# NATIONAL WEED BIOCONTROL PRIORITISATION RESULTS

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#### ENDORSEMENT

The results of the National Weed Biocontrol Prioritisation process were endorsed by the Environment and Invasives Committee on 5 March 2025.

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#### PREAMBLE

The <u>National Weed Biocontrol Pipeline Strategy</u> (CSIRO and Centre for Invasive Species Solutions 2023) was established to guide the coordination of weed biocontrol research, development and extension (RD&E) investment for national weed priorities, and to align RD&E across government, industry, community, research, and on-ground weed management practice.

As part of implementing the Strategy, a *National Weed Biocontrol Prioritisation Framework* (the Framework) (CSIRO, Wild Matters and Centre for Invasive Species Solutions 2024) was developed to enable transparent and robust assessment and selection of priority weed biocontrol targets.

The Strategy also stated the need to reduce the threat of weeds to natural environments, agricultural production and livelihoods, cultural values and social values and assets. Weeds were identified for consideration in the prioritisation through either jurisdictional nomination of weeds via the Environment and Invasives Committee's Weed Working Group (EIC's WWG), or an open nomination process that was hosted on the Weeds Australia website. Additionally weeds identified as having an impact on First Nations people (and their culture) were identified through Healthy Country Plans for inclusion in the prioritisation.

This document presents the prioritisation results from implementation of the three stages of the Framework (Figure 1).



Figure 1: Flow diagram depicting the three stages of the National Weed Biocontrol Prioritisation Framework (CSIRO, Wild Matters and Centre for Invasive Species Solutions 2024).

The results have also been filtered by:

- "Novel" weeds: With either no or only very recent weed biocontrol research investment limited to exploratory research and host-specificity testing.
- "Recent" weeds: Where exploration and risk assessment have been conducted since 2014, resulting in approved agent releases, but with limited national-scale implementation. This may present an opportunity to leverage existing releases and scale up efforts.
- "Legacy" weeds:
  - Where historical exploration and risk assessment have been conducted, but no agent approved for release despite extensive research or,
  - Where historical exploration and risk assessment have led to the approval of at least one (often multiple) agent releases.

All weed biocontrol targets must be endorsed by the Environment and Invasives Committee (EIC) through the current <u>procedure</u> before permission is sought to release a biocontrol agent (EIC 2019).

The <u>Protocol for Biological Control Agents</u> (Department of Agriculture, Fisheries and Forestry 2022) provides a national standard for the assessment and introduction of exotic biocontrol agents into Australia under the *Biosecurity Act 2015* and the *Environment Protection and Biodiversity Conservation Act 1999*.

When selecting priority weeds for potential investments, it is recommended the following principles (from the Strategy and Framework) are considered:

- Consider exploratory research for novel biocontrol agents in the native range of high-threat weeds that have not received significant research attention to date.
- Support national release programs for biocontrol agents that have recently been approved for release but only in limited regional trials to date.
- Consider further investment in 'legacy' weeds previously targeted for biocontrol if novel, promising agents have been identified, and their release is likely to significantly reduce the weed's impact on agriculture or the environment.
- Consider monitoring and evaluation of historical biocontrol agent releases to understand their long-term benefits.

These guiding principles will help to ensure "…*research efforts are equitably distributed across the four biocontrol pipeline research phases*" thus "*maintain a sustainable pipeline of biocontrol research across the 5-year implementation cycles, and balance risk and reward for prospective investors*" as articulated in the Strategy (CSIRO and Centre for Invasive Species Solutions 2023).

After implementation of the endorsed prioritisation framework and review of the results by the Weed Biocontrol Alliance (the Alliance), 20 weeds across 18 projects have been proposed for prioritisation across the weed biocontrol RD&E pipeline (Figure 2).



#### Weed biocontrol RD&E pipeline

*Figure 2: Pipeline-based representation of twenty prioritised weed species listed across 18 suggested projects* (*Sida* and *Cryptostegia* species have been recommended as combined targets for project consideration).



## IMPLEMENTATION OF STAGE 3 MATRIX BASED PRIORITISATION

In total, 125 weeds evaluated for weed threat and biocontrol prospects progressed to Stage 3 of the prioritisation process. The details of seven weeds found to be ineligible or unfeasible for Stage 3 prioritisation are provided in Appendix 1. Therefore, these weeds were not included in the Stage 3 prioritisation process.

The weeds were prioritised by bringing together the results of the weed threat and biocontrol prospects assessments into a 5 x 5 matrix. Following the agreed Stage 3 method in the Framework, weeds were initially arranged in a scaled matrix (to ensure equal distribution of species across each of five 20 % frequency bands) (Figure 3). Because all the weeds included in the prioritisation process were of considerable threat, this 20% scaling approach prevented clumping within the high-threat bands of the matrix and produced a matrix of *relative* weed threat.

However, to avoid the misunderstanding that weeds on the left of the matrix (in Figure 3) are not high threat weeds, a second matrix based on the *original* weed threat banding determined by Wild Matters is presented (Figure 4) to aide in decision making. Note that, throughout this document, these two contrasting versions of the matrix are presented side by side to aide in decision making about potential investment targets.



#### Relative weed threat (20% frequency bands)

		0	2	0 4	40	60	80	100		
			Cenchrus pedicellatus (1)* Solanum linnaeanum (1) Melinis repens (1)* Alternanthera pungens (1) Cenchrus longispinus (1) Eragrostis cylindriflora (1) Cenchrus spinifex (1)	Cuscuta campestris (1) Xanthium spinosum (1)* Themeda quadrivalvis (1)* Hyparrhenia hirta (1) Ipomoea cairica (1)	Phalaris aquatica (1) Hyparrhenia rufa (1) Crataegus monogyna (1) Olea europaea subsp. cuspidata (1) Cenchrus polystachios (1)*	Asparagus scandens (1) Erica scoparia (1) Erica lusitanica (1)* Gloriosa superba (1)* Cenchrus macrourus (1) Ludwigia peruviana (1) Urochloa mutica (1)* Juncus acutus (1)	Cenchrus ciliaris (1)*			
orospects ands)		20	Rosa rubiginosa (2) Gomphocarpus fruticosus (1) Galium aparine (1) Cuscuta suaveolens (1) Conium maculatum (1,2,4) Ambrosia psilostachya (1)	Azadirachta indica (1)* Solanum elaeagnifolium (1)* Solanum sisymbriifolium (2) Ricinus communis (1,2) Pinus radiata (1) Syngonium podophyllum (1) Vinca major (1)* Barleria prionitis (1)	Senna obtusifolia (1)* Ochna serrulata (1)	Asparagus africanus (1) Asparagus aethiopicus (1) Rumex hypogaeus (1,2)	Limnobium laevigatum (1)* Ligustrum lucidum (1,2) Salix x fragilis nothovar. fragilis (1,4)			
biocontrol p	frequency b	40	Sporobolus fertilis (1) Tribulus terrestris (1)* Carduus pycnocephalus (1,2) Eragrostis curvula (1,2)* Digitalis purpurea (1) Convolvulus arvensis (1,2)	Senecio madagascariensis (1)* Orobanche ramosa (2) Ziziphus mauritiana (1)	Tamarix aphylla (1,2) Araujia sericifera (1,2) Cestrum parqui (1,2) Nassella trichotoma (1,2) Sporobolus pyramidalis (1,2) Chondrilla juncea (1)	Vachellia nilotica (3)* Moraea flaccida (1) Nymphaea mexicana (1,2) Rhaponticum repens (1) Cortaderia selloana (1,2)	Salix cinerea (1,2) Rubus fruticosus spp. agg (2 Mimosa pigra (3,4)* Lantana camara (1)* Biancaea decapetala (1,2) Ludwigia longifolia (1,2) Sporobolus anglicus (1,2) Zantedeschia aethiopica (1)	)*		
Relative b (20% fi	60	Tecoma stans (1,2) Senecio jacobaea (U) Lonicera japonica (2) Prosopis pallida (2) Marrubium vulgare (2)* Calotropis procera (1,2)*	Opuntia aurantiaca (4) Xanthium strumarium (1,4) Parthenium hysterophorus (1) Heliotropium amplexicaule (2,4 Erigeron bonariensis (2,3,4)* Cardiospermum grandiflorum (1,2) Solanum mauritianum (2,3) Silybum marianum (1)	Anredera cordifolia (1,2)* Pilosella aurantiaca subsp. aurantiaca (1) )	Bryophyllum delagoense (2) Cytisus scoparius (2)* Cirsium arvense (2) Asparagus asparagoides (1,3) Ligustrum sinense (1,2)	Alternanthera philoxeroides ( Andropogon gayanus (1)* Ulex europaeus (1,4)* Cryptostegia madagascarien (1,4)	(1) sis			
		80	Nassella neesiana (2)* Leucanthemum vulgare (2,3)* Opuntia stricta (1) Echium plantagineum (4) Carduus nutans (4)	Parkinsonia aculeata (4) Euphorbia paralias (2,3,4)* Sagittaria calycina (3,4)	Sagittaria platyphylla (2,3,4) Dolichandra unguis-cati (2,3) Harrisia martinii (1,2,3) Chrysanthemoides monilifera ssp. monilifera (2,4)	Ageratina adenophora (2,4) Egeria densa (2) Genista monspessulana (2)	Cabomba caroliniana (3) Salvinia molesta (3,4)* Eichhornia crassipes (U)* Jatropha gossypifolia (2,3)* Chromolaena odorata (2,4)* Hymenachne amplexicaulis ( Cryptostegia grandiflora (1,4 Arundo donax (2) Lycium ferocissimum (3)*	2)* )*		
		100		Prio	ritisation ca	tegory				
	Very High High Medium Low Very Low									

Figure 3: Scaled prioritisation matrix depicting standardised relative distributions of 125 species across the weed threat and prospects dimensions, and colour-coded prioritisation categories (blue shading, very low to very high) for 25 matrix cells. When more than one species occupies a cell, they are vertically ranked (highest on top to lowest on bottom) by their threat × prospect values. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans.



#### Weed Threat score range

Figure 4: Prioritisation matrix depicting relative distributions of 125 species across the weed threat and biocontrol prospects dimensions, and colour-coded prioritisation categories (blue shading, very low to very high) for 25 matrix cells. When more than one species occupies a cell, they are vertically ranked (highest on top to lowest on bottom) by their threat × prospect values. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans.

#### **CONSIDERATION OF HISTORICAL WEED BIOCONTROL INVESTMENTS**

Of the 125 weeds included in the prioritisation matrix, 71 species were identified as novel targets for biocontrol research and, as such, would be targets for exploratory research for new candidate biocontrol agents across their native ranges (Figure 5).

The remaining 54 weeds had some prior biocontrol research:

- Ten 'recent' weeds with recently approved agents, but a national mass rearing and release program has not yet been initiated (Figure 6).
- 33 'legacy' weeds with at least one biocontrol agent released in Australia (Figure 7).
- 11 'legacy' weeds that were previously targeted for biocontrol programs or nominated as candidates for biocontrol research (e.g., *Tribulus terrestris*), but with no agent successfully released in Australia (denoted by # in Figure 7).



#### "Novel" weed biocontrol targets (n = 71 species)



Figure 5: Scaled (left) and original (right) prioritisation matrices depicting distributions of 71 "novel" targets for weed biocontrol across the weed threat and biocontrol prospects dimensions, and colour-coded prioritisation categories (blue shading, very low to very high) for 25 matrix cells. When more than one species occupies a cell, they are vertically ranked (highest on top to lowest on bottom) by their threat × prospect values. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans.



"Recent" weed biocontrol targets (n = 10 weed species)

Figure 6: Scaled (left) and original (right) prioritisation matrices depicting distributions of ten "recent" weed biocontrol target species across the weed threat and biocontrol prospects dimensions, and colour-coded prioritisation categories (blue shading, very low to very high) for 25 matrix cells. When more than one species occupies a cell, they are vertically ranked (highest on top to lowest on bottom) by their threat × prospect values. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans.

Very Low

100



"Legacy" weed biocontrol targets (n = 44 weed species)

Figure 7: Scaled (left) and original (right) prioritisation matrices depicting distributions of 44 "legacy" weed biocontrol target species across the weed threat and biocontrol prospects dimensions, and colour-coded prioritisation categories (blue shading, very low to very high) for 25 matrix cells. Hashtag species previously targeted for biocontrol programs or nominated as candidates for biocontrol research (e.g., Tribulus terrestris), but with no agent successfully released in Australia. When more than one species occupies a cell, they are vertically ranked (highest on top to lowest on bottom) by their threat × prospect values. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans.

#### HIGH THREAT WEEDS WITH LOW BIOCONTROL PROSPECTS

High threat weeds with low biocontrol prospects (boxes in the top right-hand corner of matrices) (Figure 3) received low biocontrol feasibility and likelihood of success scores due to no or limited research on candidate biocontrol agents in their native ranges, as well as limited information on weed population genetics, area of origin and ecology.

Given these knowledge limitations, it is not possible as part of this first prioritisation analysis to state with a high degree of confidence that these species indeed represent low priority targets for biocontrol research investment. There may be merit in considering these very high threat species as targets after foundational research to critically test their prospects for future biocontrol research is undertaken. This may include global scale population genomic analyses to pinpoint the likely areas of origin of invasive populations in Australia, to help optimise the location of candidate biocontrol agent exploratory surveys in the weed's native range. Other considerations may include climate matching or habitat suitability analysis.

#### EQUITABLE DISTRIBUTION OF WEED TARGETS

Other elements that should be considered in this regard include:

- equity across jurisdictions, •
- equity across systems (tropical, temperate, arid),
- values (cultural weeds vs non-cultural weeds).

Distribution maps of weeds recommended as priority weeds are provided in Figures A5 and A6 of Appendix 4.

#### WEEDS IMPACTING FIRST NATIONS PEOPLE

There was limited engagement with First Nations Peoples with advice provided to review Healthy Country Plans to understand the threat of weeds to culture and cultural heritage. Further engagement is needed with First Nations land managers to determine the level of support for biocontrol agents to manage target weeds.

During review of Healthy Country plans, a total of 65 eligible weeds were identified as impacting on First Nations peoples and their cultural values. Of these, 47 species were already identified and assessed in the existing weed list, with 39 (Table 1, green shading) meeting the threshold for inclusion in the final 125 weeds for prioritisation. Of the 39 cultural weeds included in the prioritisation list, 18 species were identified solely through Healthy Country plans, and as such were assessed for biocontrol prospects only (and not weed threat) (Figure 8).





Figure 8: Biocontrol prospects scores for the 18 weed species identified through First Nations engagement and Healthy Country plans that were not already included in the prioritisation via either the jurisdictional or open nomination process. As such these weeds were assessed for Biocontrol Prospects only. Coloured bars indicate the phase(s) of research nominated by experts during assessment. The numbers in brackets after a species denote the most feasible biocontrol research phase/s for that species (1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation).



## WEED BIOCONTROL PRIORITISATION RESULTS

Weed threat and biocontrol prospects data for 125 weed species are presented in Table 1. Weeds in this table are ordered based on their Threat x prospect score along with prioritisation categories (blue shading) based on the frequency band allocations for inclusion in scaled matrix (Table A2, Figure 3) and original prioritisation categories (Table A3, Figure 4) displayed in Table 1.

Weeds identified as negatively impacting cultural values when reviewing Healthy Country plans are denoted by green shading in this table. Weeds are also identified as either 'Legacy', 'Recent' or 'Novel' weed biocontrol targets in Table 1.

Weed biocontrol research phases presented in the last column are: 1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation, rust coloured shading indicates the Alliance recommended prioritised weeds (Table A4, Figure A4, Appendix 4). Details on biocontrol prospects assessments and the Alliance recommendations for prioritised weeds are provided in Tables A5, A6, A7, A8 of Appendix 4 for each phase of the RD&E weed biocontrol pipeline.



Table 1: Data for 125 weed species, demonstrating how species were allocated to prioritisation categories (blue shading) based on the frequency band allocations (Appendix 3) for inclusion in scaled matrices (Table A2, Figure 3) and original prioritisation categories (Table A3, Figure 4). Weeds identified as negatively impacting cultural values when reviewing Healthy Country plans are denoted by green shading. Weeds were also identified as either 'Novel' weeds biocontrol targets with either no or only very recent weed biocontrol research investment limited to exploratory research and host-specificity testing, 'Recent' weeds biocontrol targets where exploration and risk assessment have been conducted since 2014, resulting in approved agent releases, but with limited national-scale implementation. This may present an opportunity to leverage existing releases and scale up efforts. 'Legacy' weed biocontrol research targets where historical exploration and risk assessment have been conducted, but no agent approved for release despite extensive research or, where historical exploration and risk assessment have led to the approval of at least one (often multiple) agent releases. Weed biocontrol research phases presented in the last column are: 1: native range exploration, 2: host specificity testing, 3: mass rearing and release, 4: monitoring and evaluation, rust coloured shading indicates the Alliance recommended prioritised weeds (Appendix 4).

Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Cabomba caroliniana	57.89	94	5441.66	Very High	Very High	No	Legacy	Phase 3
Salvinia molesta	50.52	82	4142.64	Very High	Very High	Yes	Legacy	Phase 3
Eichhornia crassipes	54.03	76	4106.28	Very High	Very High	Yes	Legacy	Unfeasible
Jatropha gossypifolia	65.61	62	4067.82	Very High	Very High	Yes	Recent	Phases 2 & 3
Chromolaena odorata	61.75	60	3705	Very High	Very High	Yes	Recent	Phases 2 & 4
Alternanthera philoxeroides	67.36	46	3098.56	Very High	Very High	No	Legacy	Phase 1
Hymenachne amplexicaulis	52.63	58	3052.54	Very High	Very High	Yes	Novel	Phases 1/2
Cryptostegia grandiflora	56.13	54	3031.02	Very High	Very High	Yes	Legacy	Phases 1 & 4
Arundo donax	50.52	58	2930.16	Very High	Very High	No	Novel	Phase 2
Ageratina adenophora	45.61	64	2919.04	Very High	Very High	No	Legacy	Phase 4
Lycium ferocissimum	52.63	55	2894.65	Very High	Very High	Yes	Recent	Phase 3
Egeria densa	45.61	63	2873.43	Very High	Very High	No	Novel	Phase 2
Sagittaria platyphylla	40.35	71	2864.85	High	Very High	No	Recent	Phases 2 & 3
Genista monspessulana	45.61	58	2645.38	Very High	Very High	No	Legacy	Phase 2
Bryophyllum delagoense	50.17	52	2608.84	High	Very High	No	Legacy	Phase 2
Dolichandra unguis-cati	38.59	67	2585.53	High	Very High	Yes	Legacy	Phases 2 & 3
Andropogon gayanus	56.13	46	2581.98	Very High	Very High	Yes	Novel	Phase 1
Parkinsonia aculeata	37.89	68	2576.52	High	Very High	Yes	Legacy	Phase 4
Salix cinerea	71.57	36	2576.52	High	High	No	Novel	Phase 1



Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Cytisus scoparius	49.12	52	2554.24	High	Very High	Yes	Legacy	Phase 2
Harrisia martinii	42.1	58	2441.8	High	Very High	No	Legacy	Phase 2
Ulex europaeus	54.03	45	2431.35	Very High	Very High	Yes	Legacy	Phases 1 & 4
Cirsium arvense	46.31	49	2269.19	High	Very High	No	Legacy	Phase 2
Cryptostegia								
madagascariensis	52.63	43	2263.09	Very High	Very High	No	Legacy	Phases 1 & 4
Asparagus asparagoides	49.12	46	2259.52	High	Very High	No	Legacy	Phase 4
Euphorbia paralias	37.89	59	2235.51	High	Very High	Yes	Recent	Phase 3
Rubus fruticosus spp.agg	61.75	36	2223	High	High	Yes	Legacy	Phase 2
Anredera cordifolia	42.1	52	2189.2	High	High	Yes	Recent	Phase 1
Chrysanthemoides								
<i>monilifera</i> ssp. <i>monilifera</i>	41.05	53	2175.65	High	Very High	No	Legacy	Phases 2 & 4
Mimosa pigra	56.13	38	2132.94	High	High	Yes	Legacy	Phase 4
Sagittaria calycina	33.68	62	2088.16	High	Very High	No	Recent	Phase 3
Opuntia aurantiaca	37.89	52	1970.28	Medium	High	No	Legacy	Phase 4
Lantana camara	57.89	33	1910.37	High	High	No	Legacy	Phase 1
Xanthium strumarium	37.89	49	1856.61	Medium	High	No	Legacy	Phase 4
Ligustrum sinense	47.36	39	1847.04	High	Very High	No	Novel	Phase 2
Parthenium hysterophorus	36.49	50	1824.5	Medium	High	No	Legacy	Phase 1
Nassella neesiana	30.87	59	1821.33	Medium	Very High	Yes	Legacy	Phase 2
Biancaea decapetala	56.13	32	1796.16	High	High	No	Novel	Phase 1
Heliotropium amplexicaule	34.73	51	1771.23	Medium	High	No	Legacy	Phases 2 & 4
Ludwigia longifolia	63.15	28	1768.2	High	High	No	Novel	Phase 1
Sporobolus anglicus	54.03	32	1728.96	High	High	No	Novel	Phase 1
Zantedeschia aethiopica	50.52	34	1717.68	High	High	No	Novel	Phase 1
Vachellia nilotica	44.21	38	1679.98	High	High	Yes	Recent	Phase 3
Erigeron bonariensis	35.08	47	1648.76	Medium	High	Yes	Recent	Phases 2 & 3



Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Leucanthemum vulgare	28.42	58	1648.36	Medium	Very High	Yes	Novel	Phases 2 & 3
Tecoma stans	31.58	52	1642.16	Low	High	No	Novel	Phases 1 & 2
Moraea flaccida	46.31	35	1620.85	Medium	High	No	Novel	Phase 1
Cardiospermum								
grandiflorum	33.68	48	1616.64	Medium	High	No	Legacy	Phase 1
Nymphaea mexicana	44.73	36	1610.28	Medium	High	No	Novel	Phase 1
Rhaponticum repens	44.21	36	1591.56	Medium	High	No	Novel	Phase 1
Tamarix aphylla	42.1	37	1557.7	Medium	High	No	Novel	Phase 1
Araujia sericifera	41.05	37	1518.85	Medium	High	No	Novel	Phases 1 & 2
Senecio jacobaea	30.87	49	1512.63	Medium	High	No	Legacy	Undetermined
<i>Pilosella aurantiaca</i> subsp.								
aurantiaca	38.59	39	1505.01	High	High	No	Novel	Phase 1
Limnobium laevigatum	54.73	27	1477.71	High	High	No	Novel	Phase 1
Cestrum parqui	42.1	35	1473.5	Medium	High	No	Novel	Phases 1 & 2
Solanum mauritianum	33.68	43	1448.24	Medium	High	No	Novel	Phase 2
Ligustrum lucidum	57.89	25	1447.25	High	High	No	Novel	Phases 1 & 2
Nassella trichotoma	38.59	37	1427.83	Medium	High	No	Legacy	Phases 1 & 2
Lonicera japonica	31.58	45	1421.1	Low	High	No	Novel	Phase 2
Prosopis pallida	29.47	48	1414.56	Low	High	No	Legacy	Phase 2
Marrubium vulgare	28.07	49	1375.43	Low	High	Yes	Legacy	Phase 2
Salix fragilis nothovar.								
fragilis	56.13	24	1347.12	Medium	High	No	Legacy	Phases 1 & 4
Cortaderia selloana	47.36	28	1326.08	Medium	High	No	Novel	Phase 1 & 2
Silybum marianum	31.93	39	1245.27	Medium	High	No	Legacy	Phase 1
Opuntia stricta	19.65	61	1198.65	Low	High	No	Legacy	Phase 1
Sporobolus pyramidalis	38.59	31	1196.29	Medium	High	No	Legacy	Phases 1 & 2
Echium plantagineum	19.65	60	1179	Medium	High	Yes	Legacy	Phase 4
Chondrilla juncea	42.1	28	1178.8	Medium	High	No	Legacy	Phase 1



Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Senecio madagascariensis	35.08	32	1122.56	Low	High	Yes	Legacy	Phase 1
Sporobolus fertilis	31.58	35	1105.3	Low	High	No	Legacy	Phase 1
Orobanche ramosa	31.93	33	1053.69	Low	High	No	Novel	Phase 2
Ziziphus mauritiana	35.08	29	1017.32	Low	High	No	Novel	Phase 1
Tribulus terrestris	28.07	35	982.45	Low	High	Yes	Novel	Phase 1
Azadirachta indica	35.08	26	912.08	Low	Medium	Yes	Novel	Phase 1
Solanum elaeagnifolium	35.08	26	912.08	Low	Medium	Yes	Legacy	Phase 1
Solanum sisymbriifolium	34.73	26	902.98	Low	Medium	No	Novel	Phase 2
Carduus pycnocephalus	31.58	28	884.24	Low	High	No	Legacy	Phases 1 & 2
Eragrostis curvula	28.42	31	881.02	Low	High	Yes	Novel	Phases 1 & 2
Asparagus africanus	46.31	19	879.89	Medium	High	No	Novel	Phase 1
Calotropis procera	19.65	43	844.95	Low	High	Yes	Novel	Phases 1 & 2
Ricinus communis	33.68	24	808.32	Low	Medium	No	Novel	Phases 1 & 2
Carduus nutans	12.63	63	795.69	Medium	High	No	Legacy	Phase 4
Rosa rubiginosa	31.58	25	789.5	Low	Medium	No	Novel	Phase 2
Asparagus aethiopicus	46.31	17	787.27	Medium	High	No	Novel	Phase 1
Senna obtusifolia	41.05	19	779.95	Low	Medium	Yes	Novel*	Phase 1
Rumex hypogaeus	45.61	17	775.37	Medium	High	No		Phases 1 & 2
Digitalis purpurea	26.31	29	762.99	Low	High	No	Novel	Phase 1
Ochna serrulata	42.1	18	757.8	Low	Medium	No	Novel	Phase 1
Pinus radiata	37.89	20	757.8	Low	Medium	No	Novel	Phase 1
Syngonium podophyllum	37.89	20	757.8	Low	Medium	No	Novel	Phase 1
Asparagus scandens	50.17	15	752.55	Low	Medium	No	Novel*	Phase 1
Vinca major	33.68	22	740.96	Low	Medium	Yes	Novel	Phase 1
Cenchrus ciliaris	50.52	14	707.28	Medium	Medium	Yes	Novel	Phase 1
Barleria prionitis	37.89	18	682.02	Low	Medium	No	Novel	Phase 1
Erica scoparia	45.61	14	638.54	Low	Medium	No	Novel	Phase 1



Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Erica lusitanica	42.45	15	636.75	Low	Low	Yes	Novel	Phase 1
Gloriosa superba	42.45	15	636.75	Low	Low	Yes	Novel	Phase 1
Phalaris aquatica	42.1	14	589.4	Low	Low	No	Novel	Phase 1
Hyparrhenia rufa	41.05	14	574.7	Low	Low	No	Novel	Phase 1
Cenchrus macrourus	42.45	13	551.85	Low	Low	No	Novel	Phase 1
Ludwigia peruviana	45.61	12	547.32	Low	Medium	No	Novel	Phase 1
Crataegus monogyna	38.59	14	540.26	Low	Low	No	Novel	Phase 1
Gomphocarpus fruticosus	31.58	17	536.86	Very Low	Medium	No	Novel	Phase 1
Galium aparine	19.65	27	530.55	Very Low	Low	No	Novel	Phase 1
Cuscuta suaveolens	29.82	16	477.12	Very Low	Medium	No	Novel	Phase 1
Convolvulus arvensis	14.74	32	471.68	Low	Medium	No	Novel	Phase 1 & 2
Conium maculatum	20.88	22	459.36	Very Low	Low	No	Novel	Phases 1,2 & 4
Urochloa mutica	45.61	10	456.1	Low	Medium	Yes	Novel	Phase 1
Ambrosia psilostachya	16.84	27	454.68	Very Low	Low	No	Novel	Phase 1
Cuscuta campestris Olea europaea subsp.	34.73	13	451.49	Very Low	Low	No	Novel	Phase 1
cuspidata	42.1	10	421	Very Low	Low	No	Novel	Phase 1
Xanthium spinosum	37.89	10	378.9	Very Low	Low	Yes	Novel	Phase 1
Cenchrus pedicellatus	28.42	12	341.04	Very Low	Low	Yes	Novel	Phase 1
Themeda quadrivalvis	37.89	8	303.12	Very Low	Low	Yes	Novel	Phase 1
Solanum linnaeanum	22.45	12	269.4	Very Low	Low	No	Novel	Phase 1
Juncus acutus	44.21	6	265.26	Low	Low	No	Novel	Phase 1
Hyparrhenia hirta	37.89	7	265.23	Very Low	Low	Yes	Novel	Phase 1
Melinis repens	19.3	13	250.9	Very Low	Low	Yes	Novel	Phase 1
Alternanthera pungens	24.56	10	245.6	Very Low	Low	No	Novel	Phase 1
Cenchrus longispinus	22.1	11	243.1	Very Low	Low	No	Novel	Phase 1
Eragrostis cylindriflora	22.45	9	202.05	Very Low	Low	No	Novel	Phase 1



Weed species	Weed threat score	Biocontrol prospect score	Threat x prospect score	Scaled Prioritisation category (Figure 2)	Original Prioritisation category (Figure 3)	Identified negative cultural impacts	Legacy, Recent or Novel target	Phase(s) of the weed biocontrol pipeline
Cenchrus polystachios	38.59	5	192.95	Low	Low	Yes	Novel	Phase 1
Cenchrus spinifex	27.01	6	162.06	Very Low	Low	No	Novel	Phase 1
Ipomoea cairica	33.68	3	101.04	Very Low	Low	No	Novel	Phase 1



#### REFERENCES

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- CSIRO, Wild Matters and Centre for Invasive Species Solutions (2024) National Weed Biocontrol Prioritisation Framework: A framework for the prioritisation of weeds for biocontrol within the Australian context, Centre for Invasive Species Solutions, Canberra.
- Department of Agriculture, Fisheries and Forestry (2022) Revised guidelines for the introduction of exotic biological control agents for the control of weeds and plant pests. A report for DAFF, Canberra. Available at <a href="https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/biological-control-agents/protocol">https://www.agriculture.gov.au/biosecurity-trade/policy/risk-analysis/biological-control-agents/protocol</a> for biological control agents. Accessed 12 February 2025.
- Environment and Invasives Committee (2019) EIC procedure for endorsing candidate weeds for biological control. A report for the EIC, Canberra. Available at <u>https://weeds.org.au/overview/lists-strategies/</u>. Accessed February 2025.



## APPENDIX 1: INELIGIBLE AND UNFEASIBLE WEED ASSESSMENTS

Table A1: Weeds that were either found to be ineligible during the Stage 1 weed threat assessment, received unfeasible weed assessments during the Stage 2 biocontrol prospect analysis or on review by the Alliance and EIC's WWG in Stage 3 was deemed to be unfeasible (n = 7).

Weed species	Stage of prioritisation	Rationale
Rubus laudatus	Stage 1	Insufficient data to undertake threat assessment
Sporobolus jacquemontii	Stage 1	Insufficient data to undertake threat assessment
Cuscuta indecora	Stage 1	Not present in Australia
Pistia stratiotes	Stage 1	Native designation (Northern Territory)
Hypericum perforatum	Stage 2	Consensus amongst biocontrol experts that all possible avenues for biocontrol research at this stage have been exhausted
Olea europaea subsp. europaea	Stage 2	Reviewers identified an insurmountable conflict of interest
Raphanus raphanistrum	Stage 2	No agents identified
Eichhornia crassipes	Stage 3	Do not include as a priority weed target for Phase 2 research. Agents nominated by two assessors are not sufficiently host specific as they have either been previously tested by CSIRO (point raised during November biocontrol prospects workshop) or are known to have a broad host-range which would not be acceptable in a release application.



## APPENDIX 2: SCATTER PLOT OF WEED THREAT X BIOCONTROL PROSPECT SCORES



*Figure A1: Unmodified weed threat × biocontrol prospect values (white circles) for 125 weed species.* 

## APPENDIX 3: FREQUENCY DISTRIBUTIONS OF WEED THREAT AND BIOCONTROL PROSPECT SCORES CONVERSION INTO PRIORITISATION CATEGORIES



*Figure A2: Frequency distribution of weed threat scores (blue bars) for 125 weed species. Red lines show grouping into the 20% frequency bands (Table A2).* 



*Figure A3: Frequency distribution of biocontrol prospect scores (blue bars) for 125 weed species. Red lines show grouping into the 20% frequency bands (Table A2).* 

Table A2: Twenty percent frequency bands based on the frequency distribution of weed threat (Figure A2) and biocontrol prospects scores (Figure A3), used to assign weeds to cells in the scaled matrix in Figure 3.

Frequency band	Weed Threat score range	Biocontrol prospect score range
0 - 20	<31.6	≤15
20-40	31.6 - 37.9	16 - 27
40-60	38 - 42.1	28 - 38
60 -80	42.2 - 50.2	39 - 52
80 - 100	>50.3	≥53

Table A3: Twenty percent frequency bands based on the frequency distribution of weed threat determined during Stage 1 method development (see page 70 of CSIRO, Wild Matters and Centre for Invasive Species Solutions 2024) and biocontrol prospects scores (Figure A3), used to assign weeds to cells in the unscaled matrix in Figure 4.

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Frequency band	Weed Threat score range	Biocontrol prospect score range
0 - 20	<4.0	≤15
20-40	4.0 - 12.2	16 - 27
40-60	12.3 – 24.9	28 - 38
60 -80	25-44.6	39 - 52
80 - 100	>44.6	≥53

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## APPENDIX 4: PRIORITISED WEEDS, DISTRIBUTIONS AND RESEARCH PHASE JUSTIFICATION

Table A4: Weeds that placed in the Very High and High prioritisation categories in the matrix (Figure 3) then displayed vertically ranked (highest on top to lowest on bottom) by their threat × prospect values within each of the prioritisation categories. The three highest ranked cultural weeds (olive shading in prioritisation category) for biocontrol prospects are also included in the table (n = 37 weeds included in the table). Asterisked weeds were additionally identified as culturally significant when reviewing Healthy Country plans. Letters in brackets after species names indicate if the weed is a 'Novel' weeds biocontrol targets with either no or only very recent weed biocontrol research investment limited to exploratory research and host-specificity testing (N), 'Recent' weeds biocontrol targets where exploration and risk assessment have been conducted since 2014, resulting in approved agent releases, but with limited national-scale implementation. This may present an opportunity to leverage existing releases and scale up efforts (R). 'Legacy' weed biocontrol research targets where historical exploration and risk assessment have been conducted, but no agent approved for release despite extensive research or, where historical exploration and risk assessment have led to the approval of at least one (often multiple) agent releases (L) Common names provided under Latin names sourced from weeds.org.au.

The Alliance reviewed the top prioritised weeds based on Figures 3, to interrogate the phases of research across the biocontrol RD&E pipeline nominated by assessors during biocontrol prospect analysis (Stage 2 of the prioritisation). 'Endorsed' with dark green shading denotes weeds that have been endorsed by the Alliance after review of the justification for research provided by assessors, 'Not Endorsed' means after review by either the Alliance insufficient justification for the weed being included in the priority list was found and 'Not Prioritised' indicates the weed was not in the top species for that research phase and was not interrogated by the Alliance. Biocontrol prospects assessments and Alliance recommendations for endorsed prioritised weeds provided in Tables A5, A6, A7, A8 for each phase of the RD&E weed biocontrol pipeline.

Weed species	Exploratory research	Host- specificity testing	Mass-rearing & release	Monitoring & evaluation	Scaled Prioritisation category
Passiflora foetida (N)		Endorsed			
Stinking passionflower					Cultural
Sida species (acuta (L) & Sida			Endorsed		
rhombifolia (L))					
Spinyhead sida & Paddy's					
lucerne					Cultural
Cabomba caroliniana (R)			Endorsed		
Cabomba					Very High
Salvinia molesta (L)*			Endorsed	Not endorsed	
Salvinia					Very High
Jatropha gossypifolia (R)*		Endorsed	Endorsed	Not endorsed	
Bellyache bush					Very High
Chromolaena odorata (R)*		Endorsed	Not endorsed	Endorsed	
Siam weed					Very High
Alternanthera philoxeroides	Endorsed				
(L)					
Alligator weed					Very High
Hymenachne amplexicaulis		Endorsed			
(N)*					
Olive hymenachne					Very High
Cryptostegia grandiflora (L)*	Endorsed	Not endorsed		Endorsed	
Rubber vine					Very High
Arundo donax (N)		Endorsed			
Giant reed					Very High
Ageratina adenophora (L)	Not endorsed			Endorsed	Very High



Weed species	Exploratory research	Host- specificity testing	Mass-rearing & release	Monitoring & evaluation	Scaled Prioritisation category
Crofton weed					
Lycium ferocissimum (R)*			Endorsed		
African boxthorn					Very High
Egeria densa (N)		Endorsed			
Leafy elodea					Very High
Genista monspessulana (N)		Not prioritised			
Cape broom	_				Very High
Andropogon gayanus (N)*	Endorsed				
Gamba grass	Endersed			Fundament	Very High
Ulex europaeus (L)*	Endorsed			Endorsed	.,
European gorse	Endorood (with		Notondorood	Endorood (with	Very High
	recommendati		as alternative	recommendati	
Cryptostegia	on to combine			on to combine	
madagascariensis (L)	with Crvptostegia			with Crvptostegia	
Purple rubber vine	grandiflora)			grandiflora)	Very High
Sagittaria platyphylla (R)		Not prioritised	Endorsed		
Delta arrowhead					High
Bryophyllum delagoense (N)		Not prioritised			
Mother-of-millions					High
Dolichandra unguis-cati (L)*		Not prioritised	Not prioritised		
Cat's claw creeper			Not prioritiond	Endorood	High
Parkinsonia aculeata (L)*			Not prioritised	Endorsed	1.15.45
Parkinsonia	Endorsed				High
	Endorsed				High
Grey Sallow		Not prioritised			
English Broom					High
Harrisia martini (1.)		Not prioritised			1 11611
Harrisia Cactus		-			High
Cirsium arvense (L)		Not prioritised			
Perennial thistle					High
Asparagus asparagoides (L)	Not prioritised		Not prioritised		
Bridal creeper					High
Euphorbia paralias (R)*			Not prioritised		Ũ
Sea spurge					High
Rubus fruticosus spp. agg (L)*		Not prioritised			
European blackberry					High
Anredera cordifolia (R)*		Not prioritised	Not prioritised		
Madeira vine					High
Chrysanthemoides monilifera		Not prioritised		Not prioritised	
ssp. monilifera (L)					
Bitou bush				Name and a start of	High
Mimosa pigra (L)*			Not prioritised	Not prioritised	
Mimosa				Not primiting d	High
Sagittaria calycina (R)			INOL PRIORITISED	NOT PROFITISED	
Arrownead	Not prioritized				High
Lantana camara (L)^	Not phonused				
Lantana					-Fign-



Weed species	Exploratory research	Host- specificity testing	Mass-rearing & release	Monitoring & evaluation	Scaled Prioritisation category
Ligustrum sinense (N)	Not prioritised	Not prioritised			
Chinese privet					High
Biancaea decapetala (N)	Not prioritised	Not prioritised			
Mysore thorn					High
Ludwigia longifolia (N)	Not prioritised	Not prioritised			
Long-leaved water primrose					High



Figure A4: Pipeline-based representation of the Alliance recommended weeds for prioritisation. Twenty weed species listed across 18 suggested projects (<u>Sida</u> and <u>Cryptostegia</u> species have been recommended as combined targets for project consideration). Letters in brackets after species names indicate if the weed is a 'Novel' weeds biocontrol targets with either no or only very recent weed biocontrol research investment limited to exploratory research and host-specificity testing (N), 'Recent' weeds biocontrol targets where exploration and risk assessment have been conducted since 2014, resulting in approved agent releases, but with limited national-scale implementation. This may present an opportunity to leverage existing releases and scale up efforts (R). 'Legacy' weed biocontrol research targets where historical exploration and risk assessment have led to the approval of at least one (often multiple) agent releases (L) \* indicate weed that were also identified in Healthy Country Plans.

Across the RD&E pipeline, in this representation, Phase I (native range exploration) has five projects (three on legacy, two on novel weed targets), Phase II (risk assessment) has seven projects (two recent, four novel weed targets, one legacy weed target), Phase III (mass rearing and release) has seven projects (five recent, two legacy weed target) and Phase IV (monitoring and evaluation) two projects (one legacy and one recent weed target).





#### **Prioritised Weeds**

- Cabomba caroliniana
- Salvinia molesta
- Jatropha gossypifolia
- Chromolaena odorata
- Alternanthera philoxeroides
- Hymenachne amplexicaulis
- Cryptostegia grandiflora
- Arundo donax
- Ageratina adenophora
- Lycium ferocissimum
- Egeria densa
- Andropogon gayanus
- Ulex europaeus
- Cryptostegia madagascariensis
- Sagittaria platyphylla
- Parkinsonia aculeata

#### Climate Zones

Hot humid summer

- Warm humid summer
- Hot dry summer, mild winter
- Hot dry summer, cold winter Warm summer, cool winter
- Mild warm summer, cold winter

#### Figure A5: National distributions of prioritised weeds (as per Figure 2). Climatic zones from https://data.gov.au/data/organization/abcb, Zone 1: High humidity summer, warm winter, Zone 2: Warm humid summer, mild winter, Zone 3: Hot dry summer, warm winter, Zone 4: Hot dry summer, cool winter, Zone



Figure A6: National distributions of the 3 highest cultural weeds across the weed biocontrol RD&E pipeline. Climatic zones from https://data.gov.au/data/organization/abcb, Zone 1: High humidity summer, warm winter, Zone 2: Warm humid summer, mild winter, Zone 3: Hot dry summer, warm winter, Zone 4: Hot dry summer, cool winter, Zone 5: Warm temperate, Zone 6: Mild temperate, Zone 7: Cool temperate, Zone 8: Alpine

Table A5: Summary of biocontrol prospects for prioritised weeds in the exploratory research phase of the weed biocontrol RD&E pipeline and the Alliance recommendations after interrogation of the justifications provided by assessors during biocontrol prospects analysis (Stage 2 of the Weed Biocontrol Prioritisation Framework). Letters in brackets after species names indicate if the weed is a legacy weed biocontrol research target (L) (meaning it has had agents already approved for release), a target which has had agents recently approved for release (R) or a novel weed biocontrol target (N), weed common names sourced from weeds.org.au.

Weed species & common names	Summary of Phase 1 exploratory biocontrol prospects provided by biocontrol assessors	The Alliance recommendation after review
Alternanthera philoxeroides (L) Alligator weed	Further exploration needed to specifically look for agents targeting terrestrial forms of the weed, which is currently not under biocontrol from existing agents. Population genetic analysis should be used to direct new exploration efforts. A few candidate agents remain to be risk assessed and evaluated for impact include two leaf-mining fly species <i>Ophiomyia alternantherae</i> and <i>Ophiomyia buski</i> as well as a rust <i>Uredo pacensis</i> .	<b>Endorse</b> as a priority weed target for Phase 1 research.
<i>Cryptostegia grandiflora</i> (L) Rubber vine	Native range surveys to focus on stem and root feeders to complement existing agents. Population genetic analysis to direct new exploration efforts. All three assessors nominated the exploratory phase of research in conjunction with Phase 4 monitoring and evaluation to provide quantitative understanding of their impacts and determine what is required from any additional biocontrol agents for this species.	<b>Endorse</b> as a <u>combined</u> priority weed target for Phase 1 research with <i>Cryptostegia madagascariensis</i> (Alternative 1 below).
<i>Ageratina adenophora</i> (L) Crofton weed	There may be a need for additional agents if the rust fungus is not effective – requires monitoring and evaluation of the establishment and impacts of existing agents before undertaking further exploratory surveys of new agents. No compelling evidence that novel agents are available, given strong legacy of previous exploratory surveys.	<b>Do not endorse</b> as a priority weed target for Phase 1 research in the Weed Biocontrol Investment report. Phase 4 monitoring and evaluation of the establishment and impacts of existing agents needs to be undertaken to determine if further exploratory surveys of new agents is required.



Weed species & common names	Summary of Phase 1 exploratory biocontrol prospects provided by biocontrol assessors	The Alliance recommendation after review
<i>Andropogon gayanus</i> (N) Gamba grass	Systematic exploratory research needed as has not been investigated as a weed biocontrol target previously. Population genetic analysis to direct new exploration efforts.	<b>Endorse</b> as a priority weed target for Phase 1 research.
<i>Ulex europaeus</i> (L) Gorse	Need to revisit exploratory research phase as at least two subspecies of the weed have been recently identified. Thus, native and invasive populations of gorse need to be assessed, mapped and matched to delimit the area to search for new agents. This would include population genetic analysis to direct new exploration efforts.	<b>Endorse</b> as a priority weed target for Phase 1 research.
Cryptostegia madagascariensis (L) Purple rubber vine	Previous biocontrol program has used the same agents released for <i>Cryptostegia grandiflora</i> (above), mainly the rubber vine rust ( <i>Maravalia cryptostegiae</i> ) collected from <i>Cryptostegia grandiflora</i> , as host-specificity testing indicated this weed species is also highly susceptible. It is possible that more severe infection in the field on this species could be achieved if an accession of this rust is isolated from <i>Cryptostegia madagascariensis</i> .	<b>Endorse</b> as a <u>combined</u> exploratory Phase 1 research project combined with <i>Cryptostegia grandiflora</i> .
<i>Salix cinerea</i> (N) Grey sallow	Native range research needed to identify agents.	<b>Endorse</b> as a priority weed target for Phase 1 research.



Table A6: Summary of biocontrol prospects for the prioritised weeds in the host-specificity testing phase of the weed biocontrol RD&E pipeline and the Alliance recommendations after interrogation of the justifications provided by assessors during biocontrol prospects analysis (Stage 2 of the Weed Biocontrol Prioritisation Framework). Letters in brackets after species names indicate if the weed is a legacy weed biocontrol research target (L) (meaning it has had agents already approved for release), a target which has had agents recently approved for release (R) or a novel weed biocontrol target (N), weed common names sourced from weeds.org.au.

Weed species & common names	Summary of Phase 2 host-specificity testing biocontrol prospects	The Alliance recommendation after review
	Sap-sucking mirid <i>Engytatus</i>	<b>Endorse</b> as a priority weed target for Phase 2 research.
Culturally prioritised weed Passiflora foetida (N) Stinking passionflower	<i>passionarius</i> and stem-galling weevil <i>Philonis inermis</i> in the early phase of host specificity testing in Australian quarantine. Several other candidates have been identified during exploratory work in Brazil and Colombia.	Current Department of Biodiversity, Conservation and Attractions project concludes in 2026 which needs to be considered in Stage 3 biocontrol contextualisation. Any resulting research plan for inclusion in the Weed Biocontrol Investment report should commence at the conclusion of this project.
latronha	Prodiplosis hirsutus gall midge	<b>Endorse</b> as a priority weed target for Phase 2 research.
<i>gossypifolia</i> (L) Bellyache bush	identified for importation and host testing dependent on future funding.	Additional agents that complement the approved leaf-mining moth are likely needed to impact bellyache bush sufficiently.
<i>Chromolaena odorata</i> (L) Siam weed	<i>Dichrorampha odorata</i> shoot-boring moth, <i>Polymorphomyia basilica</i> stem-galling fly identified as candidates for host specificity risk assessment.	Endorse as a priority weed target for Phase 2 research. Additional agents that complement the approved stem-galling fly are likely needed to impact Siam weed sufficiently. Thus, the shoot-boring moth should be prioritised over another stem-galling fly.
Hymenachne amplexicaulis (N) Olive hymenachne	Ischnodemus variegatus bug – preliminary host characterisation in Florida undertaken but no results yet in the Australian context. Supplementary exploratory work likely required to identify additional biocontrol candidate agents.	<b>Endorse</b> as a priority weed target for Phase 2 research.
Arundo donax (N) Giant reed	Three agents developed and released in the USA that could be risk assessed in Australia. Candidate	<b>Endorse</b> as a priority weed target for Phase 2 research.



Weed species & common names	Summary of Phase 2 host-specificity testing biocontrol prospects	The Alliance recommendation after review
	agents include shoot-tip galling wasp Tetramesa romana, armoured scale Rhizaspidotus donacis and a leaf- miner Lasioptera donacis.	
<i>Egeria densa</i> (N) Leafy elodea	Preliminary host specificity testing of <i>Hydrellia egeriae</i> undertaken as part of NSW Environmental Trust funded project. Host testing of additional species required to submit release application.	<b>Endorse</b> as a priority weed target for Phase 2 research.

Table A7: Summary of biocontrol prospects for the prioritised weeds in the mass-rearing and release phase of the weed biocontrol RD&E pipeline and the Alliance recommendation after interrogation of the justifications provided by assessors during biocontrol prospects analysis (Stage 2 of the Weed Biocontrol Prioritisation Framework). Letters in brackets after species names indicate if the weed is a legacy weed biocontrol research target (L) (meaning it has had agents already approved for release), a target which has had agents recently approved for release (R) or a novel weed biocontrol target (N), weed common names sourced from weeds.org.au.

Weed species & common names	Summary of Phase 3 mass-rearing and release biocontrol prospects	The Alliance recommendation after review
Culturally prioritised weed Sida acuta (L) & Sida rhombifolia Spinyhead sida & Paddy's lucerne	Already a highly effective biological control agent ( <i>Calligrapha</i> <i>pantherina</i> ) established in the wild but requires augmentative release. Development of a biocontrol manual for <i>S. acuta</i> and <i>S.</i> rhombifolia to assist in improved education and outreach could be of benefit.	<b>Endorse</b> as <u>combined</u> priority weed targets for Phase 3 research.
<i>Cabomba caroliniana</i> (R) Cabomba	Weevil Hydrotimetes natans, approved for release. Mass rearing and releases commenced in Queensland and New South Wales at a small number of nursery sites but currently no national mass- rearing and release program.	<b>Endorse</b> as a priority weed target for Phase 3 research.
<i>Salvinia molesta</i> (L) Salvinia	The weevil <i>Cyrtobagous salviniae</i> identified as highly effective biocontrol agent but one that needs to be inundatively released (reintroduced at critical points in the season). All three assessors recommended coordinated inundative release program at the national scale, including with First Nations rangers in NT and elsewhere.	<b>Endorse</b> as a priority weed target for Phase 3 research.
<i>Jatropha gossypifolia</i> (R) Bellyache bush	Leaf-mining moth <i>Stomphastis</i> <i>thrausticia</i> approved for release in 2022. Leaf rust <i>Phakopsora jatrophicola</i> release application in preparation. No national mass rearing and release program for these agents has been undertaken.	<b>Endorse</b> as a priority weed target for Phase 3 research.



Weed species & common names	Summary of Phase 3 mass-rearing and release biocontrol prospects	The Alliance recommendation after review
<i>Chromolaena odorata</i> (R) Siam weed	Stem-galling fly <i>Cecidochares</i> <i>connexa</i> , approved for release in 2018. Releases made in Queensland and Northern Territory, across the know distribution of the weed.	<b>Do not endorse</b> the weed has a distribution that consists of Queensland and Northern Territory where releases of <i>Cecidochares connexa</i> have already been made. Instead recommend this weed considered as priority for Phase 4 monitoring and evaluation of the stem-galling fly.
<i>Lycium ferocissimum</i> (R) African boxthorn	Leaf rust <i>Puccinia rapipes</i> approved for release. Mass rearing and releases commenced in New South Wales but no current national release program. No investment available to support release in any other Australia jurisdiction.	<b>Endorse</b> as a priority weed target for Phase 3 research.
Cryptostegia madagascariensis (L) Purple rubber vine	Mass-rearing and release of existing biocontrol for this weed and <i>Cryptostegia grandiflora</i> with the rubber vine rust ( <i>Maravalia</i> <i>cryptostegiae</i> ) and leaf feeding moth ( <i>Euclasta whalleyi</i> ) into areas not yet present.	Do not endorse as a mass rearing and release program for <i>Cryptostegia madagascariensis</i> primarily adapted for <i>Cryptostegia</i> <i>grandiflora</i> requires knowledge of whether these agents are impactful on <i>Cryptostegia madagascariensis</i> in the field. This knowledge can only be obtained through monitoring and evaluation (Phase 4) research, thus recommend both <i>Cryptostegia</i> <i>grandiflora</i> and <i>Cryptostegia</i> <i>madagascariensis</i> considered as a priority for Phase 4.
<i>Sagittaria platyphylla</i> (R) Delta arrowhead	Weevil <i>Listronotus appendiculatus</i> recently approved for release and would benefit from a national mass rearing and release program, as the weevil has only been established so far at a few nursery sites.	<b>Endorse</b> as a priority weed target for Phase 3 research.



Table A8: Summary of biocontrol prospects for the prioritised weeds in the monitoring and evaluation phase of the weed biocontrol RD&E pipeline and the Alliance recommendations after interrogation of the justifications provided by assessors during biocontrol prospects analysis (Stage 2 of the Weed Biocontrol Prioritisation Framework). Letters in brackets after species names indicate if the weed is a legacy weed biocontrol research target (L) (meaning it has had agents already approved for release), a target which has had agents recently approved for release (R) or a novel weed biocontrol target (N), weed common names sourced from weeds.org.au.

Weed species & common names	Summary of Phase 4 monitoring and evaluation biocontrol prospects	The Alliance recommendation after review
<i>Salvinia molesta</i> (L) Salvinia	Monitoring and evaluation identified by all assessors as an important component of ongoing mass-rearing and releases but not as a separate, standalone activity from mass- rearing and release.	<b>Do not endorse</b> as a separate standalone activity, as monitoring and evaluation will be undertaken as part Phase 3 (mass rearing and release) activities.
<i>Jatropha gossypifolia</i> (L) Bellyache bush	Leaf mining moth <i>Stomphastis</i> <i>thrausticia</i> approved for release in 2022. This program is still in the mass rearing, release and establishment phase.	<b>Do not endorse</b> as a separate standalone activity to monitoring and evaluation that would be undertaken as part Phase 3 (mass rearing and release).
<i>Chromolaena odorata</i> (L) Siam weed	Stem galling fly <i>Cecidochares</i> <i>connexa</i> , approved for release in 2018. Releases made in Queensland and Northern Territory.	Endorse this weed for Phase 4 (monitoring and evaluation) of previous releases of Stem galling fly <i>Cecidochares connexa.</i> Identify areas in which releases did not establish and identify priority areas for redistribution or releases of new agents developed in Phase 2.
<i>Cryptostegia grandiflora</i> (L) Rubber vine	Monitoring and evaluation to assess impact of rust ( <i>Maravalia</i> <i>cryptostegiae</i> ) released in 1995- 1997 and leaf feeding moth ( <i>Euclasta whalleyi</i> ) released in 1988- 1991.	<b>Endorse</b> as a <u>combined</u> priority weed target for Phase 4 research with <i>Cryptostegia madagascariensis</i> . Determine if impacts could be increased through agent redistribution in future or if there is a need to identify new agents through exploratory surveys.
Cryptostegia madagascariensis (L) Purple rubber vine	Monitoring and evaluation to assess impact of rust ( <i>Maravalia</i> <i>cryptostegiae</i> ) released in 1995- 1997 and leaf feeding moth ( <i>Euclasta whalleyi</i> ) released in 1988- 1991. Determine if impacts of these agents developed for <i>Cryptostegia</i> <i>grandiflora</i> are being realised on <i>Cryptostegia madagascariensis</i> .	<b>Endorse</b> as a <u>combined</u> priority weed target with <i>Cryptostegia</i> <i>grandiflora</i> for Phase 4 research. This information is critical to determine if exploratory surveys are needed to develop agents specifically for <i>Cryptostegia</i> <i>madagascariensis</i> .



Weed species & common names	Summary of Phase 4 monitoring and evaluation biocontrol prospects	The Alliance recommendation after review
<i>Ageratina adenophora</i> (L) Crofton weed	Rust fungus <i>Baeodromus eupatorii</i> released in 2014. Leaf spot fungus <i>Passalora</i> <i>ageratinae</i> and stem galling fly <i>Procecidochares utilis</i> released in the 1950s.	Endorse as a priority weed target for Phase 4 research. Need to evaluate impact of these existing agents to determine if further exploratory research is needed.
<i>Ulex europaeus</i> (L) Gorse	Evaluation of the distributions and impacts of several agents that were released in the 1980's and 1990's will provide insights that will identify if redistribution efforts are needed.	Endorse as a priority weed target for Phase 4 research. This knowledge will also direct Phase 1 exploratory surveys for new agents and prioritise potential agents for further research based on the impact still required to control invasive populations in Australia.
Cryptostegia madagascariensis (L) Purple rubber vine	Monitoring and evaluation to assess impact of rust ( <i>Maravalia</i> <i>cryptostegiae</i> ) released in 1995- 1997 and leaf feeding moth ( <i>Euclasta whalleyi</i> ) released in 1988- 1991. Determine if impacts of these agents developed for <i>Cryptostegia</i> <i>grandiflora</i> are being realised on <i>Cryptostegia madagascariensis</i> .	<b>Endorse</b> as a <u>combined</u> priority weed target with <i>Cryptostegia</i> <i>grandiflora</i> for Phase 4 research. This information is critical to determine if exploratory surveys are needed to develop agents specifically for <i>Cryptostegia</i> <i>madagascariensis</i> .
Parkinsonia aculeata (L) Parkinsonia	Monitoring and evaluation to assess impact of several decades of biocontrol agent releases of several agents.	<b>Endorse</b> as an alternative priority weed target for Phase 4 research.