Department of Sustainability and Environment

Action Statement

Flora and Fauna Guarantee Act 1988 No. 111 (Revised in 2009)

Spiny Peppercress

Lepidium aschersonii

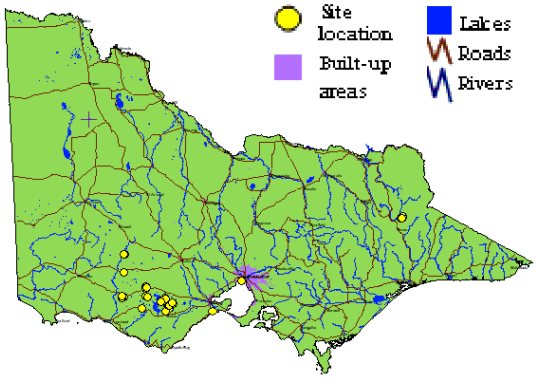
This revised Action Statement is based on the Recovery Plan prepared for this species by DSE under contract to the Commonwealth Department of the Environment, Water, Heritage and the Arts.

Description

Spiny Peppercress (*Lepidium aschersonii* Thell., Brassicaceae) is a herb with intricately branched stems that arise annually from a perennial, but relatively short-lived, underground rootstock. The stems are erect, covered with spreading or deflexed hairs, and grow to approximately 30 cm in height. The small branches become spinescent with age, and all branches become woodier and spinier in dry conditions (Harris & Smith 2000). The basal leaves are pinnately lobed and fairly fleshy, to 12 cm long; these leaves are usually not persistent. The stem leaves are lanceolate to narrowly tapering, hairy, and may have toothed or entire margins. They become smaller with increasing height up the stems. The inflorescence is a barely visible, greenish-coloured raceme which terminates in a spine. Individual flowers have four sepals approximately 0.8 mm long, reduced linear petals, two stamens and subsessile stigmata. The fruit is ovate- to obovate-shaped, hairless, two-chambered pod, 3.5 – 4.5 mm long and 2.5 – 3 mm wide, with narrow wings that form a small apical notch. The fruit is borne on a pedicel 2 – 4 mm long, which is hairy above (i.e. towards the fruit) but hairless below (Entwisle 1996). Flowering occurs from spring to autumn.

Further taxonomic descriptions of Spiny Peppercress are presented in Hewson (1981; 1982), Retter & Harden (1990) and Entwisle (1996). Other *Lepidium* species that occur within the geographic range of Spiny Peppercress include Leafy Peppercress (*L. foliosum*), Basalt Peppercress (*L. hyssopifolium*), Shade Peppercress (*L. pseudotasmanicum*), and the introduced species Matted Peppercress (*L. strictum*) and Common Peppercress (*L. africanum*). Spiny Peppercress can generally be distinguished from these species

Spiny Peppercress *Lepidium aschersonii*
(O. Carter)



Distribution in Victoria
(Flora Information System DSE 2007)

by the terminal spike on its inflorescences. Grazing, however, may lead to spine-like remnants occurring on other species such as Basalt Peppercress. Basalt Peppercress may be distinguished from Spiny Peppercress by its pedicels which are hairy above and below (the pedicels of Spiny Peppercress are hairy above but hairless below). Spiny Peppercress is also closely related to members of the genus *Papuzilla* in New Guinea (Hewson 1981).

Distribution

Spiny Peppercress currently occurs in New South Wales, Victoria and Western Australia.

The species was formerly widespread in Victoria. Approximately 18 sites are currently known from two widely separated geographic locations (Harris & Smith 2000). Most of these (approximately 16 sites) occur about 100 - 200 km west of Melbourne, approximately bordered by Mortlake in the west, Cressy in the east, Colac in the south and Ararat in the north (and potentially to the Grampians). The other sites occur at Lake Omeo, near Benambra, in north-east Victoria. There are also nineteenth and early twentieth century records of Spiny Peppercress from Skipton, the Grampians, Williamstown, Port Fairy and Lake Bolac, but these populations have not been recently re-located. Further searches may be warranted in some of these areas as well on private properties across the known range of the species in western Victoria.

In New South Wales, prior to widespread clearance of Brigalow (*Acacia harpophylla*), Spiny Peppercress is likely to have occurred across the riverine plains on heavy poorly-drained soils. It is now known from at least 14 sites in NSW, including nature reserves, roadsides and private land. A population at Brigalow Park may be the largest known population of the species, with tens of thousands of individuals (M. White pers. comm.).

Spiny Peppercress was rediscovered in Western Australia in 1976: it had not previously been collected in WA since 1903 (Harris & Smith 2000). The population is still believed to be surviving (CALM 2003), but subsequent surveys have failed to re-locate the species (K. Atkins pers. comm.).

Spiny Peppercress has never been collected in South Australia. Historical records from the Murray lands, South Australia, are in error and more accurately refer to Basalt Peppercress (*L. hyssopifolium*) (Harris & Smith 2000).

Abundance

There are 14 stands of Spiny Peppercress in eight localities in Victoria according to Harris & Smith (2000). A further seven sites not recorded by Harris & Smith (2000), bring the Victorian total to approximately 21 sites. It is not known, however, how many of these sites form discrete populations

There are estimated to be between 25 000 and 100 000 plants. Victorian estimates are based on VROTPop surveys, field assessments by the author and personal communications with various Victorian Government field staff.

Important populations

Important sites necessary to the long term survival and recovery of Spiny Peppercress have been determined using a scoring method devised by the Arthur Rylah Institute for Environmental Research. The method ranks sites according to their relative chance of long-term ecological viability based on population size, evidence of regeneration, land tenure, patch and landscape condition, and geographic location. It is important to note, however, that all populations of a vulnerable species are 'important' in real terms, and the ranking process does not imply that the lowest scoring populations are entirely 'unimportant'.

To maintain the genetic diversity of Spiny Peppercress, representative sites from across the species' range need to be protected. Larger sites on protected public land should be managed to ensure the long-term survival of these populations and provide the opportunity for these stands to increase. Private land sites should also be offered similar protection where practicable.

The most important sites occur in the following locations:

Reserves

Lake Corangamite Lake Reserve – site 2 (for site 1 see 'other populations' below)

- 2002: approximately 30 - 40 plants across 25 m^2 were recorded by J. Clarke.
- 2003: 10 - 20 plants were recorded in the same area by O. Carter and J. Clarke. Approximately 90 % of the plants observed were resprouting from basal rootstock.

Lake Omeo (reserved for public purposes) – at eastern end of lake bed

- 1940: earliest collection of Spiny Peppercress at this site.
- 1955 – 1964: the lake filled and dried.
- 1975: 'many' plants were found (Scarlett & Parsons 1982). The lake filled this year.
- 1982: one plant (Scarlett & Parsons 1982). Free water had disappeared by this time.
- 1984: 43 plants across approximately 30 ha (but 100 - 500 plants were estimated).
- 1998: no plants found.

- 1999 (March): 79 plants recorded across 100 m^2.
- 1999 (June): DSE staff recorded five plants at the south-western end of the lake (Bramwell 1999).
- 2000 (April): no plants found.
- 2001 (February): no plants found.
- 2003 (December): two plants recorded across 100 m^2.
- 2004 (January): no additional plants found despite extensive searches by ten volunteers for two hours (E. Roe pers. comm.).
- 2005 (January): 100 - 500 plants recorded by Steve Mathews and Geoff Carr in the centre of the lake.

The population fluctuates greatly in size due to the periodic filling of the lake (Harris & Smith 2000). Plants may re-appear from stored seed when the lakebed dries out (Scarlett 1984).

Lake Beeac Wildlife Reserve (eastern lunette)

- 1981: 97 plants (Scarlett & Parsons 1982).
- 1993: 100 plants across 30 m^2.
- 1999: approximately 40 plants.

P. du Guesclin also found a couple of plants on the western edge of Lake Beeac in the early 1990s, but no plants have subsequently been seen at this location.

Rossbridge Wildlife Reserve, 1 km east of Rossbridge

- 1997: no plants found.
- 1999: 161 plants – about one third of the observed plants occurred within the reserve, the rest were in adjacent private land.
- 2003: six plants observed by O. Carter, A. Arnold and P. Foster.

Mixed Tenure

Beeac Swamp

- 1996: 534 plants (approximately 70 on freehold land and 464 within the Beeac Swamp Lake Reserve).
- 2003: no plants recorded during a short search at the southern end of the site by O. Carter and J. Clarke. Most plants, however, had previously been found on the northern and western sides of the wetland and on adjoining freehold land.

Private Land

Cundare North

- 1983: 250 - 375 plants across < 10 ha.

Balintore, 7 km NNW of Colac

- 1986: 250 - 375 plants across five hectares.

Larra Road, 1 km SE of Derrinallum

- 1983: 1000 plants across < 20 ha.

Wolbunya, 19 km N of Camperdown

- 1986: 250 - 375 plants across 5000 m^2.

Breeite-Beeac Rd, NW of Lake Beeac

- 1986: 750 plants across 12 ha.

West of Lake Beeac

- 1983: > 1000 plants across eight hectares.

Mortlake

- 1983: 70 plants across 2500 m^2.

Cororooke

- 1998: anecdotal evidence of approximately 400 plants (specimen has been positively identified).

Coads Lane, Colac

- 1998: anecdotal evidence of a few thousand plants spread over approximately two hectares.

Other populations

The following sites require further surveys to determine the extant population size and site condition. At the time of last survey, each site contained a relatively small population. Given the presumably large natural fluctuations in abundance from year to year, however, these sites may be identified as important in the future if climatic conditions and management are appropriate.

Reserves

Derrinallum Station Yard Rail Reserve

- 1986: one plant.
- 1990: four plants across 10 m^2.
- 1993 (June): no plants found.

Lake Corangamite Lake Reserve – site 1

- 1984: 107 plants across 600 m^2.
- 1991: four plants across 1000 m^2.
- 1998: approximately six plants.
- 2003: O. Carter and J. Clarke searched but recorded no plants. Given the likely small number of plants which would have been dispersed over a large area (according to the 1991 record), it is expected that some plants are persisting.

Roadsides

Breamlea

- 1996: eight plants.

- 1999: approximately 20 plants.

Private Land

Ondit, 8 km NNE of Colac

- 1988: < 1000 plants across over two hectares.
- 1993: one plant – the site was heavily grazed by cattle between 1988 and 1993, causing severe pugging.

North of Lake Colac

- 1988: six plants across 2500 m^2.

It is unclear whether this site is the same as the Meredith Park site on 'the north shore of Lake Colac' where approximately 12 plants were recorded in 1988.

East of Lake Colac

- Unknown number of plants were observed in a paddock, but plants could not be re-located a couple of years later.

Lough Calvert

- 1986: 27 plants across 170 - 250 m^2.

South of Derrinallum

- 2004: newly recorded site – anecdotal evidence suggests there are only a few plants. An accurate location has yet to be recorded.

Unknown Tenure

Omeo area

- 1999 (June): five plants recorded by M. Bramwell (accurate location unknown).

Habitat

Spiny Peppercress has very specific habitat requirements. Scarlett & Parsons (1992) were unable to successfully establish self-perpetuating populations in the field. They concluded that "…successful seed regeneration and seedling persistence may be dependent on a relatively rarely achieved 'balance' between climatic conditions and soil moisture levels. The frequency and duration of flooding, the climatic conditions following these events and possibly subtle variations in soil drainage and aeration are likely to be involved."

The species mainly occurs in or around swamps and salt marshes on heavy black or clay soils (Harris & Smith 2000). The mean annual rainfall at known sites is 500 - 800 mm.

Critical habitat for the species includes sites which receive some degree of soil water-logging or seasonal flooding. Individuals at Lake Omeo may tolerate periodic submergence at intervals of five to ten years (Bramwell 1999). Spiny Peppercress growing on the littoral fringes of salt pans in the Beeac area also survive seasonal water logging and submergence (Harris & Smith 2000). Similarly, northern New South Wales sites are likely to be periodically inundated and remain wet for a few months each year. Spiny Peppercress appears to tolerate a range of salinity conditions, from hypersaline at Lake Corangamite & Lake Beeac to fresh at Beeac Swamp.

Commonly associated include Annual Celery (*Apium annuum*), Native Orache (*Atriplex australasica*), Hollow Sedge (*Carex tereticaulis*), Spike Centaury (*Centaurium spicatum*), Glaucous Goosefoot (*Chenopodium glaucum*), Windmill Grass (*Chloris truncata*), Kidney Weed (*Dichondra repens*), Australian Salt-grass (*Distichlis distichophylla*), Common Spike-sedge (*Eleocharis acuta*), Variable Willow-herb (*Epilobium billardierianum*), Northern Cranesbill (*Geranium homeanum*), Blown Grass species (*Lachnagrostis aemula* s.l., *L. billardierei* s.l., *L. filiformis*), Creeping Cotula (*Leptinella reptans* s.l.), Button Immortelle (*Leptorhynchos waitzia*), Poison Lobelia (*Lobelia pratiodes*), Small Loosetrife (*Lythrum hyssopifolia*), Common Tussock-grass (*Poa labillardierei*), Australian Saltmarsh-grass (*Puccinellia stricta*), Shining Buttercup (*Ranunculus glabrifolius*), Small River Buttercup (*Ranunculus amphitrichus*), Wiry Dock (*Rumex dumosus*), Creeping Brookweed (S*amolus repens*), Beaded Glasswort (*Sarcocornia quinqueflora*), Shiny Bog-sedge (*Schoenus nitens*), Shiny Swamp-mat (*Selliera radicans*), Annual Fireweed (*Senecio glomeratus*), Native Sow-thistle (*Sonchus hydrophilus*), Coast Sand-spurrey (*Spergularia media* s.l.), Austral Seablite (*Suaeda australis*) and Round-leaf Wilsonia (*Wilsonia rotundifolia*).

All sites contain introduced plants. Common exotic species include Great Brome (*Bromus diandrus*), Soft Brome (*B. hordeaceus* subsp. *hordeaceus*), Common Centaury (*Centaurium erthraea*), Spear Thistle (*Cirsium vulgare*), Wall Barley-grass (*Critesion murinum* subsp. *leporinum*), Mediterranean Barley-grass (*C. hystrix*), Cat's Ear (*Hypochoeris radicata*), Willow-leaf Lettuce (*Lactuca saligna*), Stiff Rye-grass (*Lolium loliaceum*), Perennial Rye-grass (*L. perenne*), Sweet Melilot (*Melilotus indicus*), Buck's-horn Plantain (*Plantago coronopus*), Curled Dock (*Rumex crispus*), Scorzonera (*Scorzonera laciniata*), Rough Sow-thistle (*Sonchus asper* s.l.), Red Sand-spurrey (*Spergularia rubra* s.l.), Strawberry Clover (*Trifolium fragiferum* var. *fragiferum*) and *Vicia* spp..

Life history and ecology

In Victoria, population numbers of Spiny Peppercress fluctuate greatly from year to year, with increased numbers often appearing during drought periods (Harris & Smith 2000). This may relate to the increased area of bare soil available

for Spiny Peppercress seed regeneration during drought conditions (Harris & Smith 2000). Increased population numbers were recorded at a number of sites during the 1982/83 drought.

Abundant seed production has been consistently noted at all stands (Harris & Smith 2000). At Lake Omeo, seed germinates from the lake bed when the lake dries out (Scarlett 1984). The species appears to be adapted to the lake's natural filling/drying cycle, which is particularly pronounced at the site at the eastern end of the lake.

Spiny Peppercress has been shown to be difficult to establish during trials at Lake Goldsmith Wildlife Reserve (Scarlett & Parsons 1992). Of the 1009 seedlings planted between 1983 and 1990, only a few remained by 1991. Most seedlings did not survive their first summer. However, some good seed germination was achieved *in situ*. It was speculated that low establishment rates were due to the relatively hard soils of the trial sites, compared to usual Spiny Peppercress habitat (Harris & Smith 2000). Plantings by Greening Australia at Lake Beeac have been more successful, with survival to maturity and abundant recruitment of second generation plants. Seed was originally collected from the same site and successfully raised by Andrew Pritchard (DSE).

Spiny Peppercress may tolerate specific levels of grazing pressure and resultant environmental conditions (e.g. light availability or soil moisture levels). For example, in 1982 the population on the eastern side of Lake Beeac was severely damaged by sheep grazing. The Fisheries and Wildlife Division (now DSE) then fenced off 200 m of the lake frontage to protect the species from stock grazing and prevent trail bike access. By 1987, however, the fenced lake frontage was infested with introduced plants and no Spiny Peppercress plants were observed. Approximately 100 plants were found on the lake frontage outside the fenced area, and these were still surviving in 1993. Occasional light grazing by domestic stock apparently kept the field layer vegetation suitably open to allow seedling regeneration.

Conservation status

Spiny Peppercress is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Spiny Peppercress is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*.

It is also listed as vulnerable under the New South Wales *Threatened Species Conservation Act 1995*, and as rare under the West Australian *Wildlife Conservation Act 1950*.

Spiny Peppercress is considered endangered in Victoria according to the Department of Sustainability and Environment's *Advisory List of Rare or Threatened Vascular Plants in Victoria – 2005* (DSE 2005).

Potentially threatening processes

Spiny Peppercress has suffered an extensive decline in distribution and abundance since European settlement. Remaining populations are patchily distributed and isolated, often occurring in degraded remnant habitat. Drainage, cultivation and livestock grazing have destroyed much of the habitat suitable for this species in Victoria.

The processes listed below are considered to currently have the potential to threaten populations or habitat. They may or may not be listed as potentially threatening processes under the *Flora and Fauna Guarantee Act 1988*.

Weed invasion

Competition with introduced plant species is a problem at all known sites. At Lake Beeac, for example, introduced Phalaris (*Phalaris aquatica*), Fog Grass (*Holcus lanatus*) and Perennial Rye Grass (*Lolium perenne*) have invaded the saltmarsh community, suppressing Spiny Peppercress plants and inhibiting seedling regeneration (Harris & Smith 2000). Boxthorn (*Lycium ferocissimum*) is also spreading at Lake Beeac and Lake Corangamite.

Grazing by rabbits

Rabbits (*Oryctolagus cuniculus*) will browse Spiny Peppercress. The impact may be greater during drought conditions (Harris & Smith 2000).

Grazing by domestic stock

Grazing by domestic stock can be a major threat to Spiny Peppercress. Sheep can destroy plants by grazing down to ground level, and by digging out and eating roots. Cattle will eat the young basal rosettes of leaves before spiny branches develop. Heavy grazing by cattle or sheep can also result in the loss of plants due to trampling, soil compaction and 'pugging' of waterlogged soils. Plant numbers have declined following increased cattle stocking rates at a number of locations (Harris & Smith 2000).

Grazing exclusion may be detrimental, however, if other processes (human-induced or otherwise) do not maintain a low cover of introduced species. For example, large numbers of Spiny Peppercress were recorded shortly after grazing exclusion at Beeac Swamp, but subsequent invasion by introduced gramnoids led to declines in the species' abundance. Low intensity grazing (including resting during the October - December when plants produce seed) may actually be beneficial for stand persistence. The negative impacts of grazing may be minimised by grazing in

winter when plants are reduced to a rootstock. The persistence of Spiny Peppercress and associated communities under different grazing regimes needs further investigation.

Habitat destruction

Many of the important sites (at least 14) occur on private land. Two other sites occur within wildlife reserves, another four on public land, one roadside site and one rail reserve. Thus, only a small proportion of the total number of known individuals (c. 7 – 11 %) occur on some form of conservation reserve. Further sites need to be given formal protection and managed for the conservation of Spiny Peppercress.

Altered hydrology

Wetland drainage destroys or degrades habitat. It also has altered the flooding/drying cycle at many Victorian sites. Water erosion or prolonged flooding may threaten plants close to lake shorelines (Harris & Smith 2000). At Lake Omeo, it is highly likely that the natural flooding/drying cycles have been substantially altered: the lake has filled only twice in last 40 years. The inflowing rivers have more than 50 dams, and so inflow is reduced; furthermore, drainage of adjacent marshland may have reduced groundwater levels. If reported plans to create a permanent waterbody at Lake Omeo are implemented, the species may be eliminated at this site (Scarlett 1984). A new dam at Lake Omeo was constructed in 2006, but it currently (2009) remains an intermittent lake.

Previous management action

Fencing/Grazing Exclusion

- Claremont Nature Reserve: sheep grazing was excluded in 1986.
- Lake Beeac Wildlife Reserve: exclusion of grazing was detrimental at this site because introduced grasses became highly abundant and competitively excluded Spiny Peppercress.
- Beeac Swamp Lake Reserve: this site was excluded from grazing in 1994 and has since become dominated with introduced grasses.
- Lake Corangamite: grazing exclusion appears to have been beneficial at the more northern site (site 2) where introduced grasses and other exotics do not thrive. The *Coxiella* shell substrate may slow weed invasion and provide protective mulch around plants.

Fencing and signposting (DSE)

- Derrinallum Railway Reserve.

Grazing (Private landholders)

- Private land sites: grazing is not known to be used as a targeted conservation measure for Spiny Peppercress on private property. Rather, it is a land-use that may be coincidentally sympathetic to plant persistence in some situations.
- Rossbridge Wildlife Reserve: the Draft Management Plan for the reserve permits light stock grazing between April and August (Moulton 1995). This regime has not always been adhered to, and some sites have been heavily grazed outside these months. Fences were checked and repaired by Parks Victoria in 2003/04.
- Lake Omeo: grazing is managed by the Committee of Management.

Revegetation (Greening Australia with liaison with DSE and Parks Victoria)

- Lake Beeac Wildlife Reserve: revegetation with Spiny Peppercress has apparently been successful.
- Lake Goldsmith Wildlife Reserve: seedlings were planted by workers from La Trobe University's Botany Department during the 1980s. Plants survived at least several years, but it is unknown whether second generation seedling regeneration has occurred. This site was chosen for reintroduction because it was the type locality for this species and also within reserved tenure.
- Lake Omeo: a small amount of seed was collected from one plant in January 2004. Germination was not successful.

Monitoring

- Rossbridge Wildlife Reserve: intermittent VROTPop monitoring has been conducted.
- Lake Omeo: There has been some liaison between DSE, the Lake Omeo Committee of Management and local landholders. An initial survey of Spiny Peppercress populations was undertaken in 2005/06.

Research

- A seed bank has been established. The Royal Botanic Gardens, Melbourne, has investigated germination (84 % on 1 % agar in 2006/07) and seed viability (100 % in 2007/08).
- Greening Australia, Victoria, is undertaking seedling studies at Lake Beeac.

Weed Management

- Lake Omeo: weed invasion and other threats have been assessed.
- Lake Corangamite: the windbreak of African Boxthorn (*Lycium ferocissimum*) has been removed and replaced with a suitable species.

- Lake Beeac Wildlife Reserve: Parks Victoria has developed a detailed weed management plan for the site. African Boxthorn (*Lycium ferocissimum*) has been removed in recent years, but ongoing removal is required to successfully eliminate the species from the site (R. Wallis pers. comm.).

Objectives and intended management actions

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

Long term objective

To ensure that Spiny Peppercress can survive, flourish and retain its potential for evolutionary development in the wild.

Specific Objectives, Actions and Targets

Objective I To improve knowledge of biology, ecology and management requirements

Action	*Targets*	*Responsible*
1. Acquire baseline population data by conducting detailed field and desk top surveys including (a) identification of the area and extent of populations, (b) estimates of the number, size and structure of populations, and (c) inference or estimation of population change.	▪ Baseline data collected. ▪ Conservation status reassessed. ▪ Populations accurately mapped.	DSE Statewide Services – South West, Gippsland Parks Victoria
2. Assess habitat characteristics and/or condition. Accurately survey known habitat, and collect floristic and environmental information relevant to community ecology and condition.	▪ Habitat data collected and analysed. ▪ Important habitat mapped.	DSE Statewide Services Parks Victoria
3. Identify potential habitat using ecological and bioclimatic information that may indicate habitat preference. Conduct surveys in areas of suitable habitat across the south west region and private property near Lake Corangamite to locate additional populations.	▪ Predictive model for potential habitat developed and tested. ▪ Potential habitat searched for additional Spiny Peppercress populations.	DSE Biodiversity and Ecosystem Services DSE Statewide Services – South West Parks Victoria
4. Undertake research to identify key biological functions.	▪ Critical life history stages identified. ▪ Recruitment and dispersal identified at known sites. ▪ Age at reproductive maturity determined. ▪ Seed bank/regenerative potential quantified for each/target population. ▪ Stimuli for recruitment/regeneration identified. ▪ Use/requirement of plant propagation and/or habitat manipulation to ensure long-term sustainability investigated.	DSE Biodiversity and Ecosystem Services Royal Botanic Gardens, Melbourne DSE Statewide Services – Gippsland, South West

5.	Undertake detailed population monitoring and collect demographic information.	▪ Techniques for monitoring developed and established. ▪ Census data for target populations collected regularly. ▪ Viability of Lake Omeo and Derrinallum private land populations assessed.	DSE Biodiversity & Ecosystem Services DSE Statewide Services – South West, Gippsland Parks Victoria
6.	Analyse population trends. Collate, analyse and report on census data and compare with management histories.	▪ Population growth rates determined and Population Viability Analysis completed for target populations.	DSE Biodiversity and Ecosystem Services

Objective II **To secure populations or habitat from potentially incompatible land use or catastrophic loss.**

Action		*Targets*	*Responsible*
7.	Negotiate management agreement with public land manager(s).	▪ All known public land sites identified and protected by agreement. ▪ Fencing and signposting completed.	DSE Statewide Services
8.	Liaise with relevant private landholders to encourage a co-operative approach to the management and protection of populations. Negotiate a voluntary management agreement with a private landholder(s).	▪ Negotiations about cooperative management undertaken with all landholders. ▪ DSE resources directed to management and protection of the most viable populations on private land. ▪ All known private land sites protected through planning processes and/or agreements. ▪ No illegal grazing in Beeac Swamp Lake Reserve. ▪ Permit conditions for appropriate light grazing of Beeac Swamp Lake Reserve established. ▪ Inappropriate application of fertilisers on land surrounding Lake Omeo discouraged.	Parks Victoria DSE Statewide Services – South West, Gippsland Trust for Nature
9.	Liaise with relevant stakeholder groups about collaborative management (including population monitoring, threat assessment/ management and site enhancement).	▪ Collaborative management approach negotiated with Greening Australia (Victoria) for Lake Beeac Wildlife Reserve, Beeac Swamp Lake Reserve and Corangamite Lake Reserve. ▪ Collaborative management approach negotiated with the Committee of Management for Lake Omeo, and with Parks Victoria for Rossbridge Wildlife Reserve.	Parks Victoria DSE Statewide Servcies - Gippsland
10.	Incorporate actions in relevant park or reserve management plan.	▪ Park management plans identify Spiny Peppercress and provide for its protection and active management.	Parks Victoria
11.	Provide information and advice to local government authorities for inclusion in planning processes.	▪ All known sites identified and protected through planning processes (e.g. environmental overlays). ▪ Fencing and signposting completed.	DSE Statewide Services – South West

12. Collect and store reproductive material as a safeguard against catastrophic loss.	▪ Reproductive material securely stored. ▪ Seed viability tested.	Royal Botanic Gardens, Melbourne

Objective III To improve the extent and/or condition of habitat

Action	*Targets*	*Responsible*
13. Identify disturbance regimes to maintain habitat.	▪ Management strategies identified to maintain, enhance or restore habitat. ▪ Impacts of present disturbance regimes on Lake Omeo populations determined.	Parks Victoria DSE Statewide Services
14. Assess threats at key sites, including weed invasion, livestock grazing, rabbit infestations, recreaction damage and other disturbances.	▪ Threats at key sites identified. ▪ The size and extent of weed invasion at Beeac Swamp Lake Reserve, Lake Beeac Wildlife Reserve, Lake Corangamite Lake Reserve, Lake Omeo, Rossbridge Wildlife Reserve and Derrinallum Station Yard Rail Reserve assessed and mapped.	DSE Statewide Services – South West, Gippsland
15. Manage environmental weeds.	▪ African Boxthorn (*Lycium ferocissimum*) controlled at Lake Corangamite and Lake Beeac Wildlife Reserve. ▪ Phalaris and other environmental weeds controlled at Derrinallum Station Yard Rail Reserve. ▪ Weed cover decreased and Spiny Peppercress recruitment increased at Lake Omeo and Beeac Swamp Lake Reserve under a strictly controlled regime of light cattle grazing. ▪ Biomass of weeds regularly controlled at Rossbridge Wildlife Reserve.	Parks Victoria DSE Statewide Services – South West, Gippsland
16. Manage impact of browsing animals. Control threats from rabbit browsing, and inappropriate grazing by sheep and/or cattle.	▪ Fences maintained at Lake Beeac Wildlife Reserve, Lake Corangamite Lake Reserve, Rossbridge Wildlife Reserve, Beeac Swamp Lake Reserve, Claremont Nature Reserve and Brigalow Park to prevent stock entering sites. ▪ Rabbit infestations controlled, notably at Lake Beeac Wildlife Reserve, Lake Corangamite Lake Reserve and where otherwise necessary. ▪ Measurable seedling recruitment/vegetative regeneration. ▪ Measurable reduction in plant mortality.	Parks Victoria DSE
17. Manage human disturbance. Control threats from physical damage, maintenance works and recreational activities.	▪ Contractors informed of plant locations and works supervised by Parks Victoria staff. ▪ Habitat loss during ongoing construction and maintenance works at Derrinallum Station Yard Rail Reserve prevented through signage and raised awareness among Australian Rail Track Corporation staff and contractors. ▪ Proposal to alter drainage patterns and	Parks Victoria DSE Statewide Services – South West, Gippsland

	permanently fill Lake Omeo managed to ensure that there are no detrimental impacts on the Spiny Peppercress population. ▪ No further habitat loss from recreational damage (particularly vehicle traffic) at Lake Omeo.	

Objective IV To increase community awareness and support

Action	*Targets*	*Responsible*
18. Involve community groups and volunteers in recovery activities.	▪ Opportunities for involvement identified, promoted and supported.	DSE Statewide Services

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