SEEK AND YOU SHALL FIND – EARLY DETECTION SUCCESS STORIES

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ABSTRACT

Preventing the establishment of high-risk invasive plants generates an estimated benefit to cost ratio of 100:1. In Queensland, the species that pose the highest risk and that are not present in the state, or are the subject of prevention or eradication actions, are listed as prohibited matter under the *Biosecurity Act 2014*.

Pre-emptive surveillance is our best chance of detecting incursions of these high-risk target species while populations are small and vulnerable to complete elimination. However, early detection is challenging and needs to be approached strategically.

Biosecurity Queensland and partners have developed several surveillance strategies, including (1) the Weed Spotters Network, a network of 1800 citizen scientists trained to detect and report target species, (2) monitoring observations of target species submitted through the online biodiversity cataloguing application iNaturalist, and (3) monitoring 'sentinel sites' – locations where target species are most likely to be found.

Three outstanding early detection success stories are: (1) yellow fever tree (*Vachellia xanthophloea*) reported through the Weed Spotters Network; (2) Siam weed (*Chromolaena odorata*) detected via iNaturalist and the Atlas of Living Australia Biosecurity Alerts Service; and (3) tropical soda apple (*Solanum viarum*) detected at a sentinel site. In all three examples, detection resulted in delimitation and removal of the population. Such action is predicted to have prevented multimillion-dollar problems from developing. Tropical soda apple alone costs Florida cattle producers an estimated US$15 million per annum in lost production.

These case studies demonstrate that implementing multiple targeted surveillance strategies and engaging citizen scientists increases the likelihood of early detection.

INTRODUCTION

There are thousands of potentially invasive species that pose a risk to Queensland. Focussing resources on preventing the establishment of species predicted to cause the greatest harm maximises return on investment. More than 900 high-risk plant species and thousands of high-risk mammal, reptile, and amphibian species are included as 'prohibited biosecurity matter' under Queensland's *Biosecurity Act 2014*. All of these species are targets for exclusion, surveillance (early detection) and, when found, statewide eradication (if feasible). In addition, there are a relatively small number of species listed as 'restricted biosecurity matter' in their early stages of invasion and, as such, are also targets for surveillance and statewide eradication (if feasible).

Biosecurity Queensland has implemented a range of general and active surveillance strategies to increase surveillance capability across the state. General surveillance, also referred to as passive surveillance, involves the public gathering data on pests and weeds, often opportunistically or as part of regular activities. Engaging the public is a cost-effective strategy for extending surveillance area and frequency. It is also a strategy for monitoring areas that are not readily accessible to state and local government officers, such as private property. Active surveillance is undertaken by specific staff following standard procedures, such as targeted surveys for a single species or monitoring invasion pathways.

Targeted surveillance by Biosecurity Queensland, in partnership with other agencies, has detected new incursions of high-risk invasive species in early stages of invasion, and rapid response has prevented establishment, and the associated costs and impacts have been avoided.

This paper examines three case studies where targeted surveillance resulted in the early detection of high-risk invasive plants. Two of the case studies are examples of general surveillance: the citizen science program Weed Spotters; and utilising the iNaturalist application and Atlas of Living Australia's Biosecurity Alert Service. The third case study is an example of active surveillance with the monitoring of sentinel sites.

CASE STUDIES

Case study 1 – Yellow fever tree reported through the Weed Spotters Network

The Weed Spotters Network Queensland (Weed Spotters) is a citizen science collaboration between the Queensland Herbarium, Biosecurity Queensland and the community. Local government support the program via the Land Protection Fund and comprise approximately 15% of the membership. As of May 2025, Weed Spotters has over 1800 members. The program focuses on the early detection of new and emerging weeds by harnessing and fostering community interest in identifying invasive plants. Members are trained in how to detect and report weeds. Training is focussed on identification of prohibited and restricted (category 2,3,4 & 5) weeds that are feasible targets for eradication.

Yellow fever tree (*Vachellia xanthophloea*) is a prohibited invasive plant under Queensland's *Biosecurity Act 2014*. It is native to tropical and subtropical regions of southern and eastern Africa and poses a similar risk to that of the biologically similar Prickly Acacia (*V. nilotica*). Prickly Acacia is one of Queensland's worst invasive plants of grazing land. It has infested over 6 million hectares of arid and semi-arid land and costs landholders at least $5 million per year in lost production and management costs. Yellow fever tree has been detected in Queensland gardens seven times over the past 30 years, with all individuals successfully removed before escaping cultivation – true early detection.

In January 2025, Biosecurity Queensland was notified by the Weed Spotters Network Coordinator of a yellow fever tree detected in Bundaberg. A Bundaberg Regional Council Land Protection Officer had observed several trees growing on private

property that they suspected could be Prickly Acacia but on closer inspection determined that they were not. The officer had recently attended Weed Spotters training that included identification of prohibited exotic Acacias, including *Vachellia* species, and noted that these trees had several characteristics typical of *Vachellia*. Suspecting that these trees could be a prohibited species, the officer submitted specimens and photos of the plants *in situ* to the Queensland Herbarium and the Weed Spotters Network Coordinator, and they were confirmed to be yellow fever tree.

Officers from Biosecurity Queensland and Bundaberg Regional Council undertook surveillance of the property and identified 31 mature trees and numerous seedlings of four prohibited *Vachellia* and *Senegalia* species. The trees were determined to be least 20 years old and had produced a large quantity of seed. Officers collected 2.7kg of paperbark thorn (*Vachellia sieberiana*) seed, an estimated 11,306 individual seeds, and approximately 0.7kg of seed from the other three species.

A risk assessment identified multiple pathways for seed to have potentially moved offsite. The property adjoined a public park, and onsite water drained to the park and to the Burnett River. Officers observed yellow fever tree seed pods flowing down a drain that flowed offsite. The property had also been subject to at least one flood event since the trees were planted. A second local property was owned by the landholder, and vehicles and machinery were used across both properties. Delimitation surveillance was undertaken on neighbouring properties, along the banks of the Burnett River, and at the other property owned by the landholder. To date, there is no evidence that any of the prohibited species identified have reproduced offsite.

A response plan is under development and will include active surveillance, passive surveillance and tracing activities. Seed collected from the property is undergoing testing, including salinity, buoyancy and controlled ageing tests, to determine seed longevity and potential dispersal pathways. Results will be used to refine the response plan.

Case study 2 – Siam weed detected through the iNaturalist app and reported via the Biosecurity Alert Service

iNaturalist is an online citizen science network and biodiversity information sharing platform with millions of users worldwide. Approximately 31,000 users have contributed records in Queensland and more than 18,000 users have made identifications. The Australian arm of the platform is hosted by Atlas of Living Australia (ALA). ALA aggregates data from more than 850 databases (Atlas of Living Australia 2024), including institutions such as Australian herbaria and universities, and citizen science applications including iNaturalist. ALA delivers the Biosecurity Alerts Service, a weekly email notification of new occurrences of a specified species list within a specified range.

Siam weed (*Chromolaena odorata*) is a restricted (category 3) invasive plant under Queensland's *Biosecurity Act 2014*. It is native to Central and South America and is climatically suited to large swathes of Queensland. Siam weed has similar morphology to lantana (*Lantana camara*) and poses similar risks. It is well-established in northern Queensland from Cairns to Townsville, but is not known to have established further

south than Shoalwater Bay, where an isolated population was detected in 2013. Biosecurity Queensland monitors iNaturalist records of Siam weed to document range extensions.

In June 2024, Biosecurity Queensland was alerted via ALA's Biosecurity Alerts Service of an iNaturalist record of suspected Siam weed in Strathpine, a suburb north of Brisbane. Moreton Bay Regional Council attended the site and submitted a specimen to the Queensland Herbarium, which confirmed that the plant was Siam weed, the first known record in Southeast Queensland. The site was a wooded recreation area adjoining South Pine River, which forms the border between the Moreton Bay Regional Council and Brisbane City Council local government areas.
Biosecurity Queensland and Moreton Bay Regional Council officers undertook delimitation surveillance of the site and identified three mature Siam weed plants and two seedlings, all in proximity to each other. The mature plants had likely been flowering for at least two seasons. The plants were destroyed, and the area will continue to be monitored for seedling emergence. Tracing undertaken by Moreton Bay Regional Council has not uncovered the source of the plants, although they were almost certainly an accidental introduction.

Case study 3 – Tropical soda apple detected at a sentinel site in South East Queensland

Sentinel sites are locations where a target species is most likely to be found. As surveillance costs increase exponentially with surveillance area, focussing surveillance resources at likely points of introduction improves cost-effectiveness of surveillance efforts, and increases likelihood of detection at early stages of invasion (Keeling *et al.* 2017). By inspecting these locations at a frequency relevant to the target species, it is expected that a population will be detected if it is present, even at low densities. The absence of the target species at a sentinel site improves the likelihood that the species is absent from the region (Keeling *et al.* 2017).

Tropical soda apple (*Solanum viarum*) is a prohibited invasive plant under Queensland's *Biosecurity Act* 2014. It is native to South America and appears to be climatically suited to extensive areas of coastal and subcoastal Queensland. Tropical soda apple poses a significant agricultural, economic and environmental threat to Queensland, and Australia more broadly (Bignell 2024). It can readily invade pasture and reduce cattle carrying capacity (Mullahey *et al.* 1993) and is a host of at least six viruses that affect Solanaceae vegetable crops including tomato, eggplant, potato and capsicum. In Florida, USA it is known as "the plant from hell", where it costs cattle producers an estimated $15 million USD per annum in lost production (Bignell 2024). It is widespread throughout the North Coast region of New South Wales and there are infestations in the Northern Tablelands and the Hunter region (Bignell 2024). Tropical soda apple has been detected at multiple sites in South East Queensland, all associated with cattle movement from New South Wales.

Biosecurity Queensland conducted a pathways analysis to understand dispersal vectors of tropical soda apple and to predict places where infestations are most likely to be found. The analysis identified that the highest-risk pathway was cattle transported into Queensland from infested areas of New South Wales. Several sentinel sites have been established in South East Queensland at abattoirs, sale yards

and feed lots receiving cattle from New South Wales. These sites are subject to regular monitoring in keeping with site management plans. Sentinel sites are the first line of defence against ongoing propagule pressure arriving from infested areas of New South Wales.

At one abattoir end of production processing site, tropical soda apple plants were identified during an inspection in 2020. The plants were estimated to be approximately 2 years old and were producing fruit. The plants were destroyed and a monitoring schedule was established with consideration for the reproduction rate (plants can produce fruit 75 days after germinating). Plants have been detected each year since monitoring commenced, all within expected areas such as holding yards and vehicle washdown areas. In April 2024, detections of plants in various stages of growth (immature, flowering and fruiting) triggered offsite delimitation. No plants were detected offsite.

DISCUSSION

Detecting new incursions at the early stage of invasion, ideally while the population is still in cultivation, maximises opportunities to respond and eradicate it. In each of these case studies, targeted surveillance resulted in successful early detection of high-risk species, likely before the population had become established. Delimitation found that the populations were limited to a relatively small area, and in the case of yellow fever tree and tropical soda apple, had not established outside the property boundary. Investing resources in delimitation and tracing resulted in reasonable certainty that all individuals in the population were detected and is a critical step in determining the feasibility of eradication. The sites continue to be monitored as the soil seed-bank is progressively exhausted. This active surveillance is supplemented by targeted general surveillance.

Employing various surveillance strategies increases the likelihood of early detection. In each of these cases, it is unlikely that these populations would have been detected and reported through other channels before becoming widespread in the area. The tropical soda apple and yellow fever trees were on private property, limiting opportunities for casual observation. Although the Siam weed was detected in a public and relatively well-frequented recreation area, it is not a surveillance target or a notifiable species, and Biosecurity Queensland and the local council would likely not have become aware of the incursion before it spread. The active and general surveillance programs complement each other as part of Queensland's pest prevention strategy.

Most early detections of high-risk weeds are made by trained personnel who are in a position to notice unusual new plants and who appreciate the benefit of reporting. In the tropical soda apple case, Biosecurity Queensland and partners were actively searching for this species in strategic locations, and the yellow fever trees, while not the target of an active surveillance program, were detected by a biosecurity professional who had recently attended relevant training. In 2023, 58 notifiable weed specimens – prohibited and restricted (category 2,3,4&5) – were submitted to the Queensland Herbarium for identification, all of which were submitted by Biosecurity Queensland or local government officers. The Weed Spotters program aims to

increase the number of trained people across Queensland. Between July 2024 and March 2025, 236 participants from 52 organisations attended Weed Spotters training sessions that included how to identify and report high-risk weeds.

CONCLUSION

Early detection of high-risk invasive species can deliver substantial benefits, with every successful eradication potentially saving millions of dollars. Utilising a range of targeted general and active surveillance strategies and engaging citizen scientists is proving effective in detecting high-risk species in the early stages of invasion.

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