Management information for

*Chrysanthemoides monilifera*

IUCN SSC Invasive Species Specialist Group (ISSG)

**Preventative measures:**

Prevention and early intervention is the most cost-effective form of weed control. Once an infestation of *Chrysanthemoides monilifera* occurs, it is important to prevent the spread of seeds into surrounding areas. Established plants should be destroyed before they flower. Raising awareness amongst recreational vehicle users is important in coastal areas where seed can be spread by their activity (CRC, 2003a).

**Physical:**

Intense fires will kill most mature bitou bush (*Chrysanthemoides monilifera rotundata*), although a small proportion will re-sprout. Fire also kills seeds in the litter and topsoil, but stimulates germination of seeds lower in the seed profile. However, fire can also cause other problems and should only be undertaken with the appropriate permission and training (CRC 2003a).

*C. m. rotundata* has a shallow root system, so seedlings and plants up to 1 m high can be hand pulled. Slashing alone is not effective as re-growth will occur from stumps. Applying herbicide to stems immediately after cutting should prevent re-growth (CRC 2003a).

*C. m. rotundata* does not persist when grazed or cultivated. However grazing by cattle is generally not appropriate due to other problems caused by stock, such as browsing of native plants, erosion and spread of other weeds (CRC, 2003a).

**Chemical:**

Herbicides can be applied from the air, from the ground, or by a cut and paint method, although plants close to the beach and tracks are often covered in dust or sea-spray and are therefore less affected by herbicide. An isolated plant can be treated by spot spraying. There are herbicides registered for the control of *C. m. rotundata* that can be applied at low rates during winter, with minimal effects on coastal vegetation. In the northern parts of its Australian range, two spraying programmes a year may be needed to prevent seeding. Glyphosate or metsulfuron is recommended for seedling control, but it may kill some or all competing grasses.

In contrast, Briden and Popay (2004) found that clopyralid (at 5 mL/L) kills boneseed (*Chrysanthemoides monilifera monilifera*) seedlings but not surrounding vegetation (CRC, 2003a).

Lindsay and French (2005) suggest that spraying *C. monilifera* with herbicide, then burning and spraying seedlings again, could lead to greater regeneration success for native species than spraying with herbicide alone.
Biological control:

Results of a study by Barker et al (2009) indicate the existence of substantial intraspecific variation within *C. monilifera*. The authors of the study observe that the results obtained from this study are of significance to scientists working on the biocontrol of this species especially in the ascertaining of the genetic lineage and geographic origins of the invasive plants so more effective biocontrol agents can be identified from their natural populations.

Please follow this link to the CSIRO website for information on the biological control of *C. monilifera* in general.

Downey et al. (2007) outlines the biological control agents that have been released for *C. monilifera* in Australia to date.

Six biological control agents have been released in Australia to control boneseed (*C. m. monilifera*).

Black boneseed beetle (*Chrysolina scotti*): This was the first agent to be released for the control of boneseed in Australia, and was released in Melbourne in 1989, then at a further 18 sites in Victoria, mostly on the Mornington Peninsula and the You Yang Ranges. Six releases were made at Morialta National Park in South Australia in 1989, and in ten sites in Tasmania. The beetle failed to establish at all sites.

Bitou tip moth (*Comostolopsis germana*): Bitou tip moth was released at 37 sites in Victoria, Tasmania and South Australia. It failed to establish at all but one of these, possibly due to a combination of factors including less than ideal climate conditions or the impact of natural enemies.

Blotched boneseed beetle (*Chrysolina picturata*): The blotched boneseed beetle was released at seven sites in Victoria and two in South Australia in 1992, but failed to establish at all sites.

Painted boneseed beetle (*Chrysolina* sp.): The painted boneseed beetle was released at four sites in Victoria and two in Tasmania in 1994, but failed to establish.

Lacy-winged seed fly (*Mesoclanis magnipalpis*): Five releases of lacy-winged seed fly were carried out in Victoria in 1998, and two in South Australia in 1999. It failed to establish, likely because the flowering periods of boneseed are too short for the seed fly to survive from one year to the next.

Boneseed leaf roller moth (*Tortrix* sp.): The boneseed leaf roller moth was first released at the You Yangs in Victoria in 2000, and has since been released at a total of 30 sites in Victoria, three in South Australia and 34 in Tasmania. It failed to establish, despite an intensive release strategy.

Boneseed leaf buckle mite (*Aceria* sp.): Approval to release the boneseed leaf buckle mite was obtained in 2005, and trial releases were expected to commence in 2006 in Victoria, Tasmania and South Australia.
Six of 19 potential biological control agents have been released on bitou bush (C. m. rotundata), with four successfully establishing.

Bitou tip moth (Comostolopsis germana): The bitou tip moth destroys the developing leaves, buds and flowers of bitou bush, and reduces seed production (Adair and Holtkamp, 1999). It was released in 1989, with more than 200 releases occurring up until 1997. These occurred at 72 sites in NSW, and the bitou tip moth is now widely established along most of the NSW coast, and probably throughout the range of bitou bush in Australia, with the exception of the Menindee lakes area and possibly northern Victoria. In some areas, the bitou tip moth has reached high levels and is having a significant impact on the flowering and seed production of bitou bush. The presence of two Hymenopteran parasitoids has reduced bitou tip moth populations in some areas.

Black boneseed beetle (Chrysolina scotti): This beetle was released at Tathra, NSW in 1990, and at four other sites, but failed to establish. This may be due to larvae being prone to predation by ants and spiders.

Painted boneseed beetle (Chrysolina sp.): The painted boneseed beetle was released Ulladulla, southern NSW in 1995, and seven other sites, but failed to establish. Again, ant or spider predation of larvae may be to blame.

Bitou tortoise beetle (Cassida sp.) The bitou tortoise beetle was first released in Sydney, and 12 other sites across NSW in 1995. It was shown to still be present at these sites in 2004, but at low densities and is highly localised. Impact may be limited in the immediate future. See also Kleinjan and Scott (1996).

Bitou seed fly (Mesoclanis polana): The bitou seed fly works by destroying developing seeds (Adair and Holtkamp, 1999). It was released in 1996, at Iluka Bluff and Dunbogan in NSW. Within two years it could be found from Fraser Island in Queensland to Tathra in southern NSW - over 1200km of coastline. Research suggested that the bitou seed fly reduced seed production by an average of 27%, a rate unlikely to reduce the rate of invasion or recolonisation of bitou bush, although it may decrease the number of new populations. See also Edwards et al. (1999). Willis and Memmott (2005) found that the presence of M. polana had led to an increase in abundance in native parasitoids, which heavily attacked M. polana and native hosts (such as Spaeniscus).

Bitou leaf roller moth (Tortrix sp.): The bitou leaf roller moth was first released in 2001, and since then there have been 136 releases at 45 sites from the Queensland border to Moruya in southern NSW. It has become established at six of these sites, and is still present at a further ten. The poor establishment rate may be due to predation by ants and spiders, or abiotic site factors. Please follow this link for information on the leaf-rolling moth.

Cother (2000) identified the fungal pathogen Sclerotinia sclerotiorum as a priority for research into biological control agents for bitou bush (C. monilifera rotundata). A joint project between CSIRO and the Plant Protection Research Institute in South Africa have identified another possible biological control agent, the rust species
Endophyllum osteospermi (CSIRO, 2008). Wood and Crous (2005a, b) outline the suitability of Endophyllum osteospermi for biological control of *C. monilifera* in Australia, pending the results of host specificity testing.

**Integrated management:**

An integrated management approach is required for the successful control of *C. monilifera*. Regeneration of native vegetation is an important part of the process, as otherwise other weeds (such as glory lily) will quickly invade the gaps. Due to the large seed bank, a sustained control effort is required for up to ten years (CRC, 2003a).

Mason and French (2007) examined the outcomes of intensive, manually based invader control and extensive (herbicide spraying from aircraft) control. They found that extensive management created native species complements that diverged from non-invaded site conditions. Intensively managed sites more closely resembled non-invaded site conditions, but were richer in exotic species than the extensively managed sites. Please follow this link to access the [The Boneseed Management Manual](#).