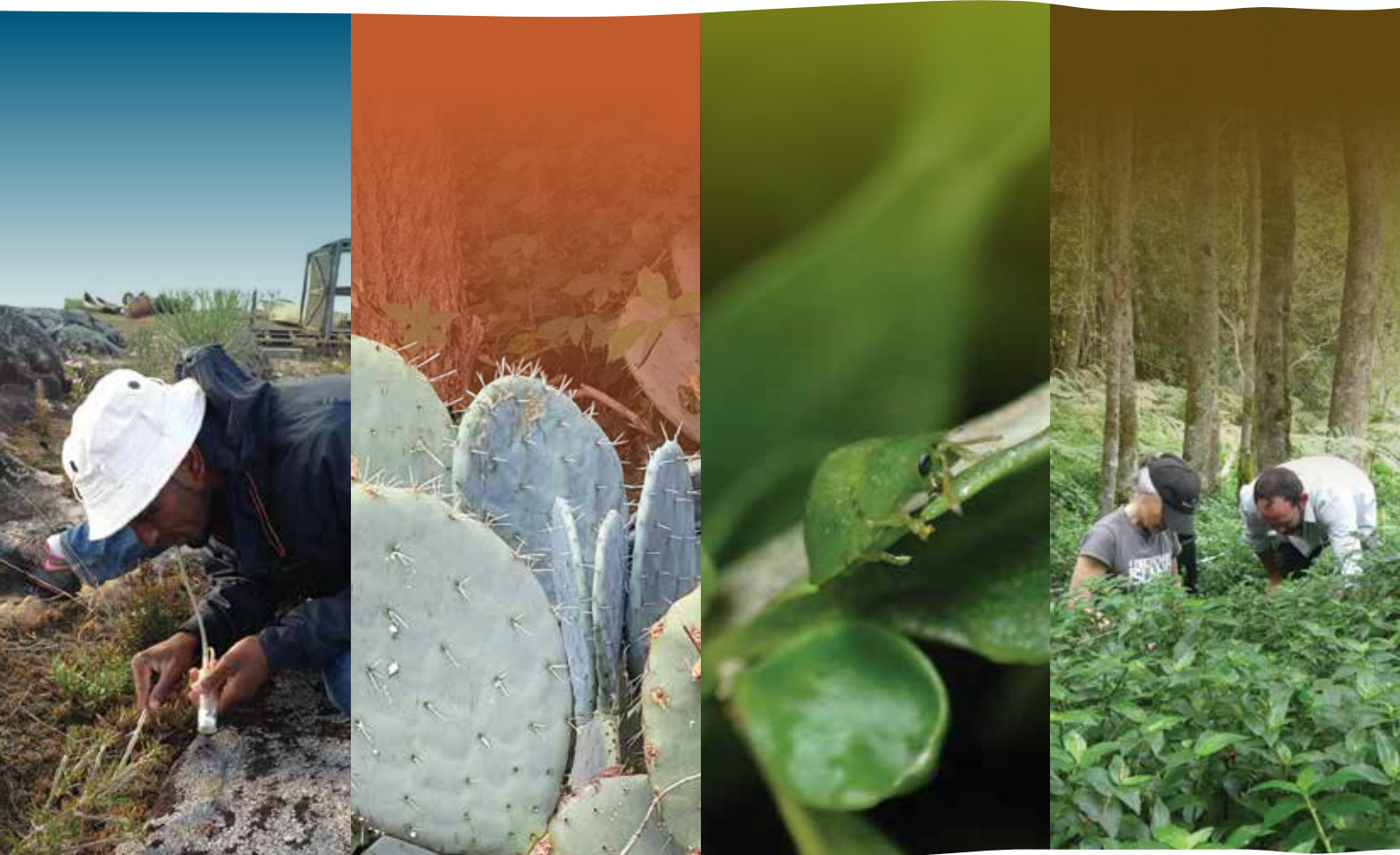




CENTRE FOR
INVASIVE SPECIES SOLUTIONS

20-YEAR NATIONAL WEED BIOCONTROL PIPELINE STRATEGY: **CONSULTATION DRAFT**

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CENTRE FOR INVASIVE SPECIES SOLUTIONS

The Centre for Invasive Species Solutions (CISS) is a national collaborative research, innovation, and engagement organisation tackling the ongoing threat from invasive pests and weeds to our threatened species, agriculture and landscapes. We bring governments, industry, community, philanthropic and research partners together to create solutions-focussed, collaborative RD&E programs and innovation pipelines. Partners also invest through our Invasive Species Solutions Trust which is a deductible gift recipient charity.

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COVER IMAGES

Tahina Rajoanera collecting biocontrol agents on mother-of-millions (*Kalanchoe delagoensis*) in its native range of Madagascar. Source: NSW DPI.

The biocontrol agent, Cochineal scale insect (*Dactylopius opuntiae*), on the opuntoid cactus (*Opuntia spp.*) at the Eldorado Dredge Historic Reserve, Victoria. Source: CISS.

The leaf-feeding beetle *Cassida distinguenda* in host-specificity testing for African boxthorn (*Lycium ferocissimum*). Source: CSIRO.

CSIRO researchers releasing the leaf-smut fungus *Kordyana brasiliensis* at a monitoring plot of wandering trad in NSW (*Tradescantia fluminensis*). Source: CSIRO.



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INTRODUCTION

This report provides an overview of the proposed 20-year National Weed Biocontrol Pipeline Strategy.

It outlines the development of an Alliance, a National Weed Biocontrol Reporting and Monitoring System and suggests rolling 5-year Research & Investment Plans.

The strategy will be underpinned by a national prioritisation process for weed biocontrol targets.

We ask for your feedback on this draft strategy to ensure that it is well-grounded, demand-driven, and outcome-focused.



Weeds: a \$5 billion problem for Australia's ecosystems, waterways and agricultural lands

Weeds have a major impact on Australia's environment. They cause significant impacts and are estimated to impose an overall average cost of nearly \$5 billion across Australia each year.^{1,2}

Weeds negatively affect natural ecosystems, waterways and vast areas of agricultural and pastoral lands, impacting the health, viability and function of ecological communities, ecosystems and landscapes.³

In particular, weeds:³

- threaten biodiversity
- disrupt ecosystem services, such as pollination and seed dispersal
- degrade ecosystem function, in particular soil health
- modify or degrade habitats through changed fire regimes (increase the intensity of fires, in the case of many invasive grass species)
- change water flows or reduce access to water
- increase competition for resources.

Australia's agricultural sector is at particular risk: the Australian Government has identified that managing threats from weeds to soil, water, threatened species and natural resources is a key challenge to agricultural productivity and livelihoods.^{5,6}

Biocontrol is an effective tool for managing weeds at landscape scales

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) there are at least three Key Threatening Processes (KTPs) caused directly by invasive plants:

1. loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
2. invasion of northern Australia by Gamba grass and other introduced grasses
3. novel biota and their impact on biodiversity.

Land clearance, fire regimes and other climate change issues are also listed as KTPs. These 'key established threats' to biodiversity, threatened native ecosystems and species, **require landscape-scale management and threat-mitigation actions.**³ Land managers also identify the importance of new or improved control methods for more efficient and sustainable weed management.⁷

Weed biocontrol is a powerful tool to mitigate emerging and established weed threats at the landscape scale.

Biological control is the practice of managing a weed by the deliberate introduction of one or more natural enemies (biocontrol agents).

After their introduction and establishment, populations of biocontrol agents can build up to very high levels, leading to a decline in the abundance, density, reproduction and spread of the weed host.

Biocontrol agents, once established, are self-sustaining and can assist the recovery of threatened biodiversity, ecosystems and agricultural assets.

Biocontrol is a cost-effective method, but Australia risks losing momentum without ongoing strategic investment

Annual benefits of \$95.3 million from an average annual investment of \$4.3 million was demonstrated in a CSIRO review of all weed biocontrol undertaken in Australia since 1903.⁸

This makes biocontrol one of the most cost-effective solutions currently available in the integrated weed management toolbox, with **benefits outweighing costs by over 23:1.**^{9,10}

Sustaining such returns on investment are vital for maintaining Australia's biodiversity, ecosystem health and agricultural productivity going forward.

Since 2014–15, the Australian government has invested approximately \$20 million in weed biocontrol projects across three rounds of the Rural R&D for Profit program, the Agricultural Competitiveness White Paper and the Established Pest Animal and Weed Management Pipeline program. These initiatives leveraged major co-investment from state governments, research and development corporations (RDCs) and other bodies such as the NSW Environmental Trust.

However, when they conclude in 2023, **there is a significant risk that weed biocontrol research capability will decline, lose momentum, and allow weeds to continue impacting priority natural and agricultural assets.**

There is currently no nationally agreed system in place to prioritise weed targets for biocontrol, which hampers strategic investments at a national scale.¹¹

Australia needs a 20-year RD&E Strategy to guide future weed biocontrol investments to meet our country's agreed weed management priorities.

Continued reductions in weed impacts would safeguard the health of Australia's natural biodiversity and ecosystems, and productivity and profitability of our agricultural landscapes.

Parkinsonia (Parkinsonia aculeata) leaf-defoliating pug moth (Eueupithecia cisplatensis) in the field after release. Source: CSIRO.



The opportunity: to strategically coordinate RD&E for enhanced weed biocontrol

A consolidated weed biocontrol strategy will ensure that future investments in weed biocontrol are:

- focused on national priorities
- guide best practice management
- align research, development and on-ground responses across government, industry and communities of practice.

Biocontrol solutions do not come about quickly. The long-term pipeline of discovering, assessing risks and releasing biocontrol agents demands a clearly articulated strategy. The strategy would be implemented in discrete stages, so that:

- progress can be readily assessed
- efforts redirected where necessary
- confidence provided to investors that desired outcomes will occur within an agreed-upon time frame.

The Centre for Invasive Species Solutions (the Centre) – in partnership with CSIRO, NSW Department of Primary

Industries, Queensland Department of Agriculture and Fisheries, and Agriculture Victoria – recognises the environmental, economic and social benefits of weed biocontrol research.

Consequently, these partners aspire to develop a long-term strategic pipeline approach, proven successful in rabbit biocontrol, to harness the unique opportunities and potential high returns on investment that successful biocontrol research can provide to weed management.

The Strategy will not aim to replace all efforts in weed biocontrol research and development (R&D), instead focusing particularly on weeds that are in the national interest for multiple sectors.

Our proposed 20-year National Weed Biocontrol Pipeline Strategy (the Strategy) will incorporate rolling five-year research and investment plans that will guide on-ground implementation of the strategic weed biocontrol research.

This consultation draft has been developed with input from key scientists experienced in researching, developing and applying weed biocontrol methods. The final Strategy will be developed after we receive feedback and hold discussions with key funding bodies/investors and stakeholders on this consultation draft.



The Strategy will unify and build on previous research and approaches

The Strategy's goals and investments will be aligned with the national Environment and Invasives Committee (EIC) and its Australian Weed Strategy 2017–27, and the Australian government's Threatened Species Strategy 2021–2031.⁴ This unified approach, integrated into Australia's national biosecurity system, is a necessity if Australia is to mitigate the negative impact of weeds.

Furthermore, the Centre's plans for weeds, building on its 10-year National Investment Plan for Weeds Research, Development and Engagement, outlines the need for a weed biocontrol component of a Weed Control Hub (see Figure 1) that could be delivered by our proposed 20-year Strategy.

Further, the proposed Strategy will aim to:

- encourage adoption of best practice management of national weed priorities
- support RD&E for integrated landscape management approaches that target multiple weed species with multiple control techniques at all scales
- reduce impacts of established weeds through the delivery of strategic pipeline of control tools, including the integration of biocontrol with industry and community weed management actions
- support better information and communication systems to enable adoption of cost-effective weed management.

We envision that developing and delivering the Strategy will be undertaken via a National Weed Biocontrol RD&E Alliance (the Alliance).

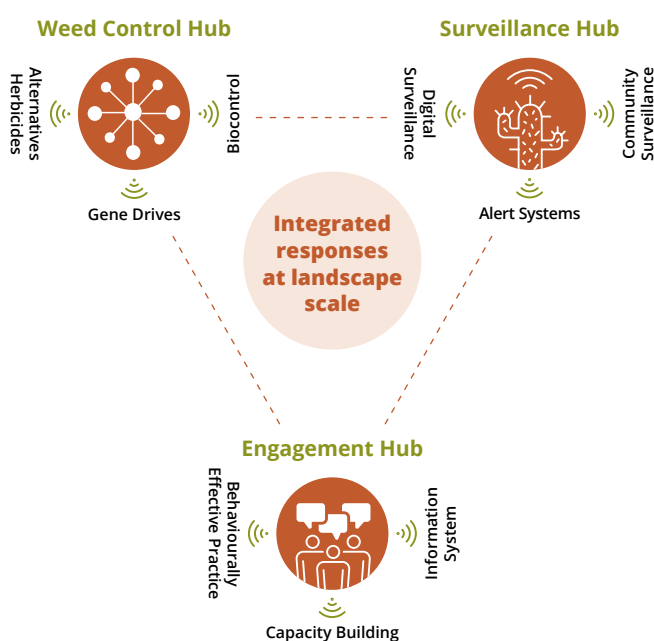


Figure 1. Biocontrol is part of a multi-dimensional approach to weed management, as envisaged by the Centre's 10-year National Investment Plan for Weeds Research, Development and Engagement.



Jatropa gall midge (*Prodiplosis hirsuta*) on bellyache bush (*Jatropa gossypifolia*). Source: QDAF.

Establishing a National Weed Biocontrol RD&E Alliance

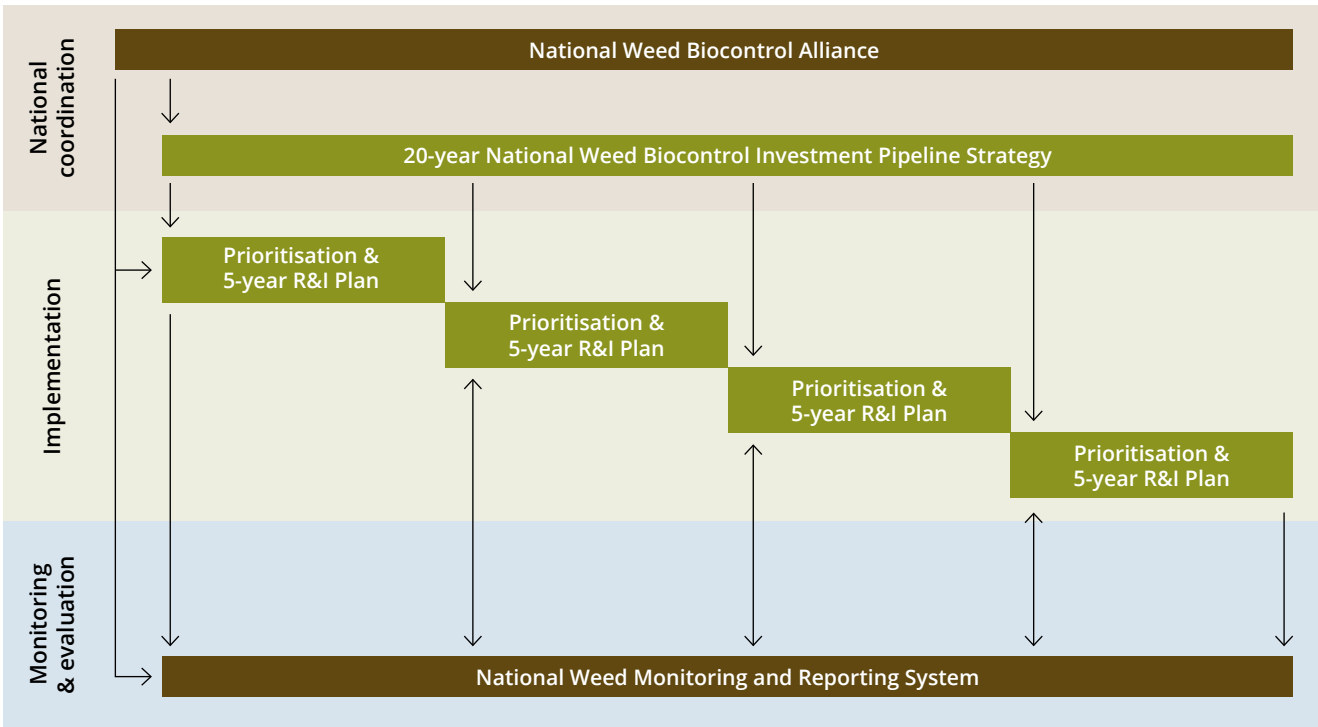
For the first time, a National Weed Biocontrol RD&E Alliance (the Alliance) will bring together representatives from leading biocontrol research service providers, Australian governments, RDCs and industry stakeholders to co-develop and implement a weed biocontrol RD&E Strategy at a national scale.

The Alliance will develop and deliver the 20-year pipeline Strategy and associated rolling 5-year Research &

Investment Plans to direct on-ground implementation of the 20-year Strategy (described below).

The first step will be to formalise the Alliance’s member base, governance structure and terms of reference. The Alliance will coordinate planning and prioritisation of weed targets for investment, and create a platform for knowledge sharing, extension and capacity building with on-ground weed managers to enable them to deliver novel weed biocontrol technologies at all scales.

Figure 2: Proposed structure of research program delivery



How we will develop the 20-year Strategy

The 20-year Strategy will set out future weed biocontrol RD&E priorities and comprise a framework to coordinate ongoing weed biocontrol research investments at a national scale.

Central to the Strategy will be a framework to prioritise how future weed targets for biocontrol research investment are selected, based on:

- their threats to biodiversity, natural ecosystems and agricultural assets
- biocontrol research feasibility (described below).
- The Strategy will also identify opportunities for investment in developing innovative biocontrol technologies such as bioherbicides, genetic biocontrol, and autonomous surveillance platforms to evaluate effectiveness of biocontrol agents at reducing weed threats.

The Alliance would coordinate Strategy development, and deliver it through extensive consultation across government, research, RDC, NRM and land use sectors. The Strategy will align with the Australian Weeds Strategy¹² and other national frameworks related to weeds.

Implementing the Strategy in planned, 5-year stages

Prioritise weed targets for investment

A three-stage prioritisation framework will be developed to select weeds for future biocontrol investment under the rolling 5-year Research & Investment Plans (Table 1).

Prioritisation at the national level will ensure investment targets the weeds of greatest threat and impacts on our native ecosystems and agricultural assets, including threatened species and ecological communities. The rationale for these assessments will:

- be robust, transparent and repeatable
- be defensible across experts, jurisdictions and sectors
- include estimates of knowledge gaps and uncertainties influencing priority outcomes to allow future refinement.

The prioritisation will be refined toward the end of each 5-year cycle to improve and inform the implementation of subsequent Research & Investment Plans.

Table 1: Proposed three-stage weed biocontrol prioritization framework

EXPERTS INVOLVED	KEY ACTIVITIES	OUTPUT
Stage 1		
Weed, agricultural and natural resource management and research stakeholders	Compile information on high-impact weeds across multiple jurisdictions and land-use sectors Develop weed threat/impact metrics for at-risk environmental and agricultural assets Clearly delineate role for biocontrol in asset protection	Ranked list of nationally prioritised weed biocontrol targets for further consideration under Stage 2
Stage 2		
Weed biocontrol research practitioners	Assess biocontrol feasibility x likelihood of success for nationally prioritised weed biocontrol targets Combine with Stage 1 ranked list – Biocontrol prospects x weed impact	List of most promising weed candidates for biocontrol RD&E investment
Stage 3		
Weed biocontrol research practitioners	Group weeds into Phase I, II & III pipeline research Identify opportunities for innovative biocontrol technology development and application	5-year implementation plan

Implement rolling 5-year Research & Investment Plans

Each 5-year Research & Investment Plan will be informed by the outputs from the prioritisation framework.

Proposed investment allocation will be equitably distributed across the three biocontrol pipeline research phases (Figure 3), to ensure that a sustainable pipeline of biocontrol research is established across the 5-year investment cycles, and balances risk and reward for prospective investors.

Within 5-years, this strategic research will seek to deliver novel biocontrol solutions for priority weed targets, leading to a measurable reduction in weed threats and enhance the condition of environmental and agricultural asset across Australia.

Left to right: Tahina Rajoanera collecting biocontrol agents on mother-of-millions (*Kalanchoe delagoensis*) in the native range of Madagascar. Source: NSW DPI; Person in photo – Tahina Rajoanera (PhD student). Quarantine host specificity testing for a rust fungus on African boxthorn (*Lycium ferocissimum*). Source: CSIRO; People in photo – Kylie Ireland and Gavin Hunter. Inspecting Parkinsonia (*Parkinsonia aculeata*) infestation on property for biocontrol agents using a beat sheet in North-western Queensland. Source: CSIRO. Person in photo – Andrew White and council weed officers.

Figure 3: Biocontrol pipeline research and delivery phases





Monitoring, evaluation and reporting to improve biocontrol delivery

Creating the new, efficient, digital National Weed Biocontrol Monitoring and Reporting System

The Monitoring and Reporting System we call the NWBMRS will be a digitally enabled platform to evaluate weed biocontrol outcomes on-ground.

The NWBMRS will facilitate both researchers and land managers to monitor agent release, establishment and impacts on target weeds – and asset recovery from weed invasion – in a more efficient, scalable and integrated way.

We will speak with experts in workshops to understand their needs, so that the NWBMRS can inform weed management goals, metrics, data standards and system compatibilities with existing monitoring infrastructure (including WeedScan, ALA, Biocontrol Hub app and iNaturalist). We will explore opportunities to integrate emerging digital and autonomous surveillance systems into the NWBMRS platform.

The NWBMRS will improve monitoring for biocontrol adoption and integrated weed management

When the NWBMRS is implemented for monitoring and reporting, we expect to see sustained suppression of weed impacts on priority assets because of the cost-effective and scalable uptake and integration of biocontrol activities with other management technologies by stakeholders.

The NWBMRS will facilitate and support collection and sharing of weed biocontrol data, to enable more robust and efficient monitoring of agent release, establishment and impacts on target weeds and associated assets.

End users will be able to monitor and contribute their own data in real time on biocontrol activities, which will foster knowledge sharing and extension with biocontrol practitioners along the research pipeline.

The NWBMRS will also provide a pathway by which end users can participate in mass release of new biocontrol agents. The redistribution of existing agents throughout Australia could also be facilitated by the NWBMRS.

Flying drone over Hudson pear
(*Cylindropuntia pallida*). Source: NSW DPI;
Person in photo – Andrew McConnachie.

We want your feedback and ideas

In this draft consultation for a 20-year National Weed Biocontrol Pipeline Strategy, we have set out the:

- rationale for a long-term approach to weed biocontrol research investment
- Alliance needed to implement it
- actions required to successfully implement it.

However, we need your feedback to ensure that the draft Strategy is well grounded, demand driven and outcome focused. We want to hear from potential partners, investors and stakeholders – anyone involved with ‘weeds’ in Australia.

You might want to offer ideas about the following areas, or something else:

- the proposed scope of the Strategy for nationally coordinated weed biocontrol, and if/where/how it will fit within the EIC and its Australian Weed Strategy 2017–27
- how to best structure the Alliance to ensure engagement from a broad range of stakeholders, including membership, governance and terms of reference
- how to best develop a National Weed Biocontrol Reporting and Monitoring System to ensure that it is accessible to both biocontrol practitioners and biocontrol end users
- whether a 20-year strategy is the best time frame over which to develop a framework and cover future priorities, taking into account where biocontrol currently is for weeds
- structure and feasibility of the rolling 5-year Research & Investment Plans
- how to best design and implement the prioritisation framework for selection of weed targets for future biocontrol investment



The rust fungus *Puccinia cnici-oleracei* (ex. *Conyza*) for the biological control of flaxleaf fleabane (*Conyza bonariensis*) in the laboratory before release. Source: CSIRO.

**WE ENCOURAGE YOU TO
SEND YOUR COMMENTS ON
DEVELOPING AND FUNDING A
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References

- ¹ McLeod, R. (2018) Annual Costs of Weeds in Australia. eSYS Development Pty Limited. Published by the Centre for Invasive Species Solutions, Canberra, Australia.
- ² ABARES (2014) *Agricultural Commodity Statistics 2014*, Australian Bureau of Agricultural and Resource Economics and Sciences, Australian Government.
- ³ Jackson WJ, Argent RM, Bax NJ, Bui E, Clark GF, Coleman S, Cresswell ID, Emmerson KM, Evans K, Hibberd MF, Johnston EL, Keyword MD, Klekociuk A, Mackay R, Metcalfe D, Murphy H, Rankin A, Smith DC, Wienecke B (2016) 'Overview: Invasive species are a potent, persistent and widespread threat to Australia's environment', in Australian Government Department of the Environment and Energy *Australia state of the environment 2016*, Australian Government.
- ⁴ Department of Agriculture, Water and the Environment (2021) *The Australian Government's Threatened Species Strategy 2021–2031*, Department of Agriculture, Water and the Environment, Australian Government.
- ⁵ Australia. Department of the Prime Minister and Cabinet, issuing body. 2015, Agricultural Competitiveness White Paper : stronger farmers, stronger economy / Australian Government [Department of the Prime Minister and Cabinet] [Canberra]. https://www.awe.gov.au/sites/default/files/documents/ag-competitiveness-white-paper_0.pdf (PDF, 3.6 MB)
- ⁶ Australia. Department of the Prime Minister and Cabinet, issuing body. 2014, Green paper on developing northern Australia Department of the Prime Minister and Cabinet Canberra, ACT. <https://www.infrastructure.gov.au/sites/default/files/documents/green-paper-on-developing-northern-australia.pdf> (PDF, 2.7 MB)
- ⁷ ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) (2021) *Pest Animal and Weed Management Survey 2016-19*, Australian Bureau of Agricultural and Resource Economics and Sciences, Australian Government.
- ⁸ CSIRO (Commonwealth Scientific Industry Research Organisation) (2017) *Research impact evaluation: Biological control of invasive plants*, Commonwealth Scientific Industry Research Organisation, Australian Government.
- ⁹ Page AR and Lacey KL (2006) 'Economic Impact Assessment of Australian Weed Biological Control', *Technical Series No. 10*, CRC for Australian Weed Management, Australian Government.
- ¹⁰ van Wilgen BW, Raghu S, Sheppard AW, Schaffner U (2020) 'Quantifying the social and economic benefits of the biological control of invasive alien plants in natural ecosystems', *Current Opinion in Insect Science*, 38:1–5.
- ¹¹ Hennecke B, Arrowsmith L and ten Have J (2013) *Prioritising Targets for Biological Control of Weeds – a Decision Support Tool for Policy Makers*, Australian Bureau of Agricultural and Resource Economics and Sciences, Australian Government.
- ¹² Invasive Plants and Animals Committee (2016) *Australian Weeds Strategy 2017 to 2027*, Australian Government Department of Agriculture and Water Resources, Australian Government.

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