# BARBAREA AUSTRALIS
# RECOVERY PLAN
# 1999-2002

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# SUMMARY


## Current Species Status

*Barbarea australis*, commonly known as Native Wintercress, is an endangered Tasmanian endemic. It is listed as Endangered in the Endangered Species Protection Act 1992, the 1997 ANZECC Threatened Plant List and the Tasmanian Threatened Species Protection Act 1995. It qualifies as Critically Endangered using 1994 IUCN criteria. Eight extant populations occur along rivers flowing south off the Central Highlands. Another population occurs on the Mersey River in the North of the State. *Barbarea australis* was also collected in the 1800's from the Hampshire Hills area near Burnie and along the St. Patricks and North Esk Rivers near Launceston, indicating a significant contraction in the range of the species. The number of individuals within populations is generally low (approximately 50) though numbers can fluctuate widely from year to year due to the short life span of the species.

## Habitat Requirements and Limiting Factors

*Barbarea australis* is found in grassy riparian vegetation and occurs on river gravels often between the exposed cobbles of riverbeds. The decline in populations has probably been caused by increased grazing pressure from domestic stock, rabbits and native animals due to agricultural activities, habitat loss through land clearance and modification of river flows due to invasion of willows and damming for generation of hydroelectricity and irrigation.

## Recovery Objectives

The overall objective is to achieve down-listing of *Barbarea australis* from Critically Endangered to Endangered over 5 years based on modified 1994 IUCN criteria by:

1. Extending the known distribution through survey and translocation.
2. Boosting numbers in populations through translocation and habitat management.
3. Developing mechanisms to manage populations in the long term.

## Recovery Criteria

1. Down-listing from Critically Endangered to Endangered using modified 1994 IUCN criteria (using distribution thresholds proposed by Keith, in press). This will require increasing area of occupancy to greater than 1 hectare.
2. Increasing the number of mature individuals to greater than 2,500 in total or increasing the number of mature individuals in a single population to greater than 250 for at least 2 successive years.
3. Securing protection against changes in land use or disturbance patterns where such changes have been identified as potential problems.
4. Increase in the number of mature individuals in populations five-fold following habitat modification.
5. Establishment of at least 2 *ex situ* populations through translocation of seed produced in seed orchards.
6. Maintenance of viability of stored seed.
7. The involvement of volunteers to monitor populations.
8. The creation of a process beyond the duration of the Recovery Plan to ensure that management strategies are implemented when monitoring indicates that intervention is required.

## Actions Needed

1. Population verification and further survey.
2. Monitoring for improved understanding of population fluctuations and quantification of effects of grazing, habitat management and seed translocation.
3. Protection of populations and encouragement of management by landowners and land managers.
4. Habitat manipulation aimed at boosting seed production in wild populations.
5. Establishment of seed orchards, translocation of seed to the wild and seed storage.
6. Co-ordination with Landcare groups with respect to river care issues.
7. Establish a mechanism to ensure management intervention when required.

## Estimated Cost of Recovery (1998 prices in $/year)

| Actions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|---|
| Year 1 | 7 724 | 8 247 | 5 475 | 10 210 | 9 134 | 8 048 | 8 148 | 56 986 |
| Year 2 | 3 862 | 8 247 | 5 475 | 8 901 | 9 134 | 8 048 | 7 232 | 50 900 |
| Year 3 | 3 862 | 8 247 | 5 475 | 8 901 | 9 134 | 8 048 | 5 839 | 49 507 |
| Year 4 | 3 862 | 8 247 | 5 475 | 4 451 | 9 134 | 8 048 | 5 839 | 45 056 |
| **Total** | 19 310 | 32 989 | 21 900 | 32 463 | 36 537 | 32 193 | 27 057 | 202 449 |

## Biodiversity Benefits

The maintenance of species diversity in an endangered ecosystem. The conservation of grassy ecosystems is a high conservation priority in Tasmania as their range has been seriously depleted since European settlement.

# INTRODUCTION

## Description

*Barbarea australis* is an erect annual or short-lived perennial herb up 50-100 cm tall. The species description is from Hewson (1982) and Curtis & Morris (1975). The lower cauline leaves are lyrate-pinnatisect with 2-3 pairs of lobes. The pinnate rosette leaves are stalked, 8-10 cm long with 2-3 pairs of small ovate lateral lobes and large terminal lobes sometimes sinuate-toothed. The upper cauline leaves are simple with sinuate margins which are auricled and stem-clasping. The upper cauline leaves distinguish it from the two introduced species in Tasmania which have pinnatifid upper cauline leaves. The yellow sepals are 2-8 mm in length and the sepals 2-4 mm. The linear siliqua is 20-40 mm long, 2-2.5 mm wide, and there are approximately 12 per 10 cm of rhachis. The siliqua is beakless and dehiscent. The pedicels are erect to spreading and less than half as wide as the siliqua (the pedicels of the non-native species are more than half as wide as the siliqua). The seeds are broadly elliptic, 1.5-2 cm long, and are irregularly marginate or narrowly winged (the seeds of the exotic species are rounded and not marginate).

## Taxonomic Status

*Barbarea* is a genus in the Brassicaceae, a family with its greatest concentration of species in the temperate regions of the northern hemisphere (Morley & Toelken 1983). In Australia, the Brassicaceae are represented by 160 species in 53 genera (Hewson 1982). There are 20 species of *Barbarea* in the temperate regions of the northern hemisphere, with two of these naturalized in Australia. There are two species endemic to Australia, *Barbarea australis* and *Barbarea grayi* Hewson. *B. grayi* is an alpine species in Victoria and New South Wales, and in Victoria it is vulnerable (Gullan et al. 1990).

In Tasmania there are 61 species of Brassicaceae, but only 17 of these are native (Buchanan 1995). It is a family with a high concentration of rare and threatened plant species in Tasmania (Kirkpatrick et al. 1991), with over half of the native species being listed as rare or threatened (Kirkpatrick et al. 1991). Three species of *Barbarea* occur in Tasmania, two are introduced.

## Distribution

*Barbarea australis* was originally collected in the 1830's and 1840's from the Hampshire Hills, (south of Burnie), the St. Patricks and North Esk Rivers (east of Launceston) and the Pine River (Central Plateau). It was thought to be extinct until it was rediscovered at Waddamana in 1982.

Extant populations are restricted to riverine vegetation on the Ouse River (4 populations; above the Shannon River, below the Shannon River, near Waddamana and north of Kluan Bridge), the Shannon River (1 population; near the Ouse River), the Clyde River (1 population; near Bothwell) and the Nive River (1 population; west of Bradys Lake). These rivers are all in the upper catchments of the Derwent River draining south from the Central Plateau. A small population also occurs on Micks Creek (1 population; near the Lake River) on the eastern Central Highlands in the Lake River catchment. A northern population was recently discovered on the Mersey River (below the Parangana dam), north of the Central Highlands. The current distribution demonstrates a significant contraction in the range of the species with the disappearance from the two river catchments that are not associated with the Central Highlands.

The botanist J. D. Hooker recorded the species as occurring in moist and marshy districts in the centre of the island and near Launceston (Hooker 1859). Curtis & Morris (1975) report it as also occurring in Victoria and New South Wales, and presumably this refers to the more recently described *B. grayi* (Hewson 1982).

## Habitat

*Barbarea australis* is a riparian plant species found near river margins, creek beds and along flood channels adjacent to the river. It has not been found on steeper sections of the river, but tends to favour slower reaches. It occurs in river alluvium deposited on large cobbles or on rocky ledges. Some of the sites were a considerable distance from the river in flood channels on sites where channels had been scoured by previous flood action, exposing river pebbles. In these sites occasional plants were found growing in *Poa* tussocks. The sites where it occurs range in altitude from 260-700m where it overlies Jurassic dolerite and Tertiary basalt. A number of the localities are associated with watercourses along contact zones between Permian mudstone and either dolerite or basalt. It is found at the margins of riverine scrub with *Leptospermum lanigerum*, *Dodonea viscosa* and *Pomaderris racemosa* in communities dominated by *Eucalyptus delegatensis*, *E. dalrympleana*, *E. pauciflora* and *E. ovata*. Adjacent sites often consist of tussock grassland or grassy woodland dominated by *Poa labillardieri* or *Themeda triandra*.

*B. australis* is found on shallow alluvial silt on rock slabs or between large river cobbles on sites frequently disturbed by fluvial processes. At most sites it grows in open situations with little competition from other plant species, although at some localities it grows amongst large *Poa* tussocks in relatively dense vegetation. One site observed was on bare soil at the base of a cliff approximately 40 m from the river and 3-4 m above a secondary stream. There was little apparent influence of water at the site but active soil movement kept the site bare and moisture seeping from the base of the cliff kept it moist.

## Life History

The seeds of *Barbarea australis* germinate in winter/early spring and a small basal rosette is produced. In late spring/early summer a flower stalk develops, growing 15-20 cm in height, occasionally reaching 50 cm. Peak flowering occurs from November through to February. Seed is produced in reasonable quantities with up to 100 siliqua per plant. Seed is readily germinated, but glasshouse studies found that seedlings grown in a relatively infertile soil mix failed to grow, flower or set seed, whilst seedlings regularly fertilized with a liquid fertilizer and grown in a loam mix grew quickly and achieved reproductive maturity. In the wild, bare ground is required for recruitment and the plants are short-lived, acting as annuals or biennials.

## Reasons for Listing

*Barbarea australis* qualifies as Critically Endangered using 1994 IUCN criteria. It qualifies under rule B (subrules B2 and B3) as it has an area of occupancy of less than 10 square kilometres and is subject to continuing declines and extreme fluctuations. Qualification for Critically Endangered also occurs using Keith's (in press) modified distribution thresholds as area of occupancy has been estimated to be less than 1 hectare.

*B. australis* is a short-lived prolific seed producer though is a poor competitor and is highly palatable. It appears that *B. australis* has always been a rare species with a restricted distribution in Tasmania. It has not been relocated at any of the localities where it was recorded last century. Many of the Brassicaceae family (including *B. australis*) are highly palatable to domestic stock, rabbits and native animals. *B. australis* is heavily browsed at some sites, preventing seed set (Kirkpatrick and Gilfedder 1998). Most of the sites are stocked with sheep, are infested with rabbits and have high numbers of native grazing animals. Insect herbivory also occurs, particularly from the introduced garden snail (*Helix aspersa*).

The rivers on which the species occur have altered flow regimes due to the effects of willow invasion, damming of headwaters for hydro-electric power schemes or being used for irrigation. The population numbers are low at most sites, and it may be that this species no longer gets the high water levels and floods that create the openness required for recruitment from seed. *B. australis* is also directly threatened by the invasion of willows and gorse as both can eliminate the bare ground on the banks and islands of rivers that is associated with recruitment.

The majority of populations occur on private land, and none are known from any secure state reserve. The Mersey River population occurs in State Forest and may occur in an adjacent formal reserve. Part of one of the Ouse River populations occurs on land owned by the Hydro Electric Commission and another occurs in a river reserve.

## Existing Conservation Measures

A Barbarea Australis Recovery Plan was prepared (Gilfedder 1994) and implemented though several actions were changed as understanding of the species and its habitat improved. This document has been prepared to update the Plan and outline continuing recovery measures.

Neyland (1991) recommended that the Micks Creek site on the eastern Central Plateau, which is on private land managed for production forestry, have a streamside reserve of 30 metres either side of the creek. This would be managed to protect the species is this area.

## Strategy for Recovery

The Barbarea Australis Recovery Plan will run for four years and is based on the following **strategies**.

1. Population verification and further survey.
2. Monitoring for improved understanding of population fluctuations and quantification of effects of grazing, habitat management and seed translocation.
3. Protection of populations and encouragement of management by landowners and land managers.
4. Habitat manipulation aimed at boosting seed production in wild populations.
5. Establishment of seed orchards, translocation of seed to the wild and seed storage.
6. Co-ordination with Landcare groups with respect to river care issues.
7. Establish a mechanism beyond the duration of the Recovery Plan to ensure that appropriate management strategies are implemented when monitoring indicates that intervention is required.

A Barbarea Australis Recovery Team has been established and currently consists of representatives from the Threatened Species and Communities Section of Environment Australia, the Tasmanian Parks and Wildlife Service, Forestry Tasmania, the Threatened Species Network, Primary Industries and Landcare. A commercial Brassica seed producer will also be invited to join the team. The Recovery Team will supervise the activities of a project officer that will be employed on a part time basis for 13 to 16 weeks per year for four years.

# RECOVERY OBJECTIVES AND CRITERIA

The overall **objective** of the Recovery Plan is to achieve down-listing of *Barbarea australis* from Critically Endangered to Endangered over 5 years based on modified 1994 IUCN criteria by:

1. Extending the known distribution through survey and translocation.
2. Boosting numbers in populations through translocation and habitat management.
3. Developing mechanisms to manage populations in the long term.

The **criteria** for achieving this objective are:

1. Down-listing from Critically Endangered to Endangered using modified 1994 IUCN criteria (using distribution thresholds proposed by Keith, in press). This will require increasing area of occupancy to greater than 1 hectare. The unmodified IUCN threshold of an area of occupancy of 10 square kilometres is considered to be unrealistic for this species. Down-listing to Vulnerable using modified 1994 IUCN criteria would require an area of occupancy greater than 10 hectares as well as improvements in numbers of mature individuals. This is the ultimate target though may not be achievable due to lack of suitable habitat.
2. Increasing the number of mature individuals to greater than 2,500 in total or increasing the number of mature individuals in a single population to greater than 250 for at least 2 successive years. This will allow down-listing to Vulnerable if the area of occupancy could be increased to greater than 10 hectares (using modified 1994 IUCN criteria).
3. Securing protection against changes in land use or disturbance patterns where such changes have been identified as potential problems.
4. Increase in the number of mature individuals in populations five-fold following habitat modification.
5. Establishment of at least 2 *ex situ* populations through translocation of seed produced in seed orchards.
6. Maintenance of viability in stored seed.
7. The involvement of volunteers to monitor populations.
8. The creation of a process beyond the duration of the Recovery Plan to ensure that management strategies are implemented when monitoring indicates that intervention is required.

# RECOVERY ACTIONS

## 1. Population Verification and Further Survey

Several new populations have been discovered since 1994, including one in the north of the State at some distance from the other populations. This highlights the real possibility of finding new populations in unrelated catchments and the possibility of meeting IUCN or modified IUCN distribution and population thresholds that would enable downlisting from Critically Endangered to Endangered or Vulnerable. The close similarity of *B. australis* with introduced *Barbarea* weeds may have caused the species to be overlooked by collecters in the past, highlighting the need for dedicated searches. The new populations discovered recently will also require taxonomic verification.

Funds are required to cover the salaries of a research and technical officer, vehicle costs, travel allowances and maps. Volunteer costs are included.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 7 724 | 3 862 | 3 862 | 3 862 | 19 310 |

## 2. Monitoring For Improved Understanding of Population Fluctuations and Quantification of Effects of Grazing, Habitat Management and Seed Translocation

Most of the *B. australis* populations are small (generally up to 50-100 individuals) and few individuals set seed due to grazing. On occasion, hundreds of seedlings have been noted in small areas suggesting large fluctuations in the number of individuals over time. The plants are short lived, surviving one or two years, raising the possibility that populations are also relatively short lived. However, little is known about the persistence of patches or populations, fluctuation in numbers within populations and conditions associated with recruitment events. Monitoring of populations is therefore deemed necessary to better understand the dynamics of populations and to enable more accurate assessment of numbers of populations and mature individuals.

The effects of grazing also require monitoring over time in order to determine possible links to habitat type or location. This will be required for the choice of areas for translocation actions. Likewise, the effects of habitat modification actions will need to be determined to gauge the success of actions.

Funds are required to cover the salaries of a research and technical officer, vehicle costs, travel allowances and stakes and tags. Volunteer costs are included.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 8 247 | 8 247 | 8 247 | 8 247 | 32 989 |

## 3. Protection of Populations and Encouragement of Management by Landowners and Land Managers

Options for the long term formal protection and management of critical populations will be pursued with private landowners. Options that are established with current landowners and that are binding to subsequent landowners include proclamation as a private wildlife sanctuary, writing of a management plan and establishment of a conservation covenant. The other option is the donation of land to the Parks and Wildlife Service for conservation purposes. Otherwise, advice and assistance will be provided to landowners for management of the populations. Participation in the CAR private reserve system will be encouraged.

Options for the conservation of critical populations in State Forest or in Forest Reserves will be pursued with Forestry Tasmania using the Management Decision Classification System described by Gerrand (1996). Management guidelines will be prepared for populations on reserved or uncommitted crown land and in areas administered by local governments. Recommendations for reservation will be made where appropriate.

Funds are required for the salary of a research officer for negotiation with landowners and preparation of management guidelines.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 5 475 | 5 475 | 5 475 | 5 475 | 21 900 |

## 4. Habitat Manipulation Aimed at Boosting Seed Production

This action involves the protection of seedlings from grazing to allow the successful production of seed in small populations threatened by grazing. Fencing to exclude domestic stock from accessing the river edges will be encouraged where practical. Fencing of populations on the actual river edges has proved unsuccessful because of damage by floods. Generally, the only plants to set fruit successfully are those afforded some protection

from grazing by fallen branches. Brush coverings will be used in order to boost seed production and afford some protection to germinants. This is preferable to the use of wire exclosures that would cause problems if washed away by floods. Bushland buffers will be promoted where practicable in order to reduce grazing pressure on populations.

Funds are required to cover the salaries of a research and technical officer, vehicle costs, travel allowances and materials. Volunteer costs are included.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 10 210 | 8 901 | 8 901 | 4 451 | 32 463 |

## 5. Establishment of Seed Orchards, Translocation of Seed to Wild and Seed Storage

Planting of *B. australis* for the establishment of *ex situ* populations has proved difficult due to recurrent flooding (Kirkpatrick and Gilfedder 1998). Reintroduction of seed at appropriate sites is more feasible and cost effective and is less damaging to potential habitat. Also, *B. australis* is a prolific seeder when grown in suitable conditions. Seed orchards will therefore be established to provide a source of seed. While a previous attempt failed to due to infection of plants with root aphids, the process appeared to be successful. Plants grown in a nursery were planted on farms adjacent to commercial *Brassica* hybrid seed crops and received the same conditions (ground preparation, fencing, irrigation and application of nutrients, herbicides and insecticides) as the commercial crops. Plants were growing well though were destroyed on discovery that the plants had been infected with root aphids at the nursery. This demonstrated the need to display the utmost care not to introduce pest or disease problems to the wild through the translocation process. Newly established seed orchards may not be grown adjacent to *Brassica* hybrid seed crops in the future due to the possible introduction to the wild of black spot (a seed borne disease of the Brassicaeae). However, cultural advice will be obtained from experts involved in the production of commercial *Brassica* seed.

Sites for reintroduction will be selected and seed will be collected from the wild using guidelines for the translocation of threatened plants in Australia (Australian Network for Plant Conservation Translocation Working Group 1997). Additionally, only those sites with low grazing pressure and that are not likely to become invaded by willows or gorse will be considered for translocation. Seed from various populations will also be stored at CSIRO in Canberra after appropriate testing of viability. Viability of seed after storage will be tested and storage conditions changed if necessary to maintain viability. Cryostorage of seed will be investigated. Guidelines for germplasm conservation in Australia will be followed (Australian Network for Plant Conservation Germplasm Working Group 1997).

Funds are required to cover the salaries of a research and technical officer, vehicle costs, travel allowances and materials required for propagation. Volunteer costs are included.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 9 134 | 9 134 | 9 134 | 9 134 | 36 537 |

## 6. Co-Ordination with Landcare Groups with Respect to River Care Issues

Invasion by willows and gorse pose a direct threat to *B. australis* as they occupy areas of bare ground required for recruitment from seed. Willows also pose a significant indirect effect due to alterations of river channels and flows. Willow invasion results in the accumulation of woody debris influencing stream and channel morphology, with increased siltation and sediment instability, and altered river flow. This in turn leads to reduced streambed scour, altered silt deposition rates, stream bank erosion, channel straightening and altered flooding regimes. Not only does this affect the availability of bare ground for recruitment, it also modifies seed dispersal patterns downstream. Current methods of willow removal are not desirable due to bank disturbance, erosion and channel modification so that habitat restoration is difficult. Prevention of willow invasion is more achievable. This problem is being tackled to a large degree by Landcare groups. Co-ordination with such groups will provide a focus for river care activities and raise public awareness of the recovery of *B. australis.* If specific problems are noted with particular catchments they can form the basis for funding applications through Rivercare or Bushcare from the National Hertitage Trust.

Funds are required to cover the salaries of a research and technical officer, vehicle costs, travel allowances and materials. Volunteer costs are included.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| Cost | 8 048 | 8 048 | 8 048 | 8 048 | 32 193 |

## 7. Establish Mechanism to Ensure Management Intervention When Required

A threatened species database has been prepared by the Threatened Species Unit at the Parks and Wildlife Service. This database is being further developed to hold population data, information from monitoring events and to update information required for the assessment of conservation status. The database will also include a monitoring schedule for future years. It is also hoped to include features to alert users of deleterious changes to populations that signify that intervention is required. Thresholds for such changes will need to be quantified and guidelines need to be prepared for staff or volunteers to monitor populations and for appropriate management action when thresholds are breached.

Funds are required for the salary of a research officer to develop the population database, prepare management guidelines for monitoring and management and to hand over responsibility for the process to the Tasmanian Threatened Species Unit.

| Year | Yr 1 | Yr 2 | Yr 3 | Yr 4 | Total |
|---|---|---|---|---|---|
| **Cost** | 8 148 | 7 232 | 5 839 | 5 839 | 27 057 |

# IMPLEMENTATION SCHEDULE

1998 costs in $/year.

| Task | Task Description | Priority | Feasibility | Year 1 | Year 2 | Year 3 | Year 4 | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Population survey | 1 | 100% | 7 724 | 3 862 | 3 862 | 3 862 | 19 310 |
| 2 | Monitoring | 1 | 100% | 8 247 | 8 247 | 8 247 | 8 247 | 32 989 |
| 3 | Tenure issues | 2 | 70% | 5 475 | 5 475 | 5 475 | 5 475 | 21 900 |
| 4 | Habitat manipulation | 2 | 80% | 10 210 | 8 901 | 8 901 | 4 451 | 32 463 |
| 5 | Seed translocation | 1 | 90% | 9 134 | 9 134 | 9 134 | 9 134 | 36 537 |
| 6 | River care | 2 | 70% | 8 048 | 8 048 | 8 048 | 8 048 | 32 193 |
| 7 | Decision support | 1 | 80% | 8 148 | 7 232 | 5 839 | 5 839 | 27 057 |
| Total | | | | 56 986 | 50 900 | 49 507 | 45 056 | 202 449 |

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