Department of
Sustainability and
Environment

National Recovery Plan for the Warby Range Swamp-gum *Eucalyptus cadens*

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Australian Government

Victoria
The Place To Be

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This is a Recovery Plan prepared under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, with the assistance of funding provided by the Australian Government.

This Recovery Plan has been developed with the involvement and cooperation of a range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Cover photograph: Warby Swamp Gum *Eucalyptus cadens* with introduced Canary Grass *Phalaris aquatica* understorey, by Glen Johnson.

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Summary

The Warby Range Swamp-gum *Eucalyptus cadens* is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 and as Threatened under the Victorian *Flora and Fauna Guarantee Act* 1988. The species is endemic to north-eastern Victoria, where about 7,700 individuals occur in 60 populations in four sub-catchments of the Ovens River. Major threats include clearing, weed invasion, grazing, fire and altered hydrology. This national Recovery Plan for *E. cadens* details the species' distribution and biology, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

Eucalyptus cadens is a spreading tree reaching 25 m in height. The species is known for its characteristic leaning habit, thus the specific epithet is derived from the Latin *cadere* 'to fall down'. The rough, compact bark is present for the first 10 m of the trunk, with smooth, ribbony, green-grey bark developing further up the tree. The juvenile leaves are greenish-grey, elliptic to ovate, to 50 mm long and 20 mm wide, with smooth to crenulate margins, sessile and initially opposite but becoming alternate. New growth is quite glaucous, which distinguishes it from its close relative *Eucalyptus aggregata.* Adult leaves are bluish-green, narrow and elliptic, ranging from 70–50 mm in length and 10–20 mm in width. Inflorescences are axillary, with seven flowers and peduncles up to 6 mm in length. Buds are pedicellate, tapering at both ends, 3 mm in diameter, up to 8 mm long, and with a conical operculum. Flowers are white with four ovules. Flowering occurs between March and June. Fruit is obconical, relatively sessile, 6 mm in diameter and up to 5 mm long. (description from Briggs & Crisp 1989).

Eucalyptus cadens is a long-lived tree producing a large amount of seed that will only germinate successfully and grow to maturity in the wild in seasonally waterlogged and permanently moist sites associated with perennial springs. It can also regenerate vegetatively from its epicormic buds and lignotubers at its base. Thus, the species requires very specific environmental conditions to survive.

Distribution

Eucalyptus cadens is endemic to north-eastern Victoria, in the NSW South Western Slopes (Victorian section) IBRA Bioregion (DEH 2000). It was originally thought to be restricted to a single locality in the Warby Ranges north of Wangaratta, but is now known from four sub-catchments of the Ovens River. The majority of stands are associated with the south-eastern foot-hills of the Pilot Range near Beechworth and Wooragee, with additional locations in the eastern foothills of the Warby Range.

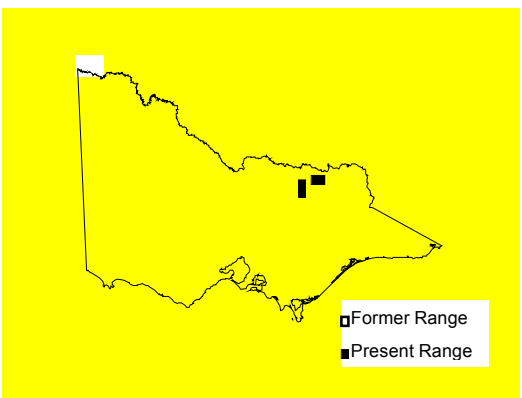

Figure 1. Distribution of the *Eucalyptus cadens* in Victoria

Population Information

The total population of *E. cadens* is estimated to be 7,700 individuals, in about 60 separate groups (populations), covering a total area of c. 29 hectares. Most groups are small, generally one hectare or less, with the largest (the type locality) being 5.5 hectares. Over seventy five percent of the population currently occurs on private land on seventeen individual landholdings. The Warby Swamp Gum has been recorded at Beechworth Historic Park and more recently the Chiltern Mount Pilot National Park. Groups at Mt Pilot also tend to be small in size ranging from between 0.1 and 2.5 hectares (10–335 individuals). Some stands also occur on road reserves and public water frontages.

Important populations (ie. due to generally high abundance and/or secure tenure) necessary to the long term survival and recovery of *Eucalyptus cadens* include the following locations:

National Parks (Parks Victoria)
Chiltern – Mt Pilot N.P., Chiltern
Old Coach Road, Chiltern – Mt Pilot N.P., Indigo
Green Wattle Creek, Chiltern – Mt Pilot N.P., Indigo

State Forest (Department of Sustainability and Environment)
Barambogie – Chiltern Water Supply

Other reserves (Parks Victoria)
Beechworth Historic Park, Beechworth

Roadsides (Indigo Shire Council)
Wardens Road, Beechworth
Tovey Road, Indigo

Roadsides (Wangaratta Rural City Council)
Sheep Station Rd, Wangaratta
Woolshed Valley (Reedy Creek), Wangaratta

Private Land
Numerous private land sites on the Northern Inland Slopes of Victoria's north east.

Habitat

Eucalyptus cadens stands tend to occur in woodlands often in or around the peripheries of springs, soaks and waterbodies, defined as 'Spring-soak Herbland/Woodland Mosaic' Ecological Vegetation Class. Vegetation communities are often dominated by *Eucalyptus cadens* with combinations of *Juncus, Carex and Baumea* spp. in the understorey. Other trees and shrubs occurring in these communities include *Eucalyptus blakelyi*, *Eucalyptus camphora*, *Eucalyptus goniocalyx*, *Eucalyptus macrorhyncha* and *Acacia dealbata*. Associated shrub species may include *Callistemon pityoides* and *Hakea microcarpa*. Ground layer species include *Hypolepis glandulifera* and *Gleichenia* spp.

Threats

The Warby Range Swamp-gum has almost certainly undergone a substantial decline in abundance, and possibly some decline in range, due to past clearing, grazing and changes to hydrology. Fires, grazing, weed invasion and pressures for future clearing are current major threats. Land clearance is listed under the *Environment Protection and Biodiversity Conservation Act* 1999 as a Key Threatening Process. Populations on private land are most at risk. Many of the populations on public land are relatively well protected, although some threatening processes may be impacting on these reserved areas. These include firewood collection, construction of infrastructure and earthworks. Grazing by native herbivores may also contribute to the lack of recruitment. These threats have caused habitat fragmentation, which increase edge affects suffered by remnants, and genetic isolation genetic isolation for populations stands not connected to others by a waterbody. Main threats include:

Land clearance: Land clearance has had a very high impact on the survival of *E. cadens* and its habitat, and may still be continuing, particularly as a result of earthworks for dams. Land Clearance is listed under the EPBC Act as a Key Threatening Process.

Grazing: Grazing, especially by domestic stock, is a major threat. Animals tend to congregate in stands of *E. cadens* for shelter and water, damaging trees by rubbing (in excess cases leading to ringbarking), and reducing seedling recruitment by excessive trampling and grazing. Trampling by stock is currently believed to be one of the most serious threatening processes operating on this species (J. Blackney, pers. comm.). Grazing by native and exotic herbivores post fire may be a threat to seedling regeneration. Rabbit grazing may threaten seedling survival. Macropod grazing may pose a threat on both public and private land. The impact of different grazing regimes and fire (which is sometimes applied to private land sites) on adult mortality, and seed germination and recruitment is not well understood. Many stands are fully occupied by mature trees and, where rushes and sedges are prolific, there may be little opportunity for regeneration. However, stock exclusion and selective weed control may help restore the native groundcover component of the swamp community. Trampling may also lead to soil compaction and damage, leading to changes in the habitat.

Weed invasion: This is a major threat, especially on private land populations. One species, the Blackberry, *Rubus fruticosus* species aggregate, is a Weed of National Significance. Perennial grasses such as *Holcus lanatus* and *Phalaris aquatica* pose a significant competitive threat to regeneration in many sites. Some remnant *E. cadens* habitat found on roadsides is significantly degraded.

Fire: *Eucalyptus cadens* grows in damp habitats that are probably quite susceptible to fire, and the species itself may be quite susceptible to hot fires. Wildfires in north-eastern Victoria in early 2003 burnt some populations in the Mt Pilot and Mt Barambogie areas, although the impact is not known.

Changes to hydrology: The reliance of *E. cadens* on damp sites, especially around springs, makes it quite susceptible to any alteration of local hydrology, such as draining or impounding springs or altering upstream water sources.

Salinity: Dryland salinity occurs at one public land site, and is currently a low-level threat. However, land degradation as a result of salinity is likely to continue to increase significantly in this region (NRE 2000). It is likely therefore, that stress to native communities such as *Eucalyptus cadens* habitat will result.

Hybridisation: *Eucalyptus cadens* may also hybridise with the sympatric *E. camphora* (Mountain Swamp gum), with the progeny of such crosses possibly producing sterile seed (A. Briggs pers. comm.).

Climate change: This is a major potential threat, with its predicted impact on raising temperatures, reducing rainfall and increasing climatic variability. The loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Act* 1999.

Recovery Information

Directions for recovery of *Eucalyptus cadens* include habitat conservation, restoration and management, combined with an understanding of the species' ecological and biological requirements. To achieve this, recovery actions are primarily structured to (i) acquire baseline data, (ii) assess habitat condition including ecological and biological function, (iii) protect populations to maintain or improve population growth and (iv) to engage the community in recovery actions.

Overall Objective

The **overall objective** of recovery is to minimise the probability of extinction of *Eucalyptus cadens* in the wild and to increase the probability of important populations becoming self-sustaining in the long term.

Within the life span of this Recovery Plan, the **specific objectives** of recovery for *Eucalyptus cadens* are to:

- Identify habitat that is critical, common or potential.
- Ensure that all populations and their habitat are protected and managed appropriately.

- Manage threats to populations.
- Determine the growth rates and viability of populations.
- Build community support for conservation.

Program Implementation

The Recovery Plan will run for five years from the time of implementation and will be managed by the Department of Sustainability and Environment. A Threatened Flora Recovery Team, consisting of scientists, land managers and field naturalists will be established to oversee threatened flora recovery in Victoria in general. Technical, scientific, habitat management or education components of the Recovery Plan will be referred to specialist sub-committees on research, *in situ* management, community education and cultivation. Regional Recovery Teams will be responsible for preparing work plans and monitoring progress toward recovery.

Program Evaluation

The Recovery Team will be responsible for annual assessments of progress towards recovery. This Recovery Plan will be reviewed within five years of the date of adoption.

Recovery Actions and Performance Criteria

Action	Description	Performance Criteria
Specific objective 1		
Identify habitat that is critical, common or potential		
1.1	Accurately survey known habitat and collect floristic and environmental information relevant to community ecology and condition. **Responsibility: DSE**	• Completion of data on essential life history stages, recruitment and dispersal at known sites. • Habitat critical to the survival of the species is mapped. • Data disseminated to relevant land management bodies. • Target populations for protection and management determined.
Specific objective 2		
Ensure that all populations and their habitat are legally protected		
2.1	Protect public land sites and provide recommendations for management to land managers and DSE. Develop Local policy, Vegetation Protection and / or Environmental Significance Overlays, in consultation with DSE, and incorporate into Local Planning Provisions to legally protect populations. *NB: these planning mechanisms and tools also apply to private land* **Responsibility: DSE / Wangaratta Rural City Council / Indigo Shire Council / PV**	• Sites protected and managed to achieve healthy populations, which naturally regenerate. • Land managers, DSE and DPI provided with data. • Vegetation Protection and / or Environmental Significance Overlays developed and incorporated into Local Planning Provisions for relevant Local Government Authorities. • Local Planning Policy, to protect currently unknown locations of *Eucalyptus cadens, d*eveloped and incorporated into Local Planning Provisions for relevant Local Government Authority. • "Significant Roadside Area" signs erected on roadside sites.
2.2	Initiate private land management agreements in consultation with private land owners under the *Victorian Conservation Trust Act* 1972, *The Conservation, Forests and Lands Act* 1987 and the *Wildlife Act* 1975 at selected private land sites. **Responsibility: DSE**	• Selected private land sites protected voluntarily.

Action	Description	Performance Criteria
Specific objective 3 **Manage threats to populations**		
3.1	Control threats of weed competition, grazing by herbivores and damage to soil substrates by stock in *Eucalyptus cadens* habitat by implementing integrated pest plant and animal control, fencing sites from stock and other herbivores and installing alternative water feeding sites. Ensure sites are not affected by earth works and in particular impoundments by land-use planning – protection in planning schemes. Relevant Local Government Authority and Water Authority to prevent inappropriate works or, dams in locations which will impact on hydrological processes. **Responsibility: PV / DSE / Rural City of Wangaratta Shire Council / Indigo Shire Council, Water Authority**	• Measurable seedling recruitment/vegetative regeneration and decline in extent and abundance of weed infestations at key localities. • Management Agreements achieved for key private land sites. • No further loss of individuals or populations. • Measurable decline at key localities.
Specific 4 **Determine the growth rates and viability of populations**		
4.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data. **Responsibility: DSE**	• Techniques for monitoring developed and implemented. • Census data for 5 target sites.
4.2	Collate, analyse and report on census data and compare with management histories. **Responsibility: DSE**	• Population growth rates determined and Population Viability Analysis completed for selected priority populations.
Specific objective 5 **Build community support for conservation**		
5.1	Identify opportunities for community involvement in the conservation of *Eucalyptus cadens*. **Responsibility: DSE**	• Leaflet or Brochure developed and distributed. • Information sign erected in appropriate location (eg Wooragee noticeboard).

Abbreviations

DSE: Department of Sustainability and Environment

PV: Parks Victoria

Management Practices

Management practices that will aid recovery

On-ground site management will aim to mitigate threatening processes to prevent declines and create conditions for maintenance or increase of population size. Major threats requiring management include accidental destruction, competition from pest plants, inappropriate fire regimes and grazing by pest animals. A range of strategies will be necessary to alleviate these threats including weed control, fire management, fencing, and control of pest animals. In addition, some *ex situ* conservation measures including seed storage and germination trails, will be required. Addressing major knowledge gaps is also required, especially determining the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the relationships between *Eucalyptus cadens* and associated flora, and its response to environmental processes. These are directly linked to biological function and are thus vital to recovery. Demographic censusing will be necessary to gather life history information and to monitor the success of particular management actions. Surveys of known and potential habitat should continue to better define the distributions and size of populations. Providing information to land owners, managers and the broader community in the region will increase awareness of the species, provide for increased protection of existing populations, an increased likelihood on new populations being found, and reducing the risk of inadvertent damage occurring. Community participation in recovery actions will be sought, particularly in regard to recovery team membership and implementation of on-ground works.

Management practices that will avoid significant adverse impacts

Providing land owners and managers with information on the location, distribution, habitat and ecology of *Eucalyptus cadens* will help to protect existing populations from inadvertent damage, and raising general awareness that may result in the location of any new populations. Populations occurring in potentially high-risk locations such as roadsides may need appropriate signposting. Negotiation with landowners with populations or suitable habitat on their properties will be required for protection of populations. Surveys in potential habitat likely to be impacted by any development proposals (including roadworks) will be required to avoid damage to or destruction of any currently unknown populations. Identification and protection of current and potential habitat such as through planning scheme overlays and restrictions on clearance of native vegetation is a high priority.

Affected interests

Recovery of *Eucalyptus cadens* primarily involves the North East Catchment Management Authority, Department of Sustainability and Environment, Parks Victoria, Trust for Nature, the Wangaratta Rural City Council and the Indigo Shire Council. Populations occur on roadsides within the aforementioned municipalities as well as in parks and reserves managed by Parks Victoria. As a result, Shires as well as Parks Victoria play a direct management role in the conservation of *Eucalyptus cadens*. The CMA and DSE provide support to private landholders and plays an important role in statewide policy and strategic planning to protect *Eucalyptus cadens* habitat. Trust for Nature makes financial assistance available to private landholders in identifying natural assets on their land as well as protecting sites legally with environmental protection covenants. Trust for Nature has been long aware of the importance of *Eucalyptus cadens* and its habitat and have continued to play a role in its protection.

Role and interests of indigenous people

Indigenous communities on whose traditional lands *Eucalyptus cadens* occurs will be advised, through the relevant DSE Regional Indigenous Facilitator, of the preparation of this Recovery Plan and invited to provide comments if so desired. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

Benefits to other species/ecological communities

The Recovery Plan includes a number of potential biodiversity benefits for other species and vegetation communities in Victoria. This will predominantly be through the protection and management of habitat. *Eucalyptus cadens* occurs in the Spring-soak Herbland/Woodland Mosaic Ecological Vegetation Class. Under the National Forest Reserve (JANIS) criteria used to assess the conservation status of EVCs in North East Victoria remnants of the Spring-soak EVC range from Rare to Endangered (Department of Sustainability and Environment 2003). The conservation status of this EVC is Endangered using Victoria's Native Vegetation Management Framework. Many stands of *Eucalyptus cadens* on private land possibly exist today as a result of the perennial wetness of their habitat, which has restricted clearing in areas unsuitable for agricultural use. However sites may have been lost through the building of impoundments or draining of spring soaks. The majority of stands grow in mostly cleared agricultural land and represent ecologically significant remnants of wetter habitats. These habitats may act as important wildlife refuges and also assist in soil and water conservation. Other threatened species that occur in this habitat are *Goodenia macbarronii,* (vulnerable national and state) and *Gonocarpus micranthus* subsp. *rammosissimus,* (poorly known, Vic).

The Recovery Plan will also provide an important public education role as threatened flora have the potential to act as 'flagship species' for highlighting broader nature conservation and biodiversity issues such as land clearing, grazing, weed invasions water quality, and general habitat degradation.

Social and economic impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts. Some rural landholders have expressed concern in regards to the costs of implementing habitat protection measures such as fencing. Landholders will be encouraged to protect their remnants. Incentive schemes will be offered wherever possible and community groups will be involved to reduce costs and broaden public knowledge. The retention of these wetland communities is also likely to benefit rural landholders by contributing to farm water quality and supply. Implementation of this Recovery Plan will support landholders to fence off these areas and install alternative drinking points that stock can access. Various government agencies including DSE and the CMA are working with rural landholders to address this issue. Determination of a waterway is a critical component of the ability or not to build a dam. Goulburn Murray Water need to consider the presence of threatened species and communities in its decision making in order to prevent further loss of individuals or stands of *Eucalyptus cadens*. Some remnant *Eucalyptus cadens* habitat found on roadsides is significantly degraded. Works to restore these vegetation communities will be undertaken in collaboration with Local Government Authorities.

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Habitat requirements**									
1.1	Survey known habitat	2	100%	DSE	$25,000	$0	$0	$0	$0	**$25,000**
2	**Legal protection of habitat**									
2.1	Protect public land habitat	2	75%	PV / DSE / Shires	$0	$10,000	$10,000	$0	$0	**$20,000**
2.2	Protect private land habitat	2	50%	DSE / DPI	$0	$5,000	$5,000	$5000	$5000	**$20,000**
3	**Manage threats**									
3.1	Control threats	1	75%	PV / DSE / Shires	$10,000	$15,000	$15,000	$10,000	$10,000	**$60,000**
4	**Growth rates, pop. viability**									
4.1	Conduct censusing	2	100%	DSE / DPI	$15,000	$15,000	$15,000	$15,000	$15,000	**$75,000**
4.2	Collate, analyse and report	2	100%	DSE / DPI	$0	$1,000	$1,000	$1,000	$10,000	**$13,000**
5	**Education & Communication**									
5.1	Community extension	3	100%	DSE	$1,000	$1,000	$1,000	$1,000	$1,000	**$5,000**
					$51,000	**$47,000**	**$47,000**	**$32,000**	**$41,000**	**$218,000**