

On the distribution, ecology and conservation status of three rare plant taxa *Zygophyllum compressum*, *Elachanthus glaber* and *Eremophila crassifolia* in southwestern New South Wales.

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Abstract: The arid and semi-arid southwest of New South Wales has received disproportionately less attention from botanists than other similar-sized geographic regions of the state. Recent work has extended our knowledge of three extremely rare plant taxa from this part of the state. *Zygophyllum compressum* (Zygophyllaceae) and *Elachanthus glaber* (Asteraceae) are restricted to gypseous rises within active saline groundwater discharge complexes with limited distribution in southwest New South Wales and occur within the plant community “Gypseous shrubland on rises and semi-arid plains” (ID253) which is listed as threatened (vulnerable) within the state. *Eremophila crassifolia* (Myoporaceae) is restricted to a few plants on a roadside and adjacent mallee vegetation approximately 35 km east of Wentworth. Based on IUCN criteria it is suggested that *Eremophila crassifolia* is critically endangered and *Zygophyllum compressum* and *Elachanthus glaber* endangered in New South Wales and all should be listed under the NSW *Threatened Species Conservation Act 1995*.

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Introduction

During rare plant and baseline flora surveys in southwest New South Wales, the author has recorded three new or rare plant taxa for the state: *Zygophyllum compressum* (J.M. Black) (Zygophyllaceae), *Elachanthus glaber* and *Eremophila crassifolia*. This paper uses the distribution, ecology and conservation status of these species in New South Wales to provide cases for potential listing under the NSW *Threatened Species Conservation Act 1995*.

The conservation status of plant taxa occurring at the regional or state level follow the criteria outlined in IUCN (2001) and terms such as population and subpopulation follow definitions as outlined there. The IUCN conservation status categories and criteria for listing have been generally accepted by Australian state conservation agencies vested with assigning conservation status and hence have been adopted in this paper.

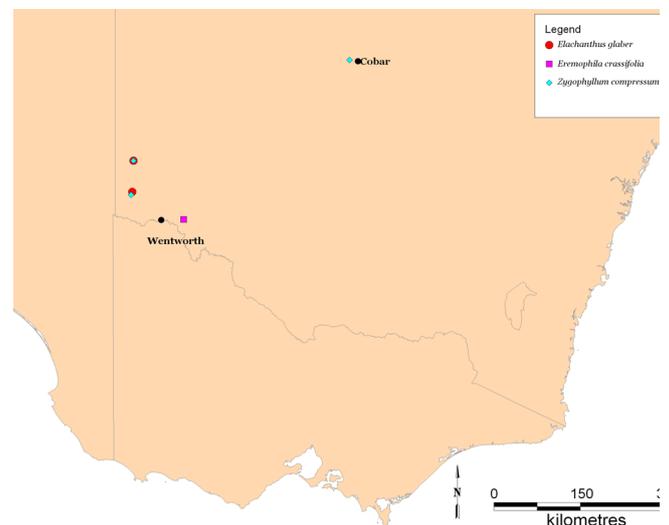


Fig. 1. Distribution map for *Zygophyllum compressum*, *Elachanthus glaber* and *Eremophila crassifolia* in New South Wales.

***Zygophyllum compressum* J.M. Black**
(family *Zygophyllaceae*)

Distribution

Zygophyllum compressum (Rabbit-ears Twin-leaf) is a short-lived, ascending, to sometimes procumbent annual that grows to 35 cm. It appears after rainfall and has a wide distribution in Australia, in the semi-arid or arid climate zones in far northwest Victoria, South Australia, Western Australia and Northern Territory.

For New South Wales, Australia's Virtual Herbarium (AVH) currently (3/8/2010) lists two herbarium records for *Zygophyllum compressum*: a collection from approximately 16 km west-north-west of Cobar (by G. Lithgow on 19/12/1974, HO542716) and one from a saline discharge complex at Nulla Nulla Station approximately 75 km northwest of Wentworth (by the author on 06/12/2001 MEL2274406A). A third specimen was collected on 23/8/2010 from the Scotia groundwater discharge complex (Ferguson *et al.* 1995) at the University of Ballarat's field research station at Nanya, 135 km north-north-west of Wentworth. This specimen (NSW866696) was submitted by the author to the National Herbarium of New South Wales. The known New South Wales distribution of *Zygophyllum compressum* is shown in Fig. 1.

Ecology

The following account is based on the author's collection sites at the Nulla Nulla and Scotia saline discharge complexes or boinkas (Macumber 1991) in the far southwest of NSW. No information has been obtained for the collection from near Cobar.

Zygophyllum compressum (Figs. 2 & 3) is restricted to gypseous plains and low gypseous rises within currently active groundwater discharge sites such as occur at Nulla Nulla and Nanya Stations. From rare plant monitoring work in northwest Victoria conducted by the author, *Zygophyllum compressum* plant numbers at known sites can vary appreciably depending upon the amount of rain received in the winter months. The gypseous soils present are of Yamba Formation (Firman 1969) origin and of Late Pleistocene to Holocene age. The gypsum, present as powder or in the crystalline form, is an evaporite residue left after saline brines have been discharged and dehydrated through evaporation at the natural ground surface. The chemistry and pH of the saline groundwater normally present within 1–3 m of the natural surface varies from location to location across the Murray-Darling Basin and in turn influences the chemistry of the evaporite that forms (Macumber 1991).

The gypsum on saline groundwater discharge complexes has often been re-worked, by the forces of prevailing winds, into hummocks and dunes of irregular shape. Yamba Formation gypseous deposits in southwest New South Wales usually

occur within NSW Vegetation Classification plant community ID253 "Gypseous shrubland on rises and semi-arid plains" (Benson *et al.* 2006) which are considered vulnerable in the state with a pre-European and current extent of just 2,000 ha and 1,400 ha respectively. The deposits at the Nulla Nulla site occurs within an ecotonal variant of the above plant community with gypseous soils, but closely associated with plant community ID64 "Samphire – Water Weed – Sea Heath shrubland of saline depressions of the arid and semi-arid (warm) zones" (Benson *et al.* 2006).

At the Nulla Nulla boinka (in December 2001) *Zygophyllum compressum* occurred in three main areas covering approximately 20 ha in total with only 50 individuals present (Sluiter 2001). Winter 2001 in southwest New South Wales was a particularly dry time, and may have been a reason for the low numbers of plants found over a relatively large search area of suitable habitat. At all three locations, the



Fig. 2. *Zygophyllum compressum* plant growing on a gypseous rise at Nanya Station, 135 km north-north-west of Wentworth in far southwest New South Wales. Photograph Ian Sluiter 23/08/2010.



Fig. 3. Close-up of flowers and fruit of *Zygophyllum compressum* from Nanya Station in August 2010. Photograph Ian Sluiter 23/08/2010.

species was growing on low, gypseous plains often with small rises up to 30 cm above the surrounding landscape. It was found in very open low shrubland (see Fig. 4) dominated by *Halosarcia pergranulata*, in association with *Frankenia foliosa*. Other species found at some, but not all Nulla Nulla localities, include *Lawrencia glomerata*, *Eragrostis falcata*, *Maireana appressa* and *Elachanthus glaber*. Salt crystals deriving from the underlying saline groundwater were often present as efflorescence on very low raised ridges and cracks of the ground surface. Sluiter (2001) estimated that up to 1,000 *Zygophyllum compressum* plants may be present at the Nulla Nulla Boinka, with not all potentially suitable habitat searched.



Fig. 4. *Zygophyllum compressum* and *Elachanthus glaber* habitat at Nulla Nulla Station. The species grows on low gypseous rises 20–30 cm above the surrounding plain. Here the gypseous rises appear as the darker patches between the surrounding halophytic shrubs including *Halosarcia pergranulata* and *Frankenia foliosa*. Photograph Ian Sluiter 13/12/2001.



Fig 5. *Elachanthus glaber* growing on a copi or gypseous rise at Nanya Station 135 km north-north-west of Wentworth, in southwest New South Wales. Photograph Ian Sluiter 23/08/2010.

At the Scotia boinka at Nanya (in August 2010) approximately 100 individuals of *Zygophyllum compressum* occurred over a 1 ha area on a gypseous rise elevated approximately 2.5 m above a surrounding saline playa lake. The vegetation at the Nanya site was dominated by *Atriplex vesicaria* in association with *Frankenia foliosa*, *Lawrencia glomerata* and *Elachanthus glaber*. (see Fig. 5). Time constraints prevented further targeted search effort in potentially suitable habitat at the Scotia boinka. It is considered likely that further searches would reveal more plants at the Scotia sub-population because the area is known to contain substantially more suitable habitat than was searched in August 2010.

An estimate of the total population at each of the two sites is estimated to be $1,000 \pm 200$ individuals. This may put the total New South Wales population at less than 2,000 individuals.

Threats to the species include grazing (most plants at the Nulla Nulla Boinka were browsed by stock and/or rabbits in 2001), rising saline groundwater, and prolonged drought, which has occurred within the Lower Murray-Darling Catchment for much of the past 16 years. Nulla Nulla Station has a high rabbit grazing presence, but stock have not grazed the saline discharge area since January 2009. Rising saline groundwater has occurred in the vicinity of Lake Victoria due to the influence of permanent storage of fresh water in the lake over the past 80 years. This has resulted in the development of a groundwater mound 4 m higher than normal beneath and immediately around the water body (Nolan-ITU 1997). It is not known how this has impacted the Nulla Nulla boinka 28 km to the north, but it is reasonable to assume that there has been some watertable rise. A further rise of 0.5–1 m in groundwater level at the Nulla Nulla boinka could severely threaten the *Zygophyllum compressum* population there due to its local dependence on land of elevation approximately 1 m above regional groundwater.

Conservation status

There are three known sites for *Zygophyllum compressum* in New South Wales with a maximum known area of occupancy estimated at < 50 ha and an estimated number of 2,000 plants. Although extremely restricted in New South Wales, not all habitat within plant community ID253 Gypseous shrubland on rises and semi-arid plains is potentially suitable habitat. The species has a particular preference for gypseous plains and low rises with very open vegetation structure elevated between 1–3 m above saline regional groundwater. The species:

- has an extent of occurrence and area of occupancy in NSW of < 500 km² = IUCN B2
- is severely fragmented (three subpopulations separated by 480 km) = IUCN B1a and B2a
- has extreme fluctuations in the area of occupancy at the Nulla Nulla subpopulation = IUCN B2cii

- has extreme fluctuations in the number of mature individuals at the Nulla Nulla subpopulation based on prolonged drought associated with climate change = IUCN B2civ
- has a total population estimate of < 2,500 individuals = IUCN C

Based on satisfying IUCN criteria B1a, B2a, B2c ii and iv; and C, *Zygophyllum compressum* is considered to be endangered in New South Wales and eligible for listing under the NSW *Threatened Species Conservation Act*. *Zygophyllum compressum* is also considered to be vulnerable in adjoining northwest Victoria (DSE 2005), although this status may be elevated after a formal review of the status of this taxon using IUCN criteria which is currently underway (David Cameron from the Arthur Rylah Research Institute, VIC, personal communication).

Elachanthus glaber Paul G. Wilson in H. Eichler
(family Asteraceae)

Distribution

Elachanthus glaber (Shiny Elachanth) (Fig. 6) is a small, glabrous green or yellowish-green herb to 10 cm tall (Walsh & Entwisle 1999). It is known from ~10 sites in northwest Victoria and two in South Australia, the SA sites both occurring west of Port Augusta on the northern Eyre Peninsula. In both Victoria and South Australia, *Elachanthus glaber* is considered to be rare (DSE 2005; NPWS 2008). It is listed as an Australian rare or threatened plant taxon with a conservation code of 3RC- (Briggs & Leigh 1995).

Three sites are known from New South Wales (Figure 1). Two sites have been recorded by the author, the Nulla Nulla boinka approximately 75 km northwest of Wentworth, on 6/12/2001 (MEL2274976A), and the Scotia boinka at Nanya on the 23/8/2010 (NSW866698-National Herbarium of New South Wales) (records from AVH as of 3/8/2010). Westbrooke *et al.* (1998) also recorded the plant species from the Scotia 1:100,000 Map Sheet area of southwestern New South Wales, occurring on an island within the saline discharge complex in close proximity to the collection site of the author. It does not show at the scale of mapping on Fig. 1.

Ecology

Like *Zygophyllum compressum* above, *Elachanthus glaber* is found in association with the Nulla Nulla and Scotia boinkas, and has a very similar ecology in that it is largely dependent on gypseous substrates with a relationship with saline brines in the underlying sediments. Observations by the author in the range of the species in northwest Victoria suggest *Elachanthus glaber* may be more tolerant of a wider range of edaphic conditions within gypseous substrates than *Zygophyllum compressum*. At the Cowangie boinka, south of Murray-Sunset National Park in northwest Victoria,

the species grows on more elevated gypseous rises and hummocks, as well as on low gypseous rises and plains, suggesting the species may be tolerant of a wider range of soil salinities and gypsum content.

Conservation status

At the Nulla Nulla site *Elachanthus glaber* was estimated to occur over 200 ha with about 2,000 plants in December 2001. At the Scotia site approximately 200 plants were observed over approximately 20 ha in August 2010, although there may have been more on suitable substrate elsewhere in the area. The species:

- has an extent of occurrence in NSW of < 5,000 km² = IUCN B1
- has an area of occupancy in NSW of < 500 km² = IUCN B2
- is known from only two subpopulations = IUCN B1a and B2a
- suffers extreme fluctuations in the number of mature individuals at both subpopulations based on prolonged drought associated with climate change = IUCN B1civ

Based on satisfying IUCN criteria B1, B1a, and B1civ; and B2, B2a and B2civ *Elachanthus glaber* is considered to be endangered in New South Wales and eligible for listing under the NSW *Threatened Species Conservation Act*

Eremophila crassifolia (F. Muell.) F. Muell.
(family Myoporaceae)

Distribution

Eremophila crassifolia (Thick-leaf Emu-bush) is a low spreading shrub 0.2–1m tall, frequently root suckering, with lilac coloured flowers (Chinnock 2007). The species is restricted to mallee vegetation communities in the Murray-Darling Depression IBRA including northwest Victoria and adjoining parts of South Australia; and the Eyre-Yorke Block Bioregion of South Australia and is extremely widespread and common on the Eyre Peninsula (Chinnock 2007). In Victoria, the species is listed as rare (DSE 2005).

On 10/12/2004 the author recorded approximately 20–30 plants of *Eremophila crassifolia* growing on a roadside and in neighbouring strip of remnant vegetation in sandplain mallee vegetation northeast of Trentham Cliffs, 35 km east of Wentworth in New South Wales. The local area, apart from a narrow band of mallee vegetation adjacent to a road, had been largely cleared for cereal production under an approved Clearing and Cultivation Licence shortly before the site was visited. This collection (MEL2269880A – Accession Number NSW593893) is the only record for the species in New South Wales (AVH as of 3/8/2010) (Figure 1).

At the New South Wales site near Trentham Cliffs, *Eremophila crassifolia* (Fig. 7) was recorded in a relatively flat sandplain with ‘whipstick’ mallee vegetation dominated by *Eucalyptus dumosa*, *Eucalyptus socialis*, *Eucalyptus gracilis* and *Eucalyptus oleosa* with a sparse *Triodia scariosa* understorey (Fig. 8). Plants were typically 40–60 cm high perennial shrubs typically separated by 20–30m. No evidence of root suckering was evident amongst plants within the remnant mallee vegetation but sporadic shrubs in an adjoining roadside verge which had been previously cleared were possibly root suckers based on their regrowth from previously cleared land. The plant community can be considered ecotonal between plant communities ID170 “Chenopod sandplain mallee woodland/shrubland of the arid and semi-arid (warm) zones” and ID171 “Spinifex linear dune mallee mainly of the Murray-Darling Depression Bioregion” (Benson *et al.* 2006). Topsoil at the site is a light sandy clay loam of Woorinen Formation (Lawrence 1966) origin with a B horizon of calcrete at 40 cm depth.

Conservation status

Based on current knowledge, *Eremophila crassifolia* in New South Wales is restricted to one very small (< 10 ha) patch of mallee vegetation and an adjoining cleared roadside. It is highly likely that the species would also have occurred on land adjacent to the remnant patch which was being prepared for cereal cropping. In New South Wales, *Eremophila crassifolia*:

- occurs in a single population of < 50 mature individuals with an area of occupancy and extent of occurrence in NSW of < 10 km² = IUCN B1a, B2a, B1ci, B1cii, B1civ, B2ci, B2cii, B2civ, C, C2ai, C2aii and D
- is anticipated (“inferred, projected or suspected”) to have experienced severe ($\geq 80\%$) decline in population numbers in the last 10 years through habitat loss associated with permits to clear for cultivation – particularly as surrounding land is now cropped on a permanent basis = IUCN A2, A4
- is likely to have suffered a decline (“inferred or projected”) in the extent of occurrence, area of occupancy and the number of mature individuals as a result of extensive clearing of its habitat = IUCN B1a, B2a, B1ci, B1cii, B1civ, B2ci, B2cii, B2civ
- is likely to have suffered extreme fluctuations “projected or inferred” in the extent of occurrence, area of occupancy and the number of mature individuals based on the permanent loss of likely surrounding habitat to wheat paddocks = IUCN C, C2ai, C2aii and D

Based on satisfying IUCN criteria A, A2, A4, B1, B2, B1a, B2a, B1ci, B1cii, B1civ, B2ci, B2cii, B2civ, C, C2ai, C2aii and D, *Eremophila crassifolia* is critically endangered in New South Wales and eligible for listing under the NSW *Threatened Species Conservation Act*.



Fig. 6. *Elachanthus glaber* growing on a copi or gypseous rise at Nanya Station 135 km north-north-west of Wentworth, in southwest New South Wales in August 2010. Photograph Ian Sluiter 23/08/2010.



Fig. 7. *Eremophila crassifolia* showing the whole plant, flowers and leaves. Photograph Copyright © Paul Gullan/Viridans Images.



Fig. 8. Habitat of *Eremophila crassifolia* northeast of Trentham Cliffs at the author’s site KEU050 (internal database code). Photograph Ian Sluiter 10/12/2004

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