Research Highlights

Invasive plants and animals research 2024-25

Department of Primary Industries

Queensland Government

Cover: Aleman grass herbicide trial using DJI Agras T16 spray drone

If you need an interpreter to help you understand this document, call **13 25 23** or visit **dpi.qld.gov.au** and search for 'interpreter'.

Contents

Introduction

This document summarises the 2024–25 program of the Invasive Plants and Animals research group in Biosecurity Queensland, Department of Primary Industries (DPI). Our applied research program aims to better manage Queensland's worst weeds and pest animals, reducing their impacts on agriculture, the environment and the community.

Our work is undertaken at four centres across the state:

• Ecosciences Precinct, Dutton Park

• Pest Animal Research Centre, Toowoomba

• Tropical Weeds Research Centre, Charters Towers

• Tropical Weeds Research Centre, South Johnstone.

We also collaborate with numerous Queensland, interstate and overseas organisations. Higher degree students are supported to work on several research projects in weed and pest animal management.

The research projects summarised in this document cover the development of effective control strategies and methods (e.g. biological control and herbicides), as well as improved knowledge of pest species' biology and assessment of pest impact.

Notable activities of the research program for 2024–25 are outlined below.

Invasive plant research

- Our biological control program covers all stages of investigation from exploration overseas in a weed's native range for potential agents, to assessing agent host specificity in quarantine, to releases of agents approved for release by the Australian Government. This is described in the National Weed Biocontrol Pipeline Strategy (see project 9) which involves prioritising weeds for investment for what is relatively long-term and expensive RD&E but is highly cost effective. A report has been compiled outlining the activities for five-year projects for 20 priority weeds and estimating the costs. We have received funding to start the identified research on two priority weeds, bellyache bush and Siam weed (*Chromolaena odorata*), in 2025-26.
- Releases are continuing for a gall thrips which is having noticeable impact on prickly acacia seedlings and has spread from many release sites. We have recently received funding to fast track this spread to other sites in Queensland and interstate with the help of landholders and other stakeholders.
- Releases have continued for a leaf miner on bellyache bush. In 2025-26, we will seek approval to release a leaf rust and have received funding to import and undertake initial host testing of another promising new agent, a gall midge.
- For giant rat's tail grass, we continue to work on integrating chemical and biological control options. This includes a naturalised fungal pathogen (leaf smut) whose impact and host specificity need assessment before it can be actively spread. Other, endemic fungal pathogens are showing promise, probably as mycoherbicides or augmentative biological control. The work is necessarily slow, but results have been promising.

- Other weeds for which we are assessing biological control agents include Navua sedge, clidemia (Koster's curse), cat's claw creeper, lantana, parthenium, chinee apple, sicklepod, *Urena lobata*, Singapore daisy, African tulip tree, Madeira vine, Harrisia and opuntioid cacti. We are also assisting Australian Government staff with releasing a rust pathogen for mikania vine on Christmas Island. Mikania vine is subject to an eradication program in Queensland and, if this fails, the rust is a fallback control measure. The experience gained on Christmas Island will be invaluable for this and for the management of other weeds with rust pathogens.
- A release application submitted to the Australian Government regulator for the damaging leaf spot pathogen for cat's claw creeper has been reviewed and a draft risk analysis is now available for public consultation. An application to release a rust pathogen for lantana has also been submitted.
- We continue to mass-rear biological control agents at our Charters Towers facility for release in northern Queensland. These include agents for prickly acacia, parthenium and *Opuntia* (prickly pear) cacti. Releases are monitored to determine agent establishment, spread and impact. This will help decide when releases can cease, the need for other agents or control methods, and to evaluate the benefit of biological control. This work will be supported with funding from the Australian Government and collaboration with CSIRO and land managers. We are also compiling locations of agents released in north Queensland which will allow redistribution of agents by land managers.
- Projects continue to support state and national eradication programs for numerous weeds, including red witchweed, miconia, mikania vine and limnocharis. Field and glasshouse trials have found all species have persistent (8-15 years) seed banks and are determining age to maturity. We also develop control methods and techniques to monitor eradication progress.
- Herbicide trials are being conducted for several weeds including sicklepod, gamba grass, bogmoss, sticky florestina, leucaena and other weedy shrubs and trees. Trials have assessed the efficacy and non-target impact of new aquatic herbicides (Clipper® and ProcellaCOR®) in managing aquatic weeds such as sagittaria, cabomba, salvinia and alligator weed in a range of environments. For Navua sedge, an integrated weed management strategy is being trialled as herbicide control is expensive with only short-term benefit.
- We are studying the ecology of established widespread weeds to assist their management. In particular, weed seed longevity and age at maturity is needed to determine the timing and duration of treatment at a site.
- We are assessing over 300 emerging weed species in Queensland to determine their priority for management. Ideally, limited resources should be directed now before the weeds are widespread and abundant. Problematic weeds have common traits and are likely to be predictable.
- Drones are now being widely used to detect weeds in broadacre crops and spot spray. We have had success with drone application of herbicides to water weeds. We are working to extend this capability to rangeland weeds such as parthenium, chinee apple and Navua sedge. This project will be supported by a PhD student with a scholarship from CSIRO.

Pest animal research

- We are continuing to trial video-GPS collars on wild dogs to determine encounter rates with canid pest ejectors and cameras. We have assessed the ability of dogs to detect the odours of 1080 and PAPP with ramifications to bait uptake. Both 1080 and PAPP could be detected in a raw form but less frequently in baits or capsules.
- We have been assessing surveillance methods for two high-risk pest animals, red-eared slider turtles and Asian black-spined toads. Turtles can be trap shy but, surprisingly, they may be detectable by their sound. For toads, an improved understanding of their habitat use, movement and activity patterns will assist an incursion response.
- The National Feral Deer Action Plan prioritises isolated populations on the edge of their spreading distributions for control. We are running workshops on managing these populations for land managers. Funding has been provided to support aerial control of two populations during 2025-26. In north Queensland, a long-term project on chital deer ecology and management funded partly by the Australian Research Council will finish during 2025-26. This has been a productive project, with three PhDs, multiple publications and numerous collaborations.
- Queensland rabbit numbers are relatively low which allows local, property level control to be effective. A National Rabbit Management Coordinator is now in place to promote and coordinate effective rabbit management. While our single-year project on monitoring rabbit abundance will finish, we will keep an eye on landholder concerns, research needs and developments (e.g. biocontrol) for what is one of Australia's costliest pest animals.
- Research needs and monitoring and control strategies for several high-risk vertebrates have been completed. The species include the American corn snake, Indian palm squirrel and African pygmy hedgehog.
- For rangeland populations of feral deer and pigs, we have evaluated control effectiveness at several demonstration sites. Aerial control of deer can feasibly stop population growth but is often insufficient to reduce populations to low density. Thermal-assisted aerial shooting has been successful in temperate Australia. Our initial assessments of the technique in the Queensland tropics indicate it will only be cost-effective in dense vegetation and at low densities when animals are difficult to detect.
- With collaborators and using telemetry, we have been assessing feral pig activity and habitat use. This will help design control and monitoring strategies and support modelling the spread of exotic diseases within feral pig populations. Sampling of these animals indicates the prevalence of diseases such as leptospirosis and brucellosis.
- In a separate project, we are working with collaborators to quantify the agricultural impacts of feral pigs.

Pesticide permits

- We obtain minor use permits from the Australian Pesticides and Veterinary Medicines Authority as required for certain weed and pest animal species, pesticides, application methods and situations or environments. Nineteen minor use or emergency use permits were obtained in 2024-25.

Funding, collaboration and research priorities

In the 2024–25 financial year, Biosecurity Queensland's Invasive Plants and Animals research program received funding from several sources. Expenditure from Queensland Government base funds was $2.1 million; expenditure from the Land Protection Fund amounted to $2.6 million; and expenditure under contracts with external partners totalled $0.8 million (see 'External funding', page 100-101). Notable funding bodies for the latter were the Australian Government, CSIRO, Manaaki Whenua Landcare Research New Zealand, Primary Industries and Regions SA and Healthy Land and Water. The Queensland Government also provided approximately $4.6 million in indirect costs that included facilities, equipment and support services.

Our research program for 2024–25 was endorsed by the Research Review Committee—a group of senior scientific, operations and policy staff from Biosecurity Queensland plus representatives from our external stakeholders, including Queensland local governments, AgForce, the Queensland Farmers' Federation, the Queensland Conservation Council and NRM Regions Queensland. The committee critically reviews proposed and current projects and allocated investments and makes recommendations on strategic priorities.

Further information

For more information, visit the 'Invasive plant and animal research' page at dpi.qld.gov.au. Journal articles and scientific reports can be obtained by emailing project leaders (see 'Research staff', pages 102-103). In addition, you can browse our recent scientific publications in the eResearch archive at dpi.qld.gov.au (search 'eResearch archive').

Part 1: Invasive plant research

1. Integrated control of aquatic weeds

Project dates

July 2012 – June 2026

Project team

Tobias Bickel, Christine Perrett and Louise Gill

Project summary

Management of aquatic weeds is challenging because of the complexity of the aquatic environment and a lack of efficient control tools. Treating aquatic weeds can be difficult with available technology and carries safety risks. This project investigates the use of two aquatic herbicides, flumioxazin (Clipper herbicide) and florpyrauxifen-benzyl (ProcellaCOR FX) to control a range of high impact water weeds. These herbicides are integrated with other control tools and remote sensing techniques to improve future aquatic weed management and to produce best management advice to control a range of aquatic weeds with herbicides. This project determines control efficacy of aquatic herbicides to manage aquatic weeds and develop new application techniques and strategies. Lab and outdoor pond trials were completed to test the efficacy of the two herbicides to control alligator weed. Florpyrauxifen-benzyl (ProcellaCOR FX) provided excellent alligator weed control efficacy in the lab trials and did not cause fragmentation as observed with other herbicides

A new emergent aquatic weed, *Lindernia rotundifolia* was detected in several water bodies around South-East Qld. Lindernia is a highly invasive aquatic plant with a similar growth form to alligator weed. Field trials with flumioxazin and florpyrauxifen-benzyl showed that the latter herbicide provides effective control.

A field trial was carried out to test the application of flumioxazin with a drone to a large site infested with salvinia. The application of the herbicides to water weeds was very promising but unfortunately the site was severely impacted by cyclone Alfred, so we were unable to get efficacy data.

Figure 1 Experiment to test the alligator weed control efficacy of florpyrauxifen-benzyl and flumioxazin; a) outdoor pond system to culture the treated alligator weed, b) preparation of stem sections for treatment, c) alligator weed stem sections exposed to herbicides, d) healthy control plant.

Collaborators

- Marie Bigot and Kumaran Nagalingam (CSIRO)
- Junfeng Xu, Aaron Misipeka and Nguyen Nguyen (University of Queensland)
- Daniel Clements and Deborah Hofstra (NIWA, New Zealand)
- Fred Oudyn, Chemistry Centre (DETSI)
- Steve Adkins, Shane Campbell and Bhagirath Chauhan (University of Queensland)
- David Roberts, Perry Ward and Jessica Doman (Seqwater)
- Iain Jamieson (Gold Coast City Council)
- Janine Clarke and Cecilie Draper (MBCC)
- Geoffrey Farrant (Brisbane City Council)
- Mark Heilman (SePRO, USA)
- Ray Gurney (Macspred)
- Doug Patton (Sumitomo Chemical)

Key publications

Bickel, **T**.**O**., **Farahani**, **B**.**S**., **Perrett**, **C**., Xu, J. & **Vitelli**, **J**. (2022). Control of the emerging aquatic weed Amazon frogbit with flumioxazin. In: Proceedings of the 22nd Australasian Weeds Conference, Melland, R., Brodie, C., Emms, J., Feuerherdt, L., Ivory, S., & Potter, S. eds, Weed Management Society of South Australia, Adelaide, 25 – 29 September.

Kumaran, N. & **Bickel**, **T**.**O**. (2023). New tools for Integrated Management of Cabomba in Australia, Management Guide (Seqwater, NRM managers), CSIRO, Brisbane, 23pp.

Nguyen, N.H.T., **Bickel**, **T**.**O**., **Perrett**, **C**. & Adkins, S. (2021). Alien invasive macrophyte put into the shade: The native floating-leaved macrophyte *Nymphoides indica* reduces *Cabomba caroliniana* growth performance through competition for light, *Freshwater Biology*, 66: 1123-1135.

2. Management of aquatic weeds in sensitive environments

Project dates

July 2022 – June 2025

Project team

Tobias Bickel, Christine Perrett and Louise Gill

Project summary

Herbicides are a useful tool to control aquatic weeds in a range of water bodies. However, haphazard application of herbicides to water bodies can result in significant non-target damage to native aquatic plants. Aquatic plants perform important ecosystem functions, such as maintaining water quality, and are frequently planted in artificial wetlands at considerable cost. Therefore, native aquatic plants need to be considered when managing aquatic weeds.

This project aims to develop herbicidal control strategies to manage aquatic weeds in sensitive water bodies while maintaining the ecological integrity of native macrophytes. The project will also identify native aquatic plants that are resistant to herbicides for future plantings to simplify aquatic weed management in the long term. Pond trials highlighted the sensitivity of native emergent vegetation to glyphosate, while flumioxazin (Clipper herbicide) and florpyrauxifen-benzyl (ProcellaCOR FX) caused little to no damage to these plants

Pond trials on other native species showed varying degrees of sensitivity to flumioxazin or florpyrauxifen-benzyl, e.g. water snowflake is resistant to the first but highly sensitive to the latter. A field trial demonstrated the regeneration of native aquatic plants from the seed bank after removal of cabomba with the herbicide flumioxazin. Diversity and abundance of native submerged plants increased in treatment plots after herbicide application.

Figure 2 An enclosure installed in a lake to test the effect of cabomba removal with flumioxazin on the regeneration of native aquatic plants from the seed bank.

Collaborators

- Nguyen Nguyen (University of Queensland)
- Iain Jamieson (Gold Coast City Council)
- Janine Clarke and Cecilie Draper (Moreton Bay City Council)
- Steve Adkins, Shane Campbell and Bhagirath Chauhan (University of Queensland)

3. Research supporting the management of nationally significant tropical weeds

Project dates

July 2008 – June 2028

Project team

Simon Brooks and Kirsty Gough

Project summary

This project supports the National Tropical Weeds Eradication Program (NTWEP) by investigating key biological parameters that influence field operations, such as seed bank persistence, time to maturity, and dispersal potential. This research develops and refines methods to monitor eradication progress, ensuring monitoring is spatially and temporally consistent across target species. The project also contributes to annual program reporting, supports external reviews, and assists with implementing the NTWEP response plan.

Field and glasshouse trials investigating *Limnocharis flava*, *Miconia calvescens*, *M. racemosa, M. nervosa* and *Mikania micrantha* seed persistence have been running for 8 to 14 years, with all species showing persistent seed banks. Bulk or depth-based field soil seed bank samples were collected from *L. flava, M. micrantha* and *M. racemosa* infestations.

The *M. micrantha* buried seed packet trial concluded after 12 years, and the data will be used to inform eradication decision-making criteria. The eradication declaration criteria will then be tailored to each incursion. These criteria include factors such as the likelihood of reversion following a monitoring period, time since the last mature plant was detected, the proximity of mature plants, and the recency, frequency and extent of searches during the monitoring phase.

Field crews have also collected data and observations on the phenology of invasive melastomes which have contributed to the development of a habitat suitability model to refine *M. calvescens* ground surveys.

Collaborators

- Kim Erbacher, John Edwards and Michael Graham (Biosecurity Queensland).
- Rod Ensby, Brook Hooson, Karen Bell and Xiaocheng Zhu (Department of Primary Industries and Regional Development NSW).
- Jesse Telford (Rous County Council).
- Francisco Encinas-Viso, Harry Eyck and Nunzio Knerr (CSIRO Canberra).

Key publications

Brooks, **S**. & **Jeffery**, **M**. (2018). Progress in the eradication of *Mikania micrantha* from Australia. In: 21st Australasian Weeds Conference, 9-12 September 2018, Sydney, New South Wales.

Brooks, **S**., **Erbacher**, **K**. & Maher, J. (2022). Progress towards the eradication of *Limnocharis flava* from Australia. In: 22nd Australasian Weeds Conference, 25-29 September 2022, Adelaide, South Australia.

Brooks, **S**. & **Erbacher**, **K**. (2022). Progress in the eradication of *Miconia calvescens* from Australia. In: 22nd Australasian Weeds Conference, 25-29 September 2022, Adelaide, South Australia.

4. Weed seed dynamics

Project dates

August 2007 – June 2030

Project team

Simon Brooks, Dannielle Brazier, Clare Warren and Kirsty Gough

Project summary

Information on seed longevity informs the duration of weed control activities. This project investigates the seed longevity of priority weeds through buried packet field trials, monitoring seedling emergence in field cages, and running controlled ageing tests in the laboratory. Controlled ageing tests allow more rapid determination of seed longevity than field trials. Additional experiments, such as depth of seedling emergence trials, can help to interpret the results of buried packet trials.

The buried packet research paddock currently has tropical soda apple, a repeat prickly acacia batch, African tulip tree and harrisia cactus seed longevity trials in progress. An African tulip tree buried packet seed longevity trial is also running at South Johnstone Research Station. Seedling emergence is being monitored for elephant ear vine, parkinsonia, chinee apple, mesquite, prickly acacia and leucaena in the field cages. The longevity of sagittaria seed is also being studied in immersed packets.

Completed buried packet trials have shown that neem and yellow bells have relatively transient soil seed banks that are exhausted after one year. Seed packets for yellow oleander, stevia, gamba grass, chinee apple, calotrope and mesquite were exhausted in under five years. Trials for lantana and parthenium showed that small numbers of seeds could retain viability for up to ten years, while viable prickly acacia seeds were retrieved after 13 years. These results, along with those for many other weeds, are being compared to outcomes from short-term controlled ageing tests. A twelfth batch of seeds from eight weed species are the subjects of a controlled ageing test this year.

To assist in explaining the results of the buried packet trials, a series of weeds are also undergoing depth of seedling emergence trials. An example of integrating multiple methods is provided by the neem tree trials, where results from three controlled ageing tests, a buried packet trial, and two emergence trials consistently confirmed a transient soil seed bank. The addition of depth of emergence data assisted in explaining the mechanisms of seed bank depletion.

Figure 3 Seedling emergence trial - cage layout, a captured emergence of a parkinsonia and elephant ears vine seedling.

Figure 4 Depth of emergence trial – calotrope, African tulip tree and neem seed germination from various depths.

Collaborators

- Shane Campbell (University of Queensland)
- Faiz Bebawi and Stacy Harris (Biosecurity Queensland)

Key publications

Bebawi, F. F., Campbell, S. D. & Mayer, R. J. (2015). Seed bank longevity and age to reproductive maturity of *Calotropis procera* (Aiton) W.T. Aiton in the dry tropics of northern Queensland, *The Rangeland Journal*, 37: 239-247.

Brooks, **S.J**, **Brazier**, **D.A**. & **Warren**, **C**. (2022). Estimating tropical weed seed longevity with a laboratory test. In: 22nd Australasian Weeds Conference, 25-29 September 2022, Adelaide, South Australia.

Long, R.L., Panetta, F.D., Steadman, K.J., Probert R., Bekker, R.M., **Brooks**, **S.J** & Adkins, S.W. (2008). Seed persistence in the field may be predicted by laboratory-controlled ageing, *Weed Science*, 56: 523-8.

5. Encapsulated herbicide control of woody weeds

Project dates

January 2021 - June 2025

Project team

Simon Brooks, Dannielle Brazier, Clare Warren and Kristy Gough.

Project summary

Stem injection is an under-utilised tool for the control of woody shrubs and small trees. A new tool has been developed to deliver dry encapsulated herbicides directly into woody stems. This method is safe for applicators, as there is no need to mix with water or diesel as a carrier or to have direct contact with the herbicide. It is also safe for the environment and can be used near waterways and desirable vegetation, as the herbicide is contained within the target plant. Stem-injected herbicides can also be applied as a liquid using a drill and fill technique, which became a focus in the later stages of this project.

Trials aimed to determine the efficacy of two stem injection techniques (encapsulated herbicides and drill and fill) on rubber vine, pond apple, leucaena, African tulip trees and neem trees. Dry encapsulated herbicides were compared with standard individual stem treatments and the stem injection of liquid herbicide solutions. The project also investigated active ingredients suited to stem injection as either dry or liquid formulations.

A trial on leucaena found one liquid herbicide and three dry encapsulated treatments were effective for stem injection. Three trials found that rubber vine is extremely susceptible to a range of both encapsulated and liquid stem injection treatments, offering effective options for tall rubber vine plants amongst creek line vegetation. Trials on neem tree also showed high efficacy for both treatment types.

Similar efficacy was found for four encapsulated treatments on African tulip trees and a second trial was established in Tyto Wetlands (Ingham). Encapsulated herbicides also showed promising results for the control of pond apple, and a second trial using liquid herbicide stem injection has been established near Babinda.

Figure 5 Rubber vine before and after drill and fill treatment. High rubber vine mortality and no off-target damage to surrounding desirable vegetation.

Figure 6 Applying a drill and fill treatment to a rubber vine stem. Treatments applied into stem as low as practical.

Figure 7 Measuring the large African tulip trees located within the Tyto Wetlands in Ingham (right) and application of an encapsulated herbicide treatment to African tulip trees (left).

Collaborators

- Matthew Buckman (Hinchinbrook Shire Council)
- Whitsunday Regional Council
- Burdekin Shire Council
- Chris Roach (Queensland Parks and Wildlife Service)

Key publications

Goulter, K.C., Galea, V.J. & Riikonen P. (2018). Encapsulated dry herbicides: A novel approach for control of trees. In: 21st Australasian Weeds Conference, 9-12 September 2018, Sydney, New South Wales.

O'Brien, C.J. Campbell, S., **Vogler**, **W**. & Galea, V.J. (2022). Evaluation of Di-Bak herbicide capsule system for control of chinee apple (*Ziziphus mauritiana*) in north Queensland. In: 22nd Australasian Weeds Conference, 25-29 September 2022, Adelaide, South Australia.

6. Weed biological control of Koster's curse (*Miconia crenata*)

Project dates

July 2023 – June 2028

Project team

Jason Callander and David Comben

Project summary

Koster's curse (*Miconia crenata*) is a highly prolific, aggressive weed of grazing, plantations, cropping and natural ecosystems in many countries across the world. There are currently two populations of *M. crenata* in Far North Queensland and it is a category 2, 3, 4 and 5 restricted invasive plant under the *Biosecurity Act 2014*. A submission to release the biological control agent *Liothrips urichi* in Queensland is currently under review due to its ability to feed and develop on native Australian plant species.

Figure 8 Clockwise from top left: Miconia crenata leaf infected with Colletotrichum clidemiae leaf spot pathogen; Microscopic preparations of Colletotrichum clidemiae spores and Miconia crenata plants inoculated with Colletotrichum clidemiae in a dew chamber.

Colletotrichum clidemiae is a leaf spot fungal pathogen, originally identified in Panama, which has been utilised for classical biocontrol of *M. crenata* in Hawaii. The Queensland DPI has contracted plant pathologists at the Commonwealth Agricultural Bureaux (CABI) in the UK to import the leaf spot pathogen into their quarantine laboratory and conduct host-screening experiments to determine its suitability as a biocontrol agent in Australia. If the pathogen is found to be host-specific, it will be imported into the quarantine facility at the Ecosciences Precinct in Brisbane for culturing and further testing.

The leaf spot has been imported into the laboratories at CABI and a plate culture successfully established. Multiple *M. crenata* plants have been inoculated with the pathogen and show infection symptoms. Multiple shipments from DPI of Australian plant species closely related to *M. crenata* have successfully arrived at CABI for use in for host-screening experiments. The pathogen has so far been screened against three important Australian native species and shows no ability to infect them.

Collaborators

- Sarah Thomas and Marion Seier (Centre for Agriculture and Bioscience International, UK)
- Tracy Johnson (USDA, Institute of Pacific Islands Forestry, Hawaii)
- Darcy Oishi (Hawaii Department of Agriculture, Hawaii)
- Kim Erbacher (National Tropical Weeds Eradication Program, South Johnstone)
- Garry Sankowsky (Horticulturalist)

Key publications

Trujillo, E. E., Latterell, F. M., & Rossi, A. (1986). *Colletotrichum gloeosporioides*, a possible biological control agent for *Clidemia hirta* in Hawaiian forests, *Plant Disease*, 70(10): 974-976.

7. Biocontrol of cactus species

Project dates

July 2021 – June 2025

Project team

Jason Callander, Zachary Shortland and David Comben

Project summary

All cactus species in the genera *Opuntia*, *Cylindropuntia*, and *Harrisia*, except for the Indian fig (*Opuntia ficus-indica*), are regulated in Queensland and classified as either restricted or prohibited under the *Biosecurity Act 2014*. The biological control of invasive cacti in Australia

Figure 9 Clockwise from top left: Cactus field surveys in Arizona with collaborators; Cylindropuntia sp. with stem borer damage (black frass); Adult Moneilema sp. resting on Cylindropuntia sp.; Dead Cylindropuntia sp. from stem boring beetle damage.

has generally been very successful. However, in some cases, existing agents may not provide adequate control due to mismatches between agents and cactus hosts, hybridization between different lineages, or extreme environmental conditions.

This project has focused on exploring new agents to complement existing established biocontrol (*Dactylopius* spp.), specifically targeting Devil's rope pear (*Cylindropuntia imbricata*) and Snake cactus (*C. imbricata* subsp. *spinosior*). Promising stem boring cactus beetles such as *Coenopoeus palmeri* and *Moneilema* spp. have been prioritised as biological control agents. Mass rearing and field releases of another stem boring beetle, *Lagocheirus funestus,* have commenced across Queensland, targeting dense infestations of *Opuntia tomentosa* and *O. streptacantha*.

A field trip to Arizona, USA was conducted to survey prospective stem boring cactus beetles. *Coenopoeus palmeri* was successfully located and imported into quarantine for rearing. After nine months of patiently waiting, adult beetles of C. *palmeri* have emerged from their pupal cases.

Figure 10 Left: Coenopoeus palmeria larvae inside Cylindropuntia imbricata stem. Right: Coenopoeus palmeri adult emerging from pupal case.

Collaborators

- Kelli Murree (Pukallus) (DPI Charters Towers)
- Department of Agriculture, Fisheries and Forestry (Funding support)
- Duncan Swan, Eloise Kippers, Nathan March, Megan Leech and Stephen Downey (Biosecurity Officers)
- Kyle Morris, Environmental Advisor (Powerlink Queensland)
- Matt Tucker, Ranger Sunshine Coast (Department of Environment and Science)
- Kirstin Beasley, Ranger (Department of Environment and Science)
- Lucas Mackie, Project Officer (Southern Queensland Landscapes)
- Andrew McConnachie (NSW Department of Primary Industries)
- Iain Paterson (Rhodes University, South Africa)
- Lauren Weidner and Andrew Meeds (Arizona State University, USA)

- Jeffrey Newton (Longreach Regional Council)

Key publications

Shortland, **Z**. & **Callander**, **J**.**T**. (2023). Optimising control of invasive cactus using biological control. In: 2nd Pest animal and weed symposium, 28-31 August 2023, Dalby, Queensland.

8. Restoring island resilience - Pacific weeds biological control research

Project dates

July 2024 – June 2026

Project team

Jason Callander and Zachary Shortland

Project summary

The DPI is working in collaboration with Manaaki Whenua - Landcare Research New Zealand, with funding support from the New Zealand Ministry of Foreign Affairs and Trade to undertake biological control research targeting two weed species of importance to Australia and certain Pacific Island nations. Singapore Daisy (*Sphagneticola trilobata*) is a hardy, fast-growing groundcover native to Mexico that has established as a weed in natural and disturbed areas in Queensland and the Pacific. Ivy Gourd (*Coccinia grandis*) is a smothering climbing vine native to tropical areas of Africa and Asia. It has become a major weed of some Pacific Island nations and poses a threat to Queensland as a potential host for Melon fly.

Singapore daisy is a novel target for biological control and so new herbivore species must be discovered and identified in its native range of Mexico then tested to determine their host-specificity. Ivy Gourd has been previously targeted for biological control in Hawaii, resulting in the release of multiple insect biological control agents there. One of these agents, the stem-boring moth *Melittia oedipus*, requires further testing to determine if it is safe for release into Queensland and Pacific Island nations.

A spittle bug from Mexico (*Clastoptera compta*) has been successfully reared in quarantine. Host specificity testing has been conducted across nine plant species. Due to off-target feeding and development on Australian native species *Wollastonia biflora*, the agent's future is currently under review.

A species of galling Eriophyid mite has been identified on Singapore daisy in Mexico and the Caribbean that will be targeted next as a biological control agent.

Host specificity testing has begun for stem boring moth *Melittia oedipus.* A larval feeding trial and adult choice tests are being conducted to determine the risk of off-target damage to commercial or native plants. A focus on commercial varieties of cucumber species is being implemented into host testing due to previous reports of insect development.

Figure 11 Eriophyid mite damage on a Singapore daisy plant in Mexico and Clastoptera compta adults on Singapore daisy

Figure 12 Melittia oedipus adults mating in water saucer and adult female resting on ivy gourd leaf.

Collaborators

- Manaaki Whenua Landcare Research NZ Ltd
- Secretariat of Pacific Regional Environment Programme (SPREP)

- New Zealand Ministry of Foreign Affairs and Trade
- Tracy Johnson and David Honsberger (USDA, Institute of Pacific Islands Forestry, Hawaii)
- Biól. Ricardo Segura Ponce de León, Mexico

9. The national weed biocontrol pipeline strategy

Project dates

October 2023 – December 2024

Project team

Jason Callander, Dhileepan Kunjithapatham, Di Taylor, Boyang Shi, Tamara Taylor and David Comben

Project summary

Biological control research is a lengthy and costly process requiring considerable investment and commitment to identify, test, release, and monitor agents against Australia's worst weeds. The National Weed Biocontrol Pipeline Strategy aims to guide research, development, and extension nationally, ensuring investment supports the entire biocontrol process — from prioritizing weed candidates to native range exploration, risk assessment, agent release, and impact monitoring and evaluation.

The Commonwealth Government has endorsed this approach and funded the initial phase of the strategy. Under a consultancy agreement, Biosecurity Queensland committed in-kind contributions to:

- Create a weed biocontrol research development and extension alliance,
- Design a national weed prioritization framework,
- Apply the national weed biocontrol prioritization framework, and
- Estimate the costs to develop five-year implementation plans.

The prioritization and feasibility framework was completed in late 2024, nominating 20 weed species as targets for biological control. These species were deemed to have the highest negative impact with the greatest feasibility for research success.

The 20 nominated species were divided amongst the collaborating research organisations which produced contextualisation documents and project plans for biological control projects targeting each weed.

All of the project plans were synthesised into a single investment report which was delivered to the Centre for Invasive Species Solutions in early 2025.

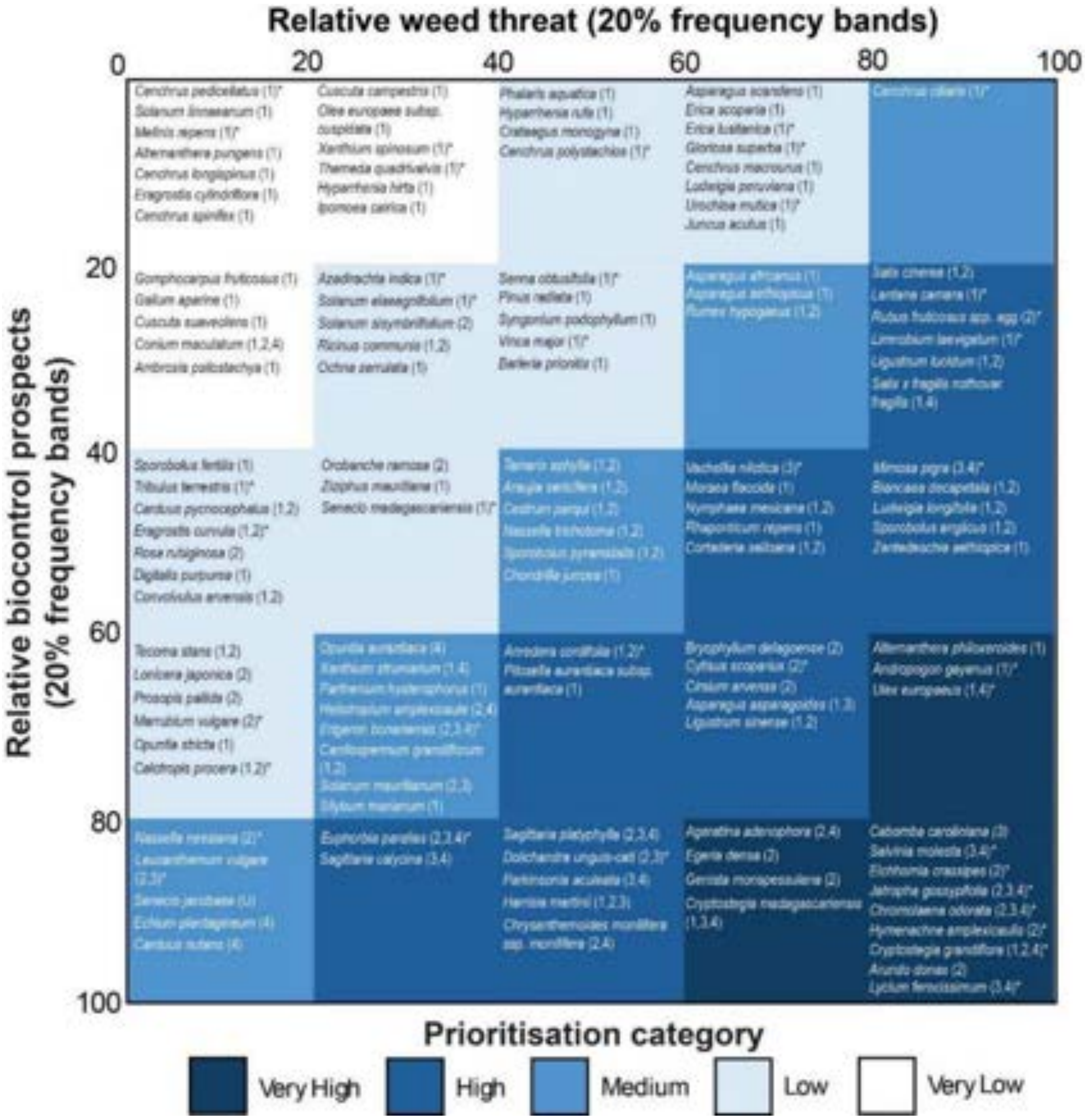

Figure 13 Matrix produced as outcome of weed prioritisation process which ultimately resulted in the nomination of 20 target weed species to be included in the investment report.

Collaborators

- Department of Agriculture, Fisheries and Forestry, Canberra
- CSIRO
- Biosciences Research Division of Agriculture Victoria
- Department of Primary Industries NSW Government
- Wild Matters
- Atlas of Living Australia

Key publications

CSIRO and Centre for Invasive Species Solutions (2023). National Weed Biocontrol Pipeline Strategy: A roadmap to guide Australia's weed biocontrol research, development, and extension, Centre for Invasive Species Solutions, Canberra.

Rafter, M. A., Gooden, B., Hopper, M., Kumaran, N., Hunter, G., McConnachie, A. J., Turner, P., **Pople**, **A**.**R**., **Callander**, **J**.**T**., **Dhileepan**, **K**., Kwong, R., Steel, J., Lefoe, G., Potter, S., Sheehan, M., Turley, A., Brenton, P. & Glanznig, A. (2025). *The development and implementation of a National Weed Biocontrol Pipeline Strategy*. in *23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management*. 2024. Brisbane, Qld. 146. http://era.dpi.qld.gov.au/id/eprint/14202/

10. Biological control of *Lantana camara*

Project dates

July 2021 – June 2026

Project team

Jason Callander and Zachary Shortland

Project summary

Lantana is a category 3 restricted invasive plant under the *Biosecurity Act 2014* and a weed of national significance. Despite an extensive history of biological control research, only about half of the established agents are considered to cause significant seasonal impact. This highly resilient weed remains persistent in the Australian environment. Biosecurity Queensland seeks to enhance management options for this weed by building on previous research of two prospective agents.

The blister-rust pathogen *Puccinia lantanae* was host tested by the Commonwealth Agricultural Bureaux International (CABI) in the UK against about forty plant species for New Zealand, South Africa, and Australia. The agent was approved for release in New Zealand and South Africa, but further testing of two plant genera, not previously tested, was deemed necessary for Australia.

The additional host testing for *Puccinia lantanae* has been completed by CABI-UK and now an import release application has been submitted to Australian federal regulators.

The lantana gall fly (*Eutreta xanthochaeta*) was introduced into Australia from Mexico twice in the 1970s but failed to establish both times. Effective in Hawaii as a biological control agent against Lantana, this fly still holds potential in Australia due to its lack of native Verbenaceae species. Biosecurity Queensland have host tested 31 species from five plant families, and the gall fly has demonstrated a very strong preference for *Lantana camara* and *Lantana montevidensis*.

Additional testing has been conducted to determine *E. xanthochaeta's* preference across seven different types of Lantana varieties found in Australia. Now *E. xanthochaeta* only requires two additional species to complete host specificity testing and is anticipated to be completed by EOFY 25/26.

Figure 14 A science technician presenting at the Australian Weeds Conference (left) and size comparison of E. xanthochaeta adult females that developed on different Lantana varieties (right).

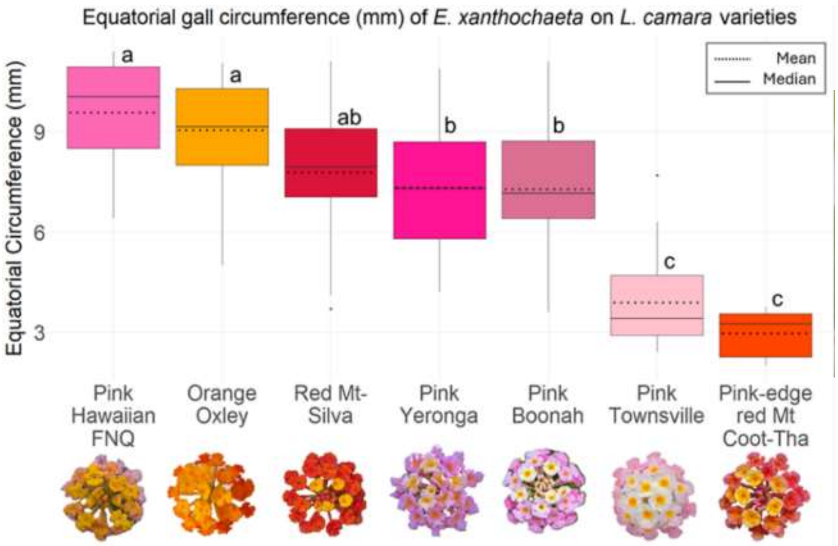

Figure 15 Analysis of equatorial gall circumference (mm) of E. xanthochaeta on L. camara varieties with Tukey HSD groupings p-value threshold 0.001.

Collaborators

- Sarah Thomas and Marion Seier (Centre for Agriculture and Bioscience International, UK)
- Alan Wood (Plant Protection Research Institute, South Africa)
- Tracy Johnson (USDA, Institute of Pacific Islands Forestry, Hawaii)
- Particia Lu-Irving (NSW Royal Botanic Gardens)

- Queensland Parks and Wildlife Service
- Local governments in coastal and subcoastal Queensland

Key publications

Callander, **J & Shortland**, **Z**. (2024). Biology, host specificity and varietal preference of the lantana gall fly: lessons learnt in time. In: 23rd Australasian Weeds Conference, 25-29 August 2024, Brisbane. Queensland. https://era.dpi.qld.gov.au/id/eprint/14192/

Lu-Irving, P., Encinas-Viso, F., **Callander**, **J**., **Day**, **M**.**D**. & Le Roux, J. (2023). Population genomics of invasive lantana: implications for improved biocontrol, 4th International Congress on Biological Invasions, New Zealand, Christchurch, 1-4 May.

Shortland, **Z & Callander**, **J**. (2024). Lantana gall-fly – The tetralogy, 23rd Australasian Weeds Conference, Brisbane, 25-29 August.

11. *Mikania micrantha* biocontrol for Christmas Island

Project dates

March 2025 – September 2026

Project team

Jason Callander and David Comben

Project summary

Mikania vine (*Mikania micrantha*) is a fast-growing climbing vine from the Americas, which is a category 2, 3, 4 and 5 restricted invasive plant under the *Biosecurity Act 2014*. There are invasive populations in Far North Queensland, where it is a target for eradication, and on the Christmas Island territory. *Puccinia spegazzinii* is a rust fungus native to South America which was found to be very host-specific and damaging to Mikania through host-screening conducted by the Commonwealth Agricultural Bureaux International (CABI) and DPI.

The Federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) has contracted DPI to export *P. spegazzinii* from the Ecosciences Precinct, Brisbane, to Christmas Island and establish a laboratory culture there to be maintained under the care of DCCEEW staff. Two trips will be conducted to the island by a DPI staff member to establish the culture, conduct field releases and monitor the impact of the rust on the weed populations in the field.

Mikania micrantha plant material infected with *Puccinia spegazzinii* was imported from Vanuatu into the quarantine facility at the Ecosciences Precinct to establish a laboratory culture. The species identity of the rust was confirmed morphologically by a plant pathologist and by genetic barcoding.

One trip has been made by a DPI staff member to transport the rust to the island. Infection symptoms have been recorded on island-grown Mikania plants and vegetation field surveys were conducted to establish baseline weed coverage and native species abundance and diversity.

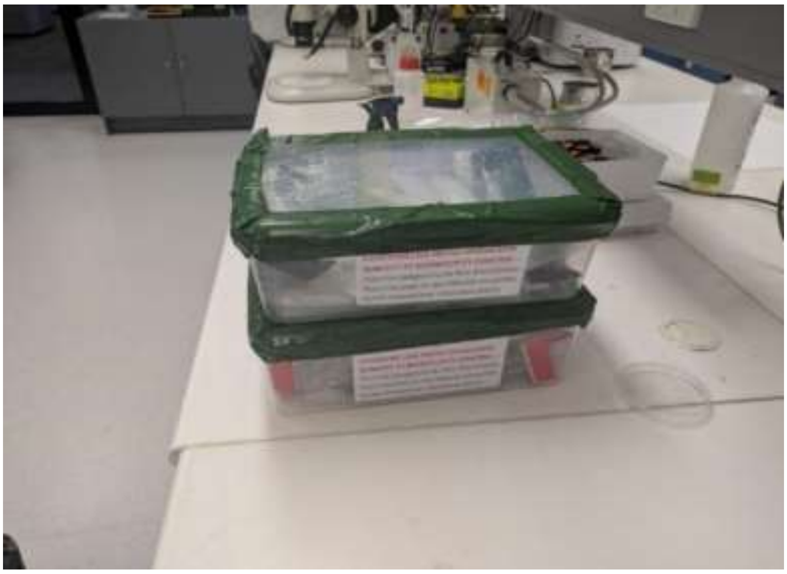

Figure 16 Mikania micrantha leaves infected with Puccinia spegazzinii packaged in Brisbane and ready for export to Christmas Island.

Figure 17 DPI staff inspecting imported Puccinia spegazzinii for unwanted pests in the DCCCEW office, Christmas Island (left) and Mikania micrantha leaves infected with P. spegazzinii suspended over healthy plants to allow falling fungal spores to land and germinate (right).

Figure 18 DCCEEW collaborator preparing a quadrat for baseline vegetation field surveys (left) and a young Mikania micrantha leaf at the Christmas Island DCCEEW office showing early signs of infection after having been exposed to the rust imported from Brisbane (right).

Collaborators

- Andre Marais and Christina Lipka (DCCEEW)
- Michael Day
- Department of Agriculture, Fisheries and Forestry (DAFF)
- Roger Shivas (DPI)

Key publications

Day, **M**. **D**., **& Riding**, **N**. (2019). Host specificity of *Puccinia spegazzinii* (Pucciniales: Pucciniaceae), a biological control agent for *Mikania micrantha* (Asteraceae) in Australia. *Biocontrol Science and Technology*, *29*(1), 19-27.

Ellison, C. A., Evans, H. C., Djeddour, D. H., & Thomas, S. E. (2008). Biology and host range of the rust fungus *Puccinia spegazzinii*: a new classical biological control agent for the invasive, alien weed *Mikania micrantha* in Asia. *Biological Control*, *45*(1), 133-145.

12. Biological control of African tulip tree (*Spathodea campanulata*)

Project dates

July 2025 – June 2026

Project team

Jason Callander and David Comben

Project summary

African Tulip (*Spathodea campanulata*) is a category 3 restricted invasive plant under the *Biosecurity Act 2014* which invades natural and disturbed areas in coastal Queensland and negatively impacts native bee populations. The African Tulip gall mite (*Colomerus spathodeae*), discovered in Ghana, was found to stunt plant growth by forming lesions known as *erinea*. The mite has already been released in multiple Pacific Island nations to control the weed and has been imported from New Zealand into the quarantine lab at the Ecosciences Precinct, Brisbane.

The bud mite will be exposed to a suite of native Australian plant species to assess its host-specificity. If it is found to only utilise the weed as a host, it will be deemed low-risk and an application to release the mite will be submitted to the Department of Agriculture, Fisheries and Forestry.

Of the 17 Australian native plant species in the same family (Bignoniaceae) as the weed, 12 have been collected or purchased for use in host-screening experiments.

To date, the mite has been exposed to at least one plant of all 12 native species and has been found either unable to utilise them as a host or can only utilise them to a minor degree. Further replication is required.

Figure 19 Spathodea campanulata plant exhibiting erinae produced by the feeding of the gall mite Colomerus spathodeae (left) and C. spathodeae viewed through a compound microscope (right).

Figure 20 Experimental setup with the native vine species Tecomanthe burungu. Erinea are attached to growing plant tips using green ties to allow mites to transfer onto the plant.

Collaborators

- Manaaki Whenua Landcare Research NZ Ltd
- Secretariat of Pacific Regional Environment Programme (SPREP)
- New Zealand Ministry of Foreign Affairs and Trade
- Garry Sankowsky (Horticulturalist)
- Stuart Worboys and Frank Zich (Australian Tropical Herbarium)
- Brandan Espe (James Cook University)
- Rowan Ward (Cassowary Coast Regional Council)
- Jake Hancock (Anderson Garden, Townsville)

Key publications

Paterson, I. D., Paynter, Q., Neser, S., Akpabey, F. J., Orapa, W., & Compton, S. G. (2017). West African arthropods hold promise as biological control agents for an invasive tree in the Pacific Islands. *African Entomology*, 25(1), 244-247.

Sutton, G. F., Paterson, I. D., & Paynter, Q. (2017). Genetic matching of invasive populations of the African tulip tree, *Spathodea campanulata* Beauv.(Bignoniaceae), to their native distribution: Maximising the likelihood of selecting host-compatible biological control agents. *Biological Control*, 114, 167-175.

13. Biological control of parthenium (*Parthenium hysterophorus*)

Project dates

January 2007 – June 2028

Project team

Kunjithapatham Dhileepan and Boyang Shi

Project summary

Parthenium weed (*Parthenium hysterophorus* L.), a Weed of National Significance in Australia, is a noxious weed of grazing areas in Queensland that causes severe health problems in both humans and animals. Eleven biological control agents (nine insects and two rust pathogens) have been released against parthenium in Australia. Most of these agents have become established and have proven effective against the weed in Central Queensland (CQ).

Parthenium is spreading into south Queensland (SQ) and southeast Queensland (SEQ), where many of the effective biological control agents widespread in the CQ are not yet present. Hence, the seed-feeding Smicornyx weevil (*Smicornyx lutulentus*), the stem-boring Listronotus weevil (*Listronotus setosipennis*), the root-boring Carmenta moth (*Carmenta ithacae*), the summer rust (*Puccinia xanthii* var. *parthenii-hysterophorae*) and the winter rust (*Puccinia abrupta* var. *partheniicola*) have been redistributed from CQ into SQ and SEQ.

Monitoring of the establishment and spread of parthenium biological control agents is continuing. Field establishment of the seed-feeding Smicronyx weevil, stem-boring Listronotus weevil, root-boring Carmenta moth, and the two rusts has been confirmed in most release sites.

Some of the biological control agents have been exported to India (Smicronyx weevil) and South Africa (Carmenta moth).

Collaborators

- Mitchell and District Landcare Association
- Queensland Murray-Darling Committee
- SEQ Catchments
- North Burnett Regional Council
- Junction View Pest Management Group
- Oxley catchment group
- Lockyer Valley Regional Council
- Cameron Allan (Meat & Livestock Australia)

- Logan City Council
- Balonne Shire Council
- Burnett Catchment Care Association
- Maranoa Landcare
- Graziers/landholders
- Gympie Landcare
- Charters Towers Regional Council
- Lorraine Strathie (Agricultural Research Council, South Africa)
- Dr Sampath Kumar (National Bureau of Agriculturally Important Insect, Indian Council of Agricultural Research, Bangalore, India)
- Dr Laila Said Al Harthy (Oman Botanic Gardens, Muscat, Sultanate of Oman)
- Mohammed Mubarak Suhail Akaak, (Dhofar Municipality, Sultanate of Oman)

Key publications

Dhileepan, **K**. & McFadyen, R.E. (2012). *Parthenium hysterophorus* L. – parthenium, In: *Biological control of weeds in Australia: 1960 to 2010*, Julien, M., McFadyen, R.E. & Cullen J., eds., CSIRO Publishing, pp. 448-462.

Dhileepan, **K**., McFadyen, R., Strathie, L. & Khan, N. (2018). Biological control,. In: *Parthenium Weed: Biology, Ecology and Management*, Adkins, S., Shabbir, A. & Dhileepan, K., eds., CAB International, pp. 137−156.

Dhileepan, **K**., **Callander**, **J**., **Shi**, **B**. & **Osunkoya**, **O**.**O**. (2018). Biological control of parthenium (*Parthenium hysterophorus*): the Australian experience, *Biocontrol Science and Technology*, 28(10):970−988.

14. Biological control of cat's claw creeper (*Dolichandra unguis-cati*)

Project dates

January 2017 – June 2028

Project team

Kunjithapatham Dhileepan, Di Taylor and Boyang Shi

Project summary

Cat's claw creeper (*Dolichandra unguis-cati*) is a Weed of National Significance in Australia and biocontrol is considered the most desirable option to manage it. To date, a leaf-sucking tingid (*Carvalhotingis visenda*), a leaf-tying moth (*Hypocosmia pyrochroma*) and a leaf-mining beetle (*Hedwigiella jureceki*) have been released in Queensland. All agents have become widely established, except for *H. pyrochroma* which is restricted to riparian corridors in southeast Queensland.

Additional agents are needed to complement the existing agents. Surveys in Brazil, Argentina and Paraguay identified a rust-gall (*Uropyxis rickiana*) and a leaf-rust (*Prospodium macfadyenae*). An accidentally introduced leaf-spot pathogen (*Neoramulariopsis unguis-cati*), also native to tropical South America and known to cause widespread defoliation in South Africa, has been identified as a prospective biocontrol agent.

Host specificity testing of the leaf-spot pathogen on 35 non-target plant species has been completed by CABI (Centre for Agricultural and Biosciences International, UK). An application seeking its approval to release the leaf-spot pathogen has been submitted to the Australian regulatory authority.

Field releases of the leaf-spot pathogen, which are anticipated to complement existing insect agents, will commence once approval has been received.

Collaborators

- Seqwater
- Marion Seier and Kate Pollard (CABI, UK)
- Anthony King (Plant Protection Research Institute, Pretoria, South Africa)
- Robert Barreto, Adans Colman (Universidade Federal de Viscosa, Brazil)
- Anibal Carvalho (Instituto de Pesquisas Jardim Botanico do Rio de Janeiro, Brazil)
- Kevin Jackson (Gympie, Qld)
- Melinda Clarke (Burnett Catchment Care Association, Monto)
- NSW biocontrol taskforce

Key publications

Dhileepan, **K**. (2012). *Macfadyena unguis-cati* (L.) A.H. Gentry - cat's claw creeper, In: *Biological control of weeds in Australia: 1960 to 010*, Julien, M., McFadyen, R.E. & Cullen J., eds., CSIRO Publishing, pp. 351-359.

Dhileepan, **K**., King, A.M., **Taylor**, **D**.**B**.**J**., Pollard, K.M., Seier, M.K. (2024). Biological control of cat's claw creeper (*Dolichandra unguis-cati*; Bignoniaceae): Current status and future prospects, *Annals of Applied Biology*, 185(2):132-145.

15. Biological control of bellyache bush (*Jatropha gossypiifolia*)

Project dates

January 2007 – June 2025

Project team

Kunjithapatham Dhileepan and Di Taylor

Project summary

Bellyache bush (*Jatropha gossypiifolia*), a Weed of National Significance, is a serious weed of rangelands and riparian zones in northern Australia. Biological control is the most cost-effective long-term management strategy for bellyache bush in Australia, although there has been limited success to date. A renewed biological control effort involving exploration in tropical America identified a leaf rust (*Phakopsora arthuriana*) from Trinidad, a leaf mining moth (*Stomphastis thraustica*) from Peru and a gall midge (*Prodiplosis hirsutus*) from Paraguay as prospective biological control agents.

Seventy-four releases of the leaf-miner have been made at 31 sites across Queensland along with three releases at three sites in the Northern Territory. Observations suggest that the leaf-miner has persisted at sites that experienced significant flooding, where bellyache bush plants also persist.

Future work will focus on confirming the establishment of the leaf-miner, preparing an application to import and release the leaf rust, and importing the gall midge from Paraguay into an Australian quarantine facility for detailed host specificity testing.

Figure 21 Bellyache bush near Barcaldine with Stomphastis leaf mines.

Collaborators

- Marion Seier and Kate Pollard (CABI, UK)
- Guillermo Cabrera Walsh, Marina Oleiro and Carolina Mengoni (Fundación Para El Estudio De Especies Invasivas, Buenos Aires, Argentina)
- Peter Kolesik (South Australian Museum, Adelaide)
- Kumaran Nagalingam (CSIRO, Brisbane)
- Jurate De Prins (Royal Museum of Central Africa, Belgium)
- Russell Jack (Cairns, Qld Department of Natural Resources, Mines, Manufacturing and Regional and Rural Development)
- Geoff Swan (Emerald, DPI)
- Charles Curry (Mt Isa, Southern Gulf NRM)

- Michelle Franklin, Gerald Danao and Bradley Sauer (Northern Territory Department of Lands Planning and Environment)
- Gilbert River Headwaters Action Group
- Barcaldine Regional Council
- Burdekin Regional Council
- Central Highlands Regional Council
- Charters Towers Regional Council
- Cook Shire Council
- Ethridge Regional Council
- Mareeba Regional Council
- Whitsunday Regional Council

Key publications

De Prins, J., **Taylor**, **D**.**B**.**J**., Gonzalez, G. F., Dobson, J., Hereward, J.P., **Shi**, **B**., Rahman, M.M. & **Dhileepan**, **K**. (2023). Taxonomic Delineation of the Old World Species *Stomphastis thraustica* (Lepidoptera: Gracillariidae) Feeding on *Jatropha gossypiifolia* (Euphorbiaceae) that was collected in the New World and imported as a biocontrol agent to Australia*, Neotropical Entomology*, 52: 380-406

Dhileepan, **K**., Neser, S. & De Prins, J. (2014). Biological control of bellyache bush (*Jatropha gossypiifolia*) in Australia: South America as a possible source of natural enemies, In: Proceedings of the XIV International Symposium on Biological Control of Weed, 2-7 March 2014, Kruger National Park, South Africa.

Kolesik, P., Kumaran, N., Oleiro, M., Gonalons, C.M., Brookes, D., Walsh, G.C. & **Dhileepan**, **K**. (2022). *Prodiplosis hirsuta*, a new species of gall midge (Diptera: Cecidomyiidae) feeding on shoot tips of *Jatropha* (Euphorbiaceae) in South America, *Austral Entomology*, 61(1): 37−48.

16. Biological control of Navua sedge (*Cyperus aromaticus*)

Project dates

January 2017 – June 2028

Project team

Kunjithapatham Dhileepan, Di Taylor and Boyang Shi

Project summary

Navua sedge (*Cyperus aromaticus*) is an extremely aggressive perennial sedge that impacts the beef and dairy industries in Queensland’s wet tropics. Biocontrol is the most cost-effective and long-term management option. Surveys in equatorial Africa have identified two promising biological control agents: a new smut fungus (*Cintractia kyllingae*) that attacks flower heads and seeds in Tanzania, Kenya and Nigeria, and a rust fungus (*Puccinia kyllingae-erectae*) that infects leaves and stems in Nigeria, Tanzania and Madagascar.

Host specificity tests for smut fungus is in progress under quarantine conditions at CABI, UK. Testing for the rust pathogen was also initiated at CABI but has since been discontinued following its detection on Navua sedge in the Queensland wet tropics in August 2023. Based on morphological and molecular studies, the rust found on Navua sedge in North Queensland has been identified as *Puccinia kyllingae-erectae.* The rust pathogen was observed only on Navua sedge and not on co-occurring tropical pasture species at rust-infected properties. It was also absent on co-occurring native Australian sedges, suggesting that the rust is likely to be host-specific.

Host specificity testing of the rust, involving closely related sedge species, local crops and co-occurring pasture species, commenced in October 2024. To date, rust infection was evident on only one non-target test plant species, *Cyperus sesquiflorus*, an introduced weed of pastures and lawn. Surveys for the incidence and abundance of the rust are being conducted across grazing properties, cropping areas (sugarcane farms and banana fields), roadsides (mowed and unmowed), and undisturbed riparian corridors in Atherton Tablelands and along the coast from Ingham to Cape Tribulation.

Figure 22 Puccinia kyllingae-erectae on Navua sedge

Collaborators

- Dr Marion Seier and Dr Daisuke Kurose (CABI-UK)
- Prof Florentine Singarayer, Dr Aakansha Chadha and Bhagya Ranasinghe Hathamune Gamage (Federation University, Ballarat)
- Prof Roger Shivas and Dr Yu Pei Tan (Queensland Plant Pathology Herbarium)
- Melissa Setter and Stephen Setter (DPI, TWRC, South Johnstone)
- Dr James Hereward (UQ, St Lucia)

- Dr Emilie Fillols (Sugar Research Australia, Gordonvale)
- Rajaonera Tahina Ernest (University of Antananarivo, Madagascar)
- Bernie English (Agri-Science Queensland, Mareeba) and John McKenna (Beef grazier, Malanda)
- Lawrence Di Bella and Richard Hobs (Herbert Cane Productivity Services Limited, Ingham)
- Lance Rodman (sugarcane farmer, Gordonvale)
- Travis Sydes (Far North Queensland Regional Organisation of Councils, Cairns)
- Malanda Beef Plan Group (Malanda)
- Tablelands Regional Council (Atherton)
- Cassowary Coast Regional Council
- Hinchinbrook Shire Council (Ingham)
- Darryn Higgins (Cook Shire Council)
- Michael Zitha (Biosecurity Queensland, Thursday Island)

Key publications

Dhileepan, **K**., Musili, P.M., Ntandu, J.E., Chukwuma, E., Kurose, D., Seier, M.K., Ellison, C.A., Shivas, R.G. (2022). Fungal pathogens of Navua sedge (*Cyperus aromaticus*) in equatorial Africa as prospective weed biological control agents, *Biocontrol Science and Technology*, 32(1):114−120.

Kruse, J., McTaggart, A., **Dhileepan**, **K**., Musili, P.M., Mutie, F.M., Ntandu, J.E., Edogbanya, O., Chukwuma, E.C., Shivas, R.G. (2021). Broad and narrow host ranges in resolved species of *Cintractia limitata* s. lat. (Anthracoideaceae Ustilaginomycotina) on *Cyperus*, *Mycological Progress*, 20(2):191−201.

Shi, **B**., **Osunkoya**, **O.O**., Chadha, A., Florentine, S.K., **Dhileepan**, **K**. (2021). Biology, Ecology and Management of Invasive Navua sedge (*Cyperus aromaticus*) – A Global Review, *Plants*, 10(9): 1851.

17. Biological control of prickly acacia (*Vachellia nilotica* ssp. *indica*)

Project dates

January 2007 – December 2028

Project team

Kunjithapatham Dhileepan and Boyang Shi

Project summary

Prickly acacia (*Vachellia nilotica* subsp. *indica*) is a weed of national significance and a target for biological control. A gall thrips (*Acaciothrips ebneri*), which induces shoot-tip rosette galls and a gall mite (*Aceria* sp.), which deforms leaflets, rachides and shoot-tips in Ethiopia, were prioritised as prospective biological control agents for further studies.

Host specificity tests for gall thrips have been completed and the species was approved for field release in October 2022. Field releases commenced in January 2023 and are continuing. Field releases have been made in 16 local government areas covering the coastal, central highlands and western inland regions in Queensland. Establishment of the gall thrips was evident in majority of the release sites.

The gall thrips induced rosette galls in the actively growing shoot tips, resulting in shoot tip dieback in prickly acacia seedlings, juvenile plants and mature trees. In some of the release sites, the gall thrips spread over 50 km in 20 months.

Future research will focus on the monitoring, field collection and redistribution of the gall thrips in partnership with NRM groups, local government agencies and grazing property owners. Importation and host specificity testing of the gall mite will commence when it is safe to travel to Ethiopia to source the gall mites.

Figure 23 Damage caused by Acacia gall thrips (Acaciothrips ebneri) on prickly acacia.

Collaborators

- Anthony King (Agricultural Research Council - Plant Protection Research Institute, Pretoria, South Africa)
- Nathalie Diagne (Senegalese Institute of Agricultural Research, Centre National de Researches Agronomique, Bambey, Senegal).
- Mindaye Teshome (Forestry Research Centre, Addis Ababa, Ethiopia)
- Southern Gulf NRM, Mt Isa.
- Central Highlands Regional Council, Springsure.
- Whitsundays Regional Council, Proserpine.
- Burdekin Regional Council, Ayr.
- Geoff Penton, Doug Allpass and Jana Sykorova (Desert Channels Group)
- David Lawrence (Rockhampton Regional Council, Rockhampton)
- Andries van Jaarsveld (Isaac Regional Council, Moranbah)
- Geoffrey Swan (Biosecurity Queensland, Invasive Plants and Animals, Emerald)
- Dache Geiger (Winton Shire Council)
- Richmond Shire Council
- McKinlay Shire Council
- Flinders Shire Council

Key publications

Dhileepan, **K**., (2009). *Acacia nilotica* ssp. *indica*. pp. 17-37. In: *Weed Biological Control with Arthropods in the Tropics: Towards Sustainability* (eds. Muniappan, R., Reddy, D.V.P. & Raman, A.), Cambridge University Press, UK.

Dhileepan, **K**., **Shi**, **B**., **Callander**, **J**., **Taylor**, **D**., Teshome, M., Neser, S., Diagne, N. & King, A. (2019). Biological control of prickly acacia (*Vachellia nilotica* subsp. *indica*): New gall-inducing agents from Africa. In: H.I. Hinz et al. (eds.), *XV International Symposium on Biological Control of Weeds*, Engelberg, Switzerland, pp. 13-19, 26-31 August 2018. https://www.ibiocontrol.org/proceedings/

Shi, **B**. & **Dhileepan**, **K**. (2024). Life cycle, host specificity and potential impact of *Acaciothrips ebneri*, a biological control agent for prickly acacia (*Vachellia nilotica* subsp. *indica*) in Australia. *BioControl* 69(6): 699-712.

18. Chemical control of glory lily (*Gloriosa superba*)

Project dates

July 2024 – June 2026

Project team

Katrina Hodgson-Kratky and Melissa Brien

Project summary

Glory lily (*Gloriosa superba*) is a perennial climbing vine native to tropical Asia and Africa. Although valued as an ornamental plant, it has become a problematic weed in sandy coastal areas of eastern Australia. Glory lily competes aggressively with native species and forms dense monocultures that displace diverse coastal vegetation. These monocultures pose a significant risk to coastal landforms, as they offer minimal protection against wind and water erosion. The plant lacks fibrous surface roots and dies back during cooler months, leaving soil exposed for much of the year. Its large, persistent tubers and fragile underground stems further complicate control, and there are currently no effective mechanical or chemical methods available. To address this, our project aims to identify and optimise the use of herbicides for controlling glory lily.

A pot trial is underway at the Ecosciences Precinct to evaluate over a dozen herbicide combinations for their efficacy in controlling glory lily. Foliage assessments are in progress, and tuber evaluations are scheduled for later this year. A follow-up trial will commence in late 2025 to refine application rates and timing for the most promising treatments identified in the initial screening.

Figure 24 Tuber collection in Noosa

Figure 25 Pot trial after foliar herbicide application.

Collaborators

- Melissa Coyle (Noosa Council)

Key publications

Sparkes, E.C., Grace, S. & Panetta, F.D. (2002). The effect of various herbicides on *Gloriosa superba* L. in the Moreton district of Queensland, *Plant Protection Quarterly*, 17: 74-76.

19. Biological control and ecology of chinee apple (*Ziziphus mauritiana*)

Project dates

January 2023 – June 2027

Project team

Olusegun Osunkoya, Kunjithapatham Dhileepan, Boyang Shi and Christine Perrett

Project summary

Ziziphus mauritiana (Chinee apple) is a major environmental and pasture weed in northern Australia, forming dense thickets that impede livestock movement and reduce pasture productivity. Control using mechanical and chemical methods is expensive, and despite its long history in Australia, there is limited understanding of its ecology, spread, economic impact, or potential for biological control.

This project aims to address these knowledge gaps by assessing the weed's ecological traits, modelling its current and future distribution under climate change, quantifying its economic impact, and identifying candidate biological control agents from its native range in India and Pakistan. This foundational work will support long-term management and guide future biocontrol efforts.

To date, several important milestones have been achieved. Economic surveys have revealed that graziers spend an average of $65,000 per year on *Z. mauritiana* control, equating to roughly $30.29 per hectare, primarily through the use of heavy machinery. Climate and niche modelling indicate that the weed's range in Queensland is likely to expand from 14% of the state's area to 22.2% by 2050 and 25.5% by 2070. These models also suggest that while *Z. mauritiana* has not shifted its climatic niche since arriving in Australia, it is now exploiting a larger proportion of its fundamental niche, potentially due to ecological flexibility in its invaded range.

Soil seed bank surveys conducted at six heavily infested sites found no viable seeds of *Z. mauritiana* stored in the soil. However, infestations were associated with a significant decline in both the abundance and diversity of native seeds, indicating negative impacts on native plant communities. Further seed bank sampling is planned to clarify these trends. A leaf-infecting pathogen, *Pseudocercospora jujube*, has been identified in Australia, but it appears to have minimal impact on *Z. mauritiana*. No other specialist natural enemies have been detected locally. Surveys for potential biological control agents in the plant's native range are planned in Pakistan, pending the availability of funding.

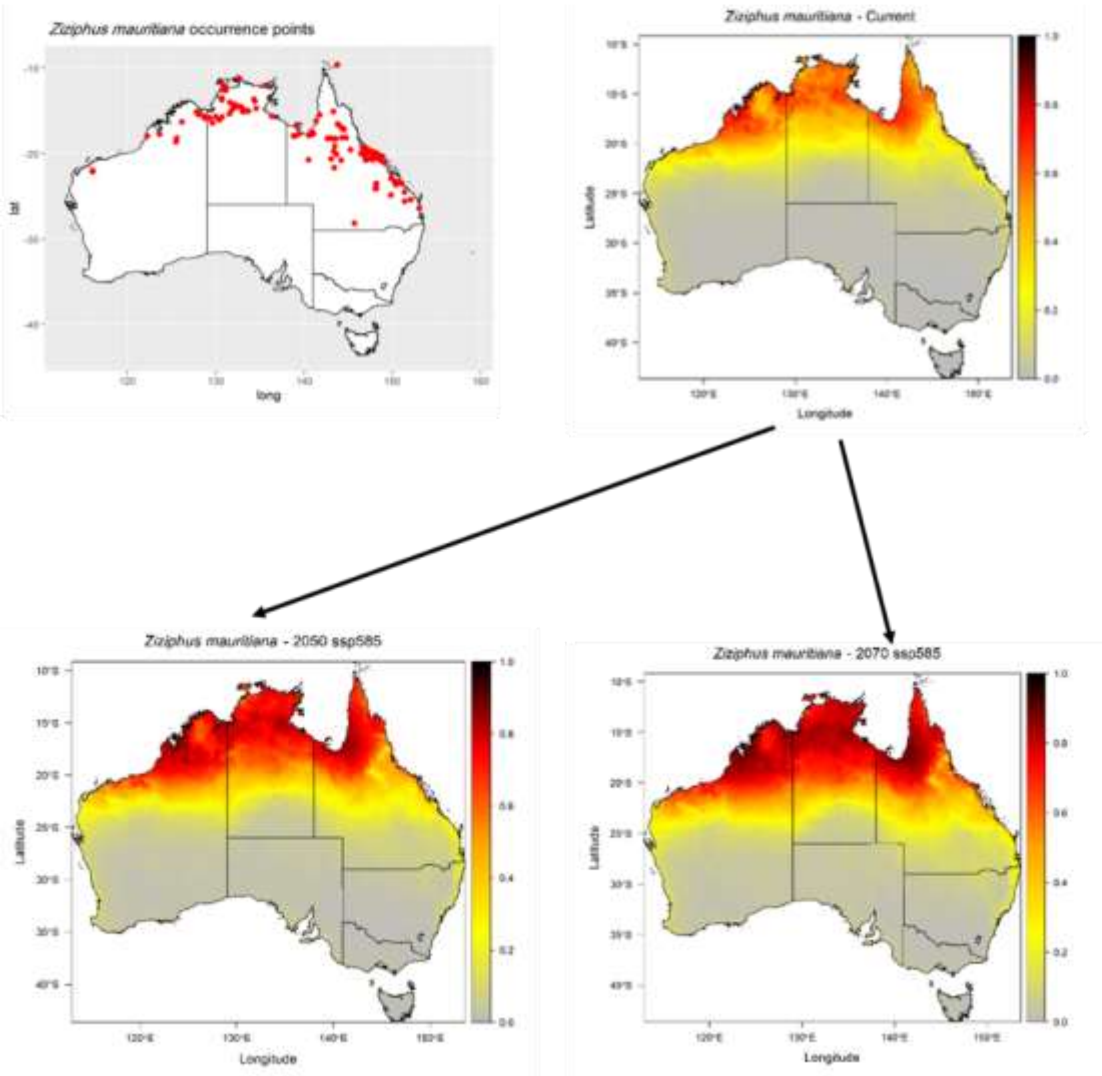

Figure 26 Spatial distribution and density of chinee apple in Australia based on MAXENT niche-based software prediction: upper illustrations are current and potential extent of the distribution, while the lower ones are distribution in response to time (i.e., climate change by 2050 and 2070, respectively).

Collaborators

- Wayne Vogler and Kelli Pukallus (TWRC)
- Bradley Gray and Moya Calvert (Prevention & Preparedness, BQ)
- NQ Dry Tropics NRM
- Scott Hardy (Whitsundays Regional Council)
- Roger Shivas (University of Southern Queensland)
- Shane Campbell (The University of Queensland, Gatton)
- Asad Shabbir (NSW Dept of Primary Industries)
- Kumaran Nagalingam (CSIRO, Brisbane)

- Jürgen Kellermann (State Herbarium of South Australia (Rhamnaceae taxonomy))
- Mengjun Liu (Hebei Agricultural University, Baoding, China)
- Saichun Tang (Guangxi Institute of Botany, Chinese Academy of Sciences, Guilin, China)
- Farzin Shaba (Qatar University, Doha)
- National Bureau of Agriculturally important insects (ICAR), Bangalore, India
- Central Institute of Arid Horticulture (ICAR), Bikaner, India
- University of Punjab, Lahore, Pakistan
- Bangladesh Agricultural University, Mymensingh, Bangladesh

Key publications

Grice, A.C. (2002). The biology of Australian weeds. 39. *Ziziphus mauritiana* Lam, *Plant Protection Quarterly*, 17: 2-11.

O'Brien, C.J., Campbell, S., Young, A., **Vogler**, **W**. & Galea, V.J. (2023). Chinee apple (*Ziziphus mauritiana*): A comprehensive review of its weediness, ecological impacts and management approaches, *Plants*, 12: 3213. https://doi.org/ 10.3390/plants12183213

Roberts, J., **Dhileepan**, **K**. & Florentine, S. (2024). A review of the biology, distribution, and management challenges posed by the invasive weed Ziziphus mauritiana L., with special reference to its invasion in Australia, *Weed Research*, *64*(1): 8-18.

20. Impact and management of Navua sedge (*Cyperus aromaticus*)

Project dates

July 2020 - June 2026

Project team

Olusegun Osunkoya, Christine Perrett, Boyang Shi and Kunjithapatham Dhileepan.

Project summary

Navua sedge (*Cyperus aromaticus*) is an invasive perennial weed spreading rapidly across northern Queensland, threatening both agricultural production and natural ecosystems. It reproduces via seeds and underground rhizomes, forms dense, unpalatable stands, and often outcompetes valuable tropical pasture species. Recent weed prioritisation identified it as requiring urgent management. Economic assessments, informed by consultation with graziers and sugarcane farmers, estimate the cost of control at around $89 per hectare.

Since the project began, research plots have been established at infested sites across Far North Queensland. These plots are being used to assess weed impacts on pasture diversity, soil seed banks, soil chemistry, and microbial communities. Attempts are being made in the field to impose appropriate herbicide treatments on the weed, but so far the findings have been inconclusive. At the same time, several potential biological control agents, including locally sourced mycoherbicides, are being tested for efficacy at CABI-UK.

An integrated weed management (IWM) strategy is being trialled, combining grazing management, herbicide application, and competition from desirable pasture species. Drone imagery, supported by artificial intelligence (AI), is being used for identification, farm-scale mapping, and quantification of yield loss due to the presence of the weed.

Initial findings show strong farmer engagement and willingness to implement biosecurity and IWM measures. Navua sedge has distinct chemical properties compared to co-occurring pasture grasses, with higher lignin and lower cellulose content. While impacts on soil chemistry in grazed areas are minimal, significant changes have been observed in natural or abandoned areas, including elevated micronutrients and heavy metals. Drone imagery from a trial site in Malanda is being analysed using AI to identify Navua sedge, track growth stages, and produce farm-scale weed maps.

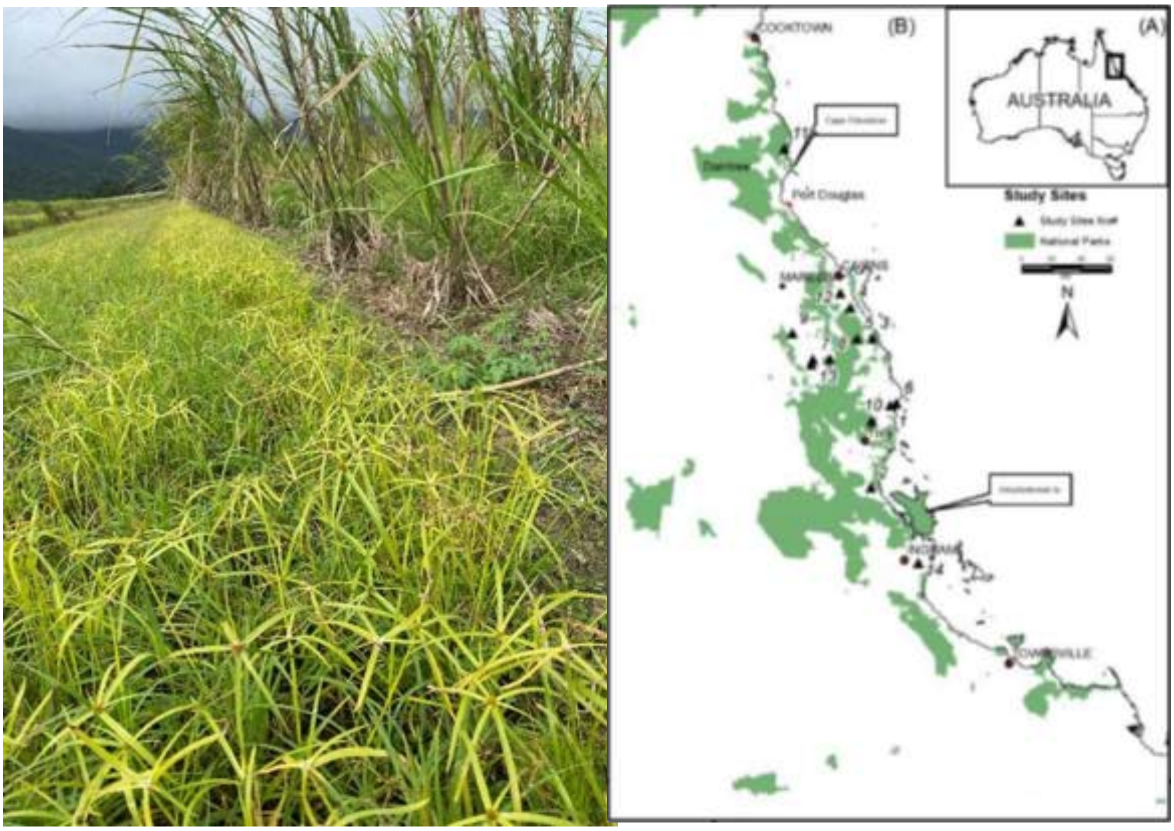

Figure 27 Left: The invasive Navua sedge, if not managed, often overran sugarcane farm plots in Gordonvale, Cairns, Far North Queensland. Right: Map of Australia, *showing study locations of Navua sedge infestation between Cooktown and Townsville in northern Queensland, Australia (A), and zoomed-in map indicating the 14 study sites (B). Numbers on the map represent nearest township to the study sites as follows: 1, McCutcheon; 2, Cardwell; 3, Babinda; 4, Aloomba; 5, Babinda II; 6, Cowley; 7, Malanda/Tarzali (upland); 8, Topaz (upland); 9, Atherton (upland); 10, Innisfail; 11, Cape Tribulation; 12, Gordonvale; 13, Malanda (upland); and 14, Ingham.*

Collaborators

- Tablelands Regional Council
- Hinchinbrook Shire Council
- Mareeba Shire Council
- Cassowary Coast Regional Council
- Malanda Beef Plan Group
- Joe Ralph (Beef producer, Malanda)
- Marcus Bulstrode (DPI, Agri Science Qld, South Johnstone)
- Travis Sydes (Far North Queensland Regional Organisation of Councils)
- Lawrence Di Bella (Herbert Cane Productivity Services Ltd, Ingham)
- Dr Shane Campbell (The University of Queensland, Gatton, Brisbane)
- Prof. Singerayer Florentine (Federation University, Ballarat, Victoria)
- Dr Nahina Islam (Central Queensland University, Rockhampton)

Key publications

Osunkoya, **O**.**O**., **Shi**, **B**. & **Dhileepan**, **K**. (2025). A glimpse at dynamics of invasion impact: The soil and plant tissue chemical profile of invasive Navua sedge (*Cyperus aromaticus*) and co-occurring pasture species, *Australian Journal of Botany* (in Review)

Osunkoya, **O**.**O**., **Shi**, **B**. & **Dhileepan**, K. (2025). Stakeholders' perspective on the economic cost of managing the invasive Navua sedge in tropical Queensland, Australia, *Weed Technology*, 39: e41.

Shi, **B**., **Osunkoya**, **O**.**O**., Soni, A., Campbell, S. & **Dhileepan**, **K**. (2023). Growth of the invasive Navua sedge (*Cyperus aromaticus*) under competitive interaction with pasture species and simulated grazing conditions: Implication for management, *Ecological Research*, 38: 331-346.

21. Risk assessment for new and emerging invasive weeds

Project dates

July 2021 - June 2026

Project team

Olusegun Osunkoya, Christine Perrett, Moya Calvert and Brad Gray

Project summary

Given Queensland's vast size, identification and awareness of emerging weed threats at state, regional, and local levels is critical. Through stakeholder consultation and citizen science, Biosecurity Queensland maintains and regularly updates a horizon list of emerging pest species (currently around 300) that may pose future threats to agriculture, human health, and natural ecosystems. Many of these weeds are in the early stages of invasion but have the potential to spread widely, especially under changing climate conditions. However, their likely distribution patterns and impacts remain poorly understood. To support more effective weed prioritisation and management across Queensland, this project aims to assess the risk posed by emerging weeds through distribution modelling and impact analysis.

Current and future distributions for 54 priority emerging weed species in Queensland were modelled using the niche-based MAXENT software. These species were also risk-assessed and prioritised at the state level. We compared climate tolerances in their native and invaded ranges using reciprocal niche models and tests of niche similarity and equivalency. These tests help to ascertain if an invasive species has retained its original ecological preferences (niche conservatism) or has adapted to new environmental conditions (niche shift) in the invaded range.

Results show that 33% of species, many of them succulents, have shifted their climatic niches indicating a need for broader surveillance across habitats that differ from their native ranges. Conversely, 13% of species showed strong niche conservatism, suggesting that a focus on areas matching their native climate is appropriate for monitoring and control.

We are now compiling data on the ecological, social, health, and economic impacts of these species to improve Queensland's emerging weed risk assessment and prioritisation framework.

Some examples of niche dynamics of emerging weeds in invaded region (i.e., Australia) based on climatic (temperature and rainfall) considerations:

Figure 28 No shift predicted in climatic requirements in Australia (i.e., niche conservatism) Praxelis clematidea and Hyparrhenia rufa.

Figure 29 Climatic niche shift predicted in Australia. Jatropha curcas (physic nut) and Cenchrus purpureus (elephant grass).

Figure 30 Partial niche expansion in Australia into novel habitat (evolutionary niche shift) Spathodea campanulate (African tulip tree) and Neptunia plena (water mimosa).

Figure 31 Partial niche expansion in Australia, but within the species fundamental nice, ie. the weed is released from home biotic constraints (realized nice shift). Cabomba caroliniana (Cabomba); Florestina tripteris (Sticky florestina) and Arundo donax.

Collaborators

- Queensland herbarium
- All Queensland Local Governments Areas
- NRM groups
- Biosecurity officers in each Queensland Local Government Area
- Josh Dyke (Local Government Association of Queensland)
- Jens Froese and Sam Nicol (CSIRO Brisbane)
- Jamie Camac (Centre for Biosecurity Risk Analysis Group, University of Melbourne Vic)
- Farzin Shabani (Qatar University, Qatar)

Key publications

Osunkoya, **O.O.**, Lock, C.B., **Dhileepan**, **K.** & Buru, J.C. (2021). Lag times and invasion dynamics of established and emerging weeds: Insights from herbarium records of Queensland, Australia, *Biological Invasions*, 23(11): 3383-3408.

Osunkoya, **O.O.**, **Perrett**, **C.**, **Calvert**, **M.** & **Csurhes**, **S.** (2022). Horizon scan for incoming weeds into Queensland, Australia. In: *22nd Australasian Weeds Conference*, 25-29 September 2022, Adelaide, South Australia.

Osunkoya, **O.O.**, Ahmadi, M., **Perrett**, **C.**, **Calvert**, **M.**, **Shi**, **B.**, **Csurhes**, **S.** & Shabani, F. (2025). Climate-induced range shift and risk assessment of emerging weeds in Queensland, Australia, *Ecology & Evolution, 15*(4): e71043.

22. Real-time, drone-based weed identification for improved pasture management - using parthenium, chinee apple and Navua sedge as exploratory examples

Project dates

July 2022 - June 2028

Project team

Olusegun Osunkoya, Christine Perrett, Kunjithapatham Dhileepan and Boyang Shi

Project summary

This is a collaborative project focussed on developing drone-based tools for weed identification and mapping. It centres on two main components: capturing aerial images of weeds using drones equipped with RGB and hyperspectral cameras and applying deep learning algorithms (AI) to automatically identify weeds from these images. The project aims to enable autonomous weed identification, generate landscape-scale weed distribution maps, and ultimately guide drones in delivering precise herbicide or biocontrol treatments.

Early work served as a proof of concept but achieved limited success. In 2023–24, both image capture and AI identification capabilities were improved, though further work is needed to validate accuracy through ground-truthing and to integrate these systems for real-time weed recognition. The project aims to leverage recent advances in drone imaging, computing power, and AI object detection to enable real-time, farm-scale weed mapping.

Field images of parthenium, Navua sedge, and chinee apple are being collected seasonally across the Whitsundays, Far North Queensland, and Central Queensland, respectively. These datasets are essential for training and validating AI models. The images are being processed for autonomous weed identification using AI. Classification of parthenium growth stages and identification from field images has so far been relatively poor. However, significant success has been achieved using datasets collected in controlled environments, where parthenium and naturally co-occurring non-target monocot species were used to train the models. The team is actively working to transfer these proven techniques from controlled settings to field-collected imagery, with the goal of achieving robust, field-applicable weed detection.

Figure 32 Drone imagery work: Chinee apple infestation in a grazing farm property in Bowen, Central Queensland. As part of the validation work, white rectangular plates are placed beside some individual chinee apple trees.

Figure 33 Above and below - Drone imagery work: Parthenium weed infestation on a grazing property in Monto- North Burnett region. As part of the validation work, infestation areas are divided into 4m x 4 m grids and coloured tags are placed on some individual parthenium weed plants. The operator of the drone (Peter Trotter) can be seen at the extreme left of the top image.

Collaborators

- Peter Trotter (Aspect Imaging, Sunshine Coast, Qld)
- Marcus Bulstrode (DPI, Agri Science, Tropical Weeds Research Centre, South Johnstone Qld)
- Dr Naina Islam, Dr Nanjappa Aswath and Assoc. Prof. Ray Biplop (Institute for Future Farming Systems, Centre for Intelligent Systems, CQU Rockhampton Qld)
- Prof. Felipe Gonzalez (Centre for Robotic Engineering- QUT Brisbane Qld)
- Prof. Mostafa Rahimi Azghadi (Agr. Technology and Innovation, JCU, Townsville, Qld)
- On ground pest officers working for Biosecurity Queensland in all local government areas

Key publications

Costello, B., **Osunkoya**, **O**.**O**., Sandino, J., Marinic, W., Trotter, P., **Shi**, **B**., Gonzalez, F. & **Dhileepan**, **K**. (2022). Detection of parthenium weed (*Parthenium hysterophorus* L.) and its growth stages using artificial intelligence, *Agriculture*, 12: 1838.

Hu, K., Coleman, G., Zeng, S., Wang, Z. & Walsh, M. (2020). Graph weeds net: A graph-based deep learning method for weed recognition, *Computer & Electronics in Agriculture*, 174: 105520.

Lambert, J.P.T, Hicks, H.L., Childs, D.Z. & Freckleton, R.P. (2018). Evaluating the potential of Unmanned Aerial Systems for mapping weeds at field scales: a case study with *Alopecurus myosuroides*, *Weed Research,* 58: 35-45.

23. Thatch grass (*Hyparrhenia rufa*) ecology for better management options

Project dates

June 2024 – July 2028

Project team

Olusegun Osunkoya, Katrina Hodgson-Kratky, Christine Perrett and Wayne Vogler

Project summary

Thatch grass (*Hyparrhenia rufa*) is an emerging invasive species in Queensland. Although it is categorised as a “sleeper weed”, it now extends from the southern border to the Torres Strait and is predicted to expand further under future climate conditions. It is spreading rapidly along roadsides, increasing the risk of wildfire and posing a serious threat to adjacent savannas and woodlands.

Despite its growing footprint, little is known about the species' biology, ecology or response to control measures. This collaborative project aims to address these knowledge gaps to support the development of effective, evidence-based management strategies

Initial research efforts have focused on surveying thatch grass invasion fronts and consulting with local government officers to better understand the current extent and behaviour of the weed. Field visits have been conducted across three regions along the eastern coast and northern parts of the state: Far North Queensland (Mareeba, Atherton, Weipa), Central Queensland (Bowen), and Wide Bay–Burnett/South East Queensland (Gympie, Nanango).

Future research will examine the species seed and reproductive biology, competitive interactions, genetic characteristics, ecological impacts, and habitat suitability. The project will also evaluate control options, including herbicide efficacy, replacement with competitive pasture species and improved biosecurity practices.

Figure 34 Thatch grass infestations. Clockwise from top left: Far North Queensland along Kennedy Highway: Ravenshoe on the Atherton Tablelands; Mareeba shire LG; along railway lines in Mookara Rd, Bowen Central Queensland; treated infestation in Barambah in the Gympie regional council area.

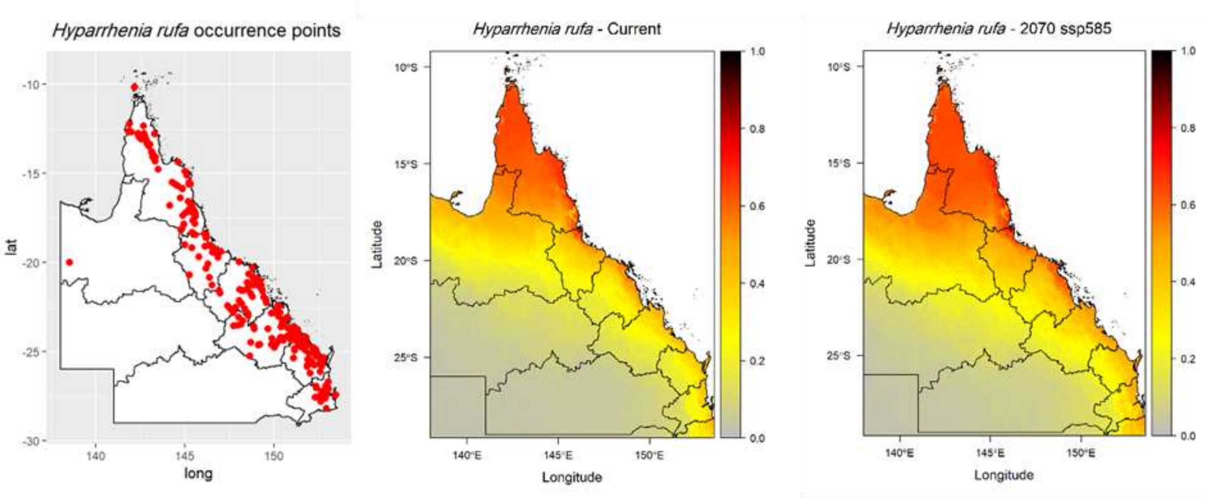

Figure 35 Thatch grass in Qld: actual (far left), and potential distribution now (middle) and in response to climate change by 2070 (far right). Bars indicate probability of occurrence.

Collaborators

- Cook Shire Council
- Mareeba Shire Council
- Atherton Tableland Council
- Whitsunday regional Council
- Gympie regional Council
- Local Government Association of Queensland/regional Organisation of Councils
- Coastline Regional Organisations of Council groups – Far North Queensland, North Queensland, Whitsunday, Central Queensland, Wide Bay Burnett, Southeast Queensland
- Dr Farzin Shabani (University of Qatar, Doha)
- Prof. Bhagirath Singh Chauhan (University of Queensland)
- Chemistry Centre (Dept of Environment, Science and Innovation (DESI) Qld)

Key publications

Lira-Martins, D., Xavier, R.O., Mazzochini, G.G., Verona, L. S., Andreuccetti, T., Martins, É.S. & Oliveira, R.S. (2025). Soil acidification controls invasive plant species in the restoration of degraded Cerrado grasslands, *Restoration Ecology, 33*(1): e14294.

Osunkoya, **O**.**O**., Lock, C.B., **Dhileepan**, **K**. & Buru, J.C. (2021). Lag times and invasion dynamics of established and emerging weeds: insights from herbarium records of Queensland, Australia, *Biological Invasions,* 23(11): 3383-3408.

Osunkoya, **O**.**O**., Ahmadi, M., **Perrett**, **C**., **Calvert**, **M**., **Shi**, **B**., **Csurhes**, **S**. & Shabani, F. (2025). Climate-induced range shift and risk assessment of emerging weeds in Queensland, Australia, *Ecology and Evolution*, *15*(4): e71043.

24. Weed biological control agent rear and release

Project dates

July 2024 – June 2026

Project team

Kelli Murree (Pukallus), Mary Butler, Jason Callander and Zach Shortland

Project summary

This project aims to mass-rear, release, monitor and redistribute biological control agents in Queensland and northern Australia, for the control and management of invasive weed species. Recent agents mass-reared at the Tropical Weeds Research Centre (TWRC) include, *Acaciothrips ebneri* (gall thrips) for *Vachellia nilotica* (prickly acacia) and *Zygogramma* syn.*Calligrapha bicolorata* (leaf-feeding beetle) for *Parthenium hysterophorus* (Parthenium), *Lagocheirus funestus* (brown prickly pear beetle) for *Opuntia* species (prickly pear).

The project conducts monitoring of establishment, spread and impact of current and past biological control agents and assists with the collection and redistribution of agents on invasive weed species for landholders and stakeholders.

The *Acaciothrips ebneri* project has released over 6,400 galled stems into prickly acacia infestations across ten Queensland Local Government areas. Establishment is noted at most sites, with the thrips spreading to nearby trees of all sizes and causing significant impact to flowering, seeding and the overall growth of prickly acacia.

Lagocheirus funestus was originally released throughout Queensland in the 1930's and a mass-rear and release program recommenced in 2024 to redistribute the longicorn beetle for control of tree prickly pear species. So far, 680 adults have been released from TWRC and Ecosciences Precinct colonies across eight Queensland Local Government areas.

Nearly 1,800 adult *Zygogramma bicolorata* beetles have been released across five Queensland local government areas to help combat parthenium. The leaf-feeding beetle was originally released in 1985, with establishment noted within Central and Southeast Queensland. Additional distributions saw the beetle released into new areas of parthenium infestations.

Figure 36 Adult Lagocheirus funestus (brown prickly pear beetle) size comparisons between individuals, with adults ranging from 20mm – 40mm in length. Note the antennal hooks on the larger male and 'X' patterning on the elytra (back).

Figure 37 Mass-rearing Lagocheirus funestus (brown prickly pear beetle) under glasshouse conditions at Tropical Weeds Research Centre.

Figure 38 A science technician releasing Parthenium leaf-feeding beetle (Zygogramma syn.Calligrapha bicolorata) into a parthenium infestation. Zygogramma adult beetle (insert).

Collaborators

- Toowoomba Regional Council
- Peter Pickering (Queensland Parks and Wildlife Service)
- Kyle Morris (Powerlink)
- Megan Leech (DPI)
- Burdekin Shire Council
- Charters Towers Regional Council
- Townsville City Council
- Carpentaria Shire Council
- Isaac Regional Council
- Central Highlands Regional Council
- Longreach Shire Council
- Etheridge Shire Council
- Flinders Regional council
- Barcaldine Regional council
- Banana Shire Council
- North Burnett regional council
- South Burnett Regional Council
- Scenic Rim Regional Council
- Western Downs Regional Council
- Southern Downs Regional Council

Key publications

Pukallus (Murree), **K**. & **Butler**, **M**. (2025). Mass rearing and releasing biological control agents for weed species. What's it all about? In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland.

25. Biological control compendium

Project dates

July 2023 – July 2026

Project team

Kelli Murree (Pukallus) and Mary Butler

Project summary

A biological control agent compendium will be compiled for agents released within Queensland for the control and management of invasive weeds. The compendium will include agent biology information, identification and history. It will also include agent locations utilising data shared on open digital platforms to enable field collections and redistribution of agents by landholders & local government staff and release procedures.

So far, 177 observations have been entered into the digital platform iNaturalist Australia. These comprise of 28 biological control agents, to assist with the identification, location and noted impact of biological control agents within Queensland. These data will transfer into the Atlas of Living Australia, an additional open catalogue resource of biodiversity data within Australia. Agent location, seasonal timing details and identification profiles all aid in the collection and redistribution of released agents.

Fact Sheet templates of new and previous biological control agents have been developed, to be incorporated into the Compendium and available for printing.

Collaborators

- Thomas Mesaglio (iNaturalist Australia)

Key publications

Pukallus, **K**. (2025). Utilising citizen science data for monitoring released biological control agents on invasive weed species. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland.

26. Sicklepod ecology and control

Project dates

July 2019 – June 2028

Project team

Melissa Setter and Stephen Setter

Project summary

Ranging from Cape York to Mackay, Sicklepod (*Senna obtusifolia*) is a serious weed of many parts of northern Queensland and often grows in pastures, crops, road and power corridors and creek banks. It degrades riparian zones and pasture systems reducing biodiversity and beef production.

In this project we aim to improve management tools for sicklepod by investigating: seed production & longevity, pre-emergent herbicide efficacy, and low-volume/high-concentration herbicide application techniques.

Pre-emergent herbicide efficacy research in the Dry Tropics has been completed, and efficacious herbicides and rates identified. Using similar methodology and herbicides, Wet Tropics pre-emergent herbicide efficacy research has commenced, and early assessments are favourable in some locations. Seed longevity research is ongoing, to date there is still some seed surviving after 8 years buried in soil in the Wet Tropics.

Figure 39 Top - an untreated (Control) plot at the Yalboroo site in January 2025. Below: The grass square of a treated plot (Grazon® Extra as post and pre-treatment) amongst the untreated edges of sicklepod at the Yalboroo site in January 2025.

Collaborators

- Darryn Higgins (Cook Shire Council)
- Maria Ferraro and Sharon Stephens (Mackay Regional Council)
- Matt Buckman (Hinchinbrook Shire Council)
- Jade Monda (Cairns Regional Council)
- Brad Everett (Douglas Shire Council)
- Mario di Carlos and Sina Leis (DPI Biosecurity officers)
- Wayne Vogler (DPI Biosecurity Queensland)
- Various officers of Department of Environment, Tourism, Science and Innovation
- Landowners and pastoralists

Key publications

Dunlop, E.A. (2007). Mapping and modelling the invasion dynamics of *Senna obtusifolia* at different levels of scale in Australia. PhD thesis, Queensland University of Technology.

Neldner, V.J., Fensham, R.J., Clarkson, J.R. & Stanton, J.P. (1997). The natural grasslands of Cape York Peninsula. Description, distribution and conservation status, *Biological Conservation*, 81: 121-136.

Setter, **M.J**., **Setter**, **S.D**., Higgins, D. & **Vogler**, **W**. (2019). Controlling weed recruitment in isolated areas of Cape York Peninsula, In: 1st Queensland Pest Animal and Weed Symposium, 20-23 May 2019, Gold Coast, Queensland.

27. Aquatic weeds of northern Australia - ecology and control

Project dates

July 2019 – June 2025

Project team

Melissa Setter and Stephen Setter

Project summary

Aquatic weeds are an increasing problem, especially with increased commercial trade of aquatic plants, particularly via the internet. Several escaped aquarium plants are markedly problematic in the Wet Tropics but have potential distributions across large parts of northern Australia. Focus species included hygrophila (*Hygrophila costata*), bogmoss (*Myacca fluviatilis*), Amazon frogbit (*Limnobium laevigatum*) and Aleman grass (*Echinochloa polystachya*).

This project proposes to answer specific ecological questions to improve management of current infestations and predict/restrict further infestations. Control options have also been investigated for selected species. Specifically, research focussed on:

- Seed and vegetative reproduction abilities in regional populations of hygrophila.
- Herbicide control of bogmoss.
- Seed viability and longevity in regional populations of Amazonian frogbit.
- Seed viability and longevity in regional populations of Aleman grass.

Research into herbicide control of Aleman grass and bogmoss, and UAV application and assessment have been completed. Several collections and investigations of Aleman grass seed did not show any viable seed, but it still cannot be completely dismissed. No hygrophila seed viability was found and continuing the research is not considered to be valuable at present. Insufficient numbers of Amazon frogbit fruiting bodies were found in North Queensland, so the planned seed longevity studies to assist with understanding dispersal mechanisms had to be discontinued.

For the reasons listed above, the project is concluding in June 2025.

Figure 40 The Aleman grass herbicide trial site was sprayed using a DJI Agras T16 spray drone.

Collaborators

- Biosecurity Researchers, including Wayne Vogler, Clare Warren, Joe Vitelli and Tobias Bickel (DPI Biosecurity Queensland)
- Biosecurity Officers, including Michael Graham and Dave Green (DPI Biosecurity Queensland)
- Travis Sydes (Far North Queensland Regional Organisation of Councils)
- Jade Monda (Cairns Regional Council)
- Matt Buckman (Hinchinbrook Shire Council)

- Graham Wienert (Mareeba Shire Council)
- Marcus Bulstrode and Carole Wright (DPI Queensland)

Key publications

Setter, **M.J**., **Setter**, **S.D**. & Styman, D.T. (2017). Survival and buoyancy of *Hygrophila costata* stem fragments in salt, brackish and fresh water. In: 14th Queensland Weed symposium, 4-7 December 2017, Port Douglas, Queensland.

Setter, **M**., **Setter**, **S**., **Vogler**, **W**. & **Warren**, **C**. (2023). Effect of foliar herbicides and Nemo® wetter on Aleman grass (*Echinochloa polystachya*) in north Queensland, Australia. In: 2nd Pest Animal and Weed Symposium, 28-31 August 2023, Dalby, Queensland.

Setter, **S**., **Setter**, **M**. & **Vogler**, **W**. (2023). Effect of foliar herbicides on emergent bogmoss (*Mayaca fluviatilis* Aubl.) in north Queensland, Australia. In: 2nd Pest Animal and Weed Symposium, 28-31 August 2023, Dalby, Queensland.

28. Developing biocontrol agents for riparian weed management - Madeira vine

Project dates

November 2024 – June 2025

Project team

Tamara Taylor, Danielle Preston, Liz Snow and Lou Gill

Project summary

Madeira vine (*Anredera cordifolia*) is one of the five most invasive plants in south-east Queensland and is listed as a Weed of National Significance. It causes significant damage to vegetation along creeks and rivers in Queensland and New South Wales, smothering native plants and trees and preventing livestock and native animal access to water. A biological control agent, the Madeira vine beetle from Argentina (*Plectonycha correntina*), was released in 2011. The leaf feeding adult beetles and larvae are capable of severely defoliating Madeira vine. However, the impact of this biocontrol agent has been reported in many regions to be insufficient for vine suppression.

Seqwater are funding this research via Healthy Land & Water (HL&W). DPI researchers are working with HL&W towards improving biological control options for Madeira vine. We believe that long-term establishment of adequate numbers of the current biological control after field release could be hampered by abiotic factors, such as micro-climate and soil, or from biotic factors such as predation. We aim to gain a better understanding of these variables, as well as determining whether there is genetic diversity within the vine populations that may explain variability in efficacy of the Madeira vine beetles. These data will also assist us with searching for a new biological control agent that could potentially be a better match for our climate and/or compliment the impact provided by the leaf feeding beetles.

Research this year included commencing mapping of Madeira vine distribution and locating persistent populations of the Maderia vine beetles, so that we can start building a picture of their ideal environmental requirements. These data will help us to provide advice on where Madeira vine management should be focussed as well as identifying where future releases of the biocontrol agents are likely to be successful. We have commenced laboratory experimentation to quantify the influence of temperature on the Madeira vine beetle development rate (fecundity and life-cycle). Madeira vine leaf samples from across Queensland are being collected for genetic analysis to determine if there is any variation within the population that may influence current or future biological control success.

Figure 41 Madeira vine (Anredera cordifolia) infestation at Redwood Park, Toowoomba.

Figure 42 Madeira vine beetle (Plectonycha correntina) biological control agent for Madeira vine. Left: adults beetles. Right: Leaf damage from beetle larvae under laboratory conditions.

Collaborators

- Leonard Ainsworth and Leigh Gould (Healthy Land & Water)
- Toowoomba Regional Council
- Lockyer Valley Regional Council
- Logan City Council
- Mary River Catchment Coordinating Committee

Key publications

Snow, **E**. **L**., Palmer, W.A. & Senaratne, K.W. (2012). The release of *Plectonycha correntina*, a leaf feeding beetle for the biological control of Madeira vine. In: 18th Australasian Weeds Conference, 8-11 October 2012, Melbourne, Victoria.

Snow, **E**.**L**. & **Dhileepan**, **K**. (2013). Update of biological control research for cat's claw creeper and Madeira vine. In: 12th Queensland Weed Symposium, 15-18 July 2013, Hervey Bay, Queensland.

Vivian-Smith, G., Lawson, B.E., Turnbull, I. & Downey, P.O. (2007). The biology of Australian weeds 46, *Anredera cordifolia* (Ten.) Steenis, *Plant Protection Quarterly*, 22(1): 2.

29. *Harrisia martinii* biological control and integrated management

Project dates

July 2020 – June 2025

Project team

Tamara Taylor, Lauren Kelk and Danielle Preston

Project summary

Over the last year, *Harrisia martinii* has been reported as increasing in density and distribution throughout Queensland. This is likely the result of an increase in rainfall in some regions, leading to rapid growth, flowering and fruiting, as well as flood assisted dispersal of plants and seeds. Several media reports have highlighted injuries to people and livestock from Harrisia cactus spines, calling for assistance with management. New biological control agents are high on the list of landowner requests due to the costs of repeated chemical application which is required to prevent regenerative growth from underground tubers.

Biosecurity Queensland is working with Universidad Nacional del Nordeste in Argentina who have been looking for additional potential biological control agents where *Harrisia martinii* originates. They report that *Harrisia martinii* is now rare in Argentina due to extensive land clearing in its native habitat. However, they have found and formally identified two species of flies from the *Dasiops* genus that cause significant damage to Harrisia cactus stems. So far, our collaborators have not been able to rear the flies in the laboratory but will continue with their efforts during the next field collection season from October 2025. We plan to travel to Argentina to collect and import fly larvae into quarantine in late 2025 so that we can conduct our own attempts to artificially induce swarm mating, which will enable us to rear a colony of the flies for host testing.

Although delayed, we aim to release an integrated management manual for *Harrisia martinii* in July 2025. This will include the results of studies quantifying the impact of fire and livestock feeding, as well as a comprehensive summary of chemical application options. The manual also includes research results from studies to determine habitat preferences of the current *Harrisia martinii* biocontrol agent (*Hypogeococcus pungens*) and recommendations about where and when to release them. This information should assist land managers to determine which control methods are available to them and where they are likely to be most successful.

Figure 43 A collaborator from Universidad Nacional del Nordeste, Argentina, searching for nocturnal insects on Harrisia cactus and Dorper sheep on a property in Goondiwindi where Harrisia martini grazing has been investigated.

Collaborators

- Katrina Hodgson-Kratky, John Conroy, Megan Leech, Ted Vinson, Kelli Muree, Geoff Swan and Nathan March (DPI)
- Angela Ezeh (University of Queensland)
- Andrew McConnachie (NSW Department of Primary Industries)
- Hugh Leckie (NSW Government, Local Land Services)
- Clare Felton-Taylor (Narrabri Shire)
- Debi Bancroft (NSW Northern Slopes Landcare Association)

- Harrisia Cactus Task Force (NSW Department of Primary Industries – North-West Local Land Services Agency)
- Goondiwindi Regional Council
- Robert (Doughy) Deans, Goondiwindi
- CONICET – CECOAL – Universidad Nacional del Nordeste, Argentina

Key publications

Ezeh, A.E., Hereward, J.P., **Day**, **M.D**., **Taylor**, **T**. & Furlong, M.J. (2023). Confirming the identity of the Hypogeococcus species (Hemiptera: Pseudococcidae) associated with *Harrisia martinii* (Labour.) Britton (Cactaceae) in Australia: implications for biological control, *Austral Entomology*, 62(2): 235-245.

Ezeh, A.E. (2024). Herbivore-plant interactions: implications for the biological control of *Harrisia martinii* (Cactaceae) by Hypogeococcus species (Hemiptera: Pseudococcidae) in Australia. PhD Thesis, University of Queensland.

Ezeh, A.E., Zalucki, M.P., **Day**, **M.D**., **Taylor**, **T**. & Furlong, M.J. (2025). Thermal biology of *Hypogeococcus pungens* (Hemiptera: Pseudococcidae) explains its variable performance as a classical biological control agent for *Harrisia martinii* (Cactaceae) in Australia, *Environmental Entomology*, 54: 454-466.

30. Biological control of pasture weeds in Vanuatu and Queensland – sicklepod

Project dates

October 2018 – June 2025

Project team

Tamara Taylor, Lauren Kelk and Danielle Preston

Project summary

Biosecurity Queensland have been collaborating with Manaaki Whenua Landcare Research New Zealand on a project that aims to find biological control solutions for pasture weeds in Vanuatu including Sicklepod (*Senna obtusifolia* and *S. tora*). The project is funded by the New Zealand Ministry of Foreign Affairs and Trade as part of an aid program that provides Pacific Island countries with assistance to support their grazing industries. This collaboration has resulted in valuable progress toward finding biological control agents that might assist with management of sicklepod, which is a category 3 restricted species in Queensland.

We aim to import a potential biocontrol agent, *Conotrachelus* sp. Dejean, 1835 (Coleoptera, Curculionidae) from Mexico and commence host specificity testing on closely related plant species that occur in Vanuatu and Queensland. *Conotrachelus* sp. is a stem galling weevil that was previously imported in the late 1990s. Data from early testing were positive.

However, the laboratory culture soon failed due to the insects not eclosing from pupation after winter.

A new importation from Mexico was conducted in November 2024. Hundreds of sicklepod stems with stem galls were collected and returned to our quarantine facility in Brisbane. In Mexico, sicklepod is a very fast-growing species with an annual habit. The timing of seed germination and subsequent plant growth is determined by the start of seasonal rainfall, which can sometimes be unpredictable. Despite the number of stem galls we collected, there were no live larvae or pupae in the stems as we had arrived too late. Our next importation is planned for August 2025, with a goal to collect adults as well as stem-galls. We have high hopes that we will be successful this time.

Figure 44 A DPI science technician in a patch of sicklepod in Mexico where Conotrachelus sp. weevil stem galls were collected in November 2024 and bags of sicklepod stems with Conotrachelus sp. weevil stem galls from Mexico, ready for export back to Brisbane in November 2024.

Collaborators

- Manaaki Whenua Landcare Research, New Zealand
- Ministry of Foreign Affairs and Trade, New Zealand
- Biosecurity Vanuatu
- Department of Environment, Vanuatu
- Michael Day (entomologist and biological control consultant, DPI honorary)
- Malaysian Agricultural Research and Development Institute
- Kelvin Guerrera (environmental consultant biologist and entomologist, Dominican Republic)
- Ricardo Segura (Consultant entomologist, Mexico)
- Ek del Val de Gortari (Consultant ecologist - National Autonomous University of Mexico)
-

Key publications

Cock, M.J.W. & Evans, H.C. (1984). Possibilities for biological control of *Cassia tora* and *C. obtusifolia*, *Tropical Pest Management*, 30:339-350.

Palmer, W.A. & Pullen, K.R. (2001). The phytophagous arthropods associated with *Senna obtusifolia* (Caesalpiniaceae) in Mexico and Honduras and their prospects for utilization for biological control, *Biological Control*, 20: 76-83.

Palmer, W.A., Heard, T.A., Sheppard, A.W. (2010). A review of Australian classical biological control of weeds programs and research activities over the past 12 years, *Biological Control*, 52(3): 271-287.

31. Chemical registration – providing tools for weed control

Project dates

July 2012 – June 2027

Project team

Joseph Vitelli, Katrina Hodgson-Kratky, Melissa Brien and David Holdom

Project summary

For many weed species and management situations, chemical control options are limited. This is because the cost of registering new use patterns on herbicide labels often outweighs the expected economic return for product registrants. To address this gap, minor use permits issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA) allow for "off-label" use of registered products, enabling chemical control for weeds and situations not covered by product labels.

From 2024–25, Biosecurity Queensland secured 17 APVMA minor use permits. These permits support the management of invasive weed species such as bamboo, hymenachne, Aleman grass, Amazon frogbit, cacti, Siam weed, fireweed and kidneyleaf mudplantain. Notably, the Siam weed permit now includes a range of aerial application options, which will significantly improve treatment efficiency in large or difficult-to-access areas. Permits were also renewed for the insecticide control of a lantana stem sucking insect in ornamental fiddlewood trees, and for the use of chlorine and glyphosate in quarantine settings.

Updated control recommendations are available in pest fact sheets on the Biosecurity Queensland website: https://www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/fact-sheets.

Collaborators

- Local governments
- Perry Ward, Todd Thistleton, Harry Smith and Ben McClymont (Seqwater)

- Doug Paton (Sumitomo Chemical)
- Marie Bigot (CSIRO)
- Sonia Jordan, Wayne Vogler, Simon Brooks, Clare Warren, Melissa Setter, Stephen Setter, Dannielle Brazier, Brett Jackson, Christine Perrett and Tobias Bickel (Biosecurity Queensland)
- Shelley Inglis and Josh Maeer (Northern Territory Government)

Key publications

APVMA (2022) PER11463: Permit to allow minor use of picloram, triclopyr, aminopyralid, imazapyr, glyphosate, 2,4-D, fluroxypyr and many other herbicides for control of environmental weeds in non-crop areas. Issued 14 April 2022.

32. Treatments and strategies for red witchweed (*Striga asiatica*) eradication

Project dates

July 2014 – June 2025

Project team

Joseph Vitelli, Katrina Hodgson-Kratky, Bahar Farahani and Melissa Brien

Project summary

Red witchweed (RWW) is a national eradication target that was first discovered in Australia in 2013 on a sugarcane farm west of Mackay. As a parasitic plant that affects several grass and legume crops, RWW poses a significant threat to the agricultural industry if allowed to spread. Over the last ten years, the eradication program has focused on reducing the soil seed bank and preventing further seed production on infested properties. The aims of this project were to support the eradication program by optimising seed bank depletion treatments and tracking its progress toward eradication.

Monitoring the RWW soil seed bank proved challenging because the seeds are very small and difficult to identify in soil samples. To overcome this, seeds were enclosed in plastic sachets within perforated canisters and buried across the eradication zone. Each year, seeds were exhumed and tested for viability. In the first year, viability dropped by approximately 50%, followed by an annual decline of 6.5%, reaching around 1.0% in 2022 and <0.2% by 2023. More than 99.9% of seeds exhumed in 2024 and 2025 were also non-viable, providing strong evidence that the RWW seed bank has been depleted after seven years of soil treatments. As a result, more than 98% of affected paddocks have now been released from quarantine.

A four-year pot trial at the Ecosciences Precinct was also conducted to optimise treatment strategies. Tested methods included soil fumigation with dazomet, ethylene application, and planting a false host crop to trigger suicidal germination. The combination of all three treatments resulted in the most substantial reduction in seed viability—over 90% within three years—confirming their effectiveness in accelerating soil seed bank decline and supporting eradication efforts.

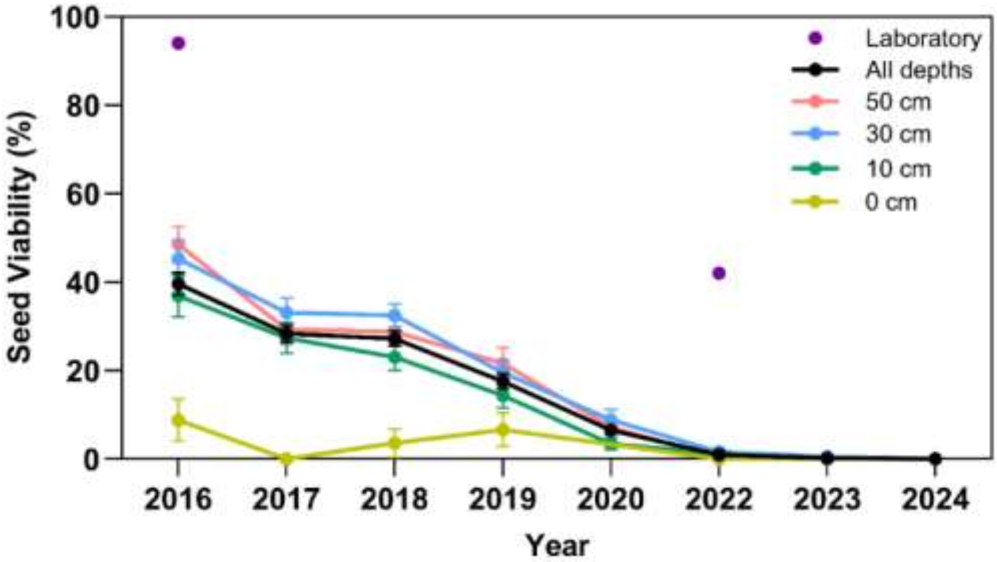

Figure 45 Decline in viability of red witchweed seeds buried in the eradication zone and subjected to various soil treatments.

Collaborators

- Michelle Smith and Matthew Birch (Biosecurity Queensland)
- University of Queensland

Key publications

Epée, M. & Paul,T. (2018). Comparative analysis on the management of the parasitic weed *Striga* in the USA, Australia and Kenya.

Smith, M., Bowditch, T., Birch, M., & **Vitelli**, **J**. (2023). The witch hunt continues – the use of integrated research and treatment approaches to rid Australia of the parasitic plant pest red witchweed. In: 2nd Pest Animal and Weed Symposium, 28-31 August 2023, Dalby, Queensland.

Williams, **A**.**M**., **Riding**, **N**. & **Vitelli**, **J**.**S**. (2022). Monitoring *Striga asiatica* (Orobanchaceae) seedbank for eradication success. In: 22nd Australasian Weeds Conference, 25-29 September 2022, Adelaide, South Australia.

33. Improved control strategies and methods for *Leucaena leucocephala*

Project dates

July 2023 – December 2026

Project team

Joseph Vitelli, Katrina Hodgson-Kratky, Bahar Farahani and Clare Warren

Project summary

Leucaena is a forage crop that has become a major environmental weed in tropical and sub-tropical Australia. The management of leucaena is problematic, with limited cost-effective control options for dense infestations and a long-lived seed bank that results in heavy regrowth following above-ground control. This collaborative project led by the University of Queensland is evaluating a range of control techniques and strategies for different life stages of leucaena and in different environments.

Two trials testing chemical control of leucaena seeds planted in pots have been completed. In one trial conducted in Gatton, several products were screened for pre-emergent control of leucaena, with tebuthiuron and picloram identified as the most effective herbicides. In another trial conducted at the Ecosciences Precinct, the fumigant dazomet was applied to the soil. However, it had no effect on seed viability regardless of seed depth or product rate suggesting that soil fumigation with dazomet is not an effective method for depleting the leucaena soil seed bank. Fire is another method currently being tested to target the soil seed bank. A fire simulation trial in Gatton is ongoing where soil cores containing seeds of leucaena and other species were exposed to oven temperatures at 90°C for 2 min or 150°C for 1 min and then treated with smoke water. Seedling emergence is being monitored to understand how germination and seed viability in these species are affected by fire.

A post-emergent herbicide screening trial is also underway in Gatton. Various products are being assessed for their ability to control mature leucaena plants when applied as overall foliar sprays. One year post-treatment, several herbicides have caused substantial damage, with aminocyclopyrachlor and aminopyralid showing the greatest efficacy. Monitoring will continue for another 12 months to assess plant recovery and long-term control. A follow-up trial has also been initiated to evaluate leucaena's response to varying rates of the most promising herbicides identified in the initial screening trial.

Figure 46 Trials assessing dazomet fumigation (left) and fire (right) for depleting the leucaena soil seed bank.

Figure 47 Effects of foliar herbicides on mature leucaena plants one year after treatment.

Collaborators

- Caian Oliveira, Alexander Leslie, Shane Campbell, Bhagirath Chauhan and Victor Galea (The University of Queensland)
- Eric Dyke and Glenn Proctor (Bundaberg Regional Council)
- Wayne Vogler (Biosecurity Queensland)

Key publications

Campbell, S., **Vogler**, **W**., **Brazier**, **D**., **Vitelli**, **J**. & **Brooks**, **S**. (2019). Weed leucaena and its significance, implications and control, *Tropical Grasslands—Forages Tropicales*, *7*(4): 280-289.

34. Integrated management of giant rat's tail grass (*Sporobolis* spp.)

Project dates

July 2024 – June 2027

Project team

Joseph Vitelli, Katrina Hodgson-Kratky, Bahar Farahani, Melissa Brien and David Holdom

Project summary

Giant rat's tail grass (GRT) and other introduced weedy *Sporobolus* species are unpalatable pasture weeds that cause substantial economic losses to the pastoral industry each year.

While integrated management practices, combining chemical and mechanical control with the maintenance of competitive pasture species is recommended, it has proven largely ineffective for many graziers. One of the key challenges in GRT management is its persistent soil seed bank, which necessitates long-term control strategies that are often costly. Furthermore, chemical control options for GRT remain limited. While biological control offers potential to support existing approaches, no agents are currently approved for use against GRT in Australia. This project aims to identify alternative chemical control options and develop fungal biocontrol agents that can be integrated with current practices to improve GRT management.

Several pot trials were conducted at the Ecosciences Precinct to optimise and identify new chemical control options. In one trial, the effect of dazomet soil fumigation was assessed on GRT seeds buried in soil at various depths. Dazomet significantly reduced both germination and seed viability at doses below recommended label rates, suggesting that dazomet could be used in the field for depleting the GRT soil seed bank. Two wick wiper simulation pot trials were also conducted to identify alternative herbicides and optimise application volume. Micropipettes were used to apply herbicides directly to GRT foliage, ensuring consistency and accuracy, as wick wiper applicators can vary in output volume.

Assessments of fungal pathogens identified as promising candidates for biocontrol of GRT are also underway. Isolates of *Stagonospora tauntonensis*, an endemic species, were tested for pathogenicity to GRT under sterile laboratory conditions. These isolates caused severe damage to GRT seedlings, but further testing on mature plants under glasshouse conditions is required to confirm efficacy and assess host-specificity. Survey sites have also been established at a grazing property in Conondale to monitor the natural infection of the GRT leaf smut (*Ustilago sporoboli-indici*), a naturalised pathogen. These sites will be monitored for up to three years to evaluate the smut's impact on GRT populations and its specificity to target hosts.

Figure 48 Leaf smut infection in GRT (left) and survey site in Conondale (right)

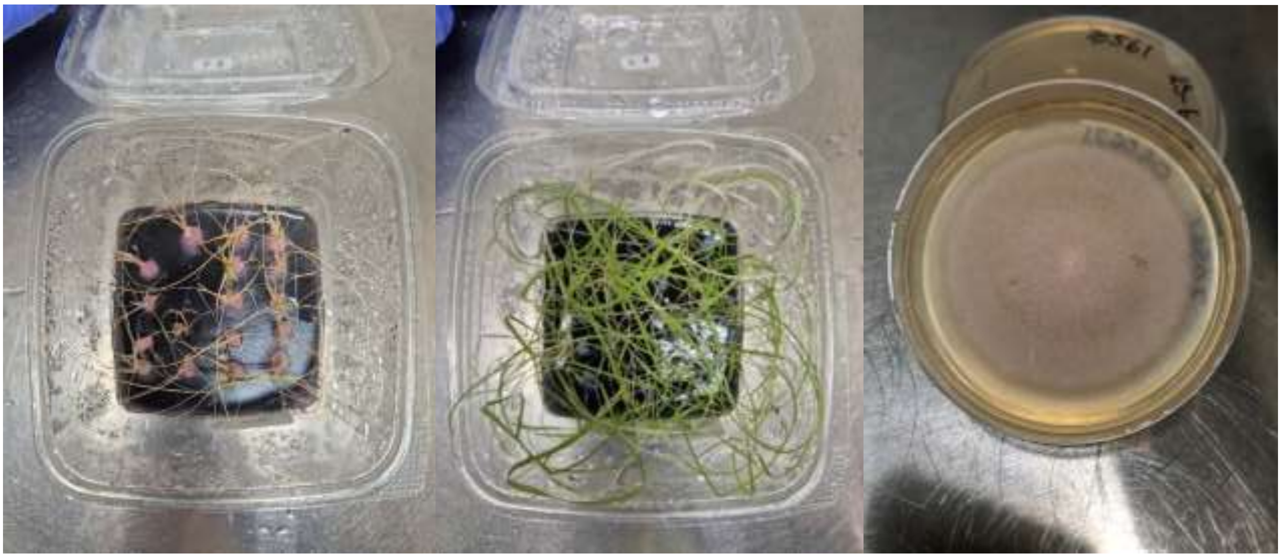

Figure 49 Seedling death observed in GRT seedlings (left) inoculated with Stagonospora tauntonensis mycelium (right) compared to uninfected seedlings (centre).

Collaborators

- Afroza Sultana, Shane Campbell, Bhagirath Chauhan and Victor Galea (University of Queensland)
- Peter Thompson (Conondale property manager)
- Tobias Bickel (Biosecurity Queensland)
- David Officer (NSW Department of Primary Industries)
- Melodina Fabillo (Queensland Herbarium)

Key publications

Officer, D., Shivas, R. & **Vitelli**, **J**. (2023). Geographic range extension of *Ustilago sporoboli-indici* on *Sporobolus natalensis* in Australia, *Australasian Plant Disease Notes,* 18: 36.

Steinrucken, T.V. & **Vitelli**, **J**.**S**. (2023). Biocontrol of weedy *Sporobolus* grasses in Australia using fungal pathogens, *BioControl*, 68(4): 341-361.

35. Feasibility of biological control of sticky florestina (*Florestina tripteris*)

Project dates

July 2024 – June 2026

Project team

Di Taylor

Project summary

Sticky florestina (*Florestina tripteris* DC) has become naturalised in central-western and south-western Queensland and has been identified as a weed of significant concern by local regional councils. This feasibility study will provide information critical to potential future control work on the biological control of sticky florestina.

A literature review of available information on the weed has been completed and samples have been collected from across the range of the weed in Queensland and NSW for genetic analysis to confirm the geographic origins of the Australian infestations.

Figure 50 Left: sticky florestina; Right: sticky florestina infestation in a field near Ilfracombe.

Collaborators

- RAPAD (Remote Area Planning and Development Board)
- Wayne Vogler and Clare Warren (DPI, Tropical Weeds Research Centre, South Johnstone)
- Philip Hayward (DPI, Blackall)
- Longreach Regional Council
- Barcaldine Regional Council
- Narrabri Shire (NSW)

Key publications

McKenzie, J., **Brazier**, **D**., Campbell, S.D., **Vitelli**, **J**.**S**., Anderson, A. & Mayer, R. (2014). Foliar herbicide control of sticky florestina (Florestina tripteris D C.), *The Rangeland Journal,* 36: 259-265.

Soto-Trejo, F., Schilling, E.E., Oyama, K., Lira, R. & Davila, P. (2016). A taxonomic revision of the genus Florestina (Asteraceae, Bahieae), *Phytotaxa*, 268(2): 91-109.

Sparkes, E. & Rogers, M. (2007). Sticky florestina *(Florestina tripteris* DC. Prod.) herbicide screening for a recent invasive species in central western Queensland. In: 21st Asian Pacific Weed Society Conference, 2-6 October 2007, Colombo, Sri Lanka.

36. Management of sticky florestina (*Florestina tripteris*)

Project dates

July 2022 – June 2026

Project team

Wayne Vogler and Clare Warren

Project summary

Sticky florestina (*Florestina tripteris*) is an annual plant from semi-arid North America that was introduced to central-western Queensland anecdotally in the 1960s and reported as a pest in the late 1980s. Much of central, western and southern Queensland is highly suitable for florestina and improved management options are needed to reduce future potential negative impacts to production and the environment.

The project aims to improve the control and management options for sticky florestina in central-western Queensland by improving knowledge about the ecology and biology of florestina. Improved integrated management options for florestina along roadsides, pasture and environmental areas in central-western Queensland will also be identified as part of this project.

Research indicates that seed dispersal via moving water is a significant spread mechanism as seed floats for several hours. Seed appears to be relatively long lived but susceptible to mortality caused by relatively low temperature for short durations. Dry heat from wildfires will kill a portion of the seed bank but with the viable seed bank estimated at 28,000/m^2 in dense florestina the long-term impact on plant populations will be minimal.

Florestina contains cyanogenic compounds (hydrogen cyanide (HCN)). Testing of green fresh flowering plants collected in the Aramac, Barcaldine, Ilfracombe areas during the 2024-25 season indicates that green flowering plants contain on average ~ 900 mg HCN/Kg dry matter. This indicates *Florestina* is toxic and if livestock eat enough there is a risk of death. The risk of toxicity decreases with maturity of the plant, older plants and leaves contain less cyanogenic glycoside. The lethal dose of HCN for cattle and sheep is about 2 mg/kg of body weight. How much *Florestina* livestock are eating is unknown. Green plants are the most toxic while dry plants have little HCN present.

Figure 51 Flowering sticky florestina in Mitchell grass pastures near Barcaldine (left) and on the roadside north of Barcaldine.

Collaborators

- Jeff Newton (Longreach Regional Council)
- Central West Regional Pest Management Group
- Remote Area Planning and Development Board (RAPAD)

Key publications

McKenzie, J., **Brazier**, **D**., Campbell, S.D., **Vitelli**, **J**.**S**., Anderson, A. & Mayer, R. (2014). Foliar herbicide control of sticky florestina (*Florestina tripteris* D C.), *The Rangeland Journal,* 36: 259-265

Soto-Trejo, F., Schilling, E.E., Oyama, K., Lira, R. & Davila, P. (2016). A taxonomic revision of the genus Florestina (Asteraceae, Bahieae), *Phytotaxa*, 268(2): 91-109.

37. Strategic invasive grass control to reduce risk of further invasion in northern Queensland

Project dates

July 2022 – June 2025

Project team

Wayne Vogler, Clare Warren, Melissa Setter and Stephen Setter

Project summary

Gamba grass, grader grass and giant rat's tail grass are serious invasive weeds in northern Australia causing large scale environmental damage and economic loss. In northern and eastern areas of Queensland, these high priority grasses are spreading from small early invasion infestations. The particular hotspots being targeted are Cape York, Atherton Tablelands, Yeppoon, Mackay, Whitsunday and Burdekin regions.

The project is engaging a range of land managers via linking with local governments to identify and control or eradicate strategic outlier infestations of these grass species on both private and publicly owned land. Strategic infestations have been identified within the boundaries of the six local government collaborators. On ground activities have been defined for each grass species relevant to their situation and are continuing in all local government areas.

The project has effectively supported the eradication of the only Gamba grass infestation in the Livingstone Shire with only minor monitoring and mop up activities to continue over the next year. It has also supported the annual Gamba grass taskforce at Cooktown and the testing of control strategies using replacement pasture species as well as Gamba control work near Atherton.

Testing of some control options for grader grass was done in the Burdekin and Whitsunday Council areas as well as giant rats tail grass control in Mackay Council area.

Final reports have been submitted to the Commonwealth.

Figure 52 Mature giant rats tail grass before treatment (Feb 2023) (Left) and giant rats tail grass post three treatments (Sept 2024) (Right).

Collaborators

- Sharon Stephen (Mackay Regional Council)
- Darryn Higgins (Cook Shire Council)
- Megan Davies (Burdekin Shire Council)
- Dave Mitchell (Livingstone Shire Council)
- Ken Goleby (Tablelands Regional Council)
- Matt Bath (Whitsunday Regional Council)

Part 2: Pest animal management

38. National feral deer containment buffer zone workshops

Project dates

February 2025 – September 2025

Project team

Matt Amos, Michael Brennan and Tony Pople

Project summary

The National Feral Deer Action Plan 2023-2028 has identified areas outside traditional ranges of deer as a priority for control. These areas are referred to as the 'Containment Buffer Zone'. The aim is to contain the spread of deer where populations are isolated and in sufficiently low numbers to be feasibly reduced to and maintained at very low numbers, or potentially locally eradicated.

Biosecurity Queensland deer researchers have delivered two of three planned workshops. The first workshop was held in Quilpie and focussed on engaging local governments and major public land managers in the southern part of the state's Containment Buffer Zone. It attracted 35 participants representing 10 organisations. The second workshop took place in Barcaldine, targeting land managers in Central Queensland. It was attended by 11 participants from six organisations. The final workshop will be held in the Southern Gulf region in August 2025.

Attendees at the Quilpie workshop reported very few, if any, deer in their respective areas. The local governments in south-west Queensland are mostly deer free (with the odd sighting in a few places). However, participants in the central Queensland workshop reported areas with localised high-density populations (already known to Biosecurity Queensland). These include the Barcaldine town common and in the smaller towns of Moranbah and Alpha. There was considerable interest from the regional organisation of councils (RAPAD) in this region to support deer management. A funding application has since been submitted to the Australian Government for a deer management program in the Barcaldine and Alpha region.

Figure 53 Researcher presenting at Barcaldine feral deer workshop in March 2025

Collaborators

- John Fisher (Barcaldine Shire Council)
- Jeff Newton (Longreach Regional Council)
- Winton Shire Council
- Blackall-Tambo Regional Council
- Remote Area Planning & Development Board (RAPAD)
- Geoff Swan, Philip Hayward, Gavin O'Connor, Ted Vinson, Nathan March and Megan Leech (Biosecurity Qld)
- Quilpie Shire Council
- Murweh Shire Council
- Balonne Shire Council
- Bulloo Shire Council
- Paroo Shire Council
- Maranoa Regional Council
- Western Downs Regional Council
- Southern Downs Regional Council

Key publications

Bengsen, A.J., Forsyth, D.M., **Pople**, **A**., **Brennan**, **M**., **Amos**, **M**., Leeson, M., Cox, T.E., Gray, B., Orgill, O., Hampton, J.O., Crittle, T. & Haebich, K. (2022). Effectiveness and costs of helicopter-based shooting of deer, *Wildlife Research* 50: 617-631.

Forsyth D., Comte S., Bengsen, A.J., Hampton, J. & **Pople**, **T**. (2023). Glovebox guide to managing feral deer. (Centre for Invasive Species Solutions). https://pestsmart.org.au/wp-content/uploads/sites/3/2023/10/CISS-Glovebox-Guide-Feral-Deer-final.pdf

National Feral Deer Action Plan 2023-2028. https://feraldeerplan.org.au/wp-content/uploads/2023/08/National-Feral-Deer-Action-Plan-2023-28.pdf

39. Refining management of feral deer in Queensland

Project dates

July 2022 – June 2026

Project team

Matt Amos, Mike Brennan and Tony Pople

Project summary

In recent years, there has been a greater awareness of feral deer impacts on Australian communities, agriculture and the environment. In Queensland, populations of feral deer continue to increase. Best practice methodology for control and monitoring continues to evolve but requires further investigation and documentation as well as dissemination to stakeholders.

This project is assessing, documenting and disseminating information on the cost-effectiveness and feasibility of control and monitoring methods at five study sites in Queensland: Brisbane, North Pine Dam, Sunshine Coast, Yeppoon and Wild Duck Island. The first four sites are urban or peri-urban and require on-going control. The last site is an offshore island and provided an opportunity for eradication. Depending on the site, control has involved trapping, ground or aerial shooting, and sometimes a mix.

The eradication of rusa deer at Wild Duck Island has been documented and information presented at various forums.

Figure 54 Stakeholders viewing a presentation at the Quilpie deer workshop (left) and the last deer removed from Wild Duck Island (right).

Collaborators

- Dave Forsyth, Sebastien Comte and Andrew Bengsen (NSW Department of Primary Industries and Regional Development)
- Steve Burke (Queensland Parks and Wildlife Service, Department of Environment and Science)
- Mark Kimber (Sunshine Coast Regional Council)
- Jess Doman and Perry Ward (Seqwater)
- Bill Manners, Dan Franks and Robyn Jones (Brisbane City Council)
- Darren Sheil (Moreton Bay Regional Council)

- Leise Childs, Dave Mitchell and John Wyland (Livingstone Shire Council)

Key publications

Amos, **M**., **Pople**, **T**., **Brennan**, **M**., Sheil, D., Kimber, M., & Cathcart, A. (2023). Home ranges of rusa deer (*Cervus timorensis*) in a subtropical peri-urban environment in South East Queensland, *Australian Mammalogy,* 45(1): 116-120.

Brennan, **M**., **Amos**, **M**., **Pople**, **T**. & Burke, S. (2024). And then there was one: Monitoring the eradication of rusa deer from an island with camera traps, In: 19th Australasian Vertebrate Pest Conference, 30 July-1 August 2023, Sydney, New South Wales.

Forsyth, D., Comte, S., Bengsen, A., Hampton, J. & **Pople**, **T**. (2023). *Glovebox Guide to Managing Feral Deer*, a PestSmart publication, Centre for Invasive Species Solutions, Canberra. https://pestsmart.org.au/wp-content/uploads/sites/3/2023/10/CISS-Glovebox-Guide-Feral-Deer-final.pdf

40. Monitoring and control methods for new vertebrate pests

Project dates

July 2023 – June 2025

Project team

Peter Elsworth

Project summary

The global increase in the trade and keeping of exotic pets opens pathways for incursions of novel invasive species. Often, there is little local knowledge of these species which can hinder effective and quick detection and removal of individuals following a report of an animal in the wild.

The project aims to review the biology and ecology of species with a high risk of incursion and establishment. Using this information, strategies to maximise detection and capture of these species will be developed, with critical knowledge gaps identified to guide research priorities.

High risk species have been prioritised using national risk assessments, recent incursion events and local advice from biosecurity staff. These include American corn snake, African pygmy hedgehog, Red-eared slider turtle, and Indian palm squirrel. Detection and capture

Figure 55 Red-eared slider turtle and Indian palm squirrel – two high risk invasive species that would compete with native animals and spread diseases to native animals and humans if they became established in Queensland.

strategies have been identified for these species, with further species, such as tokay geckos, to be examined under a new project.

Collaborators

- Steve Csurhes, Duncan Swan and Michelle Smith (Biosecurity Queensland)

Key publications

ABARES. (2021). The national priority list of exotic environmental pests, weeds and diseases: Information paper (Version 2.0), ABARES report to client prepared for the Chief Environmental Biosecurity Officer, Department of Agriculture, Water and the Environment, ACT. CC BY 4.0.

Elsworth, **P**. (2024). American corn snake, *Pantherophis guttatus*: Invasion risk, detection, surveillance and research priorities. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, p37.

Elsworth, **P**. (2025). African pygmy hedgehog, *Atelerix albiventris*: Invasion risk, detection, surveillance and research priorities. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, p39.

41. Monitoring rabbit populations in Queensland

Project dates

July 2024 – June 2025

Project team

Peter Elsworth

Project summary

Rabbits continue to have significant impacts to agricultural industries and natural ecosystems across Australia. On-going monitoring provides insight into populations that may be spreading beyond the ability for landholders to manage rabbit issues on their own. A National Rabbit Managers Network was recently established to share information across Australia on rabbit populations, issues and management. This project provided information on key areas for rabbit management in Queensland.

Long-term monitoring in the Southern Downs has recorded a dramatic decline in the rabbit population following a successful control program by landholders and the Darling Downs - Moreton Rabbit Board. Currently, rabbit populations across Queensland are generally low, sporadic and localised, allowing landholder-level control to be effective, rather than requiring landscape-level management. A National Rabbit Management Coordinator is now in place to promote and coordinate effective rabbit management.

Figure 56 These were the only two rabbits seen in a spotlight count (left), and the only active burrow found during the latest monitoring on a property outside Wallangarra in the Southern Downs (right) where a control program ripped 97 warrens (about 600 burrows) and shot nearly 200 surface rabbits. At the peak of the rabbit population in 2015, our spotlight count was over 1000 rabbits.

Collaborators

- Nathan Ring, Mat Warren and Craig Magnussen (Darling Downs and Moreton Rabbit Board)
- Peter Day and Wayne Meyer (National Rabbit Managers Network and Rabbit-Free Australia)

Key publications

Cox, T.E., Ramsey, D.S.L., Sawyers, E., Campbell, S., Matthews, J. & **Elsworth**, **P**. (2019). The impact of RHDV-K5 on rabbit populations in Australia: an evaluation of citizen science surveys to monitor rabbit abundance, *Scientific Reports*, 9(1): 1-11.

Elsworth, **P**. (2023). Property-level rabbit control using harbour destruction restricts breeding success. In: 2nd Pest animal and weed symposium, 28-31 August 2023, Dalby, Queensland.

42. Refining aerial shooting practices for feral pigs and deer in Queensland - Thermal-assisted aerial control and population recovery

Project dates

May 2024 – June 2025

Project team

Matthew Gentle, Lana Harriott, Aiden Sydenham and Tony Pople

Project summary

Aerial culling can be a highly effective method for reducing populations of medium-large herbivores such as feral pigs and deer. In temperate Australia, thermal cameras can increase the detection of animals and improve the efficiency of aerial culling programs. Thermal cameras rely on a temperature contrast between mammals and their surrounding environment. The thermal contrast will be less marked in tropical Australia and so the effectiveness of the technique needs to be assessed.

In winter 2024, Biosecurity Queensland collaborated with Whitsunday Regional Council to quantify the benefits of using a thermal camera during aerial control of feral deer (and pigs) near Collinsville, northern Queensland. Promisingly, the thermal camera successfully detected animals during all thermal runs conducted at different times of the day, under a variety of temperatures and in a range of canopy densities (e.g. dense to open). However, there were no significant gains in culling rates over visual culling across the trial, but they are expected at lower densities and dense canopy cover where animals are difficult to detect. Selective use of thermal cameras could yield benefits in future programs, and further assessments are recommended to optimise control practices.

The response of a feral pig population in southern Queensland subjected to intensive aerial culling (2022-24) was measured. Feral pig density more than doubled in the 12 months following the final cull, indicating population growth at the maximum rate of increase. This demonstrates that, in the absence of further control efforts, feral pig populations may rapidly recover from significant reductions when supported by good seasonal conditions.

Figure 57 Thermal camera operator with harness-mounted camera and (right) HD video screen used to view thermal detections. Photos: Bren Fuller.

Collaborators

- Bren Fuller and Scott Hardy (Whitsunday Regional Council)
- Jordan Munn (Trap and Trigger, New Zealand)

Key publications

Cox, T.E., Paine, D., O'Dwyer-Hall, E., Matthews, R., Blumson, T., Florance, B., Fielder, K., Tarran, M., Korcz, M., Wiebkin, A., Hamnett, P.W., Bradshaw, C.J.A. & Page, B. (2023). Thermal aerial culling for the control of vertebrate pest populations, *Scientific Reports*, 13: 10063.

Gentle, **M**., **Sydenham**, **A**., Fuller, B. & **Pople**, **T**. (2025). *Assessment of thermal detection in aerial culling of feral deer and pigs in northern Queensland*. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, Toowoomba, Queensland, p39.

43. Agricultural impacts of feral pigs in Australia

Project dates

April 2024 – June 2026

Project team

Matthew Gentle and Tony Pople

Project summary

Feral pigs can have a wide range of impacts in agricultural landscapes, including damage to crops, pasture and infrastructure, lamb predation, weed dispersal, water quality, and disease transmission to domestic livestock, wildlife, humans and plants. However, feral pig agricultural impacts and the costs of control have not been comprehensively reviewed for ~30 years.

The project is assessing the agricultural impacts and costs of feral pigs in Australia and testing methods to better quantify losses. This information will help producers to identify when (e.g. crop timing) and where (e.g. landscape positions) feral pigs should be managed. Information at the grower and industry (e.g. grains, sheep, and sugarcane) levels would encourage strategic, coordinated and adaptive management of feral pigs.

Collaborators from Manaaki Whenua – Landcare Research, New Zealand, have collated, reviewed and compiled studies on the agricultural impacts and costs of feral pigs in Australia. Further analysis of the national pest animal and weed management survey of agricultural land managers collected by ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) is currently being completed.

Field trials are planned to investigate how technologies, including satellite and drone imagery, could be used to quantify the impacts of feral pigs on crops and pastures.

Figure 58 Feral pig damage to a wheat crop

Collaborators

- Cecilia Arienti and Dave Latham (Manaaki Whenua – Landcare Research, New Zealand)
- Dave Forsyth and Andrew Bengsen (New South Wales Department of Primary Industries, Research and Development)
- Peter Adams and Stuart Dawson (Western Australia Department of Primary Industries and Rural Development)
- Heather Channon (National Feral Pig Management Coordinator / Australian Pork Limited)
- Tony Arthur (Australian Bureau of Agricultural and Resource Economics and Sciences)

Key publications

Gentle, **M**., **Speed**, **J**. & Marshall, D. (2015). Consumption of crops by feral pigs (*Sus scrofa)* in a fragmented agricultural landscape, 37: 194-200.

44. Feral pig movements, contact rates, disease prevalence, and management in southern Queensland

Project dates

July 2023 – June 2026

Project team

Matthew Gentle, Lana Harriott and Aiden Sydenham

Project summary

Feral pigs are reservoirs of infectious diseases of economic or public health significance, including many exotic to Australia. This project collects data on feral pig movements and interactions with intensive livestock production facilities, to inform enterprise risk, disease modelling and pig management strategies.

Feral pigs on two sites in southern Queensland have been fitted with GPS collars/tags and are being monitored to examine movements, interactions, and contact with domestic enterprises and control or monitoring tools. Sampling of these animals at capture showed varying prevalence of disease including leptospirosis and *Brucella suis*. Movements and activity of these animals will be monitored for the next 12 months.

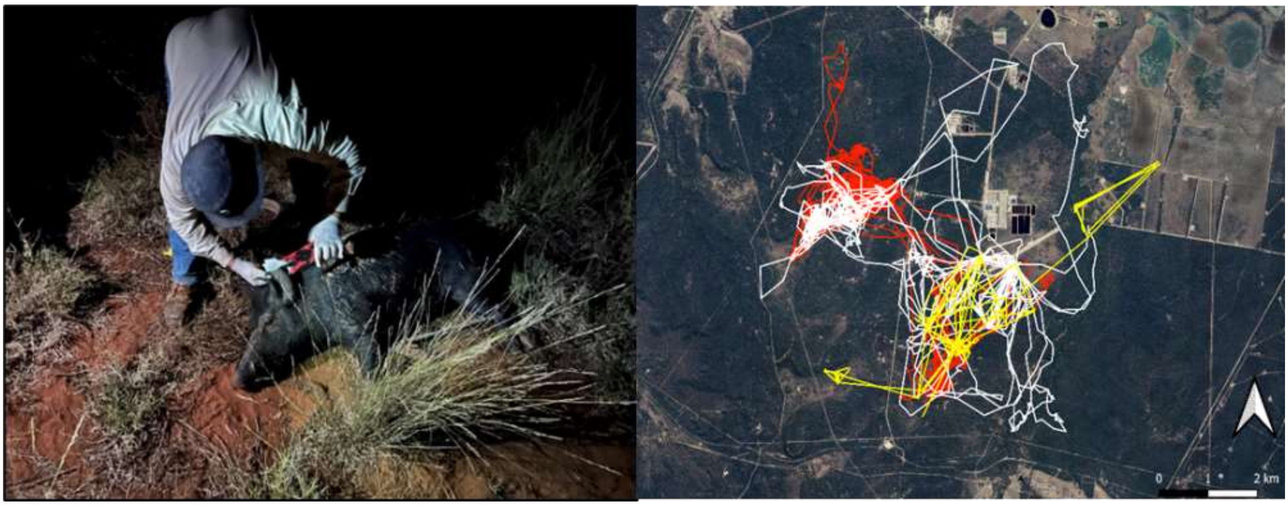

Figure 59 Ear tagging a sedated feral pig (left) and movements of GPS-tracked feral pigs on one study site (right).

Collaborators

- Darren Marshall, Lachlan Marshall and Tony Buckmaster (Centre for Invasive Species Solutions)
- Heather Channon (National Feral Pig Coordinator)
- Kirsty Richards (SunPork)
- Chris Gaschk (Western Downs Regional Council)
- African Swine Fever Prevention and Preparedness Project (Department of Primary Industries, Biosecurity Qld)

Key publications

Proboste, T., Turnlund, A., Bengsen, A., **Gentle**, **M**., **Wilson**, **C**., **Harriott**, **L**., Fuller R.A., Marshall, D. & Soares Magalhães, R.J. (2024). Quantifying feral pig interactions to inform disease transmission networks, *eLife,* 13: RP102643.

45. Pest animal control – toxin permit support

Project dates

July 2022 – June 2026

Project team

Matthew Gentle and Peter Elsworth

Project summary

Toxins for vertebrate pests require ongoing assessments for suitability, supply or alternatives under minor-use permit or national registration. This project collates and reviews available data on bait/toxin efficacy and non-target safety to support the optimal and safe use of (suitable) vertebrate toxins in Queensland. We collaborate with researchers, regulators, commercial manufacturers and end-users to develop alternative toxins/baits or delivery mechanisms and provide appropriate strategies and guidelines for their use.

The minor use permit providing for the off-label use of 1080 in meat baits to target feral pigs has been extended until October 2029. This supports the use of 1080 in meat for the effective management of feral pig impacts in key local government areas and estates managed by Queensland Parks and Wildlife Service. Review of additional or alternative bait types and delivery techniques for feral pigs will continue.

Effective management of feral cats in Queensland remains constrained by the lack of safe and effective baits for broadscale use. This project provided regulatory guidance, information and interpretation of local field trial data to the registrant to assist in the submission for the national registration of Eradicat (1080 bait for feral cats).

Figure 60 Feral pigs consuming a 1080 meat bait.

Collaborators

- Bronwyn Fancourt and Stuart Johnson (Queensland Parks and Wildlife Service and Partnerships)

Key publications

APVMA (2024) PER89572v2: Permit to allow minor use of 1080 in meat baits for control of feral pigs in specific jurisdictions and situations. Issued 20 August 2024.

APVMA (2024) PER89377v2: Permit to allow supply and minor use of 1080 for the control of feral pigs using mango and banana baits in specific jurisdictions and situations. Issued 12 April 2024.

APVMA (2024) PER91667v3: Permit to allow minor use of 1080 baits at a higher rate for aerial baiting of wild dogs in Southern Downs Regional Council. Issued 16 October 2024.

46. Improving detection and response to red-eared slider turtles

Project dates

July 2020 – June 2025

Project team

Lana Harriott and Aiden Sydenham

Project summary

Red-eared slider turtles (REST) are the most traded reptile in the world and have significant environmental impacts where they establish outside of their native range. In Australia, REST have been assessed as having an 'extreme' risk of establishment. In Queensland, it is important we have the knowledge and tools available for early detection and to inform a timely response for eradication.

This project aims to increase understanding of REST behaviour, ecology and effectiveness of control tools. The project will test if acoustic sounds can be recorded for REST in captivity and the wild to assess this as a suitable method for REST detection.

The project had some difficulty with monitoring control tools due to extremely trap shy adult REST and significant predation of turtle nests by foxes. However, several acoustic recordings were conducted in the wild and in captivity producing approximately 672 hours of audio footage. These data will continue to be analysed to assess if acoustic methods can be developed for detection of REST.

Figure 61 Acoustic record device attached to a juvenile surveillance platform (left) and several red eared sliders captured in a trap (right)

Collaborators

- Andrew O'Brien (Sydney Feral and Commercial Pest Control Pty Ltd)
- Eddie Ferry (Fairfield City Council, NSW)
- Robyn Young (Canterbury-Bankstown Council, NSW)
- Simon Linke (CSIRO)
- Stacy Harris, Matt Ryan and Duncan Swan (Biosecurity Queensland)
- Dianne Gleeson and Jack Rojhan (University of Canberra)
- Lisa Wellman and Tarnya Cox (NSW Department of Primary Industries)
- Rachel Anderson and Paul Fraser (Woollahra Municipal Council, NSW)

Key publications

García-Díaz, P., Ramsey, D.S., Woolnough, A.P., Franch, M., Llorente, G.A., Montori, A., Buenetxea, X., Larrinaga, A.R., Lasceve, M., Álvarez, A. & Traverso, J.M. (2017). Challenges in confirming eradication success of invasive red-eared sliders, *Biological Invasions*, 19(9): 2739-2750.

Harriott, **L**., **Amos**, **M**., **Brennan**, **M**., **Elsworth**, **P**., **Gentle**, **M**., Kennedy, M, **Pople**, **T**., Scanlan, J., **Speed**, **J**. & **Osunkoya**, **O**.**O**. (2022). State-wide prioritisation of vertebrate pest animals in Queensland, Australia, *Ecological Management and Restoration*, 23(23): 209-218.

Harriott, **L**., Kelly, C., **Gentle**, **M**., Kennedy, M. & O'Brien, A. (2024). *Trachemys scripta elegans* (Red-eared slider). Basking behaviour, *Herpetological Review,* 55(3): 442-443.

47. Development of surveillance tools for the Asian black-spined toad (*Duttaphyrnus melanostictus*)

Project dates

July 2020 – June 2025

Project team

Lana Harriott

Project summary

The Asian black-spined toad (ABST) has a high probability of establishment in Queensland and is a species of significant biosecurity concern. This project aligns with priorities under the Queensland Biosecurity Strategy 2018-2023 relating to preparing for, preventing, and dealing effectively with new pests and diseases entering, spreading or becoming established in Queensland.

This project aimed to understand Asian toad ecology and to test a range of new and developing tools that could be applied in this network. We have conducted experiments to test, optimise, and determine the effectiveness of management tools for ABST. This will benefit Queensland through access to field-tested tools to respond to an ABST incursion.

It was determined that Asian toads selectively lay eggs in small waterbodies with gently sloping banks, while other factors such as surrounding vegetation, water chemistry or depth, or the presence of other species had no influence. Daily activity of Asian toads in an invaded range was relatively sedentary and shelter sites during the day are frequently re-used. A manuscript on spawning site selection by Asian toads has recently been published and an additional manuscript on ABST movements is under development by collaborators. This information will be critical to biosecurity officers if an incursion response is required in Queensland.

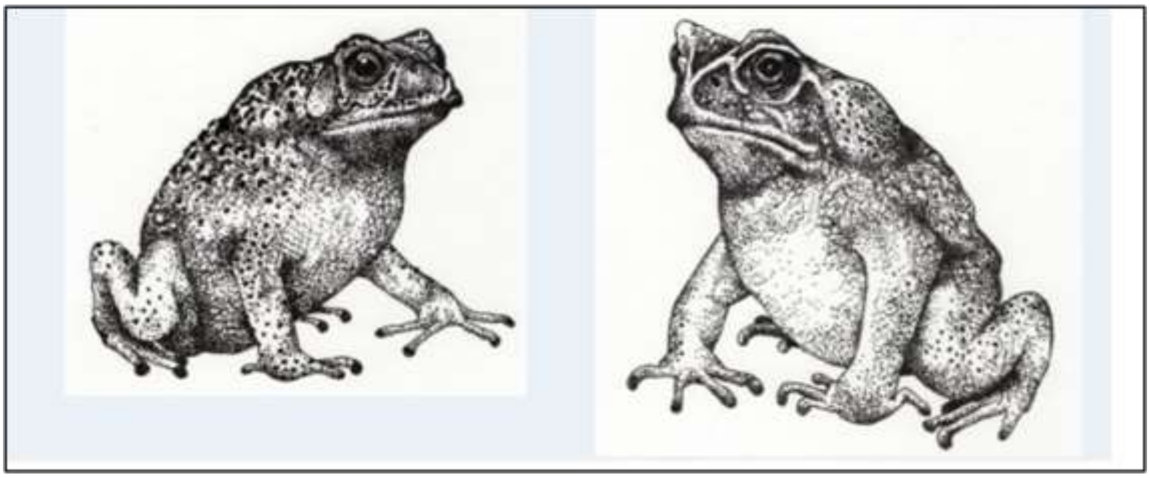

Figure 62 Asian black-spined toad (left) compared to the cane toad (right). Illustration by Catherine Kelly (Kelly et. al. 2023)

Collaborators

- Malcom Kennedy (Queensland Department of Environment and Science)
- Lin Schwarzkopf (James Cook University)
- Ben Muller (Madagascar Fauna and Flora Group)
- Mirzura Kusrini (IPB University, Indonesia)
- Dianne Gleeson (University of Canberra)
- Peter Caley (CSIRO)
- Susan Campbell (Western Australian Department of Primary Industries and Regional Development)
- David Ramsey (Arthur Rylah Institute, Victoria)
- Phil Cassey (University of Adelaide)

Key publications

Kelly, C.L., Schwarzkopf, L., Christy, T.M. & Kennedy, M.S. (2023). The toad less travelled: comparing life histories, ecological niches, and potential habitat of Asian black-spined toads and cane toads, *Wildlife Research*, 51: WR22111.

Licata, F., Ficetola, G.F., Falaschi, M., Muller, B.J., Andreone, F., Harison, R.H., Freeman, K., Monteiro, A.T., Rosa, S. & Crottini, A. (2023). Spatial ecology of the invasive Asian common toad in Madagascar and its implications for invasion dynamics, *Scientific Reports*, 13: 3526.

Muller, B.J., Harison, R. F., Randriamanantena N. F., Allen-Ankins, S. & Schwarzkopf, L. (2024). Spawning site selection by invasive Asian toads (*Duttaphrynus melanostictus*) in eastern Madagascar, *Pest Management Science,* 81(6): 2997-3004.

48. Ecology and management of wild dogs in Queensland

Project dates

July 2024 – June 2026

Project team

Lana Harriott, Peter Elsworth and Aiden Sydenham

Project summary

Wild dogs (*Canis familiaris*) remain one of the most significant pest animals in Queensland. Information and methods that can improve management are continually sought from landowners and managers.

This project aimed to detect the feasibility of new technology to assess wild dog behaviour by fitting GPS collars with cameras to wild dogs. Two male and two female adult wild dogs were trapped and collared in September 2024 near Mt Hutton. Collars were active for 13 weeks before the programmed drop off and collection in January 2025. Collars will be deployed again in 2025 in a cooler climate before comparing and presenting activity and behaviour results.

After the successful detector dog trials with 1080, this process was repeated to determine if a dog could also be trained to detect PAPP toxin in a variety of mediums including filter paper, baits, PAPPutty, and CPE capsules. The PAPP trial was successful with the dog able to detect PAPP on filter paper. However, when the PAPP was presented in putty form it was unable to be detected, similar to the CPE capsules which were only detected once in 10 attempts. Eight out of 10 attempts to detect PAPP in DOGABAIT were correctly identified, however some indications on non-toxic baits also occurred.

Figure 63 Detector dog, Bullet, indicating on (detecting) a filter paper containing PAPP (left). Footage from camera collar of a pair of wild dogs resting (right).

Collaborators

- Tracey Kreplins (Department of Primary Industries and Regional Development, WA)
- Craig Murray and Tracey Murray (Detection Dog School)
- Darren Marshall and Lachlan Marshall (Centre for Invasive Species Solutions)

Key publications

McGregor, H., Legge, S., Jones, M. E. & Johnson, C.N. (2015). Cats are better killers in open habitats, revealed by animal borne video, *PLoS ONE,* 10(8): e0133915.

49. Ecology and management of chital deer in North Queensland

Project dates

July 2014 – June 2026

Project team

Tony Pople, Mike Brennan, Matt Amos and Cameron Wilson

Project summary

This project was initiated from increasing concern over growing numbers and the spread of feral deer in Queensland and indeed across eastern Australia. Numerous organisations collaborated (see below) to better understand the ecology of chital deer (*Axis axis*), the now abundant and widespread deer species in North Queensland, to support their management. Various funding sources have enabled the work to span just over a decade.

Satellite telemetry (50 collared females) and ~55 remote cameras are describing movement patterns, habitat use of deer and, most importantly, survival rates of adults and fawns. These data are currently being analysed and the results documented. The concentrations of populations around homesteads and on certain properties but not others are associated with soil phosphorus. Regular population monitoring has described population declines of ~80% during drought but recovery in ~6 years at the species' maximum rate of increase of 41%.

A genetic component explores possible movement corridors across the region to try and explain their slow rate of spread and patchy distribution. A broader diet in the dry season has been described by metabarcoding compared with macroscopy.

Figure 64 Wild dogs are common in the northern rangelands and prey on chital deer, although agile wallabies are a more common prey item. Dog predation did not prevent chital deer increasing at their maximum rate following drought in 2014-15.

Collaborators

- Australian Research Council Linkage grant to James Cook University
- Keith Staines and Glen Harry (Sporting Shooters Association of Australia)
- Kurt Watter (University of Queensland)
- Dave Forsyth, Andrew Bengsen and Sebastien Comte (NSW DPI)
- Carlo Pacioni and Luke Woodford (Arthur Rylah Institute, Victoria)
- Jordan Hampton (Ecotone Wildlife Veterinary Services)
- Tom De Ridder (Q Biotics Group)
- Landholders in the Charters Towers region
- Ashley Blokland (Charters Towers Regional Council, now Biosecurity Queensland)
- Heather Jonsson (Dalrymple Landcare Committee)
- Thijs Krugers and Rachel Payne (NQ Dry Tropics)
- Catherine Kelly, Matt Quin, Jodie Nordine, Mohit Deolankar, Ben Hirsch, Lin Schwarzkopf, Jan Strugnell and Iain Gordon (James Cook University)
- Centre for Invasive Species Solutions

Key publications

Forsyth, D.M., **Pople**, **A**., Woodford, L., **Brennan**, **M**., **Amos**, **M**., Moloney, P.D., Fanson, B. & Story, G. (2019). Landscape-scale effects of homesteads, water, and dingoes on invading chital deer in Australia's dry tropics, *Journal of Mammalogy*, 100: 1954-1965.

Kelly, C L., Schwarzkopf, L., Gordon, I.J., **Pople**, **A**., Kelly, D.L. & Hirsch, B.T. (2022). Dancing to a different tune: Changing reproductive seasonality in an introduced chital deer population, *Oecologia*, 200: 285-294.

Pople, **A**., **Amos**, **M**. & **Brennan**, **M**. (2023). Population dynamics of chital deer (*Axis axis*) in northern Queensland: Effects of drought and culling, *Wildlife Research*, 50: 728-745.

50. Coordinated management of feral deer in Queensland

Project dates

May 2022 – August 2025

Project team

Tony Pople, Mike Brennan, Matt Amos and Cameron Wilson

Project summary

With funding from the Australian and Queensland Governments, control of seven feral deer populations is being evaluated. These were priorities for management given factors such as the assets being protected, feasibility of long-term suppression and containment, and local land manager support.

The project aims to evaluate the effectiveness of ground and aerial control of deer in a range of environments. The results will be documented as a set of case studies. Three local or regional control strategies will also be developed. As part of the project, workshops on deer management were run during 2022-23.

In North Queensland, two large chital deer populations were surveyed prior to aerial and ground culling. An additional chital deer population will be surveyed then culled in winter 2025. These populations are regionally concentrated and so culling offers a long-lasting reduction in density.

The eradication of an island rusa deer population off the Central Queensland coast was monitored with a grid of remote cameras. Cameras monitored the decline over five years, indicating the size of the removal required down to the last animal. A survey following the cull provided a probability of eradication of 99%.

In southern Queensland, a red deer population on the northern edge of the species' southern distribution near Kingaroy was culled from the air following an aerial survey. A camera survey following the cull estimated a substantial residual population despite intensive searches from the air during the cull. In the granite belt, a large fallow deer population has been monitored with remote cameras, prior to culling in mid-2025.

Apart from the island eradication, removals represented 14-60% of the populations, enough to stop population growth but not drive it to low density. This highlights the need for >40 hours of aerial culling per 1,000 deer for reductions of >60%.

Figure 65 Locations (yellow dots) of a grid of trail cameras that monitored the eradication of rusa deer from Wild Duck Island in the Broad Sound Island National Park in Central Queensland.

Collaborators

- Annelise Wiebkin (National Deer Management Coordinator)

- NQ Dry Tropics
- Burnett Mary Regional Group
- Queensland Parks and Wildlife Service
- Whitsunday Shire Council & Burdekin Shire Council
- Biosecurity Officers
- Queensland landholders

Key publications

Bengsen, A.J., Forsyth, D.M., **Pople**, **A**.**R**., **Brennan**, **M**., **Amos**, M., Leeson, M., Cox T.E., Gray, B., Orgill, O., Hampton, J.O., Crittle, T. & Haebich, K. (2022). Effectiveness and costs of helicopter-based shooting of deer, Wildlife Research, 50: 617-631.

Forsyth, D., **Pople**, **T**., Page, B., Moriarty, A., Ramsey, D., Parkes, J., Wiebkin, A. & Lane, C. (eds) (2017). 2016 National Wild Deer Management Workshop Proceedings, Adelaide, 17-18 November 2016, Invasive Animals Cooperative Research Centre, Canberra, Australia.

National Feral Deer Action Plan. (https://feraldeerplan.org.au/).

Queensland Feral Deer Management Strategy 2022-27. (https://www.daf.qld.gov.au/__data/assets/pdf_file/0008/1644218/Feral-Deer-Management-Strategy.pdf)

External funding

Research and development contracts

Project/research area	Funding body	Funds spent ($)
Integrated management of cabomba	CSIRO	83,705
Weed management in the Pacific	Landcare Research New Zealand	275,661
Biocontrol of pasture weeds, Vanuatu	Landcare Research New Zealand	69,193
Mikania biocontrol	Australian Government	9,301
Biocontrol of invasive cacti	Australian Government	3,543
Madeira vine biocontrol	Healthy Land and Water	77,505
Navua sedge management	Australian Government	12,025
Strategic invasive grass control	Australian Government	12,089
Sticky florestina biocontrol	Remote Area Planning and Development Board (RAPAD)	24,210
Four tropical weeds eradication	National cost share	111,951
Weed biocontrol prioritisation	Centre for Invasive Species Solutions	5,768
Coordinated management of feral deer	Australian Government	75,264
National feral deer containment workshops	Australian Government and Primary Industries and Regions SA	14,991
Feral pig management	Australian Government and Primary Industries and Regions SA	45,000
Total		**820,206**

Land Protection Fund

Project/research area	Funds spent ($)
Pesticide permits	20,445
Biocontrol of prickly acacia	166,833
Biocontrol of bellyache bush	158,616
Biocontrol of cat's claw creeper	79,778
Biocontrol of parthenium	30,521
Biocontrol of opuntioid cactus	45,007
Biocontrol of Harrisia cactus	190,282
Biocontrol of Navua sedge	96,536
Biocontrol of African tulip tree	124,439
Biocontrol of clidemia	78,667
Biocontrol of chinee apple	79,711
Biocontrol of lantana	39,381
Rearing and release of biocontrol agents	196,957
Biocontrol agent compendium	55,859
Weed biocontrol prioritisation	8,040
Quarantine management	165,078
Water weed ecology and management	138,999
Aquatic weeds in sensitive environments	71,435
Weed seed dynamics	80,067
Thatch grass ecology and management	26,242
Navua sedge ecology and management	70,949
Drone-based weed identification	50,815
Weed risk assessment	66,071
Red-eared slider eradication	89,625
Asian black-spined toad surveillance	14,947
Evaluating rabbit breeding success	27,344
Ecology and management of chital deer	107,964
Coordinated management of feral deer	29,580
Refining management of feral deer	122,401
Refining aerial shooting	140,531
Feral pig management	11,525
Pest animal toxin support	45,558
Total	**2,630,203**

Research staff

Ecosciences Precinct

GPO Box 267, Brisbane Qld 4001
Tel: 13 25 23 or (07) 3255 4518 **Email:** donna.buckley@dpi.qld.gov.au
Email for other staff: firstname.lastname@dpi.qld.gov.au

Name	Position
Tony Pople	Senior principal scientist
Kunjithapatham Dhileepan	Senior principal scientist (entomologist)
Olusegun Osunkoya	Principal scientist (ecology)
Joseph Vitelli	Senior principal scientist (weeds)
Tobias Bickel	Senior scientist (aquatic weeds)
Jason Callander	Scientist
Lana Harriott	Scientist
David Holdom	Scientist
Boyang Shi	Scientist
Di Taylor	Scientist
Tamara Taylor	Scientist
Katrina Hodgson-Kratky	Scientist
Michael Brennan	Principal science technician
Liz Snow	Principal science technician
David Comben	Science technician
Bahar Farahani	Science technician
Christine Perrett	Science technician
Melissa Brien	Science technician
Zachary Shortland	Science technician
Louise Gill	Science technician
Donna Buckley	Administration officer

Pest Animal Research Centre

PO Box 102, Toowoomba Qld 4350
Tel: 13 25 23
Email for staff: firstname.lastname@dpi.qld.gov.au

Name	Position
Matthew Gentle	Principal scientist
Matt Amos	Senior scientist
Peter Elsworth	Principal science technician
Cameron Wilson	Scientist
James Speed	Senior science technician
Aiden Sydenham	Science technician

Tropical Weeds Research Centre, Charters Towers

PO Box 976, Charters Towers Qld 4820
Tel: 13 25 33
Email: Wayne.Vogler@dpi.qld.gov.au
Email for other staff: firstname.lastname@dpi.qld.gov.au

Name	Position
Dr Wayne Vogler	Senior principal scientist
Simon Brooks	Senior scientist
Dannielle Brazier	Senior science technician
Mary Butler	Science technician
Kirsty Gough	Science support officer
Kelli Pukallus	Principal science technician
Clare Warren	Science technician

Tropical Weeds Research Centre, South Johnstone

PO Box 20, South Johnstone Qld 4859
Tel: 13 25 33
Email: firstname.lastname@dpi.qld.gov.au

Name	Position
Melissa Setter	Scientist
Stephen Setter	Senior science technician

Publications and presentations

Journal articles

Brooks, **S.J**., **Bebawi**, **F.F**., **Brazier**, **D.A**., **Gough**, **K.L**. and Campbell, S.D. (2025). Seedling Emergence and Soil Seedbank Persistence of the Invasive *Azadirachta indica* A. Juss. Seeds 2025, 4,11. https://doi.org/10.3390/seeds4010011

Bruce, T., Amir, Z., Allen, B.L., Alting, B.F., **Amos**, **M**., Augusteyn, J., Ballard, G.-A., Behrendorff, L.M., Bell, K., Bengsen, A.J., Bennett, A., Benshemesh, J.S., Bentley, J., Blackmore, C.J., Boscarino-Gaetano, R., Bourke, L.A., Brewster, R., Brook, B.W., Broughton, C., Buettel, J.C., Carter, A., Chiu-Werner, A., Claridge, A.W., Comer, S., Comte, S., Connolly, R.M., Cowan, M.A., Cross, S.L., Cunningham, C.X., Dalziell, A.H., Davies, H.F., Davis, J., Dawson, S.J., Di Stefano, J., Dickman, C.R., Dillon, M.L., Doherty, T.S., Driessen, M.M., Driscoll, D.A., Dundas, S.J., Eichholtzer, A.C., Elliott, T.F., Elsworth, P., Fancourt, B.A., Fardell, L.L., Faris, J., Fawcett, A., Fisher, D.O., Fleming, P.J.S., Forsyth, D.M., Garza-Garcia, A.D., Geary, W.L., Gillespie, G., Giumelli, P.J., Gracanin, A., Grantham, H.S., Greenville, A.C., Griffiths, S.R., Groffen, H., Hamilton, D.G., Harriott, L., Hayward, M.W., Heard, G., Heiniger, J., Helgen, K.M., Henderson, T.J., Hernandez-Santin, L., Herrera, C., Hirsch, B.T., Hohnen, R., Hollings, T.A., Hoskin, C.J., Hradsky, B.A., Humphrey, J.E., Jennings, P.R., Jones, M.E., Jordan, N.R., Kelly, C.L., Kennedy, M.S., Knipler, M.L., Kreplins, T.L., L'Herpiniere, K.L., Laurance, W.F., Lavery, T.H., Le Pla, M., Leahy, L., Leedman, A., Legge, S., Leitão, A.V., Letnic, M., Liddell, M.J., Lieb, Z.E., Linley, G.D., Lisle, A.T., Lohr, C.A., Maitz, N., Marshall, K.D., Mason, R.T., Matheus-Holland, D.F., McComb, L.B., McDonald, P.J., McGregor, H., McKnight, D.T., Meek, P.D., Menon, V., Michael, D.R., Mills, C.H., Miritis, V., Moore, H.A., Morgan, H.R., Murphy, B.P., Murray, A.J., Natusch, D.J.D., Neilly, H., Nevill, P., Newman, P., Newsome, T.M., Nimmo, D.G., Nordberg, E.J., O'Dwyer, T.W., O'Neill, S., Old, J.M., Oxenham, K., Pauza, M.D., Pestell, A.J.L., Pitcher, B.J., Pocknee, C.A., Possingham, H.P., Raiter, K.G., Rand, J.S., Rees, M.W., Rendall, A.R., Renwick, J., Reside, A., Rew-Duffy, M., Ritchie, E.G., Roach, C.P., Robley, A., Rog, S.M., Rout, T.M., Schlacher, T.A., Scomparin, C.R., Sitters, H., Smith, D.A., Somaweera, R., Spencer, E.E., Spindler, R.E., Stobo-Wilson, A.M., Stokeld, D., Streeting, L.M., Sutherland, D.R., Taggart, P.L., Teixeira, D., Thompson, G.G., Thompson, S.A., Thorpe, M.O., Todd, S.J., Towerton, A.L., Vernes, K., Waller, G., Wardle, G.M., Watchorn, D.J., Watson, A.W.T., Welbergen, J.A., Weston, M.A., Wijas, B.J., Williams, S.E., Woodford, L.P., Wooster, E.I.F., Znidersic, E. and Luskin, M.S. (2025), Large-scale and long-term wildlife research and monitoring using camera traps: a continental synthesis. Biol Rev, 100: 530-555. https://doi.org/10.1111/brv.13152

Cock, M.J.W., **Day**, **M.D**., Solis, M.A. & Winston, R.L. (2025). Publicly-shared DNA barcodes and citizen science images provide new evidence on the establishment and spread of a weed biological control agent, *Orphanostigma haemorrhoidalis* (Lepidoptera, Crambidae) for the control of *Lantana camara* (Verbenaceae). *CABI Agriculture and Bioscience* 6(1), 0010. DOI: https://doi.org/10.1079/ab.2025.0010

Day, **M.D**. **& Callander**, **J.T**. (2024). The benefits and potential of pre-emptive weed biological control: three case studies in Queensland, Australia, *Biological Control*, 198: 105635.

Day, **M.D**. & **Senaratne**, **K.A.D.W**. (2024). Weed biological control status and options for Sri Lanka, *Weeds – Journal of Asian-Pacific Weed Science Society*, 6: 20-33.

Dhileepan, **K**., King, A.M., **Taylor**, **D**.**B**.**J**., Pollard, K.M., Seier, M.K. (2024). Biological control of cat's claw creeper (*Dolichandra unguis-cati*; Bignoniaceae): Current status and future prospects. *Annals of Applied Biology* 185(2): 132-145.

Dhileepan, **K**. (2024). Pupal diapause in *Hypocosmia pyrochroma* (Pyralidae: Lepidoptera), a weed biological control agent for *Dolichandra unguis-cati* (Bignoniaceae). *International Journal of Tropical Insect Science* 44(4): 2219-1113.

Ezeh, A.E., Zalucki, M.P., **Day**, **M**.**D**., **Taylor**, **T**. & Furlong, M. J. (2025). Thermal biology of *Hypogeococcus pungens* (Hemiptera: Pseudococcidae) explains its variable performance as a classical biological control agent for *Harrisia martinii* (Cactaceae) in Australia. *Environmental Entomology*, nvaf026. https://doi.org/10.1093/ee/nvaf026.

Gautam, D., Mawardi, Z., Elliott, L., Loewensteiner, D, Whiteside, T. & **Brooks**, **S**.**J**. (2025). *Detection of Invasive Species (Siam Weed) Using Drone-Based Imaging and YOLO Deep Learning Model* Remote Sensing, 2025, 17 (1): 120 https://doi.org/10.3390/rs17010120

Harriott. **L**., Kelly, C., **Gentle**, **M**., Kennedy, M. & O'Brien, A. (2024). Trachemys scripta elegans. (Red-eared slider). Basking behaviour. *Herpetological Review,* 55(3): 442-443

Kelly, C., Schwarzkopf, L., Gordon, I., **Pople**, **A**. & Hirsch, B. (2025). Soil mineral content is associated with habitat use of invasive chital deer. *Wildlife Research*, **52**: WR24173. doi:10.1071/WR24173

Mitchell, C.M., Paynter, Q., McGrannachan, C.M., McGrath, Z., Morton, S., **Day**, **M**.**D**., Shohaimi, M.S.M., Zulkifli, N.I.M., Kadir, A.A., Ismail, N.A., Jamil, S.Z., Saranum, M.M. & Haron, F.F. (2024). Genetic matching and the identification of a promising biocontrol agent validates a decision to survey natural enemies of *Urena lobata* in Malaysia, *Biological Control*, 195: 105533.

Osunkoya OO, **Shi B**, **Dhileepan K**. (2025). Stakeholder perspective of the economic cost of managing Navua sedge (*Cyperus aromaticus*) in tropical Queensland, Australia. *Weed Technology* **39**(e41), doi:10.1017/wet.2025.16.

Osunkoya, **O**.**O**., Ahmadi, M., **Perrett**, **C**., **Calvert**, **M**., **Shi**, **B**., **Csurhes**, **S**. & Shabani, F. (2025). Climate-Induced Range Shift and Risk Assessment of Emerging Weeds in Queensland, Australia. *Ecology and Evolution*, *15*(4), e71043.

Osunkoya, **O**.**O**., **Shi**, **B**., **and Dhileepan**, **K**. (2025). Stakeholders' perspective on the economic cost of managing the invasive Navua sedge in tropical Queensland, Australia. *Weed Technology*, *39*, e41. doi:10.1017/wet.2025.16.

Proboste, T., Turnlund, A., Bengsen, A., **Gentle**, **M**., **Wilson**, **C**., **Harriott**, **L**., Fuller R.A., Marshall, D., Soares Magalhães, R.J. (2024). Quantifying Feral Pig Interactions to Inform Disease Transmission Networks *eLife* **13**:RP102643. https://doi.org/10.7554/eLife.102643.2

Quin, M.J., Hirsch, B.T., Schwarzkopf, L., Watter, K., **Pople**, **A**., & Strugnell, J.M. (2025). DNA metabarcoding provides new insight into the diet of invasive chital deer (*Axis axis*) in a tropical savanna landscape. *Ecosphere* **16**, e70288. doi: https://doi.org/10.1002/ecs2.70288.

Roberts, J., Dhileepan, K., and Florentine, S. (2024). A review of the biology, distribution, and management challenges posed by the invasive weed Ziziphus mauritiana L., with special reference to its invasion in Australia. *Weed Research*, *64*(1), 8-18.

Shi, **B**., **Dhileepan, K**. (2024). Life cycle, host specificity and potential impact of *Acaciothrips ebneri*, a biological control agent for prickly acacia (*Vachellia nilotica* subsp. *indica*) in Australia. *BioControl* 69(6): 699-712.

Wilson, **C**., **Gentle**, **M**., Fancourt, B. (2024) Advancing spatial analysis of invasive species movement data to improve monitoring, control programs and decision making: feral cat home range as a case study. *Pacific Conservation Biology* 30, PC24031. https://doi.org/10.1071/PC24031

Zhang, W., Huang, Q., Kuang, Y., Clements, D.R., Xu, G., Zhang, F., Shen, S., Yin, L. & **Day**, **M.D**. (2025). Predicting the potential distribution of the invasive weed *Mikania micrantha* and its biological control agent *Puccinia spegazzinii* under climate change scenarios in China. *Biological Control* doi: https://doi.org/10.1016/j.biocontrol.2025.105754

Conference proceedings and presentations

Bickel, **T.O**., Bigot, M., **Perrett**, **C**., **Farahani**, **B**. & **Gill**, **L**., 2024, Water weed management with the new aquatic herbicides flumioxazin and florpyrauxifen-benzyl. In: *23rd Australasian Weeds Conference*, 25-29 August 2024, Brisbane, Queensland.

Bigot, M., **Bickel**, **T.O**., McVay, M., **Gill**, **L**. & **Perrett**, **C**., 2024, Reducing non-target damage to native emergent plants when managing aquatic weeds In: *23rd Australasian Weeds Conference*, 25-29 August 2024, Brisbane, Queensland.

Brennan, **M**., **Amos**, **M**., **Pople**, **T**. & Burke, S. (2024). And then there was one: Monitoring the eradication of rusa deer from an island with camera traps, In: 19th Australasian Vertebrate Pest Conference, 30 July-1 August 2024, Sydney, New South Wales.

Brooks, **S.J**, **Brazier**, **D.A**. & **Warren**, **C**. (2025). Responses of Fabaceae seed lots to controlled ageing tests. In: 2025 Pest Animal and Weed Symposium, 185-190, 19-23 May, Gladstone, Queensland.

Brazier, **D.A**., **Brooks**, **S.J**., **Gough**, **K.L**. **& Warren**, **C**. (2025). Controlling five invasive woody species using the drill and fill stem injection method In: 2025 Pest Animal and Weed Symposium, 19-23 May, Gladstone, Queensland. pp. 176-181.

Brazier, **D.A**., **Brooks**, **S.J**., **Warren**, **C**. **& Gough**, **K.L**. (2024). Controlling *Leucaena leucocephala* with encapsulated herbicides. In: 23rd Australasian Weeds Conference, 25-29 August, Brisbane, Queensland. pp 218-222.

Brooks, **S**. & **Erbacher**, **K**. (2025). Progress of the national tropical weed eradication program In: 25th Pest Animal and Weed Symposium, May Gladstone, Queensland. pp 64-9.

Brooks, **S**., **Warren**, **C**., **Brazier D**., Meer J., Inglis S., Price T. & **Gough K**. (2024). The efficacy of simulated and aerial foliar herbicides on *Chromolaena odorata*. In: Proceedings of the 23rd Australasian Weeds Conference, 25-29 August, Brisbane, Queensland. pp 240-4.

Callander, J.T. & Shortland, Z. (2024). *Biology, host specificity and varietal preference of the lantana gall fly: lessons learnt in time*. in *23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management*. 2024. Brisbane, Qld. 26. http://era.dpi.qld.gov.au/id/eprint/14192/

Campbell, S.D., **Brazier**, **D.A**., Millan, H. & Perkins, M.L. (2024). *Refinement of splatter gun technology for control of bellyache bush (Jatropha gossypiifolia)*. in *23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management*. 2024. Brisbane, Queensland, Australia. 38. http://era.dpi.qld.gov.au/id/eprint/14194/

Dhileepan, **K**., English, B., **Shi**, **B**., Florentine, S.K., Kurose, D., **Taylor**, **D.B.J**., Tan, Y.P. & Shivas, R.G. (2024). A rust pathogen affecting Navua sedge (*Cyperus aromaticus*) in Australia – A fortuitous biocontrol agent? pp. 176-180. In: *Proceedings of the 23 Australasian Weeds Conference*, Brisbane, Australia, 25-29 August 2024

Elsworth, **P**. (2025). Getting ahead of the game: preparing for novel incursions. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland. https://icebergevents.eventsair.com/paws-2025/proceedings

Gamage, B.R.H., Chadha, A., **Dhileepan**, **K**., Larkins, J.A., Singarayer, S.K. (2024). The effectiveness of herbicides and their combinations for controlling *Cyperus aromaticus* (Navua sedge) in Queensland (abstract), p. 264. *Proceedings of the 23 Australasian Weeds Conference*, Brisbane, Australia, 25-29 August 2024.

Gamage, B.R.H., **Dhileepan**, **K**., Larkins, J.A., Singarayer, S.K. (2024). Effectiveness of various herbicide strategies for controlling the mature *Cyperus aromaticus* (Navua sedge). *HRD Conference, Federation University,* Ballarat, Australia, 11 July 2024.

Gamage, B.R.H., Chadha, A., **Dhileepan**, **K**., Larkins, J.A., Singarayer, S.K. (2024). Effect of different herbicide strategies on germination ability of Navua sedge (*Cyperus aromaticus*) seeds of various growth stages. *10th Biodiversity Across Borders Conference, Federation University,* Ballarat, Australia.

Gaschk, C., **Wilson**, **C**., Cuskelly, J., **Gentle**, **M**. & Marshall, D. (2025). Spatially assisted aerial shooting (SAAS) - translating feral pig habitat preferences into improved on ground outcomes. In: National Feral Pig Conference 2025 - Getting the fundamentals right, 24-26 March 2025, Surfers Paradise, Queensland. https://feralpigs.com.au/wp-content/uploads/2025/03/National-Feral-Pig-Conference-2025-proceedings.pdf

Gentle, **M**., **Sydenham**, **A**. **&** Fuller, B. (2025). Exploring the use of thermal in aerial culling in northern Queensland. In: National Feral Pig Conference 2025 - Getting the fundamentals right, 24-26 March 2025, Surfers Paradise, Queensland. https://feralpigs.com.au/wp-content/uploads/2025/03/National-Feral-Pig-Conference-2025-proceedings.pdf

Harriott, **L**, Kelly, C., **Speed**, **J**. & **Gentle**, **M**. (2024). Efficacy of canid pest ejectors in a peri-urban landscape. In: 19th Australasian Vertebrate Pest Conference, 30 July-1 August 2024, Sydney, New South Wales

Harriott, **L**., Kelly, C., **Speed**, **J**., O'Brien., A, Kennedy, M. & **Gentle**, **M**. (2024). Developemnt of surveillance techniques for juvenile red-eared slider turtles. In: 19th Australasian Vertebrate Pest Conference, 30 July-1 August 2024, Sydney, New South Wales

Murray, C., Rafter, M., Brookes, D., **Murree**, **K**., White, A., Mc Kay, F. & Walter, G. (2024). Two cryptic species, one weed. Molecular and behavioural tests to screen and monitor biocontrol agents. In; 23rd Australasian Weeds Conference proceedings. 25-29 August 2024. Brisbane, Queensland.

Nagalingam, K., **Bickel**, **T**.**O**., Dell, Q., Jones, L., Bigot, M., Vance, T. and Rapley, D., 2024, Managing *Cabomba caroliniana*: prospects for integrating biological control and chemical control. In: *23rd Australasian Weeds Conference*, 25-29 August 2024, Brisbane, Queensland.

Nguyen, N., **Bickel**, **T**.**O**., & Adkins, S., 2024, Seed ecology of two invasive aquatic plant species: *Cabomba caroliniana* and *Sagittaria platyphylla*. In: *23rd Australasian Weeds Conference*, 25-29 August 2024, Brisbane, Queensland.

O'Brien, C., Campbell, S.D., **Warren**, **C**., **Vogler, W.D.** & Galea, V.J. (2024). *Optimisation of a Stem-Implanted Herbicide Capsule System for Effective Management of Chinee Apple (Ziziphus mauritiana)*. in *23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management*. 2024. Brisbane, Qld. 68. http://era.dpi.qld.gov.au/id/eprint/14198/

Osunkoya, **O**.**O**., **Shi**, **B**. & **Dhileepan**, **K**. (2024). The economic cost of managing Navua sedge (Cyperus *aromaticus*)- a monocot weed of tropical Queensland, Australia. In: Proceedings of the 23rd Australasian weeds conference, CAWS, Brisbane, 25-29 Aug 2024, pp. 184-188. https://icebergevents.eventsair.com/awc24/e-proceedings

Proboste, T., Turnlund, A., Bengsen, A., **Gentle**, **M**., **Wilson**, **C**., **Harriott**, **L**., Marshall, D., Fuller, R., & Soares Magalhães, R. (2025). Unravelling the swine web: Decoding feral pig networks for disease prevention in Australia. In: National Feral Pig Conference 2025 - Getting the fundamentals right, 24-26 March 2025, Surfers Paradise, Queensland. https://feralpigs.com.au/wp-content/uploads/2025/03/National-Feral-Pig-Conference-2025-proceedings.pdf

Pukallus (Murree), **K**. & **Butler**, **M**. (2025). Mass rearing and releasing biological control agents for weed species. What's it all about? In: Pest Animal and Weeds Symposium 2025 proceedings.19-22 May 2025. Gladstone, Queensland. https://era.dpi.qld.gov.au/id/eprint/14993/

Pukallus, **K**. (2025) Utilising citizen science data for monitoring released biological control agents on invasive weed species. In: Pest Animal and Weed Symposium 2025 (PAWS 2025), 19-22 May 2025, Gladstone, Australia. https://era.dpi.qld.gov.au/id/eprint/14994/

Rafter, M. A., Gooden, B., Hopper, M., Kumaran, N., Hunter, G., McConnachie, A. J., Turner, P., **Pople**, **A**.**R**., **Callander**, **J**.**T**., **Dhileepan**, **K**., Kwong, R., Steel, J., Lefoe, G., Potter, S., Sheehan, M., Turley, A., Brenton, P. & Glanznig, A. (2025). *The development and implementation of a National Weed Biocontrol Pipeline Strategy*. in *23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management*. 2024. Brisbane, Qld. 146. http://era.dpi.qld.gov.au/id/eprint/14202/

Setter, **M**. **J**., **Setter**, **S**. **D**. & **Vogler**, **W**.**D**. (2024) Efficacy of pre-emergent herbicides on sicklepod (*Senna obtusifolia*) in the Dry Tropics of Cape York. In: 23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management, 25-29 August 2024, Brisbane, Qld. (Paper and Oral presentation). https://era.dpi.qld.gov.au/id/eprint/14189/

Setter, **M**.**J**., **Setter**, **S**.**D** & **Vogler**, **W**.**D**. (2025). Using pre-emergent herbicides for the control of sicklepod (*Senna obtusifolia*) in the Wet Tropics. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland. (Paper, speed presentation and poster by Melissa Setter).

Setter, **S**.**D**., **Setter**, **M**.**J**., Bulstrode, M., **Vogler**, **W**.**D**. and **Warren**, **C**. (2024) Comparing traditional and unmanned aerial vehicles (UAV) assessment methodologies in aquatic weed control research. In: 23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management, 25-29 August 2024, Brisbane, Qld. (Paper, poster and speed presentation by Stephen Setter). https://era.dpi.qld.gov.au/id/eprint/14195/

Setter, **S**.**D**., **Setter**, **M**.**J**., Bulstrode, M., **Vogler**, **W**.**D**. & **Warren**, **C**. (2025). Utilising unmanned aerial vehicles (UAV) for remotely assessing and effectively controlling emergent weeds in aquatic systems using herbicides. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland. (Paper and poster by Stephen Setter).

Shi, **B**. & **Dhileepan**, **K**. (2024). *Acaciothrips ebneri,* a new biological control agent for prickly acacia in Australia. pp. 171-175. In: *Proceedings of the 23 Australasian Weeds Conference*, Brisbane, Australia, 25-29 August 2024.

Shi, **B**. & **Dhileepan**, **K**. (2025). An update on prickly acacia (*Vachellia nilotica* ssp. *indica*) biocontrol research in Queensland. *Pest and Weeds Symposium* (PAWS 2025), Gladstone, Queensland, Australia, 19-22 May 2025.

Smith, M., Birch, M. & **Vitelli**, **J**.**S**. (2025). *Ding dong the witch is (nearly) dead – the end is in sight for the Red Witchweed Eradication Program*. in *Pest Animal and Weed Symposium 2025 (PAWS 2025)*. 2025. Gladstone, Australia. 50-56. https://era.dpi.qld.gov.au/id/eprint/15068/

Smith, D.A., Meek, P.D., Marshall, D.M., Marshall, L., **Gentle**, **M**., **Sydenham**, **A**., Bengsen, A., Adams, P., Dawson, S., Perry, J., Hoskins, A., Templeton, J., Pauza, M., Machon, S., Bradhurst, R. & Fleming, P. (2025). Feral pig (Sus scrofa) activity areas across Australia for integration into disease spread models. In: National Feral Pig Conference 2025 - Getting the fundamentals right, 24-26 March 2025, Surfers Paradise, Queensland. https://feralpigs.com.au/wp-content/uploads/2025/03/National-Feral-Pig-Conference-2025-proceedings.pdf

Taylor, **D**. & **Dhileepan**, **K**. (2025). An update on the biological control of bellyache bush. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025 2025, Gladstone, Queensland p. 114.

Taylor, **D**.**B**.**J**. & **Dhileepan**, **K**. (2024). The tale of the Jatropha leaf-miner, *Stomphastis thraustica* in Australia. In: 23rd Australasian Weeds Conference; Breaking the cycle: Towards sustainable weed management, 25-29 August 2024, Brisbane, Qld . https://era.dpi.qld.gov.au/id/eprint/14223/

Taylor, **T**.**K**, & Kelk, L.P. (2024). Integrated management of Harrisia cactus - the importance of understanding every tool in the box. In: Proceedings of the 23rd Australasian Weeds Conference. 25–29 August 2024, Brisbane, Queensland. ISBN: 978-0-646-70156-1.

Vogler, **W**.**D**. (2025). Grassed up; living with the legacy. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland.

Vogler, **W**.**D**., Hele, M.M. & Call, M. (2025). Understanding the risk: real world application of the general biosecurity obligation; more than killing invasives. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland.

Warren, **C**. & **Vogler**, **W**.**D**. (2024). Spot application of flupropanate results in high mortality of Sporobolus pyramidalis. 23rd Australasian Weeds Conference, 25-29 August 2024, Brisbane, Queensland.

Warren, **C**. & **Vogler**, **W**.**D**. (2025). Buoyancy of Florestina tripteris seed, an invasive exotic weed of central western Queensland. In: 3rd Pest Animal and Weed Symposium, 19-22 May 2025, Gladstone, Queensland.

Xu, J., **Bickel**, **T**.**O**. & Adkins, S., 2024, Controlling *Cabomba caroliniana* with different flumioxazin application strategies. In: *23rd Australasian Weeds Conference*, 25-29 August 2024, Brisbane, Queensland.

Media

Biosecurity Queensland, 2024, *Happy National Science Week,* Facebook,16 August. https://www.facebook.com/biosecurityqld/

Biosecurity Queensland, 2025, '*Tiny thrips, big impact'*, Facebook, 9 April. https://www.facebook.com/biosecurityqld

Burdekin Shire Council, 2024, '*Did you know? Biological control'*, Facebook, 7 October. https://www.facebook.com/BurdekinShireCouncil

Gentle, **M**. (2025). *Study identifies male feral pigs as potential disease 'super spreaders',* ABC Online, 13 March.

Gentle, **M**. (2025). *Feral Pigs*, ABC Rural Radio, Rockhampton, 7 March.

North Queensland Register, 2025, '*Accidental insect brings hope for Hughenden family fighting prickly acacia',* 28 March. https://www.northqueenslandregister.com.au/story/8926330/

Reports, newsletters, fact sheets and theses

Amos, **M**., **Brennan**, **M**. & **Pople**, **T**. (2024). *Final Report: Deer monitoring and control on Wild Duck Island 2019 – 2024*, Report submitted to Queensland Parks and Wildlife Service, Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, Toowoomba, Queensland, p14.

Elsworth, **P**. (2024). American corn snake, *Pantherophis guttatus*: Invasion risk, detection, surveillance and research priorities. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, p37.

Elsworth, **P**. (2025). African pygmy hedgehog, *Atelerix albiventris*: Invasion risk, detection, surveillance and research priorities. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, p39.

Gentle, **M**., **Sydenham**, **A**., Fuller, B. & **Pople**, **T**. (2025). *Assessment of thermal detection in aerial culling of feral deer and pigs in northern Queensland*. Pest Animal Research Centre, Biosecurity Queensland, Department of Primary Industries, Toowoomba, Queensland, p39.

Misipeka, A. (2024). *Herbicides effect on Alligator Weed (Alternanthera philoxeroides)*, MA thesis, University of Queensland.

Pavanato, H., Fewster, R., Redmond, A., Bengsen, A., **Amos**, **M**., Forsyth, D., MacKenzie, D. (2025). *Multi-species abundance estimates using three-observer mark-recapture distance sampling surveys in Cuttaburra Basin, New SouthWales*, Client Report for Department of Primary Industries, NSW, Australia, Proteus Client Report: 196. Proteus, Outram, New Zealand, p150.

Ramsay J.S, (2025), Effects of temperature on the life history and damage potential of *Hedwigiella jureceki* (Coleoptera: Buprestidae) and implications for the biological control of *Dolichandra unguis-cati,* B.Sc. Honours Thesis, University of the Sunshine Coast, March 2025.

Taylor, **T**.**K**., Franceschini, C., & Dufek, M. (2024). Investigating a potential new biological control for *Harrisia Martinii*. *Cactus Quarterly*. Spring/Summer 2024. New South Wales Local Land Services and Northern Slopes Landcare Association. Available at: heyzine.com/flip-book/042314c7ed.html#page/12

Xu, J. (2024). *The management of the invasive aquatic plant - Cabomba caroliniana with the herbicide flumioxazin*, PhD thesis, University of Queensland.

Posters

Brien, **M**. & **Hodgson-Kratky**, **K**. (2025). Wick wiper application in giant rat's tail grass management: evaluating herbicide efficacy and rates, *3rd Pest Animal and Weed Symposium*, Gladstone, 19-22 May.

Hodgson-Kratky, **K**., **Holdom**, **D**.**G**., & **Vitelli**, **J**. (2024). Minor use permits for chemical control of environmental weeds in Queensland, *23rd Australian Weeds Conference*, Brisbane, 25-29 August.

Pukallus, **K**. (2025). Utilising citizen science data for monitoring released biological control agents on invasive weed species. *Pest Animal and Weeds Symposium*. Gladstone, Queensland, 19-22 May.

Forums and workshops

Bickel,T.**O**. (2025). *Wet Tropics Biosecurity Futures: Management of Aquatic Weeds - Control tools and technology update*, Government and local stakeholders, Cairns, 8th May.

Brazier, **D**. **& Brooks**, **S**. (2024). *Encapsulated herbicide research update*. Dry Tropics Regional Pest Management Group. Townsville, 28th November.

Brooks, **S**. (2025). *Herbicide research update*. Dry Tropics Regional Pest Management Group. Ayr, 15th May.

Dhileepan K, **Shi**, **B**. (2025). Biological control of parthenium (Parthenium hysterophorus) in Australia (online). Fourth International Workshop of the IOBC Working Group on the Biological Control and Management of Parthenium Weed, Dhakka, Bangladesh, 7-8 April 2025.

Dhileepan, **K**. (2024). Biocontrol project updates (Chinee apple, bellyache bush, prickly acacia & parthenium). Bowen – Collinsville Landcare AGM Meeting, Whitsunday Regional Council, 25 July 2024.

Dhileepan, **K**. (2025). An update on the biological control of cat's claw creeper. Cubberla-Witton Catchments NetWork (CWCN), Chappel Hill, Brisbane, 3 February 2025.

Dhileepan, **K**. (2025). Update on biocontrol trials for prickly acacia and Chinee apple (Microsoft Teams), Mackay Regional Pest Management Group, Mackay, 14 May 2025.

Dhileepan, **K**. (2024). Cat's claw creeper biological control. Mackay Regional Pest Management Group Stakeholder Meeting. Whitsundays Regional Council, Proserpine, 14 August 2024.

Gentle, **M**. (2024). *Feral pig research update,* South East Queensland Pest Advisory Forum, Esk, 27 November.

Harriott, **L**. (2024). *Development of surveillance techniques for juvenile red-eared slider turtles,* South East Queensland Pest Advisory Forum, Esk, 27 November.

Hodgson-Kratky, **K**. (2024). *Weed management research update*, South East Queensland Pest Advisory Forum, Esk, 27 November.

Hodgson-Kratky, **K**. (2025). *Development of pathogen biocontrol agents for weedy* Sporobolus *spp.* Invasive Grass Forum, Bowen, 18-19 March.

Osunkoya, **O**.**O**. (2024). *Risk Assessment of emerging weeds of Queensland: A horizon approach*, Presentation to The Darling Down Southwest Queensland regional Council, St George, Darling Downs, July 2024

Osunkoya, **O**.**O**. (2024). *Risk Assessment of emerging weeds of Queensland: A horizon approach,* Presentation to The Burdekin dry tropics management group, Bowen, Central Queensland, Nov 2024

Pople, **T**., **Brennan**, **M**. & **Amos**, **M**. (2025). *Local Government and other land managers deer workshop*, Barcaldine, 21 March.

Pople, **T**., **Brennan**, **M**. & **Amos**, **M**. (2025). *Local Government and other land managers deer workshop*, Quilpe, 19 March.

Pukallus, **K**. & **Warren**, **C**. (2025). World of Insects. Year 3 students, Distance Education, Charters Towers. 25 February.

Pukallus, **K**. (2025). Biological control display, *Pest Animal and Weeds Symposium*, Gladstone, 19 May.

Pukallus, **K**., **Butler**, **M**., **Warren**, **C**., **Brazier**, **D**., **Blokland**, **A**. **& Brooks**, **S**. (2024). Cert III Agricultural students, Distance Education. Weed control and Research at TWRC. Charters Towers. 17 July.

Shi, **B**. 2025. New approved bio-control agent for prickly acacia. Western Queensland Regional Beef Research Committee, Aramac, 5 June.

Shi, **B**. 2024. Biocontrol for weeds – release, monitoring and opportunities for use now/in future, North West Queensland Regional Beef Research Committee, Gregory, 2 December 2024.

Taylor, **T**.**K**. (2024). Harrisia cactus – Queensland research update. Harrisia cactus taskforce meeting. Lightning Ridge, NSW (presented online). 12 November 2024.

Taylor, **T**.**K**. (2025) Harrisia cactus – Queensland research update. Harrisia cactus taskforce meeting. Lightning Ridge, NSW (presented online). 1 May 2025.

Vogler, **W**. (2025). *Invasive grass ecology, identification and management*, Invasive grass weed workshop – Technical, Reef Catchments, Marani, 25 June.

Vogler, **W**. (2025). *Invasive grass ecology, identification and management*, Invasive grass weed workshop – Landholders and public, Reef Catchments, Marani, 26 June.

Vogler, **W**. (2025). *Invasive grass forum*, Invasive Grass Project Collaborators, Bowen, 18-19 March.

Vogler, **W**. (2025). *Invasive grass forum*, Invasive Grass Project Collaborators, Virtual, 15 April.

Vogler, **W**. (2025). *Sticky Florestina project update*, Central Queensland Regional Pest Forum, Airlie Beach, 18-19 June.

Wilson, **C**. & **Gentle**, **M**. (2024). *Feral pigs – background, recent research findings and future directions,* DPI Feral Pig Management Workshop, Brisbane, 2 December.

Lectures and seminars

Amos, **M**. (2025). *Monitoring towards eradication: Rusa deer on Wild Duck Island*, Department of Primary Industries and Regional Development Western Australia, Online, 23 April.

Bickel, **T**.**O**. (2025). *Integrated Crop Health and Management/Aquatic Plant Ecology and Management*, University of Queensland, Gatton, May 2025.

Elsworth, **P**. (2025). *Biological control of vertebrate pests* – AGRC3042, School of Veterinary Science, The University of Queensland, Gatton, 27 March.

Elsworth, **P**. (2025). *Vertebrate pest impacts on plants and the environment* – Plant and Environmental Health, School of Agriculture and Food Sciences, The University of Queensland, Gatton, 21 March.

Gentle, **M**. (2025). *Invasive vertebrate Pests – overview and management*, AGRC3042 School of Veterinary Science, The University of Queensland, Gatton, 10 April.

Gentle, **M**. and **Wilson**, **C**. (2025). *Feral pigs – status and management*, Reef 2050 Advisory Committee (RAC) and Independent Expert Panel (IEP) webinar, Brisbane, 21 March.

Osunkoya, **O**.**O**. (2025). Studying population dynamics of invasive alien species for better management, Seminar presentation to higher degree (M.Sc.) students, School of Agriculture, Queensland University, Brisbane, May 2025

Permits

APVMA (2024) PER94148: Permit to allow minor use of glyphosate and haloxyfop for control of hymenachne and Aleman grass in various situations. Issued 15 July 2024.

APVMA (2024) PER81752: Permit to allow minor use of glyphosate and metsulfuron-methyl for control of African boxthorn in various situations. Issued 20 August 2024.

APVMA (2024) PER89572v2: Permit to allow minor use of 1080 in meat baits for control of feral pigs in specific jurisdictions and situations. Issued 20 August 2024.

APVMA (2024) PER91667v3: Permit to allow minor use of 1080 baits at a higher rate for aerial baiting of wild dogs in Southern Downs Regional Council. Issued 16 October 2024.

APVMA (2024) PER91744: Permit to allow minor use of flumioxazin and glyphosate for control of Amazon frogbit in non-potable and offline potable waterways associated with Wappa Dam. Issued 21 October 2024.

APVMA (2024) PER12818: Permit to allow emergency use of chlorine for decontamination of tools and equipment in agricultural quarantine situations. Issued 22 November 2024.

APVMA (2024) PER80472: Permit to allow minor use of glyphosate and amitrole for control of water mimosa and dead and awake in aquatic situations. Issued 26 November 2024.

APVMA (2024) PER94775: Permit to allow minor use of clopyralid for control of leucaena in various situations. Issued 2 December 2024.

APVMA (2024) PER13706: Permit to allow minor use of imidacloprid for control of lantana stemsucking treehopper in fiddlewood trees. Issued 10 December 2024.

APVMA (2025) PER80929: Permit to allow minor use of metsulfuron-methyl for control of bahia grass and fireweed in various situations. Issued 10 February 2025.

APVMA (2025) PER83165: Permit to allow minor use of flupropanate for control of running bamboo species in various situations. Issued 6 March 2025.

APVMA (2025) PER95598: Permit to allow minor use of flumioxazin for control of kidneyleaf mudplaintain in non-potable and offline potable waterways. Issued 28 April 2025.

APVMA (2025) PER81236: Permit to allow minor use of Bonus adjuvant for weed control in aquatic and riparian situations. Issued 5 May 2025.

APVMA (2025) PER95644: Permit to allow minor use of glyphosate for destruction of plants in quarantine surveillance or control operations. Issued 8 May 2025.

APVMA (2025) PER92459: Permit to allow minor use of glyphosate, metsulfuron-methyl, imazapyr, amitrole, triclopyr, aminopyralid and picloram for control of cacti in various situations. Issued 12 May 2025.

APVMA (2025) PER11833: Permit to allow minor use of fluroxypyr, metsulfuron-methyl, tebuthiuron, triclopyr, aminopyralid and picloram for control of Siam weed in various situations. Issued 6 June 2025.

APVMA (2025) PER83249: Permit to allow minor use of flupropanate for control of Sporobolus species in pastures and non-crop areas. Issued 18 June 2025.

APVMA (2025) PER12436: Permit to allow minor use of metsulfuron-methyl, triclopyr, imazapyr, and aminopyralid for control of ginger species in various situations. Issued 24 June 2025.

APVMA (2025) PER86933: Permit to allow minor use of glyphosate for control of salvinia, water hyacinth and water lettuce in aquatic situations. Issued 25 June 2025.