



CENTRE FOR
INVASIVE SPECIES SOLUTIONS

BEST PRACTICE MANAGEMENT FOR THE CONTROL OF bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*)

ADDENDUM TO THE WEEDS OF NATIONAL SIGNIFICANCE
BITOU BUSH CURRENT MANAGEMENT AND CONTROL OPTIONS MANUAL



weeds.org.au

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NO PRODUCT PREFERENCES: The product trade names in this publication are supplied on the understanding that no preference between equivalent products is intended and that the inclusion of a product name does not imply endorsement over any equivalent product from another manufacturer.

ALWAYS READ THE LABEL: Users of agricultural chemical products must always read the label and any permit, before using a product, and must strictly comply with the directions on the label and the conditions of any permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication.

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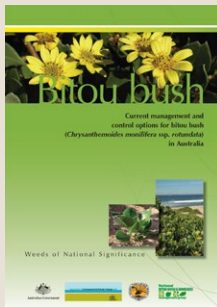
**Department of Agriculture,
Fisheries and Forestry**

Cover images

Front — Bitou bush. Image by NSW Department of Primary Industries.

Back — Bitou bush. Image by Wild Matters.

How to use this addendum



The [bitou bush current management and control options manual](#) (PDF, 10.9 MB) was published in 2008 and provides information on the weed and best practice management options. The manual has since been reviewed to ensure currency of best practice management advice and information. Any updates to the information contained within the manual are included in this addendum and should be taken as the most current source of information.

Note: the addendum is not a standalone document and should be read in conjunction with the 2008 manual.

The addendum focuses on updates to control options, including mechanical, chemical and biological control methods. It also includes updates on available herbicides and where to go to find additional information on boneseed and its management.

When new or additional information is provided in the addendum, page numbers reference the related text in the original manual.

Section 4: Control methods

Chemical methods

Page 37

Herbicide labels and legislation

Page 37 – The Australian Pesticides and Veterinary Medicines Authority (APVMA) regulates the availability of all pesticides, which includes herbicides. Herbicides are registered with the APVMA for specific applications, as stated on the label. State governments regulate the use of pesticides after sale. A herbicide label is a legal document that defines where, when and how a herbicide can be used on which weed species and at what rate.

Note: not all registered herbicides are commercially available. Often, companies improve herbicide formulations and only market the new formulation. For example, many herbicides are being marketed in higher concentrations. This reduces transport, storage and container-disposal costs.

In addition to herbicides being registered and described 'on-label' for specific weeds and situations, herbicides can sometimes be used through permits or 'off-label' use. These situations are described below.

Minor use and emergency use permits

APVMA may issue minor use and emergency use permits for herbicide applications that are not otherwise registered for that particular use. Minor use permits are sometimes referred to as 'off-label' permits. Minor use and emergency permits are valid ('in force') for a limited time. See the [APVMA website](#) to find current permits.

Some states also have permits for the control of 'declared' weeds and may not specifically list the weed species to be controlled. These permits will often list a range of herbicides that can be used for the control of declared or environmental weeds. To find these permits for your state:

- go to the [APVMA permits database](#) search
- enter 'declared weeds' or 'environmental weeds' in the SEARCH box
- click the search term 'Pest/purpose'
- click 'Search'.

It is also recommended that if you are unsure which herbicides can legally be used on a particular weed in your state, contact the relevant biosecurity section of your state department of agriculture. When using herbicides in aquatic situations, only use those that are registered or permitted for use in and around aquatic areas.

Any minor use permits relevant to bitou bush at time of publication are listed in Table 6.

Off-label use

Off-label use is the use of a registered chemical to address a specific issue that is not covered by the APVMA-approved label. Off-label use is to:

- control a different weed (or pest)
- apply at a different rate (only lower)
- apply in a different manner (not allowed in ACT, NSW and Tasmania).

Off-label use is permitted in all states and territories; however, conditions vary in each jurisdiction (Table 1).

Table 1. Where to find specific rules relating to herbicide use, including off-label use, in each state and territory

STATE/ TERRITORY	WEBSITE AND FURTHER INFORMATION
ACT	Agvet chemical use https://www.accesscanberra.act.gov.au/s/article/pest-and-weed-control-tab-Agvet-chemical-use
NSW	Pesticides https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview Weed control and identification https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control
NT	Chemical use https://nt.gov.au/industry/agriculture/farm-management/using-chemicals-responsibly
Qld	Chemical use https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture/chemicals/registered
SA	Rural chemicals https://pir.sa.gov.au/biosecurity/rural_chemicals Weed control handbook https://www.pir.sa.gov.au/_data/assets/pdf_file/0020/232382/WEB_8867_PIRSA_Weed_Control_Handbook_2018.pdf (PDF, 4.2 MB)
Tas	Agricultural and veterinary chemicals https://nre.tas.gov.au/agriculture/agvet-chemicals Weeds https://nre.tas.gov.au/invasive-species/weeds
Vic	Off-label chemical use https://agriculture.vic.gov.au/farm-management/chemicals/offlabel-chemical-use
WA	Using pesticides safely https://ww2.health.wa.gov.au/Articles/U_Z/Using-pesticides-safely

Safety and training

Page 37 – Personal protective equipment (such as protective clothing, eye or face shields, and respiratory protection) must be used in accordance with the recommendations stated on the herbicide label or permit. Chemical-use training is required for people using herbicides as part of their job or business. Training is recommended for community groups and may be required if working on public land. Training courses are run by ChemCert, AusChem and TAFE in each state. Other training courses may be available through state agencies (e.g. AgTrain in Victoria, SMARTtrain in NSW), local councils or non-government organisations.

By law, you must read the label (or have it read to you) before using any herbicide product. Always follow the label or permit.

Chemical user certification

Page 38 – Commercial weed-control operators need to be licenced in most states (Table 2). It should also be noted that there is now shared responsibility between landholders and their contractors for any breaches of laws and regulations (such as herbicide drift).

Table 2. Chemical-user certification by state and territory

STATE/ TERRITORY	WEBSITE
ACT	www.accesscanberra.act.gov.au/s/article/pest-and-weed-control-tab-Agvet-chemical-use
NSW	www.epa.nsw.gov.au/your-environment/pesticides/licences-and-advice-for-occupational-pesticide-users
NT	nt.gov.au/industry/agriculture/farm-management/using-chemicals-responsibly/spray-applicator-licences
Qld	www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/chemical-controls/commercial-operators
SA	www.sa.gov.au/topics/business-and-trade/licensing/building-and-trades/pest-control-licence
Tas	nre.tas.gov.au/agriculture/agvet-chemicals/licences-and-certificates/ground-spraying-and-pest-management-licences
Vic	agriculture.vic.gov.au/farm-management/chemicals/licences-and-permits/commercial-operator-licence-for-contractors
WA	https://www.health.wa.gov.au/articles/n_r/pest-industry-licensing-and-registration

Effective use of herbicides

Page 33 – Successful herbicide control is dependent on the right herbicide for the target species, growth stage of the target species, weather conditions during and after spraying, how thoroughly the herbicide is applied, and the herbicide mix and application rate.

Page 39 – Success using glyphosate: care should be taken using all pesticides. Glyphosate is no exception. Always use personal protective equipment as specified on the label.

Page 39 – Success using metsulfuron-methyl: the original manual contains a statement regarding metsulfuron-methyl residues in the soil: “Metsulfuron methyl is broken down by microbial activity and chemical hydrolysis. The average half-life of metsulfuron methyl in soil ranges from five days in acidic soils to 69 days in alkaline soils.” **This is misleading: herbicides like metsulfuron can move down the soil profile and remain active there for many years.** When plant roots explore this zone, they absorb the herbicide and – depending on their sensitivity – can stop growing and eventually die.

Page 39 – Picloram characteristics: while picloram is absorbed through the roots, it is also absorbed through foliage.

Page 49 – Aerial boom spraying: the manual mentioned is no longer available for downloading, so use this checklist of aerial-spraying activities instead <https://www.environment.nsw.gov.au/pestsweeds/BitouSprayingGuidelines.htm> (PDF, 76 kB)

For spraying, wind speeds should be low (< 15 km/h) with no rain expected in the following six hours.

Do not apply herbicide to plants that are under any sort of stress, as herbicide will not be absorbed and translocated effectively, resulting in a reduced level of control. Plants may be stressed due to:

- dry soil
- low humidity
- air temperatures above 30 °C
- frost.

Effectiveness of herbicides can be maximised further by:

- mixing dye with the herbicide to help minimise missed areas and prevent overspraying (double spraying)
- using an adjuvant – an additive that improves herbicide uptake (always read the adjuvant’s product labels to ensure that they are compatible with the particular herbicide and there are no restrictions on their use; e.g. most adjuvants should not be used near waterways)
- ensuring spray equipment is correctly calibrated and maintained, including being thoroughly cleaned between uses.

Spraying in sensitive areas

Herbicide users have a legal obligation to avoid spray drift damage and to ensure that the chemicals applied stay within the target area. Target-weed infestations are often located in areas of native vegetation, so great care should be taken to avoid spraying surrounding foliage and soil. Do not use high pump/sprayer pressures that create small droplets which float in the air. Adjust the nozzle settings to produce coarser droplet sizes.

Using herbicides near water

Never spray herbicides over bodies of water or plants standing in water. Some herbicides are formulated to be a lower risk when used near water (e.g. Roundup® Biactive). NEVER add unregistered adjuvants to herbicides that will be used near water. Some states have publications explaining the safe use of herbicides near water (Table 3).

Table 3. Safe use of herbicides near water by state and territory

STATE/ TERRITORY	WEBSITE
South-eastern Australia	archive.dpi.nsw.gov.au/__data/assets/pdf_file/0011/319448/riparian-habitat-management-guide.pdf (PDF, 1.1 MB)
Qld	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/sustainable/chemical/ground-distribution-herbicide/laws
SA	https://www.epa.sa.gov.au/files/477387_pesticide_water.pdf (PDF, 1.7 MB)
Tas	https://nre.tas.gov.au/Documents/herbicide_guidelinesFINAL2012.pdf (PDF, 689 kB)
WA	https://www.water.wa.gov.au/__data/assets/pdf_file/0016/3355/12149.pdf (PDF, 113 kB)

Regulations and permits for works in riparian zones

Areas on or near the bank of a river or other body of water (riparian zones) are sensitive habitats, and in some states a licence is required to conduct weed-control works (Table 4).

Table 4. Authorities who can advise about regulations and permits for works in riparian zones

STATE/ TERRITORY	DEPARTMENT	WEBSITE
NSW	NSW Department of Planning and Environment — Water	https://water.dpie.nsw.gov.au
SA	Landscape SA, including 8 regional boards	https://www.landscape.sa.gov.au
Vic	Catchment management authorities Department of Energy, Environment and Climate Action — Forests and Reserves	https://viccatchments.com.au/about-us/our-cma-regions Riparian management licences – www.forestsandreserves.vic.gov.au/_data/assets/pdf_file/0016/31426/Riparian-management-licences.pdf (PDF, 160 kB)

Stem injection with encapsulated herbicide

Page 43 – Stem injection of herbicide capsules can be used to control bitou bush infestations. Di-Bak AM is a herbicide produced in capsule form, containing a combination of aminopyralid and metsulfuron-methyl.

Capsules can be inserted into the tree using a specially designed handheld applicator. The applicator, used in conjunction with a hand held drill, first drills a hole into the tree stem and then inserts the capsule. The capsule is sealed in place with a plug.

Alternatively, drill a 25-mm-deep hole in the tree stem using an 8 mm-diameter drill bit, approximately 10–30 cm above ground level. Insert one capsule and seal with a plug immediately.

Over time, the capsule dissolves, releasing the herbicide into the plant. This process can be performed at any time of year and is a cost-effective method suitable for low-to-high-density populations.

Further information on using this technique can be found at <https://www.bioherbicides.com.au/about/videos-resources/>

Aerial spot spraying using drones

Page 50 – The use of drone technology is an emerging and effective method used to control bitou bush. Drone technology enables highly targeted and versatile treatment of weed infestations. Drones can be used to map out the target area and control small clusters or individual plants with high-precision spot spraying. The use of drones enables access to isolated or hard-to-access areas such as cliff faces. Drones use less chemical product compared to aerial application via helicopters, and produce minimal spray drift.

Registered herbicides

Page 40 – There are many different herbicide products registered for use on bitou bush (Table 5 and Table 6). It is important to check that each herbicide product is registered in *your* state or territory for the particular application method you are planning to use.

Table 5. Herbicides permitted for use on bitou bush under registration as at September 2023

APPLICATION METHOD	ACTIVE INGREDIENT	COMMERCIAL PRODUCT EXAMPLES ¹	STATE OR TERRITORY ²	RATE	SITUATION IN WHICH THE HERBICIDE IS REGISTERED	COMMENTS
Cut-and-paint	picloram + 2,4-D (75 + 300 g/L)	Tordon® 75-D	Qld, NSW, Vic, SA, WA only	1 L/10 L water	pastures, rights of way, commercial and industrial areas	Apply to cut stump at any time of year.
	aminopyralid + picloram (4.5 + 45 g/kg)	Vigilant® II	All	undiluted (gel)	native vegetation, conservation areas, gullies, reserves and parks	Apply 3–5-mm layer of herbicide gel to cut stump from 'brush-bottle' supplied.
Foliar spray	glyphosate ³ (360 g/L)	Roundup®, Roundup® Biactive™ etc.	All	5–10 mL/1 L water	all situations	Handgun or knapsack Best results achieved when treated at peak flowering during winter. Use higher rate on plants over 1.5 m high.
	metsulfuron-methyl (600 g/kg)	Weedmaster® Duo	All	5–10 mL/1 L water 75–150 mL/15 L (knapsack) 0.5–1 L/100 L high volume		
		Associate®	All	10 g/100 L water	native pastures, rights of way, commercial and industrial areas	High-volume handgun Spray thoroughly to wet all foliage.
	picloram + 2,4-D (75 + 300 g/L)	Tordon™ 75-D	Qld, NSW, Vic, SA, WA only	650 mL/100 L water	pastures, rights of way, commercial and industrial areas	High-volume handgun Spot spray when flowering or fruiting.
	picloram (240 g/L) + 2,4-D amine (625 g/L)	Macsprad picloram	Qld, NSW, ACT, Vic, SA, WA only	205 mL + 625 mL 2,4-D (625 g/L)/100 L water	agricultural non-crop areas, commercial and industrial areas, pastures and rights of way	High-volume handgun Flowering to fruiting
	aminopyralid + metsulfuron (375 + 300 g/kg)	Stinger®	NSW, Qld, Vic, SA only	20 g/100 L water		High-volume handgun Spray to thoroughly wet all foliage. Minimise contact with desirable species.
	bromoxynil ³ (400 g/L)	Bronco® 400	Vic, Tas only	80 mL/100 L water	pastures, roadsides and rights of way	High-volume handgun spot spray for young seedlings only

APPLICATION METHOD	ACTIVE INGREDIENT	COMMERCIAL PRODUCT EXAMPLES ¹	STATE OR TERRITORY ²	RATE	SITUATION IN WHICH THE HERBICIDE IS REGISTERED	COMMENTS
Splatter gun	glyphosate ³ (360 g/L)	Roundup®, Roundup® Biactive™	All	1:29 or 1:19 with water	all situations	Use higher rate (1:19) on bushes over 1.5 m high.
		Weedmaster® Duo	All	1:29 or 1:19 with water		
Stem injection	metsulfuron (600 g/kg)	Rygel® Metsulfuron 600 WG	All	1 g/L + organosilicone penetrant (10 mL/5 L)	native pastures, rights of way, commercial and industrial areas	
		aminopyralid + metsulfuron (375 + 300 g/kg)	NSW, Qld, Vic, SA only	20 g/10 L water + Pulse® Penetrant (20 mL/10 L)	agricultural non-crop areas, commercial and industrial areas, pastures and rights of way	Mimimise contact with desirable species.
Stem injection	aminopyralid + metsulfuron-methyl (93.7 g/kg + 75 g/kg)	Di-Bak AM	All	1 capsule every 10 cm of circumference	Forestry, Pasture, Commercial & Industrial areas, Rights of Way, Around Agricultural Buildings & Public Service areas	Use the Injecta applicator to drill a hole and deliver Di-Bak AM capsule in the sapwood layer beneath the bark. Space capsule insertions at 10 cm, centres around tree circumference below any branching, otherwise remove or treat all branches below the capsule insertion. On multiple trunk trees ensure each trunk is treated. ALL TREES: Apply the capsules to each tree at waist height or below.

Notes to this table can be found at the bottom of Table 6.

Table 6. Herbicides permitted for use on bitou bush under minor use permits as at September 2023

APPLICATION METHOD	ACTIVE INGREDIENT	COMMERCIAL PRODUCT EXAMPLES ¹	STATE OR TERRITORY ²	RATE	SITUATION IN WHICH THE HERBICIDE IS REGISTERED	COMMENTS
Permit PER12251 – Control of bitou bush and boneseed in sand dunes, bushland and grassland. NSW National Parks and Wildlife Service. Expires 31 March 2026.						
Aerial boom spraying	glyphosate (360 g/L) + etsulfuron (600 g/L)	Roundup® Blactive™ ¹ + Macspred Metmac® 600 Herbicide ¹	NSW only	Helicopter only: 2 L + 20–30 g/ha	coastal sand dunes, bushland and grassland	Staff or contractors of NSW Parks and Wildlife Service or agencies/ organisations representing NSW LLS Regional Weed Committees
Permit PER12363 – Product for controlling various environmental weeds in natural ecosystems using helicopter and drone/unmanned aerial vehicle spot-spraying equipment. NSW National Parks and Wildlife Service. Expires 31 March 2026.						
Aerial spot spray from helicopter or unmanned aircraft vehicles	Glyphosate (360 g/L) metsulfuron (600 g/L)	Roundup® Macspred Metmac® 600 Herbicide ¹	NSW only	0.5–1 L/100L 1–2 g/10 L	Natural Ecosystems (non-agricultural)	Refer to permit critical use comments.

1 Commercial products listed here are examples only, and many other products containing these active ingredients are registered for use on bitou bush visit www.apvma.gov.au. When searching for registered and permitted herbicides the APVMA databases are free to access. All other pesticide databases (such as Pest Genie®) have subscription fees.

2 Products may be registered for use on bitou bush in all states and territories (shown as 'All') or only in the specific states and territories listed.

3 Products containing different concentrations of the active ingredients. For example, registered products containing the active glyphosate are available with 350, 450, 510, 540, 570, and 600 g/L and 700, 720 and 800 g/kg. concentrations. Check the label for rates.

Note: not all currently registered herbicides are commercially available. Check the company website for a current label.

Note: herbicides are not to be used for any purpose or in any manner contrary to the label unless authorised under appropriate legislation. By law, you must read the label (or have it read to you) before using any herbicide product. The same applies for minor use permits. Always follow the label and permit directions.

Biological control

Page 55 – Eight agents have been released in Australia on bitou bush, of which four have established:

- bitou tip moth, *Comostolopsis germana*
- bitou seed fly, *Mesoclanis polana*
- leaf-roller moth, *Tortrix* sp.
- bitou tortoise beetle, *Cassida* sp.

The bitou tip moth (*C. germana*) and the bitou seed fly (*M. polana*) are contributing to significant control of bitou bush, especially reductions of the soil seed bank.

The following text is sourced from: Harvey KJ, McConnachie AJ, Sullivan P, Holtkamp R and Officer D (2021) Biological control of weeds: a practitioner's guide for south-east Australia, report to the New South Wales Department of Primary Industries, Orange. Approval from the NSW Department of Primary Industries to use this information is gratefully acknowledged.

Bitou tip moth

Page 55 – This agent is widely distributed across the range of bitou bush and generally does not require redistribution. However, should bitou bush populations be located where no signs of bitou tip moth damage are evident, then larvae and pupae (not adult moths, because they are nocturnal and unlikely to be seen) can be collected from established sites.

Bitou seed fly

Page 55 – The bitou seed fly is widespread throughout the invaded range of bitou bush in Australia and redistribution is unnecessary.

Bitou tortoise beetle

Page 56 – This agent has established and is present at most of its initial release sites. However, its numbers remain low, dispersal rate is extremely slow and its impact on bitou bush appears to be negligible. It is thus not recommended for redistribution.

Bitou leaf-roller moth

Page 56 – The long-term impacts of the leaf-roller moth have not been determined. In its native range, it can reach high densities, and significantly reduce seed production and kill entire bushes. Since its introduction, minimal establishment has occurred in south-eastern Australia and it is still the subject of ongoing research. Redistribution programs and follow-up monitoring will assist in enhancing understanding of the impact of bitou leaf-roller.

Australian Biocontrol Hub

Sharing information is vital to the success of biological control of weeds. Recording which weed species you are controlling and the locations of agent release sites can also assist others to obtain access to the right agents for their infestation.

The Atlas of Living Australia (ALA) is a national, online biodiversity database that helps share information. The Australian Biocontrol Hub is a portal within the ALA that acts as a one-stop shop for data and information sharing on weed biological control.

The Australian Biocontrol Hub can:

- facilitate recording of biological control agent release and establishment data
- capture observations of biological control agent spread
- ensure biological control agent distribution data is readily accessible
- provide access to biological control extension material.

For further information on how to contribute to or use information on the Australian Biocontrol Hub, visit the website: <https://biocollect.ala.org.au/biocontrolhub>

Contacts

STATE/ TERRITORY	DEPARTMENT	PHONE	EMAIL	WEBSITE
National	Australian Pesticides and Veterinary Medicines Authority	02 6770 2300	enquiries@apvma.gov.au	www.apvma.gov.au
ACT	Parks and Conservation	13 22 81	ACTBiosecurity@act.gov.au	www.environment.act.gov.au/parks-conservation/plants-and-animals/Biosecurity/invasive-plants
NSW	Department of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/biosecurity/weeds
NT	Department of Environment, Parks and Water Security	08 8999 4567	weedinfo@nt.gov.au	www.nt.gov.au/environment/weeds
Qld	Department of Agriculture and Fisheries	13 25 23	info@daf.qld.gov.au	www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/plants-weeds
SA	Department of Primary Industries and Regions	1300 374 731	invasivespecies@sa.gov.au	www.pir.sa.gov.au/biosecurity/weeds
Tas	Department of Natural Resources and Environment	1300 368 550	biosecurity.tasmania@nre.tas.gov.au	www.nre.tas.gov.au/invasive-species/weeds
Vic	Agriculture Victoria	13 61 86	Refer to www.agriculture.vic.gov.au/about/contact-us for contact options	www.agriculture.vic.gov.au/biosecurity/weeds
WA	Department of Primary Industries and Regional Development	08 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au/pests-weeds-diseases/weeds

Further information

Video about controlling bitou bush using drones. MidCoast Council [NSW] (2020).
https://www.youtube.com/watch?v=geT8P4_8v5c (4:39)

Harvey KJ, McConnachie AJ, Sullivan P, Holtkamp R and Officer D (2021) *Biological control of weeds: a practitioner's guide for south-east Australia*, report to the New South Wales Department of Primary Industries, <https://www.dpi.nsw.gov.au/biosecurity/weeds/weed-control/biological-control/biological-control-of-weeds-manual>

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