

3 Lowland Woodland Flora

3.1

Introduction

Grassy woodland (10–30% projective foliage cover or 20–50% crown cover density) and grassy open woodland (less than 10% projective foliage cover or 2–20% crown cover density) are characterised by a discontinuous cover of trees, with grasses dominating the ground cover (see discussion in s. 2). Grassy woodland may also contain a shrub and sub-shrub (woody plants less than 0.5 m tall) layer. Woodland that has been subject to only minor disturbance contains a diversity of native forbs, including lilies, orchids, many daisies and other wildflowers, as well as sedges and rushes. More than 600 native species have been found during surveys conducted since 1991 by ACT and NSW government agencies in lowland woodlands and grasslands in the Southern Tablelands of NSW and ACT.

3.2

Lowland Woodland Flora of the ACT Region

Characteristic tree species in lowland woodlands in the ACT are Yellow Box (*Eucalyptus melliodora*), Blakely's Red Gum (*E. blakelyi*), Apple Box (*E. bridgesiana*), Snow Gum (*E. pauciflora*) and Candlebark (*E. rubida*). Other tree species that occur in these woodlands, but generally at slightly higher elevations or on rockier slopes are Broad-leaved Peppermint (*E. dives*), Bundy (*E. goniocalyx*), Mealy Bundy (*E. nortonii*), Red Box (*E. polyanthemos*) and Brittle Gum (*E. mannifera*). Where woodland merges into forest, Scribbly Gum (*E. rossii*) and Red Stringybark (*E. macrorhyncha*) become more common. Drooping She-oak (*Allocasuarina verticillata*), Kurrajong (*Brachychiton populneus*) and Acacias including Silver Wattle (*A. dealbata*), Green Wattle (*A. mearnsii*) and Hickory

Wattle (*A. falciformis*) are also found in lowland woodlands. Because of selective clearing and unequal capacities to regenerate, associations of species found today in some woodland patches may represent the mixing of marginal occurrences of previously adjoining and more integrated communities of these species (ACT Government 1999a).

The mid-layer of lowland grassy woodland is generally relatively sparse, but shrubs may become more dominant in woodlands on poorer soils or those that have been subjected to soil disturbance or fire. The mid-layer may also contain regenerating trees. Shrub species in grassy woodland include Lightwood (*Acacia implexa*), Blackthorn (*Bursaria spinosa* ssp. *lasiophylla*), *Cassinia* species, Burgan (*Kunzea ericoides*), Native Cherry (*Exocarpus cupressiformis*), Broom Bitter Pea (*Daviesia genistifolia*), Leafy Bitter Pea (*D. mimosoides*) and Australian Indigo (*Indigofera australis*). Common introduced species include Briar Rose (*Rosa rubiginosa*), Hawthorn (*Crataegus* spp.), Cotoneaster (*Cotoneaster* spp.) and Firethorn (*Pyracantha* spp.), which are often described as woody weeds.

The ground layer includes a wide range of perennial grasses, particularly Kangaroo Grass (*Themeda triandra*), wallaby grasses (*Austrodanthonia* species), spear grasses (*Austrostipa* species), Poa species (*Poa sieberiana* and *P. labillardieri*), Red-leg Grass (*Bothriochloa macra*) Weeping Grass (*Microlaena stipoides*) and, on poorer soils, Red-anther Wallaby Grass (*Joycea pallida*). There may also be a diversity of native forbs, including the more disturbance tolerant Yellow Buttons (*Chrysocephalum apiculatum*), Variable Plantain (*Plantago varia*), Common Woodruff (*Asperula conferta*), Bluebells (*Wahlenbergia* spp.) and peas including *Glycine* species and *Desmodium varians*. Moderately tolerant species include Billy Buttons (*Craspedia variabilis*), Riceflowers (*Pimelea* spp.) and lilies including Bulbine Lily (*Bulbine bulbosa*), Nodding Chocolate Lily (*Dichopogon*

fimbriatus) and Early Nancy (*Wurmbea dioica*). In sites that have been least modified, species most sensitive to disturbance can be found, including the Sun Orchids (*Thelymitra* spp.), Diuris orchids (*Diuris* spp.) and Greenhoods (*Pterostylis* spp.).

Sub-shrubs are often present in the ground layer. These include Bush Peas (*Dillwynia* spp., *Pultenaea* spp. and *Bossiaea* spp.), Bitter Cryptandra (*Cryptandra amara*), Urn Heath (*Melichrus urceolata*), Peach Heath (*Lissanthe strigosa*), Grey Guinea Flower (*Hibbertia obtusifolia*) and Ivy Goodenia (*Goodenia hederacea*).

Cryptogams, which include bryophytes (e.g. mosses, liverworts, hornworts), lichens and fungi are a significant component of woodlands. They can establish extensively in areas devoid of vascular plants, and species vary across sites depending upon levels of modification. Cryptogams provide habitat for soil fauna, facilitate nutrient cycling and absorption of water, and reduce soil erosion (Eldridge and Tozer 1997).

Woodland sites contain a variety of introduced species, both weeds (adventitious) and introduced pasture species. These include annual and perennial grasses, herbaceous species and woody weeds. The types of introduced species and degree of invasion into a site depend on past levels and types of disturbance as well as susceptibility to invasion (such as proximity to urban areas and roads). Annual species can fluctuate significantly in cover and diversity between seasons and years.

3.3

Surveys in Lowland Woodland in the ACT

Over many years, particular species or specific sites in ACT lowland woodlands have been surveyed for a range of purposes and using a diversity of techniques. Prior to 1995 most information on the distribution of woodland vegetation was based on extrapolation from surveys that were limited in scope. There was little information about the condition of the woodlands.

In 1995–97 a preliminary assessment of the extent and quality of remnant woodland vegetation in the ACT identified important areas of high quality woodland (Ingwersen *et al.* 1997). Woodland patches were identified on air photos, and defined as polygons (survey units) on the basis of uniformity of tree cover. These polygons were then surveyed in the field and

the data provided the information base for Action Plan 10 (Yellow Box–Red Gum Grassy Woodland) (ACT Government 1999a). Additional surveys using the same methods were undertaken in 1998–99.

Action Plan 10 (ACT Government 1999a) identified the need to undertake more detailed floristic surveys of remnant woodland patches to improve the assessment of the botanical significance of the understorey and to evaluate secondary grassland areas. These were commenced in 2001 and 2002 in parts of East Gungahlin, Kinlyside, North Gungahlin, south and east Belconnen, Coolamon Ridge, Jerrabomberra Valley and North Watson. Native woodland areas on land managed by ACT Forests in Stromlo and Isaacs were also surveyed. Polygons used in these surveys were similar to the earlier polygons, but were modified where necessary to reflect more accurately the homogeneity of vegetation composition and structure.

Other data were collected on the characteristics, condition and habitat features of sites, including tree and shrub structure, fallen timber, rockiness and water courses. Records were made of animals that were sighted, heard or where there was evidence of their presence. A condition rating of the vegetation has also been developed using attributes of vegetation structure, species composition and habitat disturbance.

For those areas where new information has not yet been obtained (Tuggeranong–Naas, Majura Valley, Kowen and river corridors), data from surveys undertaken between 1995 and 1999 have been used in this *Strategy*. In these surveys less detailed data on the understorey and habitat features were collected and consequently no vegetation condition rating comparable with the later, more comprehensive data is available. This deficiency will be corrected progressively.

In this *Strategy*, descriptions of the distribution of lowland woodland across the ACT and the condition of woodland sites are based on surveys undertaken between 1995 and 1999 and more detailed surveys undertaken in 2001 and 2002. Details of the methods used, analyses undertaken, and the results of the surveys can be obtained from Environment ACT (Wildlife Research and Monitoring).

While the new surveys did not attempt to provide a complete species inventory, or to assess their abundance, the polygons were adequately surveyed to allow for interpretation of the extent to which sites are likely to have been modified. This was based on the

diversity and abundance of species that have been identified as sensitive to disturbance. Studies undertaken by Prober and Thiele (1995) and Dorrough (2002) have described which species occur more frequently in grazed and ungrazed areas. Plant ecologists from Environment ACT and the NSW Department of Environment and Conservation have been analysing the frequency with which native species have been encountered during grassland and woodland surveys in over 700 sites in the ACT and NSW Southern Tablelands since 1991. These studies have provided information on those species that are less common, and those that appear to have declined as a result of site disturbance. Table 3.1 lists examples of these species.

The data were analysed to assess the condition of remaining woodland remnants in relation to altitude. The data show that remnants that occur at lower altitudes (below 625 m) are likely to be more modified than the remnants at higher altitudes. Remnants occurring at higher altitudes (above 875 m) are unlikely to be highly modified.

3.4

Threatened Lowland Woodland Communities and Plant Species in the ACT

3.4.1 Conservation Goal

Consistent with the requirements for threatened species in the *Nature Conservation Act 1980*, one of the two goals adopted for the *Lowland Woodland Conservation Strategy* is to:

Conserve in perpetuity, viable, wild populations of all lowland woodland flora and fauna species in the ACT and support regional and national efforts towards conservation of these species (including declared threatened species).

From the discussion in Section 2.3 of changes to woodland since European settlement and ongoing threats, it is evident that woodland flora will be advantaged by the conservation of large areas of woodland with the least amount of disturbance, low perimeter/area ratios, and some buffer from incompatible adjacent land uses. ACT woodlands bear the legacy of high levels of disturbance in the past reflected in fragmentation, weed invasion, selective removal of species and changes in the tree cover e.g. lack of regeneration.

This part of the *Strategy* gives particular consideration to the ecological community and two woodland plant

species currently declared as threatened under ACT legislation. Following this, specific conservation objectives and/or actions are outlined for two species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth), and for Snow Gum woodland, eucalypt outliers, and a number of uncommon and rare woodland species.

Objectives and actions for the *Strategy* related to woodland flora are contained in Table 6.1. More detailed actions are outlined in this section and will be developed further by responsible agencies, often with community involvement, and refined over time as more information is gained (as part of 'adaptive management', see s. 5.9.2).

3.4.2 Tablelands and Slopes Yellow Box–Red Gum Grassy Woodland Endangered Ecological Community

On the recommendation of the ACT Flora and Fauna Committee, Yellow Box–Red Gum grassy woodland was declared an endangered ecological community in 1997 under the *ACT Nature Conservation Act 1980*. The ACT Flora and Fauna Committee takes account of the bioregional context when considering nature conservation issues in the ACT. While Yellow Box–Red Gum grassy woodland can still be found across the ACT, the Committee recommendation to declare it an endangered ecological community recognised its threatened status regionally (Landsberg 2000).

The Flora and Fauna Committee adopted the following definition in recommending the Yellow Box–Red Gum grassy woodland as an endangered ecological community:

Yellow Box–Red Gum Grassy Woodland is an open woodland community in which either or both of Yellow Box *Eucalyptus melliodora* and Blakely's Red Gum *E. blakelyi* are usually present and commonly dominant or co-dominant. Apple Box *E. bridgesiana* is a frequent associate. The trees form an open canopy above a species-rich understorey of native tussock grasses, herbs and scattered shrubs. The combination results in a variegated mosaic of vegetation patches with features that are transitional between forest and grassland, and the community is frequently interspersed with these other vegetation types. Yellow Box–Red Gum Grassy Woodlands are utilised by a large number of animal species. The name of this ecological community (Yellow Box–Red Gum Grassy Woodland) is intended to encompass the dominant trees of the upper stratum, the characteristic plants of the understorey and the characteristic animals that interact with the vegetation complex.

Table 3.1: Species Typical of Different Levels of Disturbance in Lowland Woodland

Degree of Disturbance	Ground Layer Species	Examples of Characteristic Species	Typical Flora of the Ground Layer
Very low	<i>Disturbance sensitive species</i>	<i>Diuris</i> spp., <i>Caladenia</i> spp., <i>Thelymitra</i> spp.	Native species include orchids, lillies and other highly sensitive species, as well as more tolerant species
Low	<i>Moderately disturbance tolerant species</i>	<i>Dichopogon</i> spp., <i>Bulbine bulbosa</i> , <i>Craspedia variabilis</i> , <i>Cryptandra amara</i> , <i>Themeda triandra</i> , <i>Pimelia</i> spp., <i>Wurmbea dioica</i>	Species present include those moderately tolerant of disturbance, as well as disturbance tolerant species
Moderate	<i>Disturbance tolerant species</i>	<i>Chrysocephalum apiculatum</i> , <i>Convolvulus erubescens</i> , <i>Plantago varia</i> , <i>Asperula conferta</i> , <i>Glycine</i> spp., <i>Hibbertia obtusifolia</i>	Native species include those commonly found in a range of sites that have been subject to moderate disturbance; sensitive species are rarely present.
High	<i>Disturbance tolerant native grasses</i>	<i>Poa</i> spp., <i>Austrodanthonia</i> spp., <i>Austrostipa</i> spp., <i>Bothriochloa macra</i> , <i>Microlaena stipoides</i>	Site may contain a variety of native grass species but few or no native forbs are present.
Very high	<i>Exotic species</i>	Perennial and annual* weeds, introduced or adventitious species.	Either dominated by perennial exotic species or a low cover and diversity of native species, of which most are native grasses

* Because annual exotic species fluctuate in cover and diversity between seasons and years, they are not used in the evaluation of the degree of disturbance although generally there is a greater cover of annual exotic species in the more disturbed sites.

In Action Plan 10, the Yellow Box–Red Gum Grassy Woodland endangered ecological community was described as having the following characteristics:

- (a) *E. melliodora* and/or *E. blakelyi* contribute 40% or more of the crown cover;
- (b) There is a species-rich understorey of native tussock grasses, herbs and scattered shrubs. The understorey is not exotic pasture or degraded beyond recovery.
- (c) Remnants are not isolated trees or clumps. (ACT Government 1999a)

Since 1999 the definition of the ecological community has been modified to explicitly include secondary grassland. This effectively replaces part (c) above with:

- (c) Remnants of Yellow Box–Red Gum Grassy Woodland that contain a species-rich native understorey of native tussock grasses, herbaceous species and scattered shrubs but the trees have been removed or reduced.

As part of this *Lowland Woodland Conservation Strategy*, it is the Yellow Box–Red Gum Grassy Woodland endangered ecological community that requires the preparation of an Action Plan under the *Nature Conservation Act 1980*.

Species diversity, functional integrity and resilience to disturbance and/or weed invasion need to be considered when determining whether a remnant is part of the listed community. Many Yellow Box–Red Gum Grassy Woodland remnants have been reduced to Yellow Box and or Red Gum trees over either exotic pasture or highly degraded understorey. In most of these areas, although some native species may remain in the understorey, the native soil seed store is likely to have been lost, as many woodland plants do not produce a long-lived seed bank. Without the injection of substantial resources, and even then for uncertain outcomes, the proportion of native species remaining at these sites is too low for restoration work to be able to successfully re-establish the ecological community. Other areas that contain trees over a less modified understorey or where trees have been cleared but the understorey is more intact (for example sites that may be grazed but have been subject to lower levels of soil disturbance) can be expected to contain a native seed store and a greater diversity of fauna, and are likely to regenerate naturally with a change in management. An injection of resources facilitate this regeneration is likely to be effective in increasing species diversity, functional integrity and resilience to disturbance.

There is a continuum from partially modified lowland woodland to remnant trees with no native understorey or to secondary grassland where the trees have been totally or mostly removed (Table 2.3). However, as Yellow Box-Red Gum Grassy Woodland is declared an endangered ecological community under the *Nature Conservation Act 1980*, a decision has to be made as to whether any particular woodland area retains sufficient characteristics of that community for the legislation to apply.

Other woodlands (Tablelands Valley Snow Gum Grassy Woodland, low elevation Dry Shrubby Box Woodland), former woodland community now with exotic understorey, isolated groups of trees, and individual trees with exotic understorey, which do not meet the definition of the grassy woodland ecological community are not the subject of the formal Action Plan. However, these areas should not be devalued, as they are significant ecological resources of the ACT. They may contain threatened flora or fauna, provide habitat for particular species, form important buffers or provide connectivity between remnants, and are therefore included in this *Strategy*. The *Strategy* recognises that these woodland areas also may have aesthetic and recreational value to local residents.

3.4.3 Threatened Plant Species in ACT Lowland Woodland

Some plant species that naturally occur in lowland woodland in ACT region have become uncommon or threatened with extinction as a result of loss and/or modification of the woodland habitat. Three of these species are declared endangered under the *Nature Conservation Act 1980*. These are:

- (a) A leek orchid (Tarengo Leek Orchid)
Prasophyllum petilum
- (b) Small Purple Pea *Swainsona recta*
- (c) Button Wrinklewort *Rutidosia leptorrhynchoides*

Prasophyllum petilum and *Swainsona recta* Action Plans are included in this *Lowland Woodland Conservation Strategy*, as grassy woodland is the only habitat for these two species in the ACT. *Rutidosia leptorrhynchoides* is generally considered to be a herb of Natural Temperate Grassland although in the ACT it occurs on the margins of Yellow Box-Red Gum Grassy Woodland. Populations at Red Hill, Stirling Park and State Circle are found within grassy woodland. The largest population at Stirling Park occupies open areas within the woodland, especially previously disturbed areas and patches with skeletal soils. *Rutidosia leptorrhynchoides* will be included in a

lowland grassland conservation strategy to be prepared in 2004.

Action Plans pursuant to the *Nature Conservation Act 1980* were adopted for these species in 1997 and 1998 (ACT Government 1997b, 1998b). Other declarations of these species are summarised in Table 3.2.

Table 3.2: Conservation Status Nationally of ACT Threatened Lowland Woodland Plant Species

	ACT	NSW	Other
Tarengo Leek Orchid	E (SPSS)	E	E (Cwlth)
Small Purple Pea	E (SPSS)	E	E (Cwlth), T(E) (Vic.) ¹

E: Endangered; SPSS: Special Protection Status Species (ACT);
T: Threatened

1. The conservation status of the species in Victoria is 'endangered' and it is listed as 'threatened' under the *Flora and Fauna Guarantee Act 1988* (Victorian Department of Natural Resources and Environment 2000)

Legislation:

Commonwealth: *Environment Protection and Biodiversity Conservation Act 1999*

ACT: *Nature Conservation Act 1980*

NSW: *Threatened Species Conservation Act 1995*

Vic.: *Flora and Fauna Guarantee Act 1988*

3.4.4 Tarengo Leek Orchid (*Prasophyllum petilum*)

Tarengo Leek Orchid was declared an endangered species in 1996 under the *Nature Conservation Act 1980* (ACT). It is a rare orchid of grasslands and grassy woodlands of the Southern Tablelands of NSW and the ACT. In the ACT the species is known only from the Hall Cemetery where it was first collected in 1965, but not formally described as a new species until 1991. It has subsequently been found in two sites in NSW (NSW NPWS 2003). Based on population counts between 1995 and 2002, the Hall Cemetery population may be in decline. Further details of the species including distribution and abundance, habitat and ecology are contained in APPENDIX 1.

Planning principles and guidelines for Hall Cemetery are set out in the *Master Plan for the Village of Hall* (PALM 2001) and the cemetery is included in the Hall Village Precinct that was entered on the ACT Heritage Places Register in 2001. Both the Master Plan and the Heritage Register are part of the Territory Plan. A management protocol for the orchid at Hall Cemetery was outlined in Action Plan 4 (ACT Government 1997b).

THREATS TO ACT POPULATION

Threats to survival of this species at Hall Cemetery have been identified as:

- (a) **Small population:** The population count has varied between 90 and 22 since 1995 when detailed monitoring began; with the count in 2003 being 63 plants.
- (b) **Mechanical injury:** The Tarengo Leek Orchid population in the ACT is located within an active cemetery where ground disturbance for burials could remove a group of plants with potentially serious consequences for the population as a whole. However, new initiatives by the ACT Cemeteries Trust to extend the cemetery may reduce pressure on existing plants in the future.
- (c) **Competition from other native species:** Tarengo Leek Orchid occurs in a vigorous sward of Kangaroo Grass (*Themeda triandra*) that potentially may impact on the orchid's establishment and/or flowering.
- (d) **Weed invasion:** The introduced grasses Sweet Vernal Grass (*Anthoxanthum odoratum*) and Yorkshire Fog (*Holcus lanatus*) are abundant and increasing in the cemetery. Other introduced perennial species may also be increasing. Potentially, horticultural introductions may also pose a problem.
- (e) **Herbicides:** Tarengo Leek Orchid may be affected by herbicides used to treat weeds and control plant growth around graves.

SPECIFIC CONSERVATION OBJECTIVES

- Preserve the existing ACT population as one of the only three known natural populations where the species survives.
- Maintain as diverse a gene pool as possible consistent with the limitations imposed by only three sites of occurrence.
- Develop successful propagation techniques.
- Provide opportunities for research and enjoyment of the species in the ACT.
- Foster an appreciation of both the natural and cultural heritage values of the Hall Cemetery.

CONSERVATION ACTIONS

Information

- Maintain alertness to the possible presence of the species while conducting woodland surveys.
- Continue to monitor flowering of the Tarengo Leek Orchid to provide information and guidance for cemetery management.

Protection and Management

- Finalise a management plan based on accurate mapping of the location of the plants.
- Coordinate management actions by the ACT Cemeteries Trust with Environment ACT.
- Implement the policy in the Master Plan for the Village of Hall, p.18 (PALM 2001) which seeks an alternative location for future burials and minimise future burials within the Hall Cemetery.
- Undertake remedial weeding in orchid habitat.

Monitoring and Research

- Continue monitoring of the Tarengo Leek Orchid at the Hall Cemetery and undertake analysis to assist in management.

National and Regional Cooperation

- Liaise with the National Recovery Team for Tarengo Leek Orchid and ensure actions undertaken at Hall Cemetery are consistent with achieving national recovery of the species.
- Provide information from monitoring at Hall Cemetery to the Recovery Team.
- Ensure that visitors to the cemetery understand and comply with conservation requirements in and around specific grave sites.

3.4.5 Small Purple Pea (*Swainsona recta*)

Small Purple Pea was declared an endangered species in 1996 under the Nature Conservation Act 1980 (ACT) and its conservation status nationally is shown in Table 3.2. It is a small slender erect perennial plant with purple or bluish flowers. Formerly widespread from north-eastern Victoria to central-western NSW, its range has been drastically reduced. The Canberra–Williamsdale (NSW) area is one of the two remaining population clusters. Another, very small population of the species was discovered in Aranda bushland in October 2003. Further details of the species including ACT listing, distribution and abundance, habitat and ecology are contained in APPENDIX 1.

THREATS TO ACT POPULATIONS

Throughout the local region the Small Purple Pea is at risk from habitat loss and degradation due to agricultural practices, urban development, changes in grazing pressures and competition from invading weeds and understorey species that flourish under prevailing fire frequencies or biomass reduction programs. The small and fragmented nature of ACT

populations makes each susceptible to destruction from a single catastrophic event.

SPECIFIC CONSERVATION OBJECTIVE

Maintain viable populations of the Small Purple Pea as a component of the indigenous biological resources of the ACT and as a contribution to the regional and national conservation of the species.

CONSERVATION ACTIONS

Information

- Maintain alertness to the possible presence of the species while conducting other surveys.

Protection and Management

- Maintain or increase the size of the Mt Taylor, Kambah and Aranda populations through effective management.
- Evaluate the feasibility of increasing the population at Kambah and Aranda by introducing new material or artificially germinating seed in-situ.
- Maintain collections of viable seed at the National Botanic Gardens Herbarium.
- Develop management plans and implementation timetables for the three sites.

Monitoring and Research

- Maintain monitoring programs for the Mt Taylor, Kambah and Aranda populations.
- Participate in and support research on the monitoring of populations in the ACT and adjacent areas in NSW.
- Investigate further the criteria for optimal timing and frequency of burns.

National and Regional Cooperation

- Participate in a regional and multi-agency effort to increase knowledge of the biology and conservation requirements of the species so that management can be improved.
- Participate in the National Recovery Team.
- Ensure that lessees and maintenance crews responsible for land adjacent to the populations of the Small Purple Pea along the Tralee/Williamsdale railway and road easement are aware of the species, and do not damage it directly or indirectly.

3.5

Conservation of Other Uncommon Plant Species/Communities in the ACT

3.5.1 Austral Toadflax (*Thesium australe*)

CONSERVATION STATUS

Vulnerable: *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).

Vulnerable: *Threatened Species Conservation Act 1995* (NSW).

Threatened (endangered): *Flora and Fauna Guarantee Act 1988* (Vic.) and Victorian Department of Natural Resources and Environment (2000).

Vulnerable: *Nature Conservation Act 1992* (Qld).

Extinct: Tasmania.

DESCRIPTION, DISTRIBUTION AND ECOLOGY

Austral Toadflax is a hairless, yellowish–green perennial herb to 40 cm high (Eddy *et al.* 1998). Flowers are small and inconspicuous, greenish–yellow. The species is found on a variety of soil types over a wide range of altitudes in grassland, grassy woodland and grassy heath. It appears to be strongly associated with a Kangaroo Grass dominated herbaceous understorey. It is a semi-parasite, deriving water and mineral salts from the roots of other plants (Scarlett 1980). Attempts to germinate seed from the ACT populations have been unsuccessful (Briggs and Leigh 1985).

The species is likely to have been once widespread but always rare, occurring from Victoria to Queensland and in Tasmania. Remaining populations are found on the tablelands and coastal areas from southern Queensland to the south coast of NSW, in central and southwest Victoria. It formerly occurred in eastern Tasmania. The species has recently been surveyed on the Victorian Open Grounds, where there were 1.6 million plants present that year (Prober and Thiele 1998). New populations have been recently found in NSW (Prober pers. comm.). All known populations in the ACT occur in nature reserves (Mulligans Flat Nature Reserve, Kambah Pool Reserve, Tidbinbilla Nature Reserve (two populations) and Namadgi National Park).

THREATS TO ACT POPULATIONS

The small localised nature of occurrences and small population numbers make the local populations vulnerable to destructive events. Other threats are heavy grazing (stock, rabbits, kangaroos and grasshoppers) and the development of dense shrub or tree cover.

SPECIFIC CONSERVATION OBJECTIVE

Maintain the known populations of Austral Toadflax.

CONSERVATION ACTIONS

Information

- Maintain alertness to the possible presence of the species while conducting surveys in appropriate habitat (e.g. Kangaroo Grass in grassy woodlands).

Protection and management

- Prepare management guidelines for each of the populations.
- Ensure known populations are protected from inadvertent damage. (The Kambah Pool site is fenced to control any stock grazing).
- Manage sites to retain an open vegetation structure while minimising grazing damage from kangaroos or rabbits.
- Consider nomination for ACT listing if the species shows evidence of local decline in extent and abundance.

Monitoring and Research

- Facilitate and encourage research that will assist in maintaining the species and developing management guidelines.
- Investigate the impacts of burning.

National and Regional Cooperation

- n Liaise with the NSW Department of Environment and Conservation and the Victorian Department of Sustainability and Environment to increase knowledge of the biology and conservation requirements of the species so that management can be improved.

3.5.2 Hoary Sunray (*Leucochrysum albicans* var. *tricolor*)

CONSERVATION STATUS

Endangered: *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).

Endangered: *Threatened Species Protection Act 1995* (Tasmania).

DESCRIPTION, DISTRIBUTION AND ECOLOGY

The Hoary Sunray is a low tufted to mounding perennial, to 30 cm tall, which flowers in spring and summer. The flowerhead is an everlasting daisy, commonly white in the Canberra region and yellow to the east of Canberra (Eddy *et al.* 1998). The species is usually found in ungrazed and lightly grazed areas, along roadsides in particular. It appears to be very sensitive to grazing, but responds to disturbance as a coloniser and appears to tolerate mowing. The species occurs from Queensland to Victoria and in Tasmania. In NSW it is distributed on the inland slopes and plains including grassland on the Monaro. In the ACT Hoary Sunray can be seen in spring in abundance on the roadside along Fairbairn Avenue and into Mt Ainslie Nature Reserve, on the western slopes of Mt Majura and adjacent to the Federal Highway road easement.

THREATS TO ACT POPULATIONS

Hoary Sunray does not tolerate moderate to heavy grazing and is vulnerable to weed invasion along roadsides.

SPECIFIC CONSERVATION OBJECTIVE

Maintain Hoary Sunray populations.

CONSERVATION ACTIONS

Information

- Maintain a database of known occurrences and abundance to enable analysis of changes in distribution and abundance.

Protection and Management

- Maintain populations through management of grazing pressure.
- Control invasive weeds on roadsides, especially Chilean Needle Grass (*Nassella neesiana*) on Fairbairn Avenue.
- Consider ACT listing if the species shows evidence of local decline in extent and abundance.

Monitoring and Research

- Maintain a watching brief on the ACT populations of the Hoary Sunray.

National and Regional Cooperation

- Liaise with interstate agencies that are involved in protection and management of the species.

3.5.3 Lowland Snow Gum Woodland

Very few areas of lowland Snow Gum woodland remain in the ACT. Snow Gum woodland typically occurs on the fringe between woodland and lowland

native grassland in frost hollows, where low winter temperatures limit the growth of trees. The common trees in these woodlands are Snow Gum (*E. pauciflora*) and Candlebark (*E. rubida*). The pre-1750 distribution and extent of these woodlands is unclear, as remnant stands of trees or the community occur only in scattered areas.

The most significant patches of lowland Snow Gum woodland that remain in the ACT are in Aranda Bushland (0.6 ha), Gungaharra Reserve (0.3 ha), Gungahlin Central (9.2 ha in three areas) and Kinlyside (4.6 ha in two patches). Remnants of lowland Snow Gum woodland, indicating previous occurrences of this community, occur in the Jerrabomberra Valley, Gungahlin (Harcourt Hill), Campbell and Reid (south of the War Memorial and pockets on Mt Pleasant) and Belconnen (Glenloch Interchange). These remnants are characterised by a few remaining trees usually over an exotic understorey.

Lowland Snow Gum woodland, which forms an ecotone between Natural Temperate Grassland and Yellow Box–Red Gum Grassy Woodland, is a different community from Snow Gum woodland that occurs in montane valleys and at higher elevations in the western parts of the ACT. Extensive areas dominated by Snow Gum and Black Sally (*E. stellulata*), a common co-dominant, occur in the Naas Valley and Tidbinbilla areas.

SPECIFIC CONSERVATION OBJECTIVE

The existing areas of lowland Snow Gum woodland that are partially or moderately modified are maintained in a viable state in perpetuity.

CONSERVATION ACTION

- Prioritise for protection and management all remaining lowland Snow Gum woodland areas.
- Monitor the condition of these remnants.
- Consider listing as a threatened ecological community under ACT legislation.

3.5.4 Eucalypt Outliers

There are three naturally occurring woodland eucalypt species in the ACT that are geographic outliers of their species. These are:

- White Box (*Eucalyptus albens*) which is found mainly to the north and west of the ACT (one tree on 'Huntly' property in the Bulgar Creek land unit. This was burnt in the bushfires of January 2003 (Carey *et al.* 2003)).

- River Red Gum (*E. camaldulensis*) which is common along river banks in inland NSW and Victoria (one tree south of Tharwa).
- Black Gum (*E. aggregata*) that is found in scattered groups on lower slopes near streams (frost hollows) to the east and south of the ACT in NSW and Victoria (one clump of several trees along Kings Highway in the Kowen area, extreme east of the ACT).

SPECIFIC CONSERVATION OBJECTIVE

Protect existing trees or groups of trees that are outliers of their species and encourage regeneration.

CONSERVATION ACTIONS

- Maintain a register of trees.
- Fence off outlier trees to protect from trampling or other damage.
- Carry out weeding as required.

3.5.5 Other Uncommon Species

Some species in lowland woodland in the ACT are naturally rare or have become uncommon due to clearance or modification. Achievement of the objectives of this Strategy (especially with regard to protection and management of lowland woodland) should ensure the conservation of rare and uncommon species, however, some species may require specific management to ensure their long-term viability.

Plants that are regarded as uncommon in the region and occur in woodlands in the ACT include Zornia (*Zornia dictiocarpa*), Australian Anchor Plant (*Discaria pubescens*), Cullen species, particularly Emu-foot (*Cullen tenax*), Mountain Swainson-pea (*Swainsona monticola*), Silky Swainson-pea (*S. sericea*), Wedge Diuris (*Diuris dendrobioides*), Purple Diuris (*D. punctata* var. *punctata*), Hairy Buttons (*Leptorhynchus elongatus*), Austral Trefoil (*Lotus australis*), Yam Daisy (*Microseris lanceolata*), Picris species, a milkwort (*Polygala japonica*) and Wild Sorghum (*Sorghum leiocladum*) (Crawford 1995, Prober pers. comm.). Further analyses of information from regional surveys and publication of this information will assist in identifying the uncommon species (including outliers) and their habitat requirements. This will facilitate the identification of sites that may require specific management.

SPECIFIC CONSERVATION OBJECTIVE

Rare and uncommon species in ACT lowland woodland are maintained in viable populations in perpetuity.

CONSERVATION ACTIONS

- Maintain a database of known occurrences of populations and abundance of rare or uncommon species, to allow for analysis of any changes in distribution and abundance.
- Consider ACT listing if any rare or uncommon species are declining in extent, sites are threatened or are being destroyed.