# National Recovery Plan

# Asterolasia elegans







Australian Government

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#### Disclaimer

This recovery plan sets out the actions necessary to stop the decline of, and support the recovery of, the listed threatened species or ecological community. The Australian Government is committed to acting in accordance with the plan and to implementing the plan as it applies to Commonwealth areas.

The plan has been developed with the involvement and cooperation of a broad range of stakeholders, but the making or adoption of this plan does not necessarily indicate the commitment of individual stakeholders to undertaking any 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.

# **Recovery Plan for** *Asterolasia elegans*

### Foreword

This document constitutes a Commonwealth recovery plan for *Asterolasia elegans*. It considers the conservation requirements of the species across its known range, and identifies the actions to be taken to ensure the long-term viability of *A. elegans* in nature and the parties who will undertake these actions.

A. elegans is included as endangered on the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, and endangered on the NSW Threatened Species Conservation Act 1995. A. elegans is a tall shrub endemic to the hills north of Sydney. It produces large white flowers covered in dense star shaped hairs. There are seven known populations of A. elegans. Three populations of the species exist entirely within conservation reserves.

The overall objective of this recovery plan is to ensure the long-term survival of *A. elegans* in the wild by promoting *in situ* conservation. The recovery objectives detailed in this plan include:

- Coordinate the recovery of *A. elegans*,
- Identify where the species occurs and identify and assess the conservation status of the species habitat,
- Identify and minimise threats where the species occurs,
- Minimise the loss and fragmentation of *A. elegans* habitat using land-use planning mechanisms and increase the species legislative protection,
- Raise awareness of the species presence at sites and manage sites to minimise threats,
- Provide public authorities with information that assists in conserving the species and
- Promote research projects that will assist future management decisions.

It is intended that the recovery plan will be implemented over a 5-year period. The actions in this plan will primarily be undertaken by OEH in consultation with Hornsby Shire Council, Hawkesbury City Council and Baulkham Hills Shire Council, the Department of Lands and the NSW Rural Fire Service. The total cost of implementing the plan is \$90,900 over a five-year period (Table 3). Implementation of recovery actions is reliant on securing funding.

# Asterolasia elegans

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# Asterolasia elegans

### 1 Introduction

Asterolasia elegans is a tall shrub to three metres belonging to the family Rutaceae (McDougall and Porteners 1990). It occurs only in the northern hills of Sydney, New South Wales (NSW), and is currently only known from 7 populations in the Central Coast botanic subdivision of NSW. The species was first found in 1979, but not documented until 1990.

This document constitutes the formal Commonwealth recovery plan for *A. elegans* and, as such, considers the requirements of the species across its known range. It identifies the actions to be taken to ensure the long-term viability of *A. elegans* in nature and the parties who will undertake these actions. The attainment of the objectives of this recovery plan are subject to budgetary and other constraints affecting the parties involved.

This plan has been prepared by the NSW Office of Environment and Heritage (OEH) in consultation with Hornsby Shire Council, Hawkesbury City Council and Baulkham Hills Shire Council, the Department of Lands and the NSW Rural Fire Service. The information in this recovery plan was accurate to the best available knowledge on the date it was approved.

### 2 Legislative context

### 2.1 Legal status

Asterolasia elegans is listed as an endangered species on Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act) and as an endangered species under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The TSC Act and the NSW *Threatened Species Conservation Amendment Act 2002* (hereafter referred to jointly as the TSC Act) provide a legislative framework to protect and encourage the recovery of threatened species, populations and ecological communities in NSW.

# 2.2 Recovery plan preparation, exhibition and implementation

### **Environment Protection and Biodiversity Conservation Act 1999**

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides a legislative framework for the protection of threatened species across Australia. In preparing a Commonwealth recovery plan, consideration must be given to the role and interests of Aboriginal people in the conservation of Australia's biodiversity.

The Act seeks to impose the obligation (arising from the listing) for responsible agencies (particularly Commonwealth) to adopt protective measures.

The EPBC Act requires the Commonwealth Minister for Environment Protection, Heritage and the Arts to ensure that there is approved conservation advice in place for each nationallyspecies and community. listed The Commonwealth Minister may also require the preparation of a recovery plan for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. The Act includes specific requirements for the matters to be addressed by recovery plans and the administrative process for preparing recovery plans. This recovery plan has been prepared to satisfy the requirements of the EPBC Act.

As *A. elegans* is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on this species should refer the action to the Australian Government Department of Sustainability, Environment, Water, Population and Communities for consideration. The Minister will then decide whether the action requires EPBC Act approval. This is in addition to any State or Local Government approval required.

### **Threatened Species Conservation Act 1995**

Under the TSC Act, the Chief Executive of OEH must prepare a Threatened Species Priorities Action Statement, which outlines a strategy for the recovery of each listed threatened species in NSW. The strategy for any particular species may include the requirement for a recovery plan to be prepared, however this is no longer a mandatory requirement for every threatened species.

The actions identified in this plan are consistent with the Priorities Action Statement for *A*. *elegans* and are primarily the responsibility of OEH. Other public authorities may have

statutory responsibilities relevant to the conservation and protection of *A. elegans*. They include: Baulkham Hills Shire Council, OEH (Environment Protection & Regulation Division and NSW National Parks and Wildlife Service), Hawkesbury City Council, Hornsby Shire Council, Department of Lands (NSW) and NSW Rural Fire Service.

### **Consultation with Aboriginal people**

Local Aboriginal Land Councils, Elders and other groups representing Aboriginal people in the areas where *A. elegans* occurs have been identified. Their comments on the draft recovery plan were sought and considered in the preparation of the final recovery plan. The role and interests of these Aboriginal communities will be considered in the implementation of the actions identified in this plan.

The Indigenous community groups in the area affected by this recovery plan include the Deerubbin and Metropolitan Local Aboriginal Land Councils, and in the area of interest to the Darug Tribal Aboriginal Corporation, and Darug Custodian Aboriginal Corporation.

### Critical habitat

The TSC Act makes provision for the identification and declaration of critical habitat for species, populations and ecological communities listed as threatened. Once declared, it becomes an offence to damage critical habitat (unless the action is specifically exempted by the TSC Act) and a Species Impact Statement (SIS) is mandatory for all developments and activities proposed within critical habitat.

To date, critical habitat has not been declared for *A. elegans* under the TSC Act or the EPBC Act. However, this recovery plan identifies the habitat features and locations that would contain habitat that is critical to the survival of the species, as required by the EPBC Act.

### Key threatening processes

A key threatening process (KTP) is a process listed under the TSC Act or the EPBC Act that threatens, or has the capability to threaten, the survival or evolutionary development of species, populations, or threatened ecological communities. There are seven KTPs listed on the TSC Act and four under the EPBC Act that are relevant to *A. elegans*. Under the TSC Act *A. elegans* is negatively impacted by:

- 'Competition and habitat degradation by feral goats (Capra hircus)',
- 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands',
- 'Ecological consequences of high frequency fires',
- 'Bushrock removal',
- 'Infection of native plants by Phytophthora cinnamomi',
- 'Human-caused Climate Change' and
- *'Clearing of native vegetation'*, which has drastically reduced and fragmented the habitat of *A. elegans*.

Under the EPBC Act A. elegans is affected by

- Competition and land degradation by feral Goats',
- '*dieback caused by the root-rot fungus* (Phytophthora cinnamomi)',
- *'land clearance'* and
- 'Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases'.

### Licensing

Any activity not requiring development consent or approval under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) which is likely to impact on *A. elegans*, or damage its habitat, requires a licence to be issued by the Chief Executive of OEH under s91 of the TSC Act or NSW *National Parks and Wildlife Act 1974* as a defence against prosecution. If the impact is likely to be significant, an SIS is required.

### **Other conservation measures**

The TSC Act includes provision for other measures that may be taken to conserve *A*. *elegans* and its habitat, including the making of a Stop Work Order or Joint Management Agreement. For information regarding the role of other legislation relevant to *A. elegans* see Appendix 2.

### **3** Species information

### 3.1 Description and taxonomy

Asterolasia elegans is one of 20 species in the Asterolasia genus, plants that are erect or prostate shrubs with stellate hairs. A. elegans is a tall shrub to three metres belonging to the family Rutaceae (McDougall and Porteners 1990). The leaves are lance-shaped with rusty star shaped

hairs on both surfaces (DEC 2005). *A. elegans* flowers in spring producing large white flowers with long dense star shaped hairs on the outer surface (DEC 2005).

### 4 Distribution and abundance

### 4.1 Definitions: populations and subpopulations

In this recovery plan discrete groups of *Asterolasia elegans* plants that are not separated from other discrete groups by more than one kilometre are considered together as a single population. Using this definition, seven populations of *A. elegans* have been recognised:

- Laughtondale Gully Road,
- Marramarra National Park,
- Old Northern Road,
- Marramarra Creek,
- Maron's Rock Reserve,
- Putty Road and
- Ku-ring-gai National Park.

A sub-population is defined as a discrete group of *A. elegans* plants that is separated from other groups within the same population by an arbitrary distance of 200 metres or more. A total of ten sub-populations has thus been defined for *A. elegans* (Table 1).

# Table 1.Subpopulations and abundances of<br/>A. elegans, including accuracy and date of<br/>last survey

Population no. (see Figure 1)	Sub- population	Abundance	Comments
1	Laughtondale Gully Road (a)	3540 (± 520)	Recorded in October 1993, prior to January 1994 wildfire when all plants were burnt.
1	Laughtondale Gully Road (b)	840 (± 80)	Recorded in October 1993, prior to January 1994 wildfire when all plants were burnt.

1	Laughtondale Gully Road (c)	>230	Estimated at >230 in March 2006; previously estimated as 2940 (± 700) in October 1993, prior to January 1994 wildfire when all plants were burnt.
2	Marramarra National Park	12220 (± 1980)	Recorded in November 1993, prior to January 1994 wildfire when 99% of plants were burnt.
3	Old Northern Road (a)	Unknown	Not recorded.
3	Old Northern Road (b)	20+	Recorded in September 1995.
4	Marramarra Creek	250	Recorded in September 1998.
5	Maron's Rock Reserve	30	Recorded in July 1996.
6	Putty Road	15	Recorded in January 1996
7	Ku-ring-gai National Park	Unknown	Not recorded.

### 4.2 Current and historical distribution

Asterolasia elegans is endemic to and has a disjunct distribution within the hills north of Sydney. It occurs north of Maroota in the Central Coast botanical subdivision of NSW. The species' current known distribution equates to a linear range of less than 37 km and an extent of occurrence of approximately 22 km<sup>2</sup> (Figure 1). While it is possible that further populations occur within this area, the species still has a small total area of occupancy.

The majority of populations are isolated by geographical features. *A. elegans* occurs in the local government areas of Hawkesbury, Baulkham Hills and Hornsby. All populations exist within Hawkesbury/Nepean Catchment Management Authority boundary.

### 4.3 **Population size and structure**

The population size of a species is considered to be the total number of mature individuals (IUCN 1994). However, most estimates made of population sizes of *A. elegans* fail to distinguish between mature and immature individuals or have not been systematically surveyed after the last fire event. Therefore the total number of mature plants across all known extant subpopulations remains unknown.

There may have been significant changes in plant numbers since the last estimates were made as *A. elegans* is killed by fire and must grow from seed. Several populations are in areas where severe wildfires have occurred in recent years, so the numbers of individuals and the age structures of these populations are likely to have been radically altered as a result.

Prior to the January 1994 there were an estimated 16,895 individuals (Table 1). All adult *A. elegans* individuals at populations on Laughtondale Gully Road were killed during the January 1994 fire. The 1994 fire also impacted the Marramarra National Park population, only a few individuals survived in unburnt patches (Scott 1994a). In November 1993 measurements of *A. elegans* plant heights revealed that all plants were close in age, consistent with a single recruitment event, such as fire, 10 to 13 years prior (Scott 1994a).

The known extant populations of *A. elegans* have a scattered distribution and are isolated by geographical features such as roads and ridges (Figure 1). All populations are considered important for survival of the species.

A. elegans was first collected in 1979 from Maroota, north-west of Sydney (Scott 1994b). All specimens of A. elegans in the national Herbarium of NSW are from the Maroota area.



Figure 1. The distribution of *A. elegans* 

### 4.4 Tenure

### **Conservation reserves**

Four of the seven known populations of *A. elegans* occur wholly or partly on land gazetted as conservation reserves (Table 2, Figure 1). Three of these are in Marramarra National Park and one in Ku-ring-gai National Park, all in the eastern half of its geographic range only. None of the populations in the western half of its range are reserved.

A. elegans is acknowledged in the Marramarra National Park Management Plan as an endangered plant (NPWS 1998). The plan outlines threatened species as a protection priority within the park, and the control of weeds around A. elegans is a policy in the plan (NPWS 1998).

### Laughtondale Gully Road

This population exists on three tenures and therefore has three distinct management authorities, OEH, Hornsby Shire Council and private landholders (Table 2).

The population has individuals in Marramarra National Park, a Crown road reserve and on rural private property.

The private land inhabited by the population was previously Crown land which has been or is in the process of being transferred as freehold title to Local Aboriginal Land Councils, or is under claim for freehold title by one of these Land Councils, under the NSW *Aboriginal Land Rights Act 1983*. These areas are also subject to native title claims under Commonwealth legislation.

### Private freehold land

Two populations of *A. elegans* exist on freehold land (Table 2). One population of *A. elegans* on Old Northern Road is within the formerly unreserved Crown land granted under Aboriginal land claim 3441 to a Local Aboriginal Land Council. It is also within an area under native title claim. Until title is issued to the new owner, the Department of Lands remains the manager of this land, but it cannot carry out any activities to do with this land without the concurrence of the Aboriginal Land Council.

The second population in the Turnbulls subcatchment exists on private land and occurs on former Crown reserve R88881 land granted under Aboriginal land claim 3445. This land is also under native title claim. Until title is issued to the new owner, the Department of Lands manages this land, but it cannot carry out any activities to do with this land without the concurrence of the Aboriginal Land Council.

### Crown land

One population off Putty Road occurs on Crown land (Reserve R101148) reserved for future public requirements (Table 2). The population may also extend on to the adjoining Crown reserve R88714 (for sanitary purposes and rubbish depot) which is used by Hawkesbury City Council for the treatment of effluent in stabilisation ponds that is subsequently discharged (across Reserve R101148) into Turnbulls Creek.

Population	Land Use	Tenure	Land Managers
name and no.			
1) Laughtondale	Road Reserve, Conservation Reserve, Environmental	Hornsby Council,	Private/Hornsby
Gully Rd	Protection	Private, National Park	Council/OEH
2) Marramarra	Conservation Reserve, Road Reserve	National Park,	OEH/Hornsby Council
National Park		Hornsby Council	-
3) Old Northern	Rural	Private	Private
Rd			
4) Marramarra	Conservation Reserve	National Park	OEH
Creek			
5) Maron's Rock	Crown Reserve	Crown Land	Department of Lands
Reserve			
6) Putty Rd	Crown Reserve	Crown Land	Department of Lands
7) Ku-ring-gai National Park	Conservation Reserve	National Park	OEH

 Table 2.
 Land use, tenure and land managers for the known extant populations of A. elegans

### 4.5 Habitat

Asterolasia elegans grows in wet sheltered sclerophyll forests on the mid to lower slopes of

moist gullies (Harden and Mole 1991). *A. elegans* occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders. The population on Laughtondale Gully

Road inhabits the gully beneath large rock shelves that provide shelter and shade, keeping the area moist despite its north-east aspect (Scott 1993).

### 4.6 Habitat critical to survival

All currently known populations of A. elegans are considered to be critical to the survival of the species (Figure 1, Table 1). A. elegans has a small number of populations and a restricted distribution. While the vegetation communities and geology preferred by A. elegans occur simultaneously over a large area of northern Sydney only a small area around Maroota contains the landscape features and specific micro-climate preferred by A. elegans. A. elegans occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders. Asterolasia elegans grows in wet sheltered sclerophyll forests from 2 to 40 metres above the creek line (Scott 1994a). To date this specific habitat has not been mapped. Recovery actions will aid in mapping this habitat, however all known populations are considered critical to the species survival.

### 4.7 Landform, geology and soil

Asterolasia elegans is mainly found on mid- to lower slopes of rolling to very steep terrain formed from dissected Hawkesbury sandstone. It is associated with Hawkesbury sandstone geology and occurs on the Hawkesbury or Gymea erosional soil landscapes (NPWS 2002). The geology of the Hawkesbury sandstone is of the Triassic age comprised of sandstone, quartz and some shale (Geological Survey NSW 1966). *A. elegans* can be found growing among sandstone boulders and rocky outcrops making it vulnerable to habitat degradation through the removal of bush rocks.

### 4.8 Associated vegetation

Asterolasia elegans grows in wet sheltered sclerophyll forests from 2 to 40 metres above the creek line (Scott 1994a). The species has been found inhabiting Sydney coastal dry sclerophyll forests, Sydney hinterland dry sclerophyll forests, rainforests and wet sclerophyll forests (DEC 2005). A. elegans is described in various vegetation communities within with various vegetation classification systems. A. elegans can be found growing with the endangered species Zieria involucrata at all sites, but is very rare (Scott 1994a). The canopy at known A. elegans sites is dominated by Syncarpia glomulifera subsp. glomulifera, Angophora costata,

*Eucalyptus piperita, Allocasuarina torulosa* and *Ceratopetalum gummiferum* (DEC 2005).

### 4.9 Potential habitat

The vegetation communities and geology preferred by *A. elegans* occur simultaneously over a large area of northern Sydney. However, only a small area in the north of Sydney around Maroota would contain the landscape features and specific micro-climate preferred by *A. elegans*. Current knowledge of the species' habitat preferences can be used to refine the area chosen for *A. elegans* target surveys.

### 4.10 Biology and ecology

There is limited available biological and ecological information regarding *Asterolasia elegans*, the species was found only recently in 1979 and described in 1990 (McDougall and Porters 1990).

### Life cycle

Asterolasia elegans produces white star-shaped flowers in spring, from August to October and fruit in November (McDougall and Porters 1990). The breeding system of *A. elegans* is largely unknown. *Asterolasia* flowers are insectpollinated, and visitors to species in this genus are mostly beetles, occasionally flies and bees (Armstrong 1979). However, the particular pollinators of *A. elegans* are unknown. The impact of the introduced honey bee on pollination and subsequent seed production is unknown (Auld 2001).

A. elegans is an obligate seeder, all mature plants are killed during fire and regeneration is reliant on seeds stored in the soil. A. elegans fruits are covered in white and rusty hairs containing oblong shiny grey seeds (McDougall and Porters 1990). Mature fruits dehisce in December releasing the seeds. Seed dispersal in Asterolasia species is initially by forcible ejection from the fruit. The presence of an antattracting food body with the seed (J. Howell, cited in Benson and McDougall 2001) indicates that secondary dispersal by ants (termed myrmecochory) is also likely to occur. At present there is little knowledge of the nature of ant interactions with A. elegans or other Rutaceae species, nor is the fate of moved seeds known. Even with such a mechanism, seed dispersal distance is likely to be small, of the order of one to a few metres (Auld 2001).

Seed viability for the species is high and seed dormancy is variable, broken by disturbance

(Scott 1994a). A. elegans has both dormant and non-dormant seeds at the time of release. Auld et al. (2000) and Scott (1994a) observed high viable seed component (88-98%) and a variable level of seed dormancy at seed release (49-100%). While the non-dormant seeds underwent rapid decay, dormant seeds showed no significant decay over a 2-year period, suggesting that relatively long-lived persistent soil seedbanks may be established in this species. Auld et al. (2000) estimated a half-life of the dormant, viable seed fraction to be 2.3 years indicating that the species could last 5-10 years as seed in the soil after adults have died. However, the seedbank would have to receive a constant influx of new seeds for it to survive and maintain its viability for an extended period of time.

Seed dormancy can be broken by heat and smoke (Scott 1994a). Seedlings can emerge on a regular basis from the seed bank as seeds decay in the soil, but the survival of these seedlings is likely to be low if not within a few years of the last fire (Scott 1994a). Adult plants grow to 3m and the survival of adult plants is high (Scott 1994a). The life span of the species is unknown. However 30 plants from the Laughtondale Gully Road population which are presumed to have germinated after the 1994 fire and survived the December 2002 wildfire were observed, 12 years later, in March 2006 (N. Corkish pers. obs.).

### Disturbance ecology

Asterolasia elegans requires disturbance to break seed dormancy and promote germination. A. elegans seeds need smoke and temperatures between 77 and 110°C for germination to be promoted (Scott 1994a). Temperatures of 77 to 110°C are only reached in the first 4 cm of soil in fires that consume large amounts of fine ground fuels (Bradstock and Auld 1995). Moderate to high intensity fires or low intensity fires that move slowly and fully combust fuels will promote recruitment in A. elegans populations (Scott 1994a). Fires that do not break seed dormancy will lead to population declines as fire kills adult plants and recruitment is not promoted. Disturbance through fire is a key component of A. elegans life cycle, but if fire frequency and intensity parameters do not favour the species, fire can be a threat.

The non-dormant seeds stored in the soil provide a source of germination between fire events. It is likely that "natural" disturbances (resulting from storm damage, animal scratchings and possibly cooler fires) provide recruitment opportunities for the species in a healthy ecosystem. The survival of seedlings that emerge on a regular basis from the seed bank between fires is likely to be low if not within a few years of the last fire (Scott 1994a). A greater understanding of the species seedling recruitment and seedling survivorship rates after and between fires needs to be established.

A. elegans does not require disturbance in the form of slashing, trittering or tree removal (RFS 2004). A. elegans habitats often contain areas of rocky outcrops of Hawkesbury sandstone. The legal or illegal removal of bush rocks in A. elegans habitat may destroy plants and degrade the habitat of the species (DEC 2005).

### Disease

Infection of native plants by P. cinnamomi is listed as a KTP. There is no published evidence regarding the susceptibility of A. elegans to the pathogen dieback. However, other members of the Rutaceae are known to be susceptible (Auld 2001). P. cinnamomi is present in a wide range of locations in the Sydney region (McDougall unpubl., cited in Auld 2001), so it can be considered a potential threat to A. elegans due to the growing potential for spread of the pathogen because of increasing human activities on the northern outskirts of the Sydney metropolitan area. Further research into the impacts of the P. cinnamomi fungus on A. elegans needs to be established before the impacts of this potential threat are known.

### 5 Threats and management issues

### 5.1 Altered fire regimes

The "Ecological consequences of high frequency fires" is a Key Threatening Process (KTP) listed under the TSC Act, which impacts A. elegans. All seven known populations of A. elegans are threatened by too frequent fire. Too frequent fire can lead to population declines as adult plants are killed by fire and seedlings die in consecutive fires before reproducing. A. elegans needs a fire-free period to allow seedlings to mature and contribute to the seed bank as adult plants (Scott 1994a). The threatened species hazard reduction list suggests A. elegans and its habitat should not experience fire more than once every seven years (RFS 2004). A greater understanding of the fire-free period that A. elegans requires to effectively complete its lifecycle needs to be established.

Landscapes with infrequent fires can also threaten *A. elegans*. Infrequent fires allow adult plants to mature and die, but do not promote recruitment of new individuals leading to population declines. *A. elegans* populations experienced fire in 1980, 1983, 1994 and 2002, without a consistent 7 year gap between fires.

The 1994 fire killed almost all A. elegans individuals at the Laughtondale Gully Road and Marramarra National Park populations, a few individuals survived, these populations are yet to fully recover and have experienced fire since. Three or more fires in close succession may result in population decline or extinction for A. elegans (DEC 2005). Sustained high frequency fires may cause changes in vegetation structures and therefore microclimate, leading to a decline in moist sheltered habitats preferred by A. elegans (DEC 2005). The impacts of recent fires on population numbers and recruitment are unknown. Systematic surveys of the known populations would increase knowledge of the current impacts of fire on the species. Information regarding the time to first flowering and the amount and timing of seed production in populations would also aid in the conservation of the species with regard to fire management.

### 5.2 Water pollution and runoff

Asterolasia elegans occurs in habitats in moist gullies close to the creek line, making the species vulnerable to water pollution and runoff. The 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands' is listed as a KTP under the TSC Act and impacts A. elegans. The Putty Road population occurs adjacent to a creek affected by sewage pond outflow. The high level of nutrients that are being expelled from the outlet may promote the growth of weed species in A. elegans habitat. Populations that occupy areas down-slope from cleared land and roads are vulnerable to disturbance from runoff. Runoff from developed areas can wash weeds and nutrients downstream into A. elegans populations.

Laughtondale Gully Road is an untarred road that produces large amounts of dust when driven over in dry conditions. Dust from Laughtondale Gully Road covers the roadside vegetation and becomes muddy during rain, washing downstream into the creek. Most individuals at the Laughtondale Gully Road population inhabit the gully down-slope from Laughtondale Gully

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Road where rubbish and polluted runoff from the road is washed after rain.

### 5.3 Introduced species

Currently Ageratina adenophora (Crofton weed) and Sonchus oleraceus occur along Laughtondale Gully Road in Marramarra National Park. The Marramarra National Park Plan of Management identifies these weeds as a threat to A. elegans and weed populations are being monitored. A small isolated number of feral goats exist in Marramarra National Park (NPWS 1998). Goats have been identified as a possible threat to the Laughtondale Gully Road and Marramarra National Park populations. The impact of goats on native ecosystems is identified as a KTP under the TSC Act and EPBC Act.

# 5.4 Land clearing and habitat fragmentation

The known extant populations of Asterolasia elegans have a scattered distribution and are isolated by geographical features such as roads and ridges. A. elegans was listed under the TSC Act due to its very restricted distribution and small geographic range (Scott 1994a). Those sub-populations of A. elegans that do not exist in conservation reserves are vulnerable to land clearing. The clearing of native vegetation is listed as a KTP under the EPBC and TSC Act. The loss of individuals or populations through land clearing will further reduce the distribution and available habitat for the species. As populations of A. elegans are already scattered, the loss of populations will cause a decline in A. elegans numbers and fragment the species further. Fragmentation and direct loss of habitat may occur through native vegetation clearing for rural expansion and agricultural development in the area (DEC 2005).

### 5.5 Road maintenance

Most of the known extant populations of *A*. *elegans* exist on road verges in steep gullies. In the past car bodies and parts have been driven off steep road verges and into gullies supporting *A*. *elegans* (Scott 1994a).

A. *elegans* inhabits roadsides managed by Hornsby Shire Council. Road maintenance, including chemical weed control and slashing, could pose a threat to *A. elegans*, as many individuals grow in very close proximity to the road. Hornsby Shire Council does separate Reviews of Environmental Factors (REF) for road works and road maintenance (Campbell

pers. comm.). Any upgrade of Laughtondale Gully Road would heavily impact *A. elegans* populations in Marramarra National Park.

### 5.6 Bushrock removal

Theft of bushrock and rare plants has been an ongoing issue in Marramarra National Park. "Bushrock removal" is a KTP listed under the TSC Act that negatively impacts A. elegans. The removal of bushrock in A. elegans habitat may destroy plants and degrade the habitat of the species (DEC 2005). Access to A. elegans populations via road allows for easy disturbance and removal of material from the National Park. Signage has been erected along Laughtondale Gully Road to alert park users that it is an ecologically sensitive area.

### 5.7 Stock grazing and trampling

A small isolated number of feral goats exist in Marramarra National Park (NPWS 1998). Goats have been identified as a possible threat to the Laughtondale Gully Road and Marramarra National Park populations. The impact of goats on native ecosystems is identified as a KTP under the TSC Act and EPBC Act.

### 5.8 Limits to current knowledge

To effectively manage and conserve *A. elegans*, a greater understanding of the species' ecological requirements, threats and current abundance is necessary.

Key areas for improved understanding for fire management include;

- knowledge of the fire-free period required by the species,
- current impact of fire on populations and
- seedling recruitment and seedling survivorship after and between fires.

Gaps in biological knowledge of *A. elegans* are;the time to first flowering,

- amount and timing of seed production in
- populations,
  primary pollinators of the species, dispersal distances,
- fate of dispersed seeds and
- seed dispersal vectors.

Major threats that require research include the impacts of;

- the introduced honeybee
- water-borne pollution and

A. *elegans* individuals have not been systematically surveyed after the last fire event. Surveys of potential habitat and known populations need to be performed to ascertain current measures of abundance for the species.

### Ability to recover

'Recovery' in the context of this plan, is to ensure the continued and long-term survival of *A. elegans* in the wild. The likelihood of recovery of the species in this context is high provided the recovery actions outlined in this recovery plan are implemented, monitored and amended as required.

# A note on translocation and *ex situ* conservation for *A. elegans*

Given the high cost and risk associated with the technique (Vallee *et al.* 2004), translocation is not currently considered necessary for the survival of *Asterolasia elegans* as the *in situ* conservation measures proposed in this recovery plan are expected to meet the conservation needs of the species.

### 6 Previous recovery actions

In March 1994, Judith Scott prepared a recovery plan and conservation research statement for *Asterolasia elegans* through the Australian Nature Conservation Agency Endangered Species Program. The recovery plan outlined various actions regarding the management of *A. elegans*:

- Notification of the species presence to management organisations,
- Survey more locations in suitable habitat,
- Monitor population and weed invasion/removal,
- Remove rubbish and add a road verge guard rail and/or sign to deter rubbish dumpers on Laughtondale Gully Road,
- Monitor populations following fire for recruitment and survivorship and determine time to first flowering,
- Monitor survivorship and seed production for the populations,
- Develop a fire plan of management for *Asterolasia elegans* as sufficient information becomes available,
- Seek Conservation Agreements with land owners/managers and

• Use material from populations for seed storage and some cultivation.

With respect to monitoring populations of A. elegans two of the populations were being monitored at the time the 1994 recovery plan was prepared, but was not continued (T. Auld, pers. comm.). Auld et al. (2000) and Auld (2001) incorporated some of the results from this work in published papers. In the Marramarra National Park Fire Management Strategy (NPWS 2006) the fire regime requirements of A. elegans have been considered when establishing sustainable prescriptions for each of the fire management units. However, these plans do not address fire requirements management specifically for A. elegans on a site-specific basis.

More populations of Asterolasia elegans have been found since 1994. Only two populations were known in 1994, now seven extant populations have been identified. The Marramarra National Park Management Plan outlines that weeds that may threaten A. elegans are being monitored in the park (NPWS 1998). Rubbish collection and bush regeneration works have been carried out in Marramarra National Park by Hornsby Shire Council regeneration team. Hornsby Shire Council has erected a sign on Laughtondale Road to advise road construction and maintenance crews of the ecological sensitivity of the area.

Hornsby Shire Council Bushland and Biodiversity Team is carrying out a training program focused on construction, maintenance and other staff. The training includes assisting staff to recognise A. elegans and other threatened biota and be aware of known locations that are likely to be negatively impacted by construction and maintenance and measures to be taken to minimise these impacts. Additionally, the team liaises with the Council's Works Department and its Fire Management Officer to review the annual works programs and identify any A. elegans sites likely to be affected (D. Campbell pers. comm.).

A. *elegans* plants have been propagated from cutting material at Mt Annan Botanic Garden, there has been a success rate of approximately 70% (Scott 1994a). This propagation is to ensure a living collection should there be any decline in wild population.

# Preparation and implementation of a recovery plan

This recovery plan has been prepared by OEH in order to satisfy the requirements for a recovery plan under the Commonwealth EPBC Act. OEH will coordinate the implementation of the recovery plan.

### Threatened species data collection and audit

The Office of Environment and Heritage has conducted a literature review, and an audit of the Royal Botanic Gardens (RBG) NSW Herbarium, NSW National Parks and Wildlife Service (NPWS) Atlas of Wildlife, Forests NSW and other records prior to the preparation of this recovery plan.

### 7 Recovery objectives, actions and performance criteria for *Asterolasia elegans*

The overall objective of this recovery plan is to ensure the continued and long-term survival of *A. elegans* in the wild by promoting the *in situ* conservation of the species across its natural range.

**Objective 1.** Co-ordinate the recovery of *A*. *elegans*.

Action 1.1: Co-ordinate the recovery of *A*. *elegans* and ensure recovery plans for species that require the same habitat as *A*. *elegans* are consistent with the objectives and actions in the *A*. *elegans* recovery plan.

**Performance Criterion 1.1**: The recovery of the species has been coordinated and where practical, recovery actions have been integrated with those of other threatened species, populations or ecological communities.

**Responsibility:** OEH (Environmental Protection and Regulation Group (EPRG)).

**Objective 2.** Identify where the species occurs and identify and assess the conservation status of the species habitat.

Action 2.1: Identify and coordinate targeted surveys of potential habitat for *A. elegans* to identify new populations.

**Performance Criterion 2.1**: Potential habitat identified and surveyed to identify new populations.

**Responsibility:** OEH (EPRG and NPWS).

Action 2.2: Co-ordinate surveys to assess the size, characteristics of and existing threats to know *A. elegans* populations.

**Performance Criterion 2.2:** The size, characteristics and existing threats to known populations of A. elegans are assessed.

**Responsibility:** OEH (EPRG and NPWS).

**Objective 3:** Identify and minimise threats where the species occurs.

Action 3.1: Ensure that Marramarra National Park Plan of Management and plans of management for other OEH lands containing *A*. *elegans* are consistent with the objectives and actions in *A*. *elegans* recovery plan.

**Performance Criterion 3.1:** Marramarra National Park Plan of Management and plans of management for other OEH lands containing A. elegans include actions for the recovery of A. elegans after its next review.

### **Responsibility:** OEH (NPWS)

Action 3.2: Ensure that updates of Fire Management Strategies and Pest Management Strategies are consistent with the objectives and actions in *A. elegans* recovery plan.

**Performance Criterion 3.2:** Fire Management Strategies and Pest Management Strategies for lands containing A. elegans include actions for the recovery of A. elegans.

**Responsibility:** OEH (NPWS and EPRG).

Action 3.3: Where *A. elegans* is located on private and other public lands outside the OEH estate, encourage landholders to prepare Site Management Statements for those sites and maintain regular contact with landholders.

These statements will detail the specific threat abatement measures required at those sites. Consideration will be given to whether conservation agreements are appropriate to freehold sites.

**Performance Criterion 3.3:** Ongoing engagement with relevant landowners / managers with regard to Site Management

# Asterolasia elegans

Plans for land outside the OEH estate where A. elegans is found..

Responsibility: OEH (EPRG).

Action 3.4: Support implementation of the Bush Fire Environmental Assessment Code by providing best practice mitigation advice for *A. elegans* for updates to the Threatened Species Hazard Reduction List.

**Performance Criterion 3.4:** Best practice mitigation advice for A. elegans included in the Threatened Species Hazard Reduction List.

**Responsibility:** OEH (EPRG) and Rural Fire Service (RFS).

Action 3.5: Implement site protection actions at Laughtondale Gully Road (Hornsby LGA).

These will include restricting vehicular and pedestrian access to sites, fencing sites and excluding livestock and/or feral animals, undertaking targeted bush regeneration and weed control works where required.

**Performance Criterion 3.5:** Vehicular and pedestrian access is restricted, and regeneration works initiated in areas of A. elegans on Laughtondale Gully Road within three years of the publication of this plan where required.

**Responsibility:** OEH (NPWS) and Hornsby Shire Council.

Action 3.6: Implement site protection actions at other known sites containing *A. elegans*. These will include restricting vehicular and pedestrian access to sites, fencing sites and excluding livestock and/or feral animals, undertaking targeted bush regeneration and weed control works where required.

**Performance Criterion 3.6:** Where required vehicular and pedestrian access is restricted in areas of high activity, fences are erected to remove livestock/feral animals and areas of A. elegans habitat containing weed species or degraded habitats are regenerated as sites are identified or within three years of the publication of this plan..

**Responsibility:** OEH (NPWS), Department of Lands (DoL), Hawkesbury Nepean CMA,

# Asterolasia elegans

Hawkesbury City Council, Baulkham Hills Shire Council and Hornsby Shire Council.

Action 3.7: Limit the effects of pollution and run-off on the *A. elegans* site near the Hawkesbury Council Sanitation Depot.

**Performance Criterion 3.7:** Pollution and runoff do not exit the Hawkesbury Council Sanitation Depot.

**Responsibility:** OEH (EPRG) and Hawkesbury City Council.

**Objective 4:** To minimise the loss and fragmentation of *A. elegans* habitat using land-use planning mechanisms and increase the species legislative protection.

Action 4.1: Liaise with the Department of Lands (DoL) to review status of Crown Lands containing *A. elegans* to ensure appropriate classification of the relevant Crown lands.

**Performance Criterion 4.1:** Review of classification of Crown Lands which are habitat for A. elegans complete and recommendations on classification made.

Responsibility: OEH (EPRG) and DoL.

Action 4.2: Liaise with councils on all relevant Environmental Planning Instruments prepared under the EP&A Act and contribute to their preparation and review with reference to this recovery plan.

**Performance Criterion 4.2:** The level of protection afforded to A. elegans populations and habitat is increased through appropriate zoning, conservation planning and land-use decisions as issues arise.

### **Responsibility:** OEH (EPRG)

**Objective 5:** To raise awareness of the species presence at sites and manage sites to minimise threats.

Action 5.1: Develop and implement siteawareness and protection procedures for use by land owners/mangers and public utilities and their contractors when taking road, trail or easement maintenance.

**Performance Criterion 5.1**: Site awareness and protection procedures are implemented for use

by managers and contractors within twelve months of publication of this plan.

**Responsibility:** OEH (NPWS), Hornsby Shire Council and DoL.

**Objective 6:** To provide public authorities with information that assists in conserving the species.

Action 6.1: Notify OEH of new sites and populations of *A. elegans* located through both targeted survey (e.g. for environmental assessment purposes) and other sightings.

**Performance Criterion 6.1:** New records of species are recorded on the Atlas of NSW Wildlife.

**Responsibility:** All relevant authorities and groups (including Councils and DoL).

**Objective 7:** To promote research projects that will assist future management decisions.

Action 7.1: Liaise with tertiary and other research institutions to promote research into the biology and ecology of *A. elegans*. Research is required into:

- fire frequency requirements,
- sensitivity to water-borne pollution runoff,
- seedling recruitment and survivourship rates,
- sensitivity to the Cinnamon fungus and
- the time to first flowering of *A*. *elegans*.

**Performance Criterion 7.1:** Increased knowledge of the biology and ecology of A. elegans is available for formulation of management strategies for the species.

### **Responsibility:** OEH (EPRG).

# 7.1 Social and economic consequences and cultural issues

### Social consequences

The recovery plan is not expected to affect public land usage to any great extent and modification of private land management patterns will occur at the land manager's discretion. Continued liaison with the local community, affected land-holders and public authorities will address and minimise any

unforeseen negative social impacts arising from the implementation of this plan.

Indeed, it is expected that the implementation of this recovery plan will have positive social impacts on the local communities involved and, in particular, on the owners and managers of *A*. *elegans* habitat.

Increased awareness regarding the conservation of threatened species in a rural setting will encourage recognition amongst land-holders of the value of remnant vegetation and their responsibility for habitat management. Personal and regular contact with landholders and local community groups is a key strategy to achieving this.

### **Economic consequences**

The economic consequences of this recovery plan comprise costs that are associated with its implementation. This includes the costs associated with on-ground habitat management, conducting biological research and monitoring, community education and participation, and ongoing coordination of the reference group. These costs can be off-set and minimised by:

- implementing a long-term strategic framework for managing the species and its habitat,
- maintaining accurate information on the distribution and status of sites,
- adopting a cooperative approach to management by involving the relevant land managers and the local community and
- seeking funds from external sources.

The improved environmental impact assessment resulting from mechanisms established in this recovery plan will assist consent and determining authorities to meet their statutory responsibilities. The production of this recovery plan will decrease the costs associated with collating available information on *A. elegans* when undertaking impact assessment.

Substantial economic consequences may result where the species' conservation requirements prevent or restrict the use of land that is currently identified for mineral extraction, agriculture or urban development. These consequences will be identified and addressed by statutory environmental impact assessment processes.

### 7.2 Biodiversity benefits

The conservation and study of *Asterolasia elegans* will benefit other threatened species that share the same habitat, particularly *Zieria involucrata*, a species listed as endangered at state level and vulnerable at a national level. Increased awareness of *A. elegans* resulting from the implementation of this recovery plan will raise the profile in the community of all threatened species. This in turn will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

### 8 Plan evaluation

This recovery plan is to be evaluated in five years after its adoption by the Office of Environment and Heritage (NSW) and managed through the Priorities Action Statement (PAS) at

www.threatenedspecies.environment.nsw.gov.au/tsprofile/home\_PAS\_new.aspx.

### **9** Abbreviations used in this document

BFHRC	Bush Fire Hazard Reduction Certificate
CMA	Catchment Management Authority
OEH	Office of Environment and Heritage
	(NSW)
DoL	Department of Lands
DoP	Department of Planning
EP&A Act	NSW Environmental Planning and
	Assessment Act 1979
EPBC Act	Commonwealth Environment
	Protection and Biodiversity
	Conservation Act 1999
EPRG	Environment Protection and Regulation
	Group, OEH
IUCN	International Union for the
	Conservation of Nature and Natural
	Resources
LEP	Local Environmental Plan
NPWS	NSW National Parks and Wildlife
	Service
RF Act	Rural Fires Act 1997
RFS	Rural Fire Service
TSC Act	NSW Threatened Species Conservation
	Act 1995

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Action	Action description	Priority	Responsible party	Fund source	Cost estima	te (\$/year)				Total cost (\$)
					Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	
1.1	Coordinate recovery	1	OEH (EPRG)	OEH in-kind	4170	4170	4170	4170	4170	20850
2.1	Identify, map and survey potential habitat	2	OEH (EPRG & NPWS)	Unsecured	2100	2100	2100	2100	2100	10500
2.2	Assess status of existing populations habitat	1	OEH (NPWS & EPRG)	OEH in-kind	5000	5000	4000	4000	4000	22000
3.1	Plans of Management consistent with recovery plan	1	OEH (EPRG & NPWS)	OEH in-kind	1400	-	-	-	-	1400
3.2	Fire and Pest Management strategies consistent	1	OEH (EPRG & NPWS)	OEH in-kind	1800	-	-	-	-	1800
3.3	Encourage private land holders to prepare Site Management Statements	1	OEH (NPWS & ERPG)	Unsecured	1800	-	-	-	-	1800
3.4	Update Threatened Species Hazard Reduction list	1	OEH (EPRG) & RFS	Unsecured	1800	-	-	-	-	1800
3.5	Site protection at Laughtondale Gully Road	1	OEH (NPWS) & HSC	Unsecured	#	#	#	#	#	-
3.6	Site protection at other known A. elegans sites	1	OEH (NPWS), HCC, BHSC, DoL & HNCMA	Unsecured	#	#	#	#	#	-
3.7	Limit effect of run-off near Hawkesbury Council depot	1	OEH (EPRG) & HCC	Unsecured	#	#	#	#	#	-
4.1	Review of Crown land classification	2	OEH (EPRG) & DoL	OEH in-kind	#	#	#	#	#	-
4.2	Liaise with Councils on Environmental Planning Instruments	2	OEH (EPRG)	OEH in-kind	4170	4170	4170	4170	4170	20850
5.1	Site awareness and protection procedures	1	OEH (NPWS), HSC,& DoL	Unsecured	1800	-	-	-	-	1800
6.1	Notification and updates of new populations	2	All relevant authorities	OEH in-kind	1800	700	700	700	700	4600
7.1	Promote research	2	OEH (EPRG)	OEH in-kind	700	700	700	700	700	3500
Total costs				Unsecured	7500	2100	2100	2100	2100	15900
				OEH in-kind	19040	14740	13740	13740	13740	75000
				TOTAL	26540	16840	15840	15840	15840	90900

### Table 3. Estimated costs, funding source and responsible parties for implementing the actions identified in the Asterolasia elegans recovery plan.

Key to abbreviations, terms and symbols in costing table:

**BHSC** – Baulkham Hills Shire Council; **OEH** – Office of Environment and Heritage (NSW), **EPRG** – OEH Environment Protection & Regulation Group, **HCC** – Hawkesbury City Council, **HNCMA** – Hawkesbury/Nepean Catchment Management Authority, **HSC** – Hornsby Shire Council, **DoL** – Department of Lands (NSW), **NPWS** – OEH National Parks & Wildlife Service, **RFS** – Rural Fire Service NSW. **Priority rankings: 1** - Action critical to meeting plan objectives, **2** - Action contributing to meeting plan objectives.

**OEH in-kind** funds represent the salary component of permanent OEH staff and recurrent resources. Salary for in-kind contributions is calculated at \$350 per day, which includes officer salary and on-costs, provision of office space, vehicles, administration support and staff management. **Unsecured** funds will be sought from sources including OEH annual operational provisions for the implementation of threatened species programs and from external programs.

# - Action costs to be negotiated.

### Appendix 1 Site Management Statement Pro Forma

Site Management Statement
Prepared by:
Date:
Site details:
Site Name:
Site Code:
Location:
Easting:Northing:AMG Zone:
Land owner/Land manager contact details
Name:
Phone number:
Postal address:
Parcel details:
LGA:
Portion/Lot:
Street address:
Zoning:
Tenure:
Current landuse:
Population details:
No. adults: Count: [] Estimate: [] Lowest estimate =Best estimate =Upper estimate =
No. seedlings: Count: [] Estimate: [] Lowest estimate =Best estimate =Upper estimate =
Area of Occupancy:Accurate: [] Estimate: []
Detailed site map attached: Yes/No
Reproduction: Buds: [] Flowers: [] Fruit: []
Habitat:

Dominant Associated species:
Threats:
Predominant weed species and abundance.
recommant weed species and abundance.
Treuominant weed species and abundance.
Treuominant weed species and abundance.
Previous management actions (describe apparent success):
Previous management actions (describe apparent success): Threat abatement actions required:
Previous management actions (describe apparent success): Threat abatement actions required:
Previous management actions (describe apparent success): Threat abatement actions required:

### Appendix 2 Additional A. elegans information

### 10.1 Relationship to other legislation

Additional legislation relevant to the conservation and recovery of *A. elegans* in NSW includes the following:

- Environmental Planning and Assessment Act 1979,
- National Parks and Wildlife Act 1974,
- Local Government Act 1993,
- Water Management Act 2000,
- Crown Lands Act 1989,
- Rural Fires Act 1997 and
- Aboriginal Land Rights Act 1983.

The most significant implications of the above legislation with regard to A. elegans are described below.

### **Environmental Planning & Assessment Act 1979**

Consent and determining authorities are required to consider potential impacts on *A. elegans* and its habitat when considering development or activity proposals under parts 4 and 5 of the EP&A Act.

Part 3 of the EP&A Act provides for the preparation of environmental planning instruments (EPIs) and this presents opportunities to conserve important habitat for *A. elegans* at the landscape level. For example, important sites that contain *A. elegans* can be protected under an appropriate environmental zoning when councils prepare or review local environment plans (LEPs). This is a more effective means of providing for the conservation requirements of a species than through the assessment of individual development applications.

### **Rural Fires Act 1997**

The *Rural Fires Act 1997* (RF Act) requires all parties involved in fire suppression and prevention to have regard to the principles of ecologically sustainable development when exercising their functions and when preparing plans of operation or bush fire risk management plans. Within this, consideration must be given to the impact on threatened species and their habitats.

Under the Rural Fires (RF Act), certain public authorities can authorise bush fire hazard reduction work (including prescribed burning and mechanical vegetation clearance) in habitat for a threatened species by issuing a Bush Fire Hazard Reduction Certificate (BFHRC). The Threatened Species Hazard Reduction List forms part of the Bush Fire Environmental Assessment Code and contains specific conditions for sites that support threatened species.

Where proposed bush fire hazard reduction activities do not meet the criteria necessary to allow a BFHRC to be issued, then an approval under Parts 4 or 5 of the EP&A Act or s91 of the TSC Act is required.

### Local Government Act 1993

The *Local Government Act 1993* defines the powers, duties and functions of all local councils in NSW. Section 8(1) of the Act requires councils 'to properly manage, develop, protect, restore, enhance and conserve the environment of the area for which it is responsible, in a manner that is consistent with and promotes the principles of sustainable development'. This includes the integration of biodiversity considerations into the decision-making process.

Chapter 6 of the Act requires councils to prepare plans of management for community land that take into account council's obligations under approved recovery plans.

### **Crown Lands Act 1989**

Part 3 of the *Crown Lands Act 1989* sets out the process for assessing Crown land against prescribed land evaluation criteria. This leads to an assessment of the land's use for community or public purposes, environmental protection, nature conservation, water conservation, or other purposes. In identifying uses for Crown land, the Minister is to have regard to the views of any government department.

Under the Act, the Minister for Lands may place restrictions on the transfer or use of Crown land or impose a public positive covenant on Crown land for the purposes of protecting the environment or natural resources, and/or protecting other significant values of the land.

Appendix 3 Environmental Impact Assessment Guidelines

### ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES

# Asterolasia elegans

R.Br ex Benth.

### Common name: none

### Family: Rutaceae

The information provided in the species profile and the environmental impact assessment guidelines is the best available at the time of publication of this recovery plan. They will be updated periodically as new information becomes available. Consent and determining authorities, developers and EIA consultants should ensure that they obtain the most recent information by contacting the Biodiversity Conservation Section of the relevant region of the Office of Environment and Heritage.

### Survey

Survey for *Asterolasia elegans* may be undertaken at any time of the year. A combination of leaf and stem characteristics as well as habit should enable the species to be identified in the absence of flowers. However, the species is most readily observed during its flowering season between September to October when plants are covered in a dense mass of white flowers.

Survey should not necessarily be confined to areas of intact remnant vegetation because *A. elegans* plants have also been recorded growing in disturbed environments.

A. elegans is found on steep to gentle, mid- to lower slopes and valleys, usually on Hawkesbury sandstone. Surveyed sites cover a range of aspects, but most occur in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. The canopy typically includes *Syncarpia glomulifera* subsp. *glomulifera* (turpentine), *Angophora costata* (smooth-barked apple), *Eucalyptus agglomerata* (blue-leaved stringybark), and *Allocasuarina torulosa* (forest oak). A dense shrub layer is often present. In Hornsby Shire, the species is most strongly associated with *E. agglomerata* open-forest at the interface between the lower Hawkesbury and upper Narrabeen Group strata (Ecological Surveys & Planning 1998).

Where new sites are located, site details including plant numbers, habitat and location should be recorded and forwarded to the OEH visit http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp.

### Life cycle of the species

The ecology of A. elegans is described in the recovery plan and summarised in the species profile.

Proposals that are likely to impact upon the life cycle of the species include those that contribute to the following:

• Loss of individuals

The significance of a particular activity that physically destroys individual plants will require an examination of the number of plants to be destroyed in relation to the size of the population and a discussion of how recruitment, gene flow and the overall health of the population will be affected. Translocation should not be considered as an appropriate means of compensating for the loss of individuals due to the uncertainty associated with the long-term survival of translocated plants.

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• Loss and fragmentation of habitat

As the breeding system of *A. elegans* is not well understood, the effects of loss and fragmentation of its habitat are not known. Destruction of habitat may place a local population at risk of extinction.

• Altered fire regimes

The response of adult plants of the species to fire is uncertain. Auld *et al.* (2000) have classed the species as fire sensitive, but with limited resprouting capability. Most observations to date are that plants are usually killed by fire (Maryott-Brown 1994). Proposals that result in the frequent burning (ie successive fires <10 years apart) of sites are considered likely to impact upon recruitment of the species. Recommended fire frequencies for the species are provided in the recovery plan.

• Modification of habitat

Development in close proximity to *A. elegans* sites is likely to cause modification of habitat through altered hydrological conditions, soil pH and nutrient levels, weed invasion, potential introduction of plant pathogens and altered fire frequency. Subsequent increases in pedestrian and/or vehicular traffic through sites may result in trampling, soil compaction, soil erosion and rubbish dumping. Other proposals that result in grazing, slashing, spraying or burning of *A. elegans* habitat are also likely to result in the modification of that habitat.

• Damage to the soil seedbank

Disturbances that will destroy or prevent germination of *A. elegans* seed include rubbish dumping, the removal of leaf litter and topsoil, weed invasion and spraying with residual herbicides that are capable of killing seeds in the soil. Frequent disturbances (from slashing, grazing, herbicide spraying or burning for example) may prevent the soil seed bank from being replenished.

### **Threatening processes**

There are seven key threatening processes listed in Schedule 3 of the NSW *Threatened Species Conservation Act 1995* (TSC Act) that are potentially relevant to A. elegans. These are:

- *Competition and habitat degradation by feral goats (Capra hircus)'*,
- 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands',
- 'Ecological consequences of high frequency fires',
- 'Bushrock removal',
- 'Infection of native plants by Phytophthora cinnamomi',
- 'Human-caused Climate Change' and
- *Clearing of native vegetation*', which has drastically reduced and fragmented the habitat of A. *elegans*.

Other threatening processes relevant to this species include slashing and herbicide spraying to maintain road verges, grazing and trampling by livestock, weed invasion, rubbish dumping (including green waste, household rubbish and construction materials) and the other disturbances associated with adjacent urban development.

### Viable local population of the species

The viable population size for *A. elegans* is unknown. In the absence of a detailed assessment demonstrating otherwise, all populations should be assumed to be viable.

### A significant area of habitat

Assessment of habitat significance for A. elegans requires consideration of the following:

- number of A. elegans plants present (including consideration of the soil seed bank),
- proportion of the local population present,

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- location in relation to the current distributional limits of the species,
- size, condition and connective importance of the habitat,
- uniqueness of habitat and
- management potential including the likelihood of ameliorating any existing threatening processes.

OEH considers that all viable populations of *A. elegans* occupy significant area of habitat until such time as adequate and representative examples are conserved across its range.

### Isolation/fragmentation

The distance between populations that will create genetic isolation is unknown because the pollen vectors for *A. elegans* are unknown. Seed dispersal is likely to be localised, despite the possibility of secondary dispersal by ants, so interaction via this mechanism is unlikely.

The clearing of interconnected or proximate areas of habitat for the species (or its pollen/seed vectors) is clearly undesirable as this may expose populations to an increased risk of genetic isolation and subsequent decline.

### **Regional distribution of the habitat**

The known distribution of *A. elegans* is confined to the Central Coast botanical subdivision of NSW as defined in the Interim Biogeographic Regionalisation of Australia (Thackway & Cresswell 1995).

### Limit of known distribution

*Asterolasia elegans* is endemic to and has a disjunct distribution within the hills north of Sydney. It occurs north of Maroota in the Central Coast botanical subdivision of NSW. The species' current known distribution equates to a linear range of less than 37 km and an extent of occurrence of approximately 22 km<sup>2</sup>. While it is possible that further populations occur within this area, the species still has a small total area of occupancy.

### Adequacy of representation in conservation reserves or other similar protected areas

A. elegans is not considered to be adequately represented in conservation reserves across its range.

### **Critical habitat**

Critical habitat has not been declared for A. elegans.

### For further information contact

Biodiversity Conservation Section, Metropolitan Branch, Environment Protection and Regulation Group, Office of Environment and Heritage, PO Box 1967, Hurstville NSW 2220. Telephone: 02 9585 6678. Internet: www.environment.nsw.gov.au

### References

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