Image by Dana Bergstrom

Azorella macquariensis

macquarie cushions

TASMANIAN THREATENED SPECIES LISTING STATEMENT

Scientific name: ***Azorella macquariensis*** Orchard, *Muelleria* 7: 16 (1989)

Common name: macquarie cushions, macquarie azorella in Wapstra *et al.* (2005)

Group: vascular plant, dicotyledon, family **Apiaceae**

Status: *Threatened Species Protection Act 1995*: **endangered**

Environment Protection and Biodiversity Conservation Act 1999: **Critically Endangered**

Distribution: Endemic status: **Endemic to Macquarie Island**

Tasmanian NRM Region: **South**

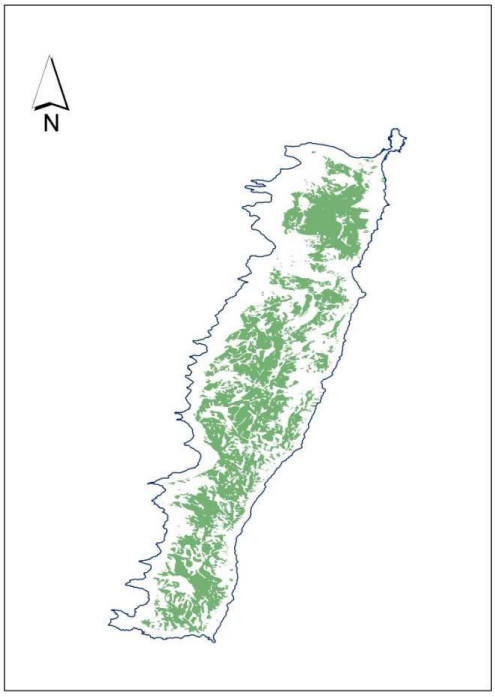

Figure 1. Map of Macquarie Island showing the extent of open short herbfield that corresponds with feldmark where *Azorella macquariensis* occurs

Plate 1. *Azorella macquariensis* cushion (green) showing typical dieback (brown) with a distinct line between healthy and dead plants in a cushion (Image by Dana Bergstrom)

IDENTIFICATION AND ECOLOGY

Azorella macquariensis is a perennial cushion-forming herb that is endemic to Macquarie Island. It can form extensive cushions reaching several metres in diameter (Plates 1 & 2). Cushion plants are a dominant lifeform in exposed situations on sub-Antarctic islands. *Azorella macquariensis* is a keystone species dominating and comprising the major structural component of feldmark vegetation on the island. It is the only species that forms cushions in feldmark on Macquarie Island. Cushions of *Azorella macquariensis* consist of numerous seedlings and some plants are capable of limited vegetative reproduction.

Azorella macquariensis can be identified at any time of year though it undergoes winter browning. It flowers from December to February and fruits from January to April. Current estimates indicate that there is less than 10% seed set in a single cushion. Like other members of the Apiaceae, the species has potential for a soil stored seed bank.

Description

There are two distinct forms of *Azorella macquariensis*, hairy and non-hairy. The leaf lamina is more or less reniform in outline, with usually 3 or sometimes 5 lanceolate lobes that are glabrous or sparsely and coarsely setose on the upper surface, free almost to base and are acute and pungent with a long setose point. The petiole is 3 to 4 mm long and broadly winged, the wings fused at the base of the lamina to form a truncate ligule. The bisexual flowers are usually solitary but sometimes paired. There are 2 involucral leaf-like or lanceolate bracts that are fused at the base to form a cup. The fruit is hidden by upper leaves and is yellow-brown, almost sessile or on a 1 mm long pedicel, obovoid, 1.3 to 1.7 mm long and weakly ribbed. The sepals are usually deciduous.

[description from Orchard (1989) and Hnatiuk (1993)]

Confusing species

Azorella macquariensis was previously considered to belong to *Azorella selago,* which is known from Heard Island and also extends from Tierra del Fuego to the Falkland, Marion, Crozet, Kerguelen and MacDonald islands. *Azorella macquariensis* differs from *Azorella selago* by its smaller leaves with fewer, more divided and acute and bristle tipped lobes and a shorter more entire ligule and by its solitary or paired flowers, shorter sessile (or nearly so) non-exserted fruit and deciduous sepals.

DISTRIBUTION AND HABITAT

Azorella macquariensis is endemic to Macquarie Island which lies approximately 1500km southeast of Hobart in the sub-Antarctic. It is largely restricted to feldmark vegetation, which occurs at attitudes between 200 to 400 m and covers roughly half the island (Figure 1). Macquarie Island is 34 km long by 5.5 km wide at its broadest point. Feldmark vegetation cover varies from over 50% in sheltered areas to less than 5% in exposed sites, with *Azorella macquariensis*, bryophytes and lichens being the dominant vegetation (PWS 2006). *Azorella macquariensis* occurs over the full range of the feldmark, but with localised losses as a result of dieback.

POPULATION ESTIMATE

Azorella macquariensis occupies approximately 42 km^2 as inferred by mapping of open short herb vegetation that corresponds with *Azorella* dominated feldmark (Figure 1). There would be many hundreds of thousands of individual cushions, which may be comprised of more than one plant making exact numbers difficult to estimate. As there are no barriers to dieback evident, the species is considered to exist in a single location (Table 1).

Azorella macquariensis has not been found on other sub-Antarctic islands despite considerable survey effort. The likelihood of finding the species outside of Macquarie Island is considered to be extremely low.

RESERVATION STATUS

The species is reserved in the Macquarie Island Nature Reserve and World Heritage Area.

Table 1. Population summary for *Azorella macquariensis* in Tasmania

	Location	Tenure	NRM region *	1:25 000 mapsheet	Year last seen	Extent of occurrence (km²)	Number of cushions (pre decline)
1	Feldmark, Macquarie Island	Macquarie Island Nature Reserve	South	N/A	2012	< 90	Hundreds of thousands

* NRM region = Natural Resource Management region

CONSERVATION STATUS

Azorella macquariensis was listed as endangered on the Tasmanian *Threatened Species Protection Act 1995* in 2009, meeting the following criterion:

A2. Total population reduction in the form of a reduction of at least 50%, projected to be met within the next 10 years based on:

b. an index of abundance appropriate for the taxon;

c. a decline in area of occupancy, extent of occurrence and/or quality of habitat.

Plate 2. Image from Macquarie Island in March 2009, showing the extent of *Azorella macquariensis* cushion dieback amongst mosses (yellow) and *Pleurophyllum hookerii* (silvery green) (Image by Dana Bergstrom)

THREATS, LIMITING FACTORS & MANAGEMENT ISSUES

Catastrophic decline: Although abundant and widespread on Macquarie Island, *Azorella macquariensis* has undergone a recent catastrophic decline. The decline is due to factors that are currently unknown and under investigation. The dieback was first noted and documented in December 2008 (Bergstrom, unpublished data). Dieback was not evident in March 2008 during botanical surveys undertaken on the island (Rudman, Bergstrom & Whinam, pers. comm). There is no indication in the literature of any dieback being recorded in other cushion plants worldwide (N. Gibson 2009, pers. comm.).

In March 2009, dieback was evident across the entire range of *Azorella macquariensis*, with the dieback most extensive advanced in the northern third of the island. The extent and severity of dieback affected cushions has increased through 2010 and 2011. Extensive and severe dieback is now present throughout the range of *Azorella macquariensis*. The oldest most advanced areas of dieback are close to devoid of live cushions. Small unaffected areas remain at low altitude on sea stacks, some low lying valley sites and sites in the south of the island. There appear to be no substantial barriers to the decline evident in the range of the species. At the current rate of spread of the dieback it is anticipated that the species could become extinct in the wild in the short term unless there is successful regeneration from soil stored seed. It is estimated that some areas of feldmark have been completely decimated with a population decline of 20% recorded in 2010 and 2011 (Bergstrom and PWS, unpublished data).

Dead cushions have been observed to erode and be lost from the feldmark on Macquarie Island, which is likely to lead to a decline in extent and/or quality of the habitat. As *Azorella macquariensis* is the main structural component of feldmark, the loss of *Azorella macquariensis* through this epidemic will cause severe modification to the ecosystem and is likely to lead to major erosion problems and decline of associated species. This may impact on the success of regeneration from soil stored seed.

Monitoring of dieback is not possible over the winter, as *Azorella macquariensis* undergoes winter browning, which makes mapping of dieback extremely difficult. Logistical and quarantine restrictions impose severe limitations on managing the response to the dieback. Management challenges include infrequent access, availability of expertise in the field and high costs.

Currently Australia does not have an adequate facility provide the environmental conditions required to successfully maintain a healthy collection of *Azorella macquariensis* plants. The Royal Tasmanian Botanical Gardens have an important but limited facility which houses one (small and struggling) specimen of *Azorella macquariensis* in the Subantarctic Island Plant House.

The Royal Tasmanian Botanical Gardens house a small collection 4,000 *Azorella macquariensis* seeds in their seedbank, the only collection in the global seedbank network (RTBG 2012). The seed collection was large enough to allow some germination studies to be commenced and testing is currently underway. The initial results suggest that this species exhibits physiological dormancy. Germination requirements have not been resolved and a larger collection of seed would allow for a broader testing regime and greater availability of plants for research. For biosecurity reasons it is not possible to export and maintain plants outside quarantine facilities in Australia.

Climate change: Feldmark is a habitat identified as being at risk from climate change. Climate data from lower elevation on Macquarie Island shows warming of over half a degree in 50 years (Pendlebury & Barnes-Keoghan 2007, Tweedie & Bergstrom 2000). Perhaps more telling are observations of dry soil conditions not previously experienced in the island (Bergstrom 2010 pers. comm.). This is backed up by analyses of climate data which indicate periods where the annual monthly temperature is above average and where average monthly precipitation is below average, suggesting a change to periods of drier conditions (Whinam & Copson 2006).

Investigations are currently underway to determine the ability of *Azorella macquariensis* to withstand periods of droughting (Prof. Marilyn Ball, pers. comm.) and possible increases in the incidence of frosts (Dr Dana Bergstrom, pers. comm.) as this may help to explain the decline.

Climate change may also impact indirectly on *Azorella macquariensis* through interspecies competition and interactions with plant diseases. The range of alien species, including pathogens, that could establish on the island is likely to change and alien species if already present or indigenous species including pathogens are likely to increase their expression and impact.

Impact of rabbits or rodents: Feldmark is the only vegetation community on Macquarie Island that is not currently showing significant adverse impacts of rabbit grazing. Rabbits occasionally 'scrape' the cushions but have not been observed to have major detrimental effects on *Azorella macquariensis*. Rabbits, rats and mice are currently the subject of a vertebrate pests eradication program (PWS & BCB 2007).

Introduction of alien species: A new introduction of an alien species (plant, vertebrate, invertebrate or pathogen) could severely affect the species directly through competition or infection, or indirectly, through degradation of habitat.

MANAGEMENT STRATEGY

What has been done?

A collaborative response program has been developed between the Australian Antarctic Division, Australian National University, Parks & Wildlife Service, Royal Tasmanian Botanical Gardens and Resource Management and Conservation Division of the Department of Primary Industries, Parks, Water and Environment.

Both intra and inter island biosecurity measures have been implemented as a precaution in case a pest or pathogen is associated with the dieback. Ten Special Management Areas in the southern part of the island have been declared

to strictly control access to minimise human impacts on remaining healthy areas of *Azorella macquariensis*.

Dieback management is integrated with the implementation of the Macquarie Island pest eradication program. The low numbers of rabbits surviving the baiting program are now being hunted (PWS 2011).

A number of research streams are underway including investigating:

- environmental associations and disease drivers;
- monitoring disease development and extent on the island;
- physiological susceptibility of *Azorella macquariensis* to environmental stress;
- investigating the potential for pathogen involvement;
- development of germination and horticulture techniques for *Azorella macquariensis*;
- establishment of an ex situ trial seed orchard on Macquarie Island.

Management objectives

- determine and address the cause of decline;
- monitor and describe the nature of the decline and any recovery of *Azorella macquariensis* and associated feldmark species;
- expand and maintain a representative *ex situ* conservation holding of seed and living plants.

What is needed?

- determine the cause of the decline and implement appropriate control measures where possible;
- monitor the impact on *Azorella macquariensis* over time and associated changes in the feldmark ecosystem;
- monitor the progress of the dieback across the island and manage areas with low levels of dieback to minimise potential adverse impacts;
- continue stringent biosecurity controls to prevent the introduction of alien species to Macquarie Island;
- implement biosecurity controls to minimise the risk of spread of any pathogen that may be implicated in the dieback, from Macquarie to other subantarctic islands or to Tasmania;
- establish a suitable facility to securely maintain *Azorella macquariensis* plants at the Royal Tasmanian Botanical Gardens;
- develop techniques to improve the condition of *ex situ* holdings and to propagate the species through tissue culture;
- supplement the collection of seed for long-term storage at the Tasmanian Seed Conservation Centre including establishing a seed orchard on Macquarie island to overcome seed collection difficulties;
- pursue the listing of the feldmark community on Macquarie Island under State and National legislation;
- maintain a co-operative program between the divisions of the Department of Primary Industries, Parks, Water and Environment, the Australian Antarctic Division and other research institutions to facilitate the conservation of the species;
- develop potential *in situ* adaptation measures;
- develop a recovery plan.

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View:
www.dpipwe.tas.gov.au/threatenedspecieslists

Contact details: Threatened Species Section, Department of Primary Industries, Parks, Water and Environment, GPO Box 44, Hobart, Tasmania, Australia, 7001. Phone (03) 6233 6556; fax (03) 6233 3477.

Permit: It is an offence to collect, disturb, damage or destroy this species unless under permit.