurity and how everyone can contribute to protecting NZ's flora and fauna, reflecting the government's Biosecurity 2025 strategy. He also supports teachers with ideas for class experiments as well as touring the school grounds with the students to identify key plants that might be affected by new pest incursions or have special significance to Māori and should be monitored for health. Some of the novel insights and feedback from the students have been used to inform aspects of our research programme.

David Teulon, Karen Armstrong, Laura Nixon, Audrey Lustig and Francesco Martoni all presented to a group of high school students (years 10-13) on various aspects of plant border biosecurity preparing themselves for a 'Future Problem Solving Competition' for students in the USA. Lincoln University. May 2017.

*David, Karen, Laura, Audrey, Francesco, please accept our sincere thanks for sharing your knowledge with us today, and enjoy the gift.*

### Summer/intern students

Two students were hosted by B3 at PFR:

- Grace Xu investigated how we can obtain information on plant pests and diseases from Chinese online language sources. This work was an extension of a previous summer student project and was later supported with additional funding by KVH/Zespri.
- Fabien Rositano, an intern student at PFR, screened microorganism volatiles attractive to Qfly in New Caledonia.

### Engagement with university students

- MGMT222. The Agribusiness Environment (LU). Lecture on Plant Border Biosecurity in NZ given by David Teulon. 6 September 2016. Lincoln University.

## Secondments/placements

- Rory McLellan joined PFR's Biosecurity Group at Lincoln for a two day strategic review of surveillance and eradication research. January 2017.

## Joint university appointments

CRI B3 researchers have joint university appointments, where they carry out undergraduate teaching, postgraduate supervision, and student mentoring, to develop biosecurity capability for tomorrow. They include:

- Barbara Barratt, Honorary Professor, University of Otago
- Ecki Bockerhoff, Adjunct Associate Professor, University of Canterbury
- Andrew Pitman, Honorary Adjunct Lecturer, Lincoln University
- Max Suckling, Professor, Auckland University, and Honorary Research Fellow, Victoria University
- David Teulon, Adjunct Professor, Lincoln University
- Darren Ward, Senior Lecturer, Auckland University.

John Kean was an external examiner for Massey University for a biosecurity PhD thesis.

## Aligned graduate students

A number of graduate students are linked to B3 through financial support, supervision by B3 researchers or by the plant border biosecurity focus of their research theses.

- Mariona Roige, Marona Rovira and Ursula Torres (all LU) submitted or defended their PhDs during 2016–17.
- Ten new PhD student products are planned as part of the B3 Operational Refresh.

Masters students linked to B3 include: Delayn Fritz, Kiran Horrocks, Zane McGrath, Chris Russell (all UoA), and Taylor Welsh (UoC).

## Graduate students linked to B3

Name	Project	University	Funding	Supervisor(s)	Status
Carol Bedoya	Acoustic identification of unwanted organisms in import pathways	Canterbury	MBIE/Dept. Homeland Security	Nelson, Hayes, Sutin (Stevens Inst. (USA), Brockerhoff	Current
Simren Brar	Genetic diversity of <i>Phytophthora pluvialis</i> and genome-based methods for assessing the genetic of new <i>Phytophthora</i> species	Massey	MBIE, FOA, Scion, B3	Ganley, Bradshaw, McDougal	Current
Audrey Lustig	Complex systems analysis of invasive species in heterogeneous environments	Lincoln	TEC/BPRC	Worner	Defended in August 2016
Francesco Martoni	Psyllid phylogenetic and endosymbiont associations in New Zealand and Australia	Lincoln	PBCRC, BPRC, MPI	Armstrong, Pitman, Bulman, Taylor	Current
Hamish Patrick	The genetic and behavioural differences between two sympatric species of Australian fruit flies	Lincoln	TEC/BPRC, MPI	Armstrong, Cruickshank, Schutze (QUT), Clarke (QUT)	Current
Laura Nixon	Identification of biogenic volatile organic compounds for improved border biosecurity	Lincoln	B3	Rostas, Brockerhoff, Goldson	Current
Mariona Roige	The structure of global invasive species assemblages and their relationship to regional habitat variables	Lincoln	Erasmus Mundus, B3, MPI	Worner, Armstrong, Phillips	Defended in July 2017
Marona DM Rovira	Matching invasive species to invaded environments using climate, habitat and phylogeny	Lincoln	Erasmus Mundus, B3, MPI	Worner, Armstrong, Phillips, Brockerhoff	Defended in April 2017
Lloyd Stringer	Optimising Allee effects using combinations of tactics for integrated pest eradication	Auckland	B3	Beggs, Suckling, Kean	Current
Ursula Torres	Modelling global distributions and risk of establishment of invasive freshwater invertebrates	Lincoln	Erasmus Mundus, B3, MPI	Worner, Armstrong	Submitted in May 2017
Hester Williams	Social acceptability of alternative eradication tools	Auckland	MPI, UoA	Brockerhoff, Barron, Ward	Current

## Outcomes for some recent PhD students

Recent PhD graduates who were aligned to B3 have continued to be active in biosecurity science:

- Gonzalo Avila is employed by PFR
- Kevin Chase has a post-doc at University of Minnesota, Food, Department of Agricultural & Natural Resource Sciences
- Audrey Lustig has a post doc at University of Canterbury. Geospatial Research Institute - Toi Hangarau
- Senait Senay has a post-doc at University of Minnesota, Department of Applied Economics

## 5. INVESTMENT

The Statements of Corporate Intent (SCI) for each of the member CRIs identify biosecurity as core to their research investments, with each agreeing that B3 is an ideal vehicle for fulfilling this purpose.

**Crown Research Institutes.** The B3 Operational Refresh in 2017 resulted in a 10% increase in investment from the B3 CRI partners with 28 new projects spanning the plant border biosecurity continuum. This SSIF Core investment provides the funds under B3 'management' but increasingly B3 partners are seeking funding from elsewhere and aligning this to B3 activities (see below).

**Government departments.** MPI and DOC make a considerable investment into B3 activities through in-kind activities. A conservative estimate is that these government departments contributed over 900 hours to B3 related activities in 2016-17

**Industry.** As the pastoral, forestry and horticultural/cropping sectors become more involved in B3 there has also been an increase in in-kind and direct funding support for plant border biosecurity research.

### New funding to mitigate the impact of myrtle rust

PFR and Scion successfully applied for funding from MBIE's Catalyst Strategic Fund for a project addressing **the threat of myrtle rust to NZ**. This programme reinforces the development of a key trans-Tasman partnership between B3 and Plant Health Australia (PHA) to further align regional border biosecurity interests. The PFR Catalyst project has three key aims: to establish the susceptibility of key species to myrtle rust, build scientific knowledge for successfully storing Myrtaceae germplasm, and develop 'in the field' plant pathogen detection and surveillance systems, and reflects the priorities identified at the recent myrtle rust science workshop. This project will employ the expertise from PFR, Scion, PHA, Te Tira Whakamātaki, MPI, Department of Agriculture and Fisheries Queensland, NSW Department of Primary Industries, Wellington Botanic Gardens and Kew Gardens (UK) and will link closely to other science initiatives being developed through B3, the Biological Heritage NSC and co-ordinated through MPI's Myrtle Rust Strategic Science Advisory Group.

### Other successful applications

B3 researchers were also successful with two new Royal Society/MBIE Catalyst proposals

- **Re-evaluating the role of colour, in the presence of odour, as a key stimuli for insect host selection.** Seeding General to PFR. A multidisciplinary collaborative team of experts from The Netherlands; Wageningen University & Research (WUR), Sweden; Lund University (LuU), Germany; Leibniz University Hannover (LUH), Colombia; Universidad Nacional de Colombia (UNC); the USA; Penn State University (PSU), and New Zealand; Plant & Food Research (PFR) and Lincoln University (LiU) will share, develop and enhance research efforts to advance our understanding of how visual and olfactory cues interrelate to enable insects to orientate to their hosts.
- **Intra- and interspecific communication in bark beetles with a view to using these signals for the detection of unwanted species in imports and for diagnostics.** This project involves a Scion collaboration with partners in the USA (US Forest Service, Northern Arizona University) who will assist with recording and signal processing technology and with the identification and interpretation of beetle sounds.

## Co-funding/aligned funding for plant border biosecurity research (2016-17)

Project	Funder	CRI	PI (or equivalent)	Amount
<b>Theme I</b>				
Biosecurity weed & pest lists for pasture	Dairy NZ	AGR	Phillips C, T James	\$25,000
Chinese language publications on BMSB impact on kiwifruit	KVH/Zespri	PFR	Teulon D	\$7,400
<b>Theme II</b>				
Pathways and Risk Assessment Framework for High Impact Species	PBCRC 1109	PFR	Teulon D	A\$73,000
Acoustic detection tools for pathways	MBIE Int. Research Fund	Scion	Brockhoff E	\$150,000
Biosecurity risks in tissue culture	MPI	Scion, PFR	Ganley	\$95,000
PEQ services	Various	PFR	Austin P, Horner M	\$25,636
BMSB treatments	MPI	PFR	Najar Rodriguez A	\$54,437
Pathway risk assessment	CEBRA	Scion	Brockhoff E	\$22,718
Myrtle rust risk assessment	BHNSC	Scion	Scott P	\$11,250
Biosecurity collaboration	Chinese Acad. Agr. Sciences	AGR	McNeill M	\$10,000
<b>Theme III</b>				
Genome-Informed Bacterial Diagnostics	PBCRC 2156	PFR	Smith G	A\$117,576
Diagnostics of <i>Pectobacterium carotovorum</i> subsp. <i>actinidiae</i>	KVH/Zespri	PFR	Pitman A	\$50,000
NGS for border biosecurity	BHNSC	PFR	Bulman S	\$32,749
Supply BVT kits & update manual	MPI	AGR	Phillips C	\$11,900
<b>Theme IV</b>				
Fruit fly surveillance	Horticulture Innovation	PFR	Suckling M	\$155,539
Lure testing	Assure Quality	PFR	Suckling M	\$1,800
Fruit fly attractants	ANU (Korea)	PFR	Park K	\$74,298
Forest surveillance model	FOA	Scion	Bulman L	\$150,000
Review research underpinning the current fruit fly surveillance system	MPI/FF Council	AGR	Kean J	\$18,000
Gypsy moth surveillance	MPI	Scion	Sopow S	\$35,937
<b>Theme V</b>				
Embedding GERDA into the biosecurity landscape	PBCRC1155	PFR	Dohmen-Vereijssen J	A\$99,662
Unmanned Aerial Vehicle (UAV) / SIT	IAEA	PFR	Suckling M	\$19,459
Collaborative Planning and Shared Decision-Making	PBCRC 4115	PFR	Hill G / Teulon D	A\$31,500
TAG participation (Myrtle rust)	MPI	PFR	Burgess L	\$7,290
Australia TPP response	Horticulture Innovation	PFR	Dohmen-Vereijssen J	\$45,579
Velvet leaf response	MPI	AGR	James T	\$69,499
Pest impact calculator	FOA	Scion	Bulman L	\$15,000

<b>Project</b>	<b>Funder</b>	<b>CRI</b>	<b>PI (or equivalent)</b>	<b>Amount</b>
BMSB chemical approval	MPI	Scion	Bulman L	\$24,694
Pheromone modelling	USDA-FS	Scion	Strand T	\$11,826
Spray modelling	USDA-FS	Scion	Strand T	\$27,000
Spray modelling	Dow Agro Science	Scion	Strand T	\$7,920
Spray modelling	MPI	Scion	Strand T	\$8,250
<b>Cross Theme</b>				
Engagement for resilience in indigenous communities – Phase II	PBCRC 4041	PFR	Marsh A	A\$73,361
US NZ Invasive species JCM	MBIE/LCR	PFR	Teulon D	\$18,305

### Peer review publications

- Aalders LT, McNeill MR, Bell NL, Cameron C. 2017. Plant parasitic nematode survival and detection to inform biosecurity risk assessment. *NeoBiota* 36: 1-16. doi.org/10.3897/neobiota.36.11418.
- Avila GA, Withers TM, Holwell GI. 2016. Courtship and mating behaviour in the parasitoid wasp *Cotesia urabae*: mate location and the influence of competition and body size on male mating success. *Bulletin of Entomological Research* 107 (4): 439-447. doi.org/10.1017/S0007485316001127.
- Avila GA, Withers TM, Holwell GI. 2016. Retrospective risk assessment reveals likelihood of potential non-target attack and parasitism by *Cotesia urabae* (Hymenoptera: Braconidae): a comparison between laboratory and field-cage testing results. *Biological Control* 103: 108-118.
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- Competition focuses male wasp's mating mind. 22 June 2017
- Throwing ants off scent. 22 June 2017
- New trans-Tasman partnership takes the fight to myrtle rust. 20 June 2017
- New Zealand scientists meet to mitigate the impact of myrtle rust. 30 May 2017
- Myrtle rust incursion on Raul Island reinforces the need for preparedness and vigilance. 7 April 2017
- The growing importance of China/New Zealand collaborations in biosecurity. 15 December 2016
- B3 science supports world first pest eradication. 1 December 2016
- BMSB-current or planned research to prevent establishment and reduce impact in New Zealand. 23 September 2016
- Trailing new taro treatment for better border biosecurity. 22 September 2016
- Future proofing New Zealand's border biosecurity system – the role of Biosecurity 2025. 6 September 2016
- B3 research supports MPI to advance international standards for preventing 'hitchhiker' pest movements with sea containers. 16 August 2016

## B3 People

### Key people in the B3 collaboration (2016-17) include:

Collaboration Council	Operational Leadership	End-user/Theme Representatives
<b>Chair</b> James Buwalda*	<b>Director</b> David Teulon	Barney Stephenson/Aurelie Castinel/Mark Bullians (MPI)
Philippa Stevens (PFR)	<b>Programme Co-ordinator</b> Margaret Hean	Chris Green (DOC)
Glyn Francis/Tony Conner (AGR)		Russell Dale (FOA)
Alison Stewart (Scion)	<b>Theme 1</b>	Clark Ehlers (EPA)
Peter Millard (LCR)	Barbara Barratt (AGR)	<b>Theme 1</b>
Travis Glare (BPRC)	Suvi Viljanen-Rollinson (PFR)	Jo Berry (MPI)
Veronica Herrera (MPI)	<b>Theme 2</b>	Helen Harman (MPI)
Allan Ross (DOC)	Ecki Brockerhoff (Scion)	<b>Theme 2</b>
David Rhodes (FOA)	Beccy Ganley (Scion)	Shane Olsen (MPI)
Richard Palmer (Hort NZ Observer)	<b>Theme 3</b>	Chris Denny (MPI)
Chris Morley (Dairy NZ Observer)	Karen Armstrong (BPRC)	<b>Theme 3</b>
Asela Atapattu/Stephen Cobb (EPA Observer)	Bevan Weir (LCR)	Robert Taylor (MPI)
	<b>Theme 4</b>	Disna Gunawardana (MPI)
	John Kean (AGR)	<b>Theme 4</b>
	Lindsay Bulman (Scion)	Paul Stevens (MPI)
	<b>Theme 5</b>	Rory MacLellan (MPI)
	Jessica Dohmen-Vereijssen (PFR)	<b>Theme 5</b>
	Vacant	George Gill (MPI)
	<b>Landcare representative</b>	Rory MacLellan (MPI)
	Darren Ward	

\*Philippa Stevens assumes the role of Chair when matters of the Biological Heritage NSC are discussed, as James Buwalda is Chair of this entity as well.

Allan Ross replaced Geoff Hicks as DOC CC member in March 2016.

Stephen Cobb replaced Asela Atapattu as EPA CC member in December 2016.

Tony Conner replaced Glyn Francis as AGR member in March 2017.

Max Suckling remains on the TLG in an *ex officio* capacity.

