

THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Minister approved this conservation advice and transferred this species from the Vulnerable category to the Critically Endangered category, effective from 04/07/2019

Conservation Advice

Gentiana bredboensis

Summary of assessment

Conservation status

Gentiana bredboensis has been found to be eligible for transferring from the Vulnerable category to the Critically Endangered category, as outlined in the attached assessment.

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by New South Wales as part of the Common Assessment Method process, to systematically review species that are inconsistently listed under the EPBC Act and relevant state/territory legislation or lists.

More information on the Common Assessment Method is available at:

<http://www.environment.gov.au/biodiversity/threatened/cam>

The information in this assessment has been compiled by the relevant state/territory government. In adopting this assessment under the EPBC Act, this document forms the Approved Conservation Advice for this species as required under s266B of the EPBC Act.

Public consultation

Notice of the proposed amendment and a consultation document was made available for public comment for at least 30 business days between 17 August 2018 and 3 October 2018. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Recovery plan

A recovery plan for this species under the EPBC Act is not recommended, because the Approved Conservation Advice provides sufficient direction to implement priority actions and mitigate against key threats. The relevant state/territory may decide to develop a plan under its equivalent legislation.

Recommendations

- (i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **transferring** from the Vulnerable category to the Critically Endangered category:

Gentiana bredboensis

- (ii) The Committee recommends that there not be a recovery plan for this species.

Threatened Species Scientific Committee

4 October 2018

***Gentiana bredboensis* L.G. Adams (Gentianaceae)**

Distribution: Endemic to NSW

Current EPBC Act Status: Vulnerable

Current NSW TSC Act Status: Critically Endangered

Proposed change for alignment: List on EPBC as Critically Endangered

Conservation Advice: *Gentiana bredboensis*

Summary of Conservation Assessment

Gentiana bredboensis was found to be eligible for listing as Critically Endangered under Criterion B1ab(iii)(iv)(v)+B2ab(iii)(iv)(v), C2a(i)(ii) and D.

The main reasons for this species being eligible are: i) a highly restricted distribution. *G. bredboensis* occurs in a single location and has an extent of occurrence (EOO) of 4 km², calculated by fitting a minimum convex polygon around all confirmed records as per IUCN guidelines (IUCN 2017), and an area of occupancy (AOO) of 4 km², calculated using a 2 x 2 km grid as per IUCN guidelines (IUCN 2017); ii) small population size, with the most recent estimate of a total of 50 mature individuals in a single population; iii) inferred continuing decline, as the species is known to have undergone significant declines of up to 75% from 2010-2014, and this trend is believed to be ongoing as the key threats (disturbance by pigs and cattle), have not ceased and the only known population occurs on private land with an unclear future with regards to land management.

Description and Taxonomy

The NSW Scientific Committee (2009) state that “*Gentiana bredboensis* (family Gentianaceae) is described by Harden (1992) as an: annual or possibly biennial herb 2–9 cm high, glabrous; stem usually many-branched, minutely scabrous; basal leafless portion very short. Basal leaves 3–6 pairs, sessile, broad-ovate, 8–20 mm long, 8–12 mm wide, margins smooth to minutely scabrous; cauline leaves 3–6 pairs, becoming smaller and thicker up stem, 6–15 mm long and 5–8 mm wide. Flowers 1–6 per plant. Calyx 5–8 mm long; ribs narrow-winged; lobes 2.5–3.5 mm long. Corolla 8–10 mm long, pinkish ribbed outside, pure white inside; lobes spreading, 2–4 mm free. Stipe elongating to 2.5 mm in fruit. Capsule oblong-ovoid, 5–6 mm long.”

Distribution and Abundance

The NSW Scientific Committee (2009) state that “*Gentiana bredboensis* is known from a single population, near Jerangle (east of Bredbo), in the Monaro Region on the NSW Southern Tablelands.”

According to the Conservation Advice for the species listing under the EPBC Act (Cwlth., 2008) “The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities:

- White Box-Yellow Box-Blakely’s Red Gum Grassy Woodland and Derived Native Grassland, and
- Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory.”

Both the extent of occurrence (EOO) (4 km²) and area of occupancy (AOO) (4 km²) fall below the thresholds for Critically Endangered (<100 km² and <10 km², respectively). EOO was calculated by fitting a minimum convex polygon around all confirmed records as per IUCN guidelines (IUCN 2017), and AOO was calculated using a 2 x 2 km grid as per IUCN guidelines (IUCN 2017). Both EOO and AOO are estimated to be 4 km² as EOO must at least be as large as AOO according to IUCN Guidelines (2017). All known records of the species occur on freehold tenure near Jerangle.

The population is considered a single location, as per the IUCN (2017) definition of location, as all individuals could be lost to the impacts of a single disturbance event by any one of the main threatening processes which include trampling by livestock, habitat destruction by pigs, fertiliser use, frequent fires and a change to the local hydrology.

With regards to population size, the NSW Scientific committee (2009) state that “The total number of mature individuals of *G. bredboensis* is extremely low. A survey undertaken in November 2008 found a population of 20 plants (J Briggs and L. Van Dyke unpublished data). Extreme fluctuations may occur in the population as a result of interactions between the annual life cycle of the species and variation in environmental conditions between years.”

“The population of *Gentiana bredboensis* has undergone a very large reduction over a time frame appropriate to the life cycle of the species. At the time of its discovery in 1967, the total population was estimated to contain several hundred plants, in three small patches separated by a couple of hundred metres on adjacent properties (L. Adams pers. comm.). By 1999 two of these colonies/subpopulations had disappeared, probably as a result of changes to the land management (including changes in stocking rates) (Hogbin 2002); in 2002, the total population was estimated to be 50-200 plants, prompting a revision of the status of the species from Vulnerable to Endangered under the *Threatened Species Conservation Act 1995* (Hogbin 2002; NSW Scientific Committee 2003). A survey conducted in late 2007 estimated the population to be 30-40 plants (R. Rehwinkel and L. Van Dyke unpubl. data). By November 2008, the population had declined to 20 mature individuals, as a result of habitat damage caused by cattle and feral pigs (J Briggs and L. Van Dyke unpublished data), and searches again failed to discover the species in the other two recorded locations (J. Briggs pers. comm.). Between 2002 and 2008 (6 years), the population has potentially declined by 60 - 90%, and has evidently continued to decline since the 1960s. Over the past ten years, a time frame appropriate to the life cycle of the species, the population is likely to have declined by at least 80% (Bray 2008).”

Surveys in 2010 estimated c. 200 mature individuals but by 2014 numbers were reduced by up to 75% down to 50 mature individuals, believed to be a result of both disturbance by pigs and the already small population size (J. Briggs, pers. comm. Jun. 2017). It is unclear whether the increase from the 20 mature individuals in 2008 to 200 in 2010 was a result of differing search effort, or if there was a true increase in population size over this period, or whether it was a part of natural fluctuations in the population size over different years. While there is some uncertainty around the current total population size, the historic declines noted in the NSW Scientific Committee’s determination (2009) combined with the more recent declines from 2010 to 2014 suggests a continuing decline has occurred over the past ten to twenty years, with reductions over different periods of time being between 60 and 90%.

Ecology

The NSW Scientific Committee (2009) state that “*Gentiana bredboensis* grows along the margin of very wet seepage slopes in pasture on granitic sandy soil (Adams and Williams 1988; Harden 1992). The species grows in short herbfield communities amongst *Baeckea*-*Leptospermum* thickets (DECC 2005).”

“*Gentiana bredboensis* produces single small bell-shaped flowers during September and October (DECC 2005).”

The flowers of *Gentiana bredboensis* only open in direct sunlight (Adams & Williams, 1988) and they produce numerous, small seeds (~0.6 mm) which, unlike the seeds of some other species within the

family, have no wing-like appendages to facilitate wind dispersal (Adams & Williams, 1988). The seed biology of the species is poorly understood and attempts to germinate seeds have so far failed (J. Briggs, pers. comm., Jun. 2017).

While it is not clear whether the species has an annual or biennial life cycle, it undoubtedly is short-lived. Other species of *Gentiana* in NSW with similar life histories senesce shortly (c. 2 months) after flowering and setting seed (Kodala *et al* 1994) and *G. wingecarribiensis* has been observed to disappear from sites for several years before reappearing (Young 2001) possibly suggesting that at least some of these species are capable of forming persistent soil seed banks.

Threats

The NSW Scientific Committee (2009) state that “*Gentiana bredboensis* is threatened by habitat degradation as a result of trampling by cattle and feral pigs.”

The NSW Scientific Committee (2009) variously state “Small-scale clearing of habitat may be undertaken to increase access and pasture for livestock grazing.” “High fire frequency may have an adverse effect on this species. The ACT Commissioner for the Environment (ACTCE 2004) recommends that *G. bredboensis* experiences fire no more than once every 6 years.” As *G. bredboensis* grows in periodically waterlogged areas, changes in hydrology and stream flow associated with projected declines in rainfall (Hennessy *et al.* 2004) or water extraction from the Bredbo River may result in drying of the habitat.” “The small range and population size of *G. bredboensis* makes this species vulnerable to environmental and demographic stochasticity.” “Other threats include nutrient enrichment as a result of runoff from improved pastures adjacent to the population and resulting competition from exotic pasture species. “

The current major threats facing *G. bredboensis* are disturbance by pigs and a small population size (J. Briggs, pers. comm., Jun. 2017).

The one remaining population was partially fenced off in 2009 minimising the threat posed by livestock and feral pigs within the fenced part of the population. Furthermore, as part of the NSW Saving Our Species (SOS) site managed program, weed and pest management schemes will be ongoing to enhance the survival of the remaining plants. However, it is also noted that feasibility of negotiating a long-term management agreement with the current landholder is low.

As the seed biology of *G. bredboensis* is poorly understood and attempts to germinate seeds have so far failed (J. Briggs, pers. comm., Jun. 2017), establishment of any ex situ seed banks, living collections or other translocated populations has not been possible.

Assessment against IUCN Red List criteria

For this assessment it is considered that the survey of *Gentiana bredboensis* has been adequate and there is sufficient scientific evidence to support the listing outcome.

Criterion A Population Size reduction

Assessment Outcome: Data Deficient.

Justification: *Gentiana bredboensis* has undergone a decline involving a loss of sites and a declining number of mature plants (e.g. Bray (2008) estimated a decline of at least 80% over a 10 year time frame based on observations between 2002 and 2008, while there has been a decline of up to 75% between 2010 and 2014 in population estimates). However, there may be natural fluctuations each year in population abundance in this annual/biennial species, making interpretation of what is an

actual decline difficult. Consequently, a reliable estimate of the population reduction of the species cannot be made.

Criterion B Geographic range

Assessment Outcome: Critically Endangered under criterion B1ab(iii)(iv)(v) + B2ab(iii)(iv)(v)

Justification: Both extent of occurrence (EOO) (4 km²) and area of occupancy (AOO) (4 km²) fall below the thresholds for Critically Endangered (<100 km² and <10 km², respectively). EOO was calculated by fitting a minimum convex polygon around all confirmed records as per IUCN guidelines (IUCN 2017), and AOO was calculated using a 2 x 2 km grid as per IUCN guidelines (IUCN 2017). Both EOO and AOO are estimated to be 4 km² as EOO must at least be as large as AOO according to IUCN Guidelines (2017).

In addition to these thresholds, at least two of three other conditions must be met. These conditions are:

- a) The population or habitat is observed or inferred to be severely fragmented or there is either 1 (CR), <5 (EN) or <10 (VU) locations.

Assessment Outcome: sub criterion met at Critically Endangered threshold

Justification: There is only a single location based on the small size of the population and the fact that any one of the major threats (pigs, stochastic events) could eliminate the entire population in a short period of time.

- b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or populations; (v) number of mature individuals

Assessment Outcome: sub criterion met for iii, iv and v.

Justification: Given the decline in number of sites with plants present and in population size from 2010 and 2014, combined with the fact that many of the threats impacting on the species remain present, it is inferred that the species has experienced continuing declines in (iii) area, extent and/or quality of habitat, (iv) number of locations and populations as well as in (v) number of mature individuals and will likely experience them again in the future as the security of the site is dependent on the cooperation of the landholder.

- c) Extreme fluctuations.

Assessment Outcome: Data Deficient

Justification: As an annual species, it may experience extreme fluctuations due to interactions between factors promoting recruitment and survival and seasonal conditions, however, at present the evidence for this is insufficient.

Criterion C Small population size and decline

Assessment Outcome: Critically Endangered under Criterion C2a(i)(ii)

Justification: The most recent (2014) population count found 50 mature individuals, and this falls below the threshold for Critically Endangered (<250).

At least one of two additional conditions must be met. These are:

- C1. An observed, estimated or projected continuing decline of at least 10, 20 or 25% in 10, 5 or 3 years or 3, 2 or 1 generations, respectively (up to a max. of 100 years in future).

Assessment Outcome: Data Deficient

Justification: While it is possible the species will continue to decline in the future and possibly even become extinct, there is insufficient data to quantify the percentage over time at present due to uncertainty around the interpretation of natural population fluctuations and decline.

- C2. An observed, estimated, projected or inferred continuing decline

Assessment Outcome: sub criterion met

Justification: Given the decline in number of sites with plants present and in population size from 2010 and 2014, combined with the fact that many of the threats impacting the species remain present, it is inferred that the species has experienced continuing declines and will likely experience them again in the future as the security of the site is dependent on the cooperation of the landholder.

In addition, at least 1 of the following 3 conditions:

- a (i). Number of mature individuals in each population <50.

Assessment Outcome: sub criterion met at Endangered threshold

Justification: The most recent (2014) population estimate was 50 mature individuals in the only known population.

- a (ii). % of mature individuals in one population = 90-100%.

Assessment Outcome: sub criterion met at Critically Endangered threshold

Justification: There is a single population which contains 100% of the mature individuals.

- b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Data Deficient

Justification: As an annual/biennial species, it may experience extreme fluctuations due to interactions between factors promoting recruitment and survival and seasonal conditions, however, at present the evidence for this is insufficient.

Criterion D Very small or restricted population

Assessment Outcome: Critically Endangered under Criterion D

Justification: Based on the most recent (2014) population count, there are only 50 remaining mature individuals. Although this number does not meet the Critically Endangered threshold for D per se there is an argument to be made for taking the precautionary approach and assuming that numbers may now be lower than they were three years ago in light of the continuing presence of threats to the species, and therefore would fall below the Critically Endangered threshold for D (<50).

Criterion E Quantitative Analysis

Assessment Outcome: Data Deficient

Justification: There is insufficient data to perform a quantitative analysis of extinction risk.

Conservation and Management Actions

There is no National Recovery Plan, however, there is a NSW Saving our Species (SOS) site managed program for this species. The following is derived from the SOS program and Conservation Advice prepared for the Commonwealth (2008).

Habitat loss, disturbance and modification

- Negotiate favourable future land management with the land holder.
- Maintain fences around the remaining plants.
- Ensure the integrity of nearby streams are maintained.
- Exclude livestock from nearby suitable habitat.
- Exclude fire where plants are present, at least until the fire response of the species is more thoroughly understood.
- Assess options to prevent effluent run off from nearby roads and farmland.

Invasive species

- Remove competing weed species regularly.
- Cull or eliminate feral pig (*Sus scrofa*) populations in the area.

Ex situ conservation

- Develop a targeted seed collection program for ex situ seed banking.
- Identify suitable sites for translocations and establish new populations.
- Cultivate in botanic gardens to create a backup ex situ population in the event that the species becomes extinct in the wild.

Stakeholder Management

- Inform land owners and managers of sites where there are known populations and consult with these groups regarding options for conservation management and protection of the species.
- Limit as much as possible any activities that could further impact the hydrology of the area.

Survey and Monitoring priorities

- Monitor any increased habitat degradation.
- Conduct regular surveys to determine population size and fluctuations.
- Monitor the effectiveness of fencing.
- Survey suitable habitat for as yet unidentified populations or possible locations for translocations.

Information and Research priorities

- Conduct genetics research to determine the impact of inbreeding on the species.
- Research seed ecology to enable germination from seed and establishment of ex situ populations.
- Understand the potential natural fluctuations that occur in response to environmental conditions to assess whether extreme fluctuations are occurring.
- Identify possible climate change refugia which may also serve as translocation sites in order to secure the species future under a changing climate.
- Investigate the response of the species to fire.

References

Commonwealth Government, 2008. Approved Conservation Advice for *Gentiana bredboensis*. URL: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/15882-conservation-advice.pdf>

Hogbin P (2002) Review of the TSC Act Flora Schedules: Recommendations to the Scientific Committee. Final Summary Report Dec 2002. NSW NPWS, Hurstville, NSW.

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Young, A. 2001. Issues and Options for Genetic Conservation of small Populations of Threatened Plants in the ACT. Consultancy Report by CSIRO Plant Industry for Environment ACT, Wildlife Research and Monitoring, June 2001.

Expert Communications

Briggs, John. Regional Operations, Office of Environment and Heritage, Queanbeyan, NSW.

***Gentiana bredboensis* - critically endangered species listing**

NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the herb *Gentiana bredboensis* L.G. Adams, as a CRITICALLY ENDANGERED SPECIES in Part 1 of Schedule 1A of the Act, and as a consequence, to omit reference to *Gentiana bredboensis* L. Adams from Part 1 of Schedule 1 (Endangered species) of the Act. Listing of Critically Endangered species is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. *Gentiana bredboensis* (family Gentianaceae) is described by Harden (1992) as an annual or possibly biennial herb 2–9 cm high, glabrous; stem usually many-branched, minutely scabrous; basal leafless portion very short. Basal leaves 3–6 pairs, sessile, broad-ovate, 8–20 mm long, 8–12 mm wide, margins smooth to minutely scabrous; cauline leaves 3–6 pairs, becoming smaller and thicker up stem, 6–15 mm long and 5–8 mm wide. Flowers 1–6 per plant. Calyx 5–8 mm long; ribs narrow-winged; lobes 2.5–3.5 mm long. Corolla 8–10 mm long, pinkish ribbed outside, pure white inside; lobes spreading, 2–4 mm free. Stipe elongating to 2.5 mm in fruit. Capsule oblong-ovoid, 5–6 mm long.
2. *Gentiana bredboensis* is known from a single population, near Jerangle (east of Bredbo), in the Monaro Region on the NSW Southern Tablelands.
3. *Gentiana bredboensis* grows along the margin of very wet seepage slopes in pasture on granitic sandy soil (Adams and Williams 1988; Harden 1992). The species grows in short herbfield communities amongst *Baeckea*-*Leptospermum* thickets (DECC 2005).
4. *Gentiana bredboensis* produces single small bell-shaped flowers during September and October (DECC 2005).
5. The total number of mature individuals of *G. bredboensis* is extremely low. A survey undertaken in November 2008 found a population of 20 plants (J Briggs and L. Van Dyke unpublished data). Extreme fluctuations may occur in the population as a result of interactions between the annual life cycle of the species and variation in environmental conditions between years.
6. *Gentiana bredboensis* has a very highly restricted distribution (Bray 2008). Its area of occupancy is likely to be no greater than 4 km², based on 2 x 2 km grid cells, the spatial scale of assessment recommended by IUCN (2008).
7. The population of *Gentiana bredboensis* has undergone a very large reduction over a time frame appropriate to the life cycle of the species. At the time of its discovery in 1967, the total population was estimated to contain several hundred plants, in three small patches separated by a couple of hundred metres on adjacent properties (L. Adams pers. comm.). By 1999 two of these colonies/subpopulations had disappeared, probably as a result of changes to the land management (including changes in stocking rates) (Hogbin 2002); in 2002, the total population was estimated to be 50-200 plants, prompting a revision of the status of the species from Vulnerable to Endangered under the *Threatened Species Conservation Act* 1995 (Hogbin 2002; NSW Scientific Committee 2003). A survey

conducted in late 2007 estimated the population to be 30-40 plants (R. Rehwinkel and L. Van Dyke unpubl. data). By November 2008, the population had declined to 20 mature individuals, as a result of habitat damage caused by cattle and feral pigs (J Briggs and L. Van Dyke unpublished data), and searches again failed to discover the species in the other two recorded locations (J. Briggs pers. comm.). Between 2002 and 2008 (6 years), the population has potentially declined by 60 - 90%, and has evidently continued to decline since the 1960s. Over the past ten years, a time frame appropriate to the life cycle of the species, the population is likely to have declined by at least 80% (Bray 2008).

8. *Gentiana bredboensis* is threatened by habitat degradation as a result of trampling by cattle and feral pigs. 'Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa*' is listed as a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

9. Small-scale clearing of habitat may be undertaken to increase access and pasture for livestock grazing. 'Clearing of native vegetation' is listed as a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

10. High fire frequency may have an adverse affect on this species. The ACT Commissioner for the Environment (ACTCE (2004) recommends that *G. bredboensis* experiences fire no more than once every 6 years. 'High frequency fires resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

11. As *G. bredboensis* grows in periodically waterlogged areas, changes in hydrology and stream flow associated with projected declines in rainfall (Hennessy *et al.* 2004) or water extraction from the Bredbo River may result in drying of the habitat. 'Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands' and 'Anthropogenic Climate Change' are listed as Key Threatening Processes under the *Threatened Species Conservation Act 1995*.

12. The small range and population size of *G. bredboensis* makes this species vulnerable to environmental and demographic stochasticity.

13. Other threats include nutrient enrichment as a result of runoff from improved pastures adjacent to the population and resulting competition from exotic pasture species. 'Invasion of native plant communities by exotic perennial grasses' is listed as a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

14. *Gentiana bredboensis* L. Adams is eligible to be listed as a Critically Endangered species as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future as determined in accordance with the following criteria as prescribed by the *Threatened Species Conservation Regulation 2002*:

Clause 14

The species has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:

(a) a very large reduction in population size

based on:

(d) an index of abundance appropriate to the taxon

(e) geographic distribution, habitat quality or diversity, or genetic diversity.

Clause 15

The geographic distribution of the species is estimated or inferred to be:

(a) very highly restricted

and

(d) a projected or continuing decline is observed, estimated or inferred in:

(i) an index of abundance appropriate to the taxon, or

(ii) geographic distribution, habitat quality or diversity, or genetic diversity

(e) the following conditions apply:

(ii) all or nearly all mature individuals are observed or inferred to occur within a small number of populations or locations

(iii) extreme fluctuations are observed or inferred to occur in either:

(A) an index of abundance appropriate to the taxon.

Clause 16

The estimated total number of mature individuals of the species is:

(a) very low

and

(d) a projected or continuing decline is observed, estimated or inferred in either:

(i) an index of abundance appropriate to the taxon, or

(ii) geographic distribution, habitat quality or diversity, or genetic diversity

(e) the following conditions:

(ii) all or nearly all mature individuals are observed or inferred to occur within a small number of populations or locations

(iii) extreme fluctuations are observed or inferred to occur in:

(A) an index of abundance appropriate to the taxon.

Clause 17

The total number of mature individuals of the species is observed, estimated or inferred to be:

(a) extremely low.

Dr Richard Major

Chairperson

Scientific Committee

Proposed Gazettal date: 11/12/09

Exhibition period: 11/12/09 – 05/02/10

References:

ACT Commissioner for the Environment (ACTCE) (2004) 'State of the Environment Report, Fire management in threatened ecological communities and threatened species'. ACTCE

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