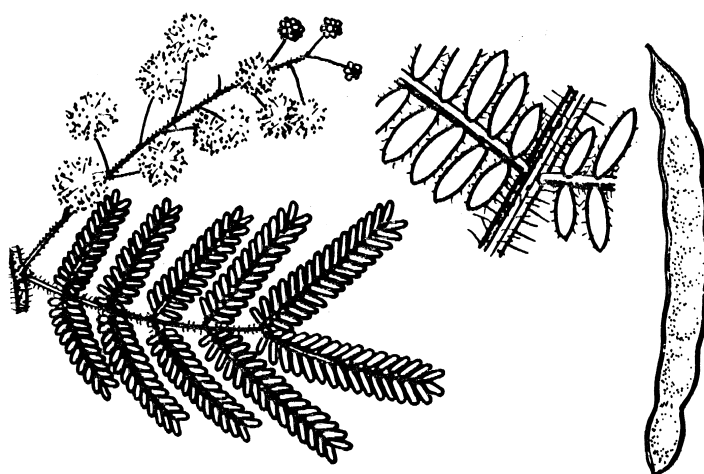


Acacia pubescens

(Downy Wattle)

Recovery Plan



February 2003

NSW
NATIONAL
PARKS AND
WILDLIFE
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***Acacia pubescens* (Downy Wattle)**
Recovery Plan

**Prepared in accordance with the New South Wales
Threatened Species Conservation Act 1995 and the Commonwealth
*Environment Protection and Biodiversity Conservation Act 1999***

March 2003

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The plan was prepared with assistance of a Recovery Team, consisting of Sarah Burke (NPWS), Teresa James (formerly Royal Botanic Gardens), Edgar Freimanis (Ecohort Environmental Consultants), George Curtis (Western Sydney Regional Organisation of Councils), Adrian Johnstone (NPWS), Peter Semple (Railway Services Authority), Paul Kravchenko (Nature Conservation Council), Matt Gray (DLWC) and Matt Hodgkis (Sydney Water).

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Foreword

The conservation of threatened species, populations and ecological communities is crucial for the maintenance of this State's unique biodiversity. In NSW, the *Threatened Species Conservation Act 1995* (TSC Act) provides the framework to conserve and recover threatened species, populations and ecological communities through the preparation and implementation of recovery plans.

The preparation and implementation of recovery plans is identified by both the National Strategy for the Conservation of Australia's Biological Diversity and the NSW Biodiversity Strategy as a key strategy for the conservation of threatened flora, fauna and invertebrates. The object of a recovery plan is to document the research and management actions required to promote the recovery of a threatened species, population or ecological community and to ensure its ongoing viability in nature.

This plan describes our current understanding of *Acacia pubescens*, documents the research and management actions undertaken to date, and identifies the actions required and parties responsible to ensure the ongoing viability of the species in the wild.

The *Acacia pubescens* Recovery Plan was prepared with the assistance of a recovery team comprising relevant land management and other government interests, and was placed on exhibition from April to June 2001. I thank these people for their efforts to date and I look forward to their continued involvement in the implementation of recovery actions identified in this plan.



BOB DEBUS MP

Minister for the Environment

Executive Summary

Introduction

Acacia pubescens (Vent.) R. Br., Fabaceae (Mimosoideae) is a spreading to slightly weeping shrub 1-5 m high with bipinnate leaves and conspicuously hairy branchlets. It is chiefly restricted to the Cumberland Plain, with recordings from Bardwell Valley to Oakdale and Mountain Lagoon.

Current Conservation Status

A. pubescens has been recorded at 195 sites but is currently known from 151 sites, in the following local government areas: Auburn, Bankstown, Baulkham Hills, Blacktown, Canterbury, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Rockdale, Strathfield, Sutherland and Wollondilly. Only five of these 151 sites occur in conservation reserves. There are many threats to the species, including loss of habitat, degradation of habitat (through weed invasion, mechanical damage, rubbish dumping, track creation, inappropriate fire regimes), disease and hybridisation. This species is considered to be vulnerable as its distribution is highly fragmented and it largely occurs on land where the future use is likely to change and threaten its continued survival. *A. pubescens* is listed as a vulnerable species on Schedule 2 of the New South Wales *Threatened Species Conservation Act 1995* and is listed on Schedule 1 Part 2 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Legislative context

The TSC Act is NSW's legislative framework to protect and encourage the recovery of threatened species, populations and communities. Under the TSC Act, the Director-General of National Parks and Wildlife has certain responsibilities including the preparation of recovery plans for threatened species, populations and ecological communities. This Recovery Plan has been prepared in accordance with the provisions of the TSC Act.

Preparation of Plan

This Recovery Plan has been prepared with the assistance of a recovery team, a non-statutory group of interested parties with relevant expertise, established to discuss and resolve issues relating to the plan. Components within the plan do not necessarily represent the views nor the official positions of all the individuals or agencies represented on the recovery team. The information in this Recovery Plan was accurate to the best of the NPWS' knowledge on the date it was approved.

A draft of this Recovery Plan was placed on public exhibition from 6 April to 1 June 2001. Ten submissions were received. The comments of the NSW Scientific Committee were also sought and this plan was finalised in view of these comments (see Appendix 5 for a summary of the advice provided by the NSW Scientific

Committee).

The plan will be reviewed and updated 5 years from the date of publication.

Implementation of Plan

The TSC Act requires that public authorities must not undertake actions that are inconsistent with a recovery plan. The government agencies relevant to this plan are the NPWS, Councils (Auburn, Bankstown, Baulkham Hills, Blacktown, Canterbury, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Rockdale, Strathfield, Sutherland and Wollondilly), the Department of Land and Water Conservation, the Department of Employment Education and Training, Rail Infrastructure Corporation, Roads and Traffic Authority, State Rail Authority, Sydney Catchment Authority and Sydney Water. Consequently, these land managers must manage *A. pubescens* in accordance with the approved plan.

The TSC Act amends to the environmental assessment provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) require that consent and determining authorities consider relevant recovery plans when exercising a decision making function under Parts 4 & 5 of the EP&A Act. Consent and determining authorities, when considering any development or activity which may affect *A. pubescens*, must consider the conservation strategy outlined in this plan. These authorities may be assisted by the guidelines for environmental assessment that have been included as Appendix 3 of this plan.

The TSC Act requires that public authorities identified in a recovery plan as responsible for the implementation of measures included in the plan, must report on actions that have been implemented in its annual report to Parliament. Likewise, Councils must report on implementation in their state of the environment report.

Recovery objectives

Overall objective

The overall objective of the recovery plan is to prevent the status of *Acacia pubescens* from becoming endangered, by reducing habitat loss and by implementing management regimes aimed at maintaining representative populations across the species' range.

Overall Performance Criteria

The overall performance criteria of the recovery plan is that the risk of the species becoming endangered is reduced, through the implementation of recovery actions.

Specific Objectives

Specific objectives of the plan are:

- to ensure that a representative sample of *A. pubescens* populations occurring on public and private lands are protected from habitat loss and managed for conservation;
- to reduce the impacts of threats at sites across the species' range;
- to ensure that any planning and management decisions that are made which affect the species, are made in accordance with the recovery objectives of this plan;
- to understand the biology, ecology, health and distribution of the species including the range of genetic variation;
- to develop the awareness and involvement of the broader community in the species and its conservation; and
- to re-assess the conservation status of the species.

Performance Criteria

Performance criteria are that:

- the number of sites that are afforded legislative protection is increased from 11 sites to 18 sites within the first 5 years (i.e. by 2008). The sites to be protected will be distributed across the total range of the species, to maximise conservation of genetic diversity.
- threat and habitat management programs that have been prepared and are being implemented at 62 sites by 2008.
- conservation of the species is facilitated through appropriate planning and management decisions.
- a research program to investigate currently unknown aspects of biology, ecology, health and distribution is implemented and this information is used in management of the species;
- stakeholders are informed about the species and involvement of stakeholders in conservation programs is increased; and
- assessment of the conservation status is undertaken, based on accurate information about the management of and threats to the species.

Recovery Actions

The plan consists of 13 recovery actions which aim to meet the overall objective. These actions include:

- identify sites that are a high priority to protect;
- carry out negotiations with public authorities to increase protection of sites;
- liaise with private landholders to increase protection of sites;
- negotiate with public authorities to implement threat and habitat management programs on public lands;
- informed environmental assessment and planning decisions are made;

- undertake studies into the genetic variability of the species;
- investigate the cause of disease in the species;
- research other aspects of the species' biology, ecology and distribution;
- encourage community involvement;
- provide advice and assistance to private landholders;
- maintain a database on the species;
- NPWS to be advised of any consents or approvals which affect *A. pubescens*;
and
- re-assess conservation status of species.

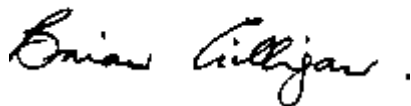
Estimated Cost of Recovery

A summary of the funds required to implement this recovery plan are identified below. This recovery plan will be implemented over a five year period. Average implementation costs per year will be approximately \$34 950.

Action	Description	Source of funding (\$)			
		NPWS		Public authorities (combined)	Unfunded
		recurrent funds	program funds		
11.3.1	identify high priority sites	4000			
11.3.2	carry out negotiations with public authorities	12000			
11.3.3	liaise with private landholders		5000		
12.3.1	negotiate & implement threat & habitat management programs	20750		98000 (= average \$4900 per authority)	
12.3.2	env. assessment and planning		no direct cost		
13.3.1	genetic studies				5000
13.3.2	disease studies				3000
13.3.3	other research				15000
14.3.1	encourage community involvement		no additional cost	no additional cost	
14.3.2	provide advice and assistance to private landholders		5000		
15.3.1	maintain database	6000			
15.3.2	NPWS advised of decisions			no direct cost	
15.3.3	re-assess status	1000			
TOTAL		43750	10000	98000	23000

Biodiversity Benefits

The conservation and study of *A. pubescens* will benefit other species which share the same habitat. Several other nationally threatened and numerous regionally significant plant and animal species (e.g. *Persoonia nutans*, *Pimelea spicata*, *Dillwynia tenuifolia*, *Meridolum corneovirens*, *Lathamus discolor* and *Litoria aurea*) occur in association with *A. pubescens*. Most of the vegetation communities in which it occurs are endangered and considered to be inadequately conserved.

A handwritten signature in black ink, reading "Brian Gilligan". The signature is written in a cursive, flowing style with a period at the end.

BRIAN GILLIGAN

Director-General

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Appendix 5: Summary of advice provided by NSW Scientific Committee

1 Introduction

Acacia pubescens (Vent.) R. Br., Fabaceae (Mimosoideae) is a spreading shrub 1-4 m high with bipinnate leaves and conspicuously hairy branchlets. It is chiefly restricted to the Cumberland Plain, with recordings from Bardwell Valley to Oakdale and Mountain Lagoon.

2 Legislative context

2.1 Legal status

Acacia pubescens is listed as a vulnerable species on Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act). The species is also listed as a vulnerable species on Schedule 1, Part 2 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.2 Recovery Plan preparation

The EPBC Act 1999 (Cth) and the TSC Act 1995 (NSW) require the Commonwealth Minister for the Environment and the Director-General of National Parks and Wildlife to prepare recovery plans for all Commonwealth listed species and communities, and State listed species, populations and ecological communities respectively. Both legislative instruments include specific requirements for the matters to be addressed by recovery plans and the process for preparing recovery plans. This plan satisfies the provisions of both the EPBC Act 1999 (Cth) and the TSC Act 1999 (NSW), and as such there will only be one recovery plan operating for *A. pubescens*.

The TSC Act 1995 (NSW) requires that in the preparation of a recovery plan, that consideration must be given to any special knowledge or interests that indigenous people may have in the species and the measures to be contained in the plan (section 57). In addition, the EPBC Act 1999 (Cth) requires that in the preparation of a recovery plan, that regard must be had to the role and interests of indigenous people in the conservation of Australia's biodiversity (section 270(3)(e)). There are a number of indigenous community groups in the area affected by this recovery plan, including the Deerubbin, Gandangara and Metropolitan Local Aboriginal Land Councils. These groups were not consulted prior to preparation of the plan, and although wattles are and were used for a variety of purposes by indigenous peoples (eg for spear-throwers, boomerangs, clubs, string bags and baskets and the seeds and gum are/were eaten), no information exists of any use of *A. pubescens* specifically. However, implementation of recovery actions under this plan will include consultation with these groups and consideration of their role and interests in the region (see section 14.3.1).

2.3 Recovery Plan implementation

The TSC Act 1995 (NSW) requires that a public authority must take any appropriate measures available to implement actions included in a recovery plan for which they are responsible. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the plan. Public authorities responsible for the implementation of this recovery plan are many, including the NPWS, Councils, the Department of Land and Water Conservation, the Department of Employment Education and Training, Rail Infrastructure Corporation, Roads and Traffic Authority, State Rail Authority, Sydney Catchment Authority and Sydney Water. Consequently, these land managers must manage *A. pubescens* in accordance with the approved plan.

The TSC Act requires that public authorities identified in a recovery plan as responsible for the implementation of measures included in the plan, must report on actions that have been implemented in its annual report to Parliament. Likewise, Councils must report on implementation in their state of the environment report.

The EPBC Act 1999 (Cth) states that Commonwealth agencies must implement a recovery plan on those areas that apply to Commonwealth lands. Those lands relevant to this recovery plan include sites at Prestons, University of Western Sydney (Bankstown Campus) and Holsworthy Military Reserve. The EPBC Act also specifies that a Commonwealth agency must not take any action that contravenes a recovery plan.

2.4 Critical habitat

The TSC Act makes provision for the identification and declaration of critical habitat only for those endangered species, populations and ecological communities listed on Schedule 1 of the TSC Act. As *A. pubescens* is listed on Schedule 2 of the TSC Act as a vulnerable species, critical habitat cannot be declared for this species.

Under the EPBC Act 1999 (Cth), critical habitat may be identified for any nationally listed threatened species or ecological community. When adopting a Recovery Plan the Federal Minister for the Environment must consider whether to list habitat identified in the Recovery Plan as being critical to the survival of the species or ecological community. At this stage, habitat critical to the survival of *A. pubescens* cannot be identified given the clonal nature of the species and a lack of genetic information about this clonality. However, genetic analysis will be further investigated as an outcome of the plan (see section 13.3.1).

2.5 Environmental assessment

The TSC Act amendments to Part 3 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) require that when draft environmental studies or environmental planning instruments are being prepared, Councils and Planning NSW must consult with the NPWS, if critical habitat, or threatened species, populations or ecological communities, or their habitats, will or may be affected by the instrument (termed a 'section 34A consultation'). The NPWS considers that these consultations are a very useful mechanism which can minimise the problems that arise due to development pressures in relation to threatened biota.

The TSC Act amendments to the environmental assessment provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that consent and determining authorities consider relevant recovery plans when exercising a decision making function under Parts 4 & 5 of the EP&A Act. Consent and determining authorities, when considering any development or activity which may affect *A. pubescens*, must consider the conservation strategy outlined in this plan. These authorities may be assisted by the guidelines for environmental impact assessment that have been included as Appendix 3 of this plan. Any other action not requiring approval under the EP&A Act, and which is likely to have a significant impact on *A. pubescens* will require a Section 91 Licence from the NPWS under the provisions of the TSC Act. Such a licence may be issued with or without conditions, or refused.

As *A. pubescens* 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 Commonwealth Minister for the Environment 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 requirement specified above for the NSW EP&A Act.

Administrative guidelines are available, from Environment Australia, to assist proponents in determining whether their action is likely to have a significant impact. In cases where the action does not require EPBC Act approval, but will result in the death of *A. pubescens* and the species is in, or on a Commonwealth area, a permit issued by the Commonwealth Minister under the EPBC Act, will be required.

2.6 Key Threatening Processes

There are currently two key threatening processes listed on Schedule 3 of the TSC Act that are relevant to *Acacia pubescens*.

“Clearing of native vegetation” is listed as a key threatening process and is identified as a threat to *Acacia pubescens*. Past clearing of the habitat of this species is a major reason for its listing as vulnerable.

“High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition” is another key threatening process which is relevant to this species. Some sites of *A. pubescens* are subject to repeated fire, apparently due to arson. Appropriate fire regimes must be considered when developing management strategies for all sites of *A. pubescens*. For more details on appropriate fire regimes see section 7.4 of this recovery plan.

3 Conservation Status

Acacia pubescens has been recorded from 195 sites and is currently known from 151 of these. Although the species is known from a large number of sites, a high percentage of these (51%) consist of populations of fewer than 20 ramets (or ‘clones’). Most of these populations are subject to numerous threats. Only 5 of the 151 sites occur within conservation reserves (those being Scheyville National Park and Windsor Downs Nature Reserve), although there are also a number of sites (62%) in other forms of public ownership, and some of these are being managed for conservation purposes.

Based on the above data, *A. pubescens* has been listed as vulnerable in New South Wales (Schedule 2 of the TSC Act) and at the Commonwealth level (Schedule 1 Part 2 of the EPBC Act 1999).

4 Description

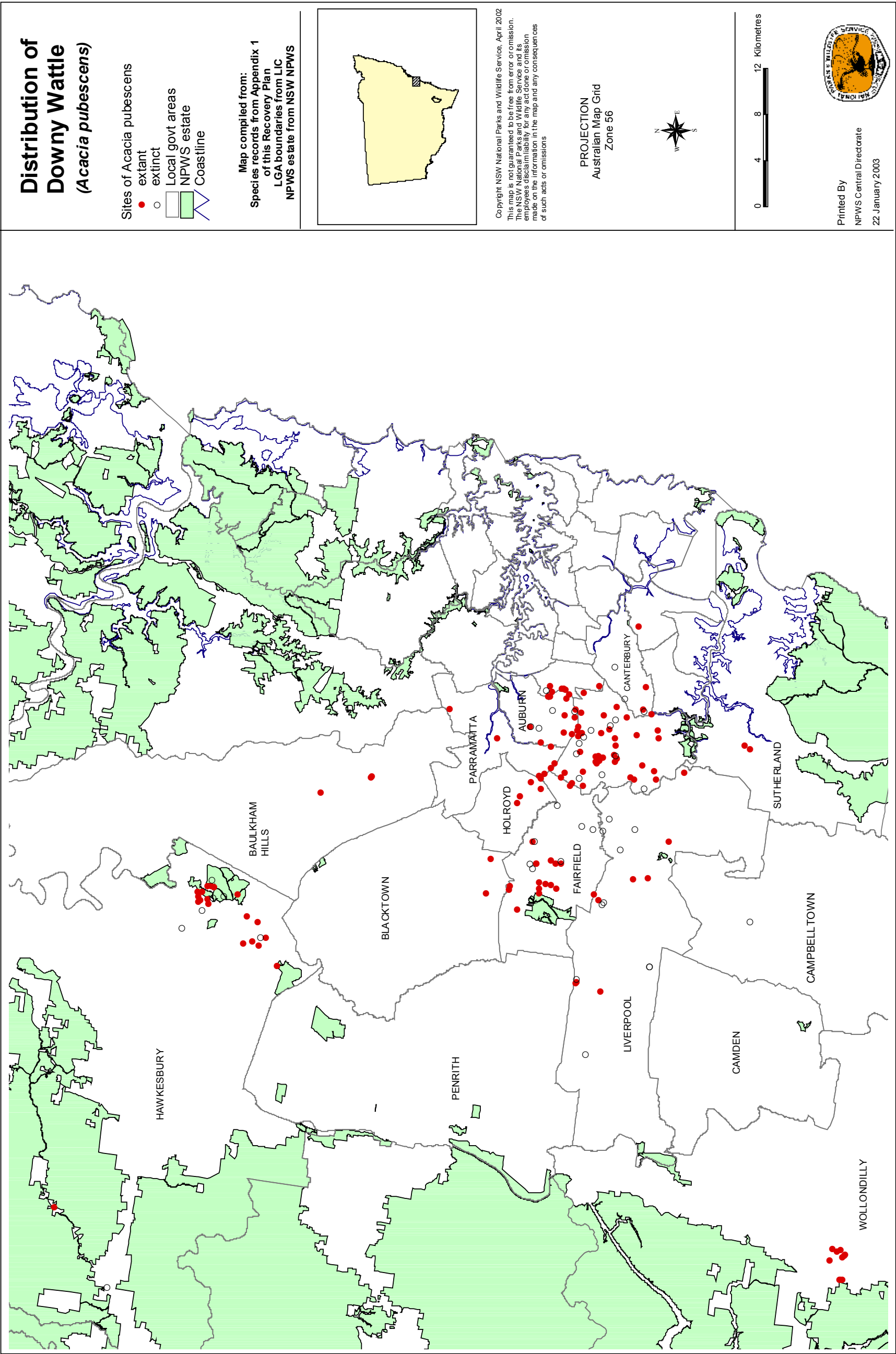
4.1 Scientific description

The following description of *A. pubescens* is taken from Kodela & Harden (in press). *A. pubescens* (Vent.) R. Br. (family Fabaceae, subfamily Mimosoideae), is a spreading to slightly weeping shrub 1-5 m high; bark smooth, brownish grey; branchlets angled at apex becoming +/- terete with ridges, hairy with long fine hairs. Leaves +/- sessile on pulvinus, rachis (i.e. the axis) 1.5-6.5 cm long, hairy, glands absent or small, often inconspicuous, jugary or rarely interjugary glands (i.e. glands along the axis) irregularly present; pinnae (i.e. leaflets) 3-12 pairs, 0.5-2.5 cm long; pinnules (the smallest leaflet segment) 5-20 pairs, mostly oblong to narrowly oblong, 1.5-5 mm long, 0.4-1 mm wide, glabrous. Inflorescences 6-49 in an axillary or terminal raceme with axis 2.5-11 cm long (axis often zigzagged) or sometimes in a terminal panicle; peduncles 2-6 mm long, glabrous or sparsely hairy; heads globose, 8-16-flowered, 3-6 mm diam., bright yellow. Pods +/- straight, +/- flat, +/- straight-sided to variably constricted between seeds, 1.5-8 cm long, 4-6.5 mm wide, firmly papery to thinly leathery, glabrous, +/- pruinose; seeds longitudinal; funicle filiform. Flowers August-October.

4.2 Distinguishing features

Acacia pubescens can be distinguished from the other bipinnate *Acacia* species in the region by its conspicuously hairy branchlets and spreading hairs. The species has been known to hybridise with other bipinnate wattles. The National Herbarium of NSW has hybrid specimens of *A. pubescens* x *A. baileyana* (Cootamundra Wattle) and *A. pubescens* x *A. jonesii*. It is also known to hybridise with *A. cardiophylla* (S.R. Douglas, consultant, *pers. comm.*). The hybrids of *A. pubescens* x *A. baileyana* are noticeable by their foliage, which is bluer than the characteristic *A. pubescens* foliage (S. Burke NPWS *pers. obs.*). The hybrids are also less hairy and have more jugary glands (T. James, consultant *pers. comm.*).

Figure 1. Distribution of *A. pubescens*



5 Distribution

5.1 Current and historical distribution

Acacia pubescens is restricted to the Sydney region. Its distribution is concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. The current and historic distribution is illustrated in Figure 1.

A complete picture of the original distribution is not apparent. An article from 1914 states that the 'centre of activity' for the species is around the Georges River area, from Canterbury through Belmore and Bankstown to Liverpool, occurring with *Melaleuca* spp. (Anon. 1914). Although the distribution includes a large area, the extant sites are mostly small and fragmented, surrounded by development. It is assumed that the species was once more common across its range, given it occurs in an area which has largely been developed.

The list of 151 extant sites are tabled in Appendix 1. A number of sites were not included in this list due to inadequate location details, or because it is assumed they have been planted, or they have been lost due to clearing. These sites are listed in Appendix 2.

There are 116 populations of the species listed in Appendix 1, occurring at 151 sites, in 14 LGA's. The number of sites and populations in each LGA are listed in Table 1 below.

Table 1. Locations of *A. pubescens* by LGA

LGA	No. of extant sites	No. of extant populations
Auburn	11	11
Bankstown	40	36
Baulkham Hills	3	2
Blacktown	4	4
Canterbury	2	2
Fairfield	14	13
Hawkesbury	33	16
Holroyd	6	6
Liverpool	14	9
Parramatta	5	5
Rockdale	1	1
Strathfield	6	4
Sutherland	2	2
Wollondilly	10	5

Note that in this recovery plan, plants within 300 m of each other have been defined as the one population, as dispersal is considered likely to occur over this distance in *Acacia* spp. (D. Keith, NPWS, *pers. comm.*). Populations may consist of a number of sites, as sites are defined largely by tenure boundaries.

Acacia pubescens is a clonal species, so an individual (or genet) may occur as a number of clumps (or ramets). Appendix 1 contains data on the number of ramets recorded at each site, which indicates that a large percentage of sites have only a small number of plants. The data on the number of ramets in each population is summarised below. Note that the number of individuals in each population will be less than or equal to than these figures indicate.

Table 2. Number of ramets in each population

number of ramets in population	<20	20-100	101-1000	>1000	unknown
no of populations	59	28	18	6	5
%age of total no of popns	51%	24%	16%	5%	4%

The large percentage of populations with fewer than 20 plants (51%) is worth noting.

As the number of *A. pubescens* individuals at a site is difficult to determine, another useful measure of the status and relative distribution of a species is the area occupied by each population. The following information is derived from the data in Appendix 1:

Table 3. Area occupied by each population

area occupied by population	<300m²	300m² – 1 ha	>1 ha	unknown
no of populations	77	18	10	11
%age of total no of popns	66%	16%	9%	9%

Again, the large percentage of sites that cover a very small area, is worth noting. Eighty-two per cent (82%) of populations are smaller than one hectare.

5.2 Tenure

Only five of the 151 known sites occur within conservation reserves (within Scheyville National Park and Windsor Downs Nature Reserve). (Note that some of the specimens at the Royal Botanic Gardens from the Mountain Lagoon area state that the location is within Wollemi National Park. However, the NPWS could only locate the species at one site in the Mountain Lagoon area, on land owned by the Department of Land and Water Conservation, i.e. not within Wollemi National Park). Four other sites are on lands zoned for environmental protection (at Mountain Lagoon, Pleasure Point, Campbell Hill Pioneer Park and Duck River Reserve) and two sites owned by the Sydney Catchment Authority are being managed for nature conservation. The tenure of the remaining sites varies. The major land managers are listed in Table 4 below, from the data in Appendix 1.

Table 4. Tenure of *A. pubescens* sites

Land Manager	Number of sites	Percentage of sites
Councils	55	36 %
Private	52	34 %
Rail Infrastructure Corp.	13	9%
NPWS	5	3%
Other public authorities	26	17 %

The data in table 4 demonstrates that a large percentage (66%) of the sites occur on lands in public ownership.

5.3 *In situ* and *ex situ* plantings

Some organisations have planted *A. pubescens* on land under their control. Before the introduction of the TSC Act, Bankstown Council planted *A. pubescens* in at least five reserves (at Mirambeena Reserve, Salt Pan Creek Reserve, Deepwater Park, Roberts Park and at The Crest of Bankstown). It is also believed that the RTA planted some plants along the M5 Motorway, which were taken from plants lost during its construction. Individuals of *A. pubescens* in these locations appear to be surviving well and flowering.

There are also *ex situ* plantings of the species in Mount Annan Botanic Garden, the Australian National Botanic Gardens and the Burrendong Arboretum. The species is sold in some commercial and Council nurseries, and is in cultivation as an ornamental in Europe and the USA (Leigh *et al.* 1984). None of these plantings has been included in the list of extant sites in Appendix 1.

6 Habitat

6.1 Landform and geology

Acacia pubescens has been recorded on a variety of geologies including Tertiary Alluvium, Holocene Alluvium and Wianamatta Shale. The soils at the sites where *A. pubescens* occurs are characteristically gravelly soils, often with ironstone. There are also a few sites that occur on the interface between Sandstone and Shale soils (eg Menai, Barden Ridge, Annangrove, Castle Hill, Pleasure Point). The topography of the habitat of the species is flat to gently undulating, a characteristic of the Cumberland Plain region (Bannerman & Hazelton 1989). The sites of *A. pubescens* range in altitude from 0 to 650 metres a.s.l. (NPWS 1998).

6.2 Climate

Acacia pubescens occurs across the range of climatic zones in Western Sydney. The highest average rainfall in this area occurs in the north-west with 1300 mm at Bilpin (Bannerman & Hazelton 1989). Most rainfall occurs in summer. Maximum daily average temperatures range from 30°C in January to 17°C in July at Penrith. Minimum daily average temperatures range from 17°C in January and 4°C in July at Penrith (Bannerman & Hazelton 1989). The winds are predominantly from the south-east during the summer and from the south-west and north-west during the winter (Doherty 1987 in Nash and Matthes 1995).

6.3 Vegetation

Acacia pubescens occurs in open woodland and forest, in a number of plant communities, which are listed in table 5 below. Most sites are within Cooks River / Castlereagh Ironbark Forest, Shale Gravel Transition Forest or Shale Plains Woodland.

Table 5. Ecological communities associated with *A. pubescens*

Community (as per NPWS 2000)	Examples of sites
Alluvial Woodland	Milperra, Fairfield, Horsley Park
Castlereagh Scribbly Gum Wldd	Kemps Creek
Cooks River / Castlereagh Ironbark Forest	Oakville, Georges Hall, Rookwood
Shale/Gravel Transition Forest	Windsor Downs, Milperra, Prestons, Prairiewood
Shale Hills Woodland	Prospect Reservoir
Shale Plains Woodland	Prospect Reservoir, Bossley Park, Lansdowne
Shale/Sandstone Transition Forest	Revesby, Annangrove, Castle Hill, Menai

The understorey species that occur with *A. pubescens* will depend upon the geology, disturbance and fire regime of the particular site. The species often associated with

A. pubescens include *Melaleuca nodosa*, *M. styphelioides*, *Angophora bakeri*, *Ozothamnus diosmifolius*, *Acacia parramattensis*, *Dillwynia sieberi*, *Pultenaea villosa*, *Bursaria spinosa*, *Acacia falcata*, *Exocarpos cupressiformis*, *Themeda australis*, *Lomandra longifolia*, *Microlaena stipoides*, *Aristida vagans*, *Austrodanthonia tenuior*, *Dianella longifolia*, *Lepidosperma laterale* and other species characteristic of the above plant communities.

Stands of *A. pubescens* have been recorded in open, disturbed areas, surrounded by exotic species. Although these areas are clearly not the natural habitat of *A. pubescens*, the species may survive in these situations for many years, due to its suckering nature and ability to tolerate some levels of disturbance. These areas are important as they provide information as to the original extent of the species and they may contain examples of genetic variability that have been lost elsewhere.

7.1 Habit, growth rate and longevity

Acacia pubescens is a bushy or weeping shrub, 1-4 m high (Robinson 1991, Benson & McDougall 1996). The plants may be single-stemmed or multi-stemmed, forming dense patches from suckering. The longevity of individuals is reported to be 50 years (Benson & McDougall 1996), though this may be an underestimate, as individuals of clonal species have been known to survive for much longer periods (M. Matthes, NPWS *pers. comm.*).

7.2 Vegetative reproduction

Acacia pubescens is a clonal species. Clonal plants exhibit two levels of organisation: the genetic individual (the 'genet') and the module produced by vegetative growth (the 'ramet') (Sydes & Peakall 1996).

A. pubescens appears to sucker at most sites (S. Burke, NPWS *pers. obs.*). This has resulted in some dense patches of the species, several metres wide. Preliminary genetic work (Moore *et al.*, 1999) has shown that in most cases these dense patches (with in some cases hundreds of stems) are in fact one individual. It is important for land managers to recognise that a census based on counts of 'individuals' may therefore overestimate the number of genetically distinct individuals.

7.3 Phenology

7.3.1 Breeding system

Acacia pubescens has bisexual flowers (i.e. each flowers has both male and female components). The breeding system of *Acacia* species can vary from highly self-incompatible (Bernhardt *et al.* 1984; Kenrick & Knox 1989 in Auld 1996) to a mixture of out-crossing and self-compatibility (Morrison & Myerscough 1989 in Auld 1996). It is unknown as to what extent the species is self-pollinating or out-crossing. Some level of outbreeding is suggested by the knowledge that hybridisation occurs with closely related Acacias, such as *A. baileyana*. It is particularly important to understand the breeding system of plants that reproduce vegetatively. There are two possible situations which would have an effect on the survival of the species:

- if the species is self-incompatible, populations with few genets may face lowered seed set because of mate scarcity (Sipes & Wolf 1997). Mate scarcity may be a particular problem for this species because such a large proportion of sites appear to have small numbers of individuals; and
- if the species is self-compatible, pollen transfers within clones will increase the level of inbreeding which may reduce the amount of genetic variability within the species (Peakall & Beattie 1991). Populations with low genetic variability

may be at increased risk of extinction because of inbreeding depression and reduced sexual reproduction (Sipes & Wolf 1997).

7.3.2 Flowering and pollination

Flowering has been recorded to occur from August to October, with a peak in September (Carolin & Tindale 1994, Benson & McDougall 1996). Plants first start flowering when they are approximately 3-5 years old (Wrigley *pers. comm.* in Maryott-Brown & Wilks 1993). Pollination of *Acacia* flowers occurs by insects (mostly by beetles, wasps and bees) (Tame 1992) and birds (Auld 1996).

7.3.3 Fruit and seed production

Pods mature in October to December, with a peak in November (Benson & McDougall 1996). Plants produce the first seed crop when approximately 3-5 years old (Wrigley *pers. comm.* in Maryott-Brown & Wilks 1993). The percentage of seed fall is unknown, but may be low. Seed on the plants appears to suffer from heavy predation, with the result that few seeds drop and are available for germination (D. Thomas, consultant *pers. comm.*). Seed that drops is often attacked by an insect which bores a small hole into the pod, which dries out the seed (S. Douglas, consultant *pers. comm.*).

Pod production is known to be low for the species. Pods were only observed at 30% of the sites visited as part of this Recovery Plan, and at these sites, only a small percentage of individuals (<10%) had pods. It appeared that only single-stemmed plants produced pods, whereas plants that were suckering did not produce pods (S. Burke, NPWS *pers. obs.*). In contrast, suckering plants at Mount Annan Botanic Garden produce fruit (P. Cuneo, RBG *pers. comm.*). It may be that plants which set seed heavily are different genotypically to those that are poor setters of seed (R. Johnson, RBG, *pers. comm.*). The generally low levels of pod production may also be caused by a lack of pollinators, low pollen viability, inbreeding or some other factor. An article from 1914 remarks that the species is known to be a 'exceptionally shy bearer' of fruit (Anon 1914), thus the low fruit setting may be natural for the species and may not be due to stresses that the species is currently subject to. It may be that the species naturally spends less resources on seed production than vegetative growth.

Fruit production of individual plants has also been observed to vary from year to year, possibly due to environmental conditions, such as rainfall (D. Little, consultant *pers. comm.*). The variation in seed crop of individuals may also be due to the increasing age of the plants. For example, for *A. suaveolens*, the seedbank reaches a maximum some ten years after a fire, after which it declines in response to seed decay in the soil, adult mortality and a decline in adult fecundity (Auld & Myerscough 1986). The triggers for fruit and seed production, and the causes of the low numbers of fruit produced, require further investigation. Management of the species must include consideration of the long-term persistence of the species at sites, not just survival of current individuals. Information on factors influencing fruit and seed production will be essential for long-term persistence of the species.

7.3.4 Seed viability and germination factors

There is no published information about seed viability of the species. *Acacia* species generally have high seed dormancy and long-lived persistent soil seedbanks (Auld 1996). Propagation work on the seed suggests this is also the case for *A. pubescens*, as treatment of seeds by scarification and hot water results in high levels of germination (D. Bishop, RBG *pers. comm.*). Mount Annan Botanic Garden has also recorded high seed viability ten years after collection (P. Cuneo, RBG *pers. comm.*). Germination of *Acacia* seed is also known to be linked to fire (Auld 1996), though this has not been investigated for this species. Investigation of the seed viability and the rates of germination will be vital information for the management of populations.

7.3.5 Recruitment and population structure

7.3.5.1 Seedling recruitment

In the Fabaceae, primary seed dispersal is short (generally 0-2 m). *Acacia* seeds are also known to be secondarily dispersed by ants, birds and possibly water (Auld 1986a). In woodlands (where *A. pubescens* occurs), it is thought that dispersal is likely to be by ants and is likely to be limited to a distance of a few metres (Auld 1996). Through their harvesting of seed, ants often bury the seed and thus ensure germination only after penetrating rain (Tame 1992).

The low seedling recruitment that is observed in *A. pubescens* is not unusual. Seedling recruitment in clonal plants is usually infrequent and irregular (Eriksson 1993). Despite this, it has been found that only a low rate of seedling input into established populations is needed to maintain genetic variability (Eriksson 1993).

7.3.5.2 Vegetative recruitment

As stated above, seed production of the species is low, and of the seed that is produced, a large number suffers from predation. Although there is no published data on the subject, it is assumed from this information that recruitment is more commonly from vegetative reproduction rather than from seedlings. From a study of the genetic variation at 10 sites of *A. pubescens*, clones were detected at all sites (Moore *et al.* 1999). Also, regeneration after disturbances such as slashing, appears to occur from suckers rather than seed, since newly emerging shoots are usually clustered together (S. Burke *pers. obs.*).

The suckering mechanism of *A. pubescens* allows the species to tolerate some levels of disturbance, though this level hasn't been quantified. The trigger for suckering to occur is unknown, but it is thought to occur as a result of disturbance, such as slashing or fire (G. Errington, RBG *pers. comm.*) or herbivory. However, there are suckering plants at Mount Annan Botanic Garden that have not been subjected to disturbance (P. Cuneo, RBG *pers. comm.*). It will be important to

understand the trigger for suckering and the level of tolerance to disturbance, so that better *in situ* management decisions can be made.

7.4 Fire Ecology

Four aspects of fires are important for germination of seeds and for vegetative recruitment – frequency, intensity, duration and seasonality (Auld 1986b). The optimal fire characteristics are not available for this species, but other *Acacia* species have been studied.

- fire frequency:

Comprehensive studies of optimal fire frequencies for Western Sydney vegetation have not been carried out. Some research that has been done on fire frequency in Cumberland Plain Woodland has shown that high frequency regimes (1-2 years) lead to the gradual decline and removal of shrub species (Thomas 1994). It is assumed that such high fire frequency regimes would also affect seedling recruitment of *A. pubescens*. Sufficient time would be needed between fires for seedlings to flower and replenish the soil seedbanks, as well as for the resprouting juveniles to become fire-resistant. In contrast, fire is required to break dormancy of *Acacia* seeds (Auld 1996). Thomas (1994) suggests that a minimum fire-free period of 5-7 years would be appropriate for legumes.

There is no published information about the effects of fire frequency on the vegetative recruitment of *A. pubescens*. It is assumed that plants would sucker after fire. Since the species tends more often to reproduce vegetatively than from seedling recruitment, it will be important for the management of the species to investigate this response to fire frequency. It may be the case that high frequency fire regimes eventually lead to the decline of genets. In contrast, fire may be needed at certain intervals to trigger vegetative reproduction or seed germination.

- fire intensity and duration:

The stems are killed by fire but resprouting occurs from suckering roots (Benson & McDougall 1996). The impact of fire temperature and fire duration are not known. The intensity of the fire will affect the degree of recruitment that occurs. Under intense fires, there is likely to be more resprouting plants killed and longer periods needed before the next fire for recovery, compared with mild fires. However, fires also need to be intense enough to break the dormancy of seeds in the soil (Auld 1996). For *A. suaveolens*, optimal fire temperatures for germination of seed are between 60°C and 80°C for any duration, or up to 100°C for duration's less than one hour. Exposure to temperatures less than 60°C leaves seed dormant and viable, whereas seed death occurs with increasing exposure to temperatures greater than 80°C (Auld 1986b). These figures hold implications for the amount of fuel load that will be appropriate for germination, as well as for other burning conditions. Smoke has also been found to be a factor that promotes germination (Roche *et al* 1997). Experimental heating and possibly smoke trials could be carried out on this species to establish optimal fire conditions.

- fire seasonality:

Little work has been done on the effect of the season of fires on the species composition of Western Sydney vegetation. It is assumed that late summer and autumn fires would be preferable, since the seedlings at these times should encounter favourable moisture conditions for growth (Auld 1996). Fires at this time would also promote the germination of a fresh seed crop, which is released from October to December.

8 Previous Management Actions

8.1 Report on Conservation Status

Acacia pubescens was considered in a report on the conservation status of five rare plants in Western Sydney (Nash & Matthes 1995). This report included information on threats and recommendations for further research and management. Some of these recommendations have been implemented, such as survey work and acquisition of land by NPWS.

8.2 Recovery Team

A Recovery Team was established in 1998 as part of the preparation of this Recovery Plan. The membership of the team included representatives from the NPWS, Royal Botanic Gardens, Western Sydney Regional Organisation of Councils, Railway Services Authority, Sydney Water, Department of Land and Water Conservation, Nature Conservation Council and an environmental consultant.

8.3 Surveys

The Urban Bushland Biodiversity Surveys undertaken by the NPWS in 1996 surveyed the biodiversity of Western Sydney with an emphasis on threatened species, communities and habitats (NSW NPWS 1997). A total of 75 sites of *A. pubescens* were recorded, many of which had not been recorded previously. An inventory of all sites where *A. pubescens* had been previously found, was completed as part of the preparation of this Recovery Plan, using data from a number of sources. Sites that had accurate location details and had not been surveyed by the UBBS teams, were surveyed in 1997-98 by S. Burke of NPWS.

8.4 *In situ* and *ex situ* propagation

Bankstown Council has planted *A. pubescens* in at least five reserves (at Mirambeena Reserve, Salt Pan Creek Reserve, Deepwater Park, Roberts Park and at the Crest of Bankstown) (R. Corby, Bankstown Council, *pers. comm.*). Strathfield Council also has stores of seed collected from Rookwood Cemetery and some planting of plants from this seed source has occurred in Frank Zions Reserve at Strathfield (J. Orton, Strathfield Council, *pers. comm.*). Auburn Council planted some *A. pubescens* along the Duck River, with seed sourced from The Crest of Bankstown Reserve (D. Sheils, Auburn Council, *pers. comm.*). The RTA also planted some individuals as compensation for habitat lost during the construction of the M5 motorway (R. Miller, consultant, *pers. comm.*). In addition, many community nurseries run by Councils have been selling *A. pubescens* over the years.

Some *ex situ* conservation work has also been carried out by Mount Annan Botanic Garden, which has collections of seed from Lansdowne, Long Neck Lagoon and Pitt Town. There are also plantings in the Threatened Species Garden and the Wattle Garden at Mount Annan (P. Cuneo, RBG *pers. comm.*). The species has also been planted in the Australian National Botanic Gardens in Canberra and the Burrendong Arboretum (Leigh *et al.* 1984). The ANBG has seed collected from Scheyville National Park, from the site at the corner of Old Stock Route Rd and Pitt Town – Dural Rd. The Burrendong Arboretum has seed from Bilpin and Menai. Greening Australia has seed collected from a Bossley Park site.

Propagation from seed has been found to be the most successful method of propagation. High levels of germination have been obtained through treatment of the seeds by scarification and hot water (D. Bishop, RBG *pers. comm.*). Propagation from cuttings and root suckers have a lower success rate (D. Bishop, RBG *pers. comm.*). Cuttings have been found to be more successful if taken from regrowth (S. Fisher, plant propagator, *pers. comm.*)

8.5 *In situ* protection

In situ protection has occurred at a number of *A. pubescens* locations, including:

- Scheyville National Park, where plants have been fenced to provide protection from mechanical damage caused by trail bikes and horses.
- Liverpool Showground, where plants have been fenced and weed removal has been undertaken.
- Avondale Rd Pitt Town, where a restriction on use of land (under Section 88B of the *Conveyancing Act*) was placed on the rear of lots, so that clearing could not occur without the consent of the NPWS.
- Rookwood Cemetery, where a Property Management Plan has been prepared, ensuring that plants will be fenced and bush regeneration will be undertaken.

8.6 Preparation of species profile and EIA guidelines

The NPWS has prepared a species profile and draft EIA guidelines for use by public authorities and private landholders to assist in conservation of *A. pubescens* on lands under their control. These documents are also designed to assist consent and determining authorities in the assessment of impacts on the species, and for members of the public who are interested in becoming involved in conservation of the species. These are attached as an appendix to this plan (Appendix 3) and can also be accessed via the NPWS Internet homepage (www.npws.nsw.gov.au).

8.7 Genetic research

In 1999, the NPWS commissioned the Australian National University to undertake genetic analysis of *A. pubescens* at a number of sites (Mountain Lagoon, Carysfield Park at Bass Hill, Louisa Reserve at Georges Hall, Rookwood Cemetery, Scheyville National Park, Prospect Reservoir, Bishop Rd at Menai, Yennora Wool Centre, Salter Rd Reserve at Bossley Park and Weeroona Rd at Strathfield). Most of the sites sampled for this study were found to consist of fewer than four individuals, even though the number of ramets recorded at these sites varies between 110 and 4300. Individuals were also found to cover large areas (up to 1.2 hectares) at most sites (Moore *et al.* 1999). This may have implications for the long-term survival of the species at sites. Further work will need to be undertaken to determine if an interaction is occurring between clonality and self-incompatibility, which is resulting in the limited seed set, or whether pollination or resources is limiting seed set (Moore *et al.* 1999).

9 Management Issues

The following sections identify our current understanding and/or limitations of the biology and ecology of *A. pubescens*, the threats operating on populations and a consideration of the social and economic factors that affect the success of the recovery program. A discussion is also included on translocation, which is another issue that is often raised in relation to the management of threatened species.

9.1 Level of current understanding

The object of a recovery plan is to promote the recovery of a threatened species to a position of viability in nature. *A. pubescens* is listed as vulnerable, so the objective will be to ensure the viability of sites and prevent its status from becoming endangered. As the species occurs at a number of sites which are largely outside of conservation reserves, and as there are a number of threats acting on the sites where it occurs, further reductions in its distribution are likely if current management practices continue. To prevent the species from becoming endangered, actions are needed to maximise the protection and security of sites of the species. On-site actions should occur at least at the most significant sites of the species. However, due to the lack of information about the genetic diversity of the species, it is difficult at this stage to identify which sites are the most significant. Small sites in highly disturbed areas, that may appear to be insignificant to some land managers, may hold quite significant genetic diversity. The lack of information on the genetic diversity within and between populations also complicates the possibility of any translocation programs that might be attempted.

Other aspects of the biology and ecology of *A. pubescens* are also not well understood. An increased understanding of these aspects of *A. pubescens* will improve the finer scale approach to the recovery of the species. A greater understanding of its habitat requirements and its lifecycle processes will increase the likelihood of the successful recovery of *A. pubescens* and our ability to manage the species in the future. The recovery actions listed in Section 13.3 aim at investigating these essential aspects.

Some of these management issues are discussed in more detail below.

9.2 Threatening Processes

The threats and reasons for the decline of *A. pubescens* can be separated into two categories – those that are leading to the loss of habitat, and those that are leading to degradation of existing sites.

9.2.1 Loss of habitat

Habitat loss is a major issue in Western Sydney. Over 90% of the original distribution of vegetation in the region has been cleared (NSW NPWS 1997). Eleven of the sites recorded on the Atlas for NSW Wildlife (NSW NPWS 1998) no longer contain *A. pubescens* (see Appendix 2). Most of these sites have been lost due to residential development. Many old records indicate that the species occurred in locations that have now been developed, such as Georges Hall, Belmore, Cabramatta, Chester Hill and Warwick Farm.

As well as reducing the numbers of individuals, loss of habitat also fragments populations. The distributional information in section 5 of this plan demonstrates this fragmentation. Fragmentation creates sub-populations of species, isolates those sub-populations from one another and often disrupts ecological processes, such as pollination, dispersal and gene flow. In doing so it increases the risk of extinction. Smaller populations are more likely to suffer local extinction and more isolated habitat fragments are less likely to be re-colonised if local extinction does occur (Margules *et al.* 1993).

A potential threat at some sites is the planned development of those sites. A large percentage of sites occur on lands zoned for residential and industrial uses. The species may be lost from these sites due to development for these uses, or developments may introduce impacts onto the site which degrade the habitat.

9.2.2 Degradation of habitat:

Several threats are acting on existing sites of *A. pubescens* which are likely to be reducing the capacity of these sites to be self-sustaining. These threats were recorded at sites during surveys for the preparation of this Recovery Plan and during the Urban Bushland Biodiversity Surveys (NSW NPWS 1997), and include weed invasion, mechanical damage, rubbish dumping, illegal track creation, arson, horses and hybridisation. The percentage of sites where such threats were recorded is summarised below:

Table 6. Summary of threats recorded at sites

Threat recorded at site	Percentage of sites
Weed invasion	89%
Mechanical damage	21%
Rubbish dumping	37%
Illegal track creation	21%
Arson	11%
Horses	5%
Hybridisation	2%

- Weed invasion:

Weeds recorded at sites include African Lovegrass (*Eragrostis curvula*), Whisky Grass (*Andropogon virginicus*), Paddy's lucerne (*Sida rhombifolia*), Prickly Pear (*Opuntia* spp.), Mother-of-millions (*Bryophyllum delagoense*), Paspalum (*Paspalum dilatatum*), Kikuyu (*Pennisetum clandestinum*), Blackberry (*Rubus fruticosus* sp. agg.), Honeysuckle (*Lonicera japonica*) and African Olive (*Olea europea* ssp. *africana*). Since large numbers of sites are threatened by weed invasion, developing a careful bush regeneration strategy at sites to remove and control weeds will be a high priority.

- Mechanical damage:

Mechanical damage includes damage from mowing, whippersnipping, slashing, and so on. As *A. pubescens* occurs in many areas that are mown, such as reserves and roadsides, the likelihood of this threat occurring is high. This threat was also noted by the Urban Bushland Biodiversity Survey (NSW NPWS 1997) as a particular problem along railway lines. The species has the ability to tolerate some level of disturbance but may not be able to tolerate repeated damage. Also, the ability of the species to regenerate may be reduced as its temporary removal allows access for other species, especially weeds. Mowing gangs need to be able to identify the species and leave an unmown buffer around where it occurs. Other strategies may be needed where contractors that maintain sites are constantly changing. This is currently an issue with the sites within railway corridors, and is likely to also be a problem in Council reserves, as local government moves increasingly towards using private contractors for park maintenance. Where this problem can be addressed, it should become less of a threat over time, as areas that are unmown start to regenerate and become established and more obvious.

- Rubbish dumping:

Dumped rubbish can degrade sites through mechanical damage. It can also lead to the introduction of weeds and increase rates of arson if the dumped material is set alight. This problem is likely to increase as government restrictions are placed on the amount of green waste that can be taken to landfill. This is a community problem that is difficult to police. The most effective methods currently available to address the problem appear to be the removal of rubbish as it appears and the erection of barriers to prevent further access. Many Councils have implemented such measures at some sites, but dumping continues to be a problem in other areas.

- Illegal track creation and impacts from horses:

The use of illegally created tracks by walkers, bicycles (particularly BMX bikes) and horses can also degrade sites. These activities lead to mechanical damage of plants, compaction of the soil, introduction of weeds and they increase edge effects. Tracks can also encourage dumping and arson. This problem should be addressed through an education campaign, negotiation with horse riding clubs and by the erection of barriers.

- Hybridisation:

There is no known natural hybridisation for *A. pubescens*, but the species is known to hybridise with some bipinnate wattles such as *A. baileyana*, *A. jonesii* and *A. cardiophylla* which occur outside the range of *A. pubescens*. Hybrids can be a major threat through reduction of the genetic integrity of the species. Hybrids and any bipinnate *Acacia* species that are not native to the area and that are in proximity to *A. pubescens* sites need to be removed. Council officers and others who may be planting such *Acacia* species in or near bushland, need to be informed about hybridisation – that it occurs and what the consequences may be. It should be noted that *A. baileyana* has been listed as a bushland weed by the Australian Association for Bush Regenerators.

- Inappropriate fire regimes:

Arson was also observed to have occurred at a number of sites. If arson is occurring repeatedly at sites, this may diminish the seedbank, as seedlings and suckers may not get the opportunity to develop and set seed in the interval between fires. Until research has been carried out on the fire requirements of the species, fire should be suppressed at those sites that are subject to arson so that the seed bank may be replenished.

In areas where arson is not occurring, lack of fire may be a threat to the continued survival of the species. As *A. pubescens* occurs largely in developed areas where fires are generally suppressed, this is likely to be an issue at a number of sites. Fire intervals which are too long have the potential to reduce seedling recruitment. The most appropriate fire regime for *A. pubescens* is currently unknown (see section 7.4). Studies of the fire ecology of the species are needed before the appropriate fire management strategies can be implemented.

- Disease:

A large proportion of individuals appear to be suffering from an unknown disease which affects the leaves of plants (T. James, consultant *pers. comm.*). The number of sites where this was occurring has not been recorded. Investigating the nature and the extent of impact of this disease should be seen as a high priority. Actions have been included in this Recovery Plan which deal with the researching and reporting of this threat.

9.3 Social and economic consequences

9.3.1 Social consequences:

The NPWS recognises that actions within this plan may have impacts on the public authorities and private individuals, who own or manage land on which the species occurs. Some landholders (both public and private) are reluctant to conserve habitat and view the recovery effort as an intrusion on their rights to manage their land. While these opinions are in the minority they certainly constitute a challenge for the recovery effort. Personal and regular contact with landholders is a key strategy in encouraging awareness and involvement in the recovery effort.

It is considered that the plan will also result in some positive impacts on sections of the community. For example, implementation of the plan will result in increased preservation of habitats, which will improve the aesthetic value and recreational and educational potential for residents in areas where *A. pubescens* occurs. This is especially beneficial for Western Sydney, where there are a limited number of opportunities for local residents to access and experience the flora and fauna of the region. However, preservation of habitats may also require that public access is restricted at some sites. As this would not occur without public consultation (e.g. through the public exhibition of draft Plans of Management for sites), any negative social consequences of restricted access should be minimised.

9.3.2 Economic consequences:

The NPWS recognises that the implementation of the actions of this Recovery Plan will result in some degree of economic impact. The proposed recovery strategy seeks to minimise these impacts through the prioritisation and targeting of recovery efforts to those populations on private land. Without a strategic approach to managing this vulnerable species, and with the continuation of current practices, it is likely that the species will be reduced to a level where it is at risk of becoming endangered or possibly extinct at many localities, given current rates of loss and degradation of habitat.

The negative economic consequences of the recovery of *A. pubescens* are those costs associated with the implementation of this plan. One of the main actions of the plan is to increase security of tenure of sites (see section 11). This may reduce development potential of some sites, and therefore result in financial losses. The exact value of these losses are difficult to estimate, due to the number of sites where the species occurs. However, an attempt has been made to minimise any direct impacts on individuals by concentrating efforts on preservation of land in public ownership, which is not zoned for development.

Actions involving on-ground management programs and the long-term monitoring of sites will also have economic consequences for land managers. However, it is considered that these management programs involve recurrent activities which are

required for the normal management of the land, such as weed control and rubbish removal. Costs can be minimised by seeking funding from external sources and by adopting a co-operative approach to management, which involves the NPWS, other relevant landholders and the community.

It is considered that some positive economic consequences will also result from the implementation of the plan. For example, it will result in more efficient resource use, as management of the species will be more co-ordinated and strategic. In addition, economic benefits should also be gained by consent and determining authorities, as the information contained in the Recovery Plan should assist in their decision making processes in relation to *A. pubescens*.

9.4 Translocation

Translocation is defined as the deliberate transfer of plants or animals from one place to another, including existing or new sites or where the species is now extinct (Australian Network for Plant Conservation (ANPC) 1997).

The booklet ‘Guidelines for the Translocation of Threatened Plants in Australia’, (ANPC 1997) provides a discussion of the issues involved in translocation. This booklet also discusses several reasons why attempts to translocate often fail, such as not removing the original threats affecting the habitat, not properly considering the biological and ecological requirements of the species, neglecting to assess the genetic variability and not providing an ongoing commitment to monitoring and maintenance.

At this stage, translocation of *A. pubescens* is not considered necessary for the continued existence of the species in the wild, given the distribution and abundance of *A. pubescens*. In addition, the clonal nature of *A. pubescens* makes it difficult to assess the impact of any translocations on the genetic integrity of populations. The collection of genetic information is included as a recovery action of this plan. At the review of the Recovery Plan, these data should be examined to assess whether translocation trials are necessary for the persistence of the species in the wild. If appropriate, translocation guidelines should be prepared for the species.

For those land managers and organisations interested in improving the conservation status of *A. pubescens*, there are two alternatives to translocation that should be attempted – ensuring conservation of areas where the species currently exists, and *in situ* regeneration of the species. These alternatives are likely to be more successful than translocation programs and will not affect the genetic integrity of the species.

9.5 Ability to Recover

‘Recovery’ in the context of this plan will be targeted towards maintaining the current vulnerable status of *A. pubescens* and preventing it from becoming endangered. It will not be possible to recover the species to its former distribution, given the degree of development and the small number of conservation reserves within its distribution. In fact, unless actions are taken to reduce threats, it is likely that reductions will continue to occur in the current number of sites and the species will become locally extinct in some areas. The likelihood of local extinctions are quite high for this species given the large percentage of sites that are very small and fragmented, and the number of threats acting on sites (see section 9.2).

Despite the current status of the species, actions can be employed to halt local extinctions and improve the quality of habitat. The threats identified in section 9.2 are manageable and solutions are straightforward. Implementation of on-ground works will slow down the current rate of habitat loss and will lead to the enhancement of existing populations. However, the majority of sites occur on lands outside of NPWS estate. Thus the NPWS will need to negotiate with relevant landholders over implementation of appropriate on-ground works. If negotiations could be successful in protecting a majority of sites of *A. pubescens*, this would greatly improve the conservation status of the species. Given that a large number of sites are on land that is in public ownership, there is a high likelihood that successful negotiations could occur in relation to a large percentage of sites. Negotiation over management of sites is included as an action in this plan (see section 11).

10 Overall recovery aim and recovery strategy

10.1 Overall objective

The overall objective of the recovery plan is to prevent the status of *Acacia pubescens* from becoming endangered, by reducing habitat loss and by implementing management regimes aimed at maintaining representative populations across the species' range.

10.2 Overall performance criteria

The overall performance criteria of the recovery plan is that the risk of the species becoming endangered is reduced, through the implementation of recovery actions.

11 Reservation/protection status

Only a small proportion of sites of *A. pubescens* have any reservation or protection status. These sites are:

- Scheyville National Park (sites HA7a, HA9b, HA10b and HA14);
- Windsor Downs Nature Reserve (HA16);
- sites at Mountain Lagoon (HA2), Pleasure Point (LV7), Campbell Hill Pioneer Park (PA3) and Duck River Reserve (PA5), which are zoned for environmental protection;
- two sites owned by the Sydney Catchment Authority within Prospect Reservoir (BL1 and BL2) which are being managed for nature conservation.

In order to ensure the survival of the species in the long term, it is essential that a larger proportion of sites are managed primarily for conservation, to reduce the effects of one of the greatest threats to the species – habitat loss. Sites on public land will be targeted for increased protection, given the land management role of public authorities and given socio-economic considerations. Negotiations will also occur with relevant interested private landholders, to increase the protection status of sites on private land.

11.1 Objective

To ensure that a representative sample of *A. pubescens* populations occurring on public and private lands are protected from habitat loss and managed for conservation.

Legislative protection of sites may be achieved through a number of mechanisms, such as acquisition by NPWS, rezoning for conservation, entering into voluntary conservation agreements, property management plans or joint management agreements, preparing development control plans or placing covenants over lands to prevent development.

11.2 Criteria

The number of sites that are afforded greater legislative protection is increased from 11 sites to 18* sites within the first 5 years (i.e. by 2008). The sites to be protected will be distributed across the total range of the species, to maximise conservation of genetic diversity.

* This target is based on the number of sites that the NPWS believes could be afforded legislative protection within the first 5 years, as they have high conservation significance, provide a realistic opportunity for protection (based on tenure) and are located in areas which are currently under-represented in terms of protected sites. It does not represent the minimum number of sites required to ensure the survival of the species or indicate the only sites that should be managed or indicate that other sites are not significant.

11.3 Recovery Actions

11.3.1 Identify sites that are a high priority to protect

The NPWS will identify sites which are of high conservation significance and which also provide realistic opportunities for protection. The assessment of significance will take into account features such as size of habitat, numbers of individuals recorded, quality of habitat and the corridor value of the site. A large percentage of known sites (66%) are currently on lands under public ownership and therefore should provide opportunities for protecting sites.

This action will be undertaken once there is a clearer indication of the genetic variability of the species (i.e. after work has been carried out in accordance with action 13.3.1).

Based on current knowledge, the sites that would be targeted for reservation would include (but not be restricted to):

Code¹	Site	Landowner
BN5a	Carysfield Park	Bankstown City Council
BN17a	Louisa Reserve	Bankstown City Council
BN17b	The Crest of Bankstown	Bankstown City Council
BN19	Norfolk Reserve	Bankstown City Council
BN20	Lansdowne Park	Bankstown City Council
BN30	Montgomery Reserve	Bankstown City Council
SU1	Menai	Sutherland Shire Council

¹see appendix 1 for explanation of site codes

11.3.2 Carry out negotiations with public authorities to increase protection of sites

Once action 11.3.1 is completed, the NPWS will carry out negotiations to increase the protection of identified sites on public land.

11.3.3 Liaise with private landholders to increase protection of sites

The NPWS will liaise with private landholders to emphasise the conservation significance of populations of *A. pubescens* occurring on or adjacent to their properties. The NPWS will also seek to achieve greater protection of populations on private land, using a variety of mechanisms (eg. property management plans, voluntary conservation agreements). The precise nature of management arrangements will depend largely on the circumstances and co-operation of private land holders.

12 Threat and Habitat Management

To achieve the goal of *in situ* protection of *A. pubescens*, requires not only a reduction in the risk of habitat loss (as addressed in section 11), it also requires that the threats that lead to habitat degradation are addressed. Threats that have been observed at sites have been described in section 9.2 of this plan. Lack of knowledge about the species is an additional threat which may be impacting on the species. This section also includes an action to address this threat.

12.1 Objective

To reduce the impacts of threats at sites and to ensure that any planning and management decisions that are made which affect the species, are made in accordance with the recovery objectives of this plan.

12.2 Criteria

Threat and habitat management programs have been prepared and are being implemented at 62* sites by 2008. Conservation of the species is facilitated through appropriate planning and management decisions.

* This target is based on the number of sites that the NPWS believes could be actively managed, given their tenure. In addition, sites have been included because they have high conservation significance and are located in areas which are currently under-represented in terms of site management. The target does not represent the minimum number of sites required to ensure the survival of the species or indicate the only sites that should be managed or indicate that other sites are not significant.

12.3 Recovery Actions

Negotiate with public authorities to implement threat and habitat management programs on public lands

A large percentage of sites are on lands owned by public authorities. Proper management of these lands by public authorities will therefore be essential for the conservation of the species. Relevant public authorities will be encouraged to prepare management plans (or other similar documents) which will stipulate that certain actions will be carried out by the authority to protect the species *in situ*.

Any sites owned by public authorities that are targeted for reservation (as a consequence of implementing action 11.3.2 above) will be included in these negotiations, to ensure threats are being managed at the most significant sites. These sites are tabled below:

Code	Site	Landowner
BN5a	Carysfield Park	Bankstown City Council
BN17a	Louisa Reserve	Bankstown City Council
BN17b	The Crest of Bankstown	Bankstown City Council
BN19	Norfolk Reserve	Bankstown City Council
BN20	Lansdowne Park	Bankstown City Council
BN30	Montgomery Reserve	Bankstown City Council
SU1	Menai	Sutherland Shire Council

Any sites owned by public authorities which already have some reservation or protection status will also be included in these negotiations, to ensure threats are being appropriately managed at these protected sites. These sites are tabulated below:

Code	Location	Landowner
HA2	Mountain Lagoon	DLWC
PA3	Campbell Hill Pioneer Park	Parramatta Council
PA5	Duck River Reserve	Parramatta Council
BL1	Prospect Reservoir	Sydney Catchment Authority
BL2	Prospect Reservoir	Sydney Catchment Authority

The NPWS will also liaise with Councils to ensure that Plans of Management are prepared and implemented in accordance with the *Local Government Act 1993*, for the following community lands that contain populations of *A. pubescens*, and ensure that these plans include actions which protect sites of *A. pubescens*.

Code	Location	Council
AU1	Auburn Botanic Gardens	Auburn
BN1	Bankstown; end Brancourt Ave	Bankstown
BN4b	Bass Hill; Walshaw Reserve	Bankstown
BN5b	Bass Hill; Manuka Reserve	Bankstown
BN12	Condell Park; 20 Hunter St	Bankstown
BN15	Condell Park; 374 Marion St	Bankstown
BN18	Georges Hall; Thornton Reserve	Bankstown
BN21	Milperra; Ashford Reserve	Bankstown
BN23	Milperra; Deepwater Park	Bankstown
BN26	Padstow; Salt Pan Creek Reserve	Bankstown
BN29	Revesby; Flood Reserve	Bankstown
BN32	Villawood; adjacent to Colgate-Palmolive	Bankstown
BN34	Villawood; Thurina Park	Bankstown

Code	Location	Council
FA1	Bossley Park; Bossley Pk Sports Complex	Fairfield
FA2	Bossley Park; Bossley Road Reserve	Fairfield
FA3	Bossley Park; Derwent Place Reserve	Fairfield
FA4	Bossley Park; Salter Road Reserve	Fairfield
FA5	Bossley Park; park on Horsley Drive	Fairfield
FA6	Bossley Park; Warragamba Crescent Park	Fairfield
FA8	Prairiewood; Fairfld Indigenous Flora Pk	Fairfield
HA6	Oakville; E side of Old Stock Route Rd	Hawkesbury
LV2	Green Valley; S side of Nth Liverpool Rd	Liverpool
RK1	Bardwell Valley Golf Course	Rockdale
ST4	Strathfield; Hudson Park Golf Course	Strathfield

NPWS will also liaise with other public authorities to prepare and implement threat and habitat management programs at the following sites:

Code	Authority	Location
BN25	DEET	Milperra; UWS Bankstown Campus
AU3a	RIC	Lidcombe; E of Minda Detention Centre
AU4	RIC	Lidcombe; railway siding between Lidcombe and Flemington
AU5	RIC	Regents Park; E of Park Rd, near Jenkins St

AU7	RIC	Regents Park; W of Minda Detention Centre
AU9	RIC	Rookwood; 100 m S of Arthur St overbridge
BN7	RIC	Birrong; 50m N of Rodd St overbridge
BN8	RIC	Birrong; rwy cutting nr cnr Wellington Rd/Auburn Rd
BN28	RIC	Revesby; Doyle Road overpass
BN36	RIC	Yagoona Railway Station
FA11	RIC	Villawood; N side of Villawood Railway station
PA4	RIC	Rosehill; rail corridor at Rosehill Station
ST3c	RIC	Rookwood; cutting near Weeroona Rd
CA1	RTA	Beverly Hills/Narwee; M5 fwy, N of Windarra St

AU6	SRA	Regents Park; on west side of station
BL3	Sydney Water (SW)	Prospect Reservoir
BL4	SW	Prospect Reservoir
BN9	SW	Birrong; Potts Hill Reservoir
BN10	SW	Chester Hill; pipeline corridor W of Barbers Rd
HO2	SW	Guildford; edge of drain cnr of Berwick & Beauford Sts
PA2	SW	Guildford; behind Girl Guide's Hall near pipeline

Actions will include that public authorities will:

- identify existing and potential threats (e.g. weed invasion, hybridisation and reducing access to sites);
- develop and implement threat and habitat management programs; and
- monitor populations on a regular basis to assess the effectiveness of threat and habitat management programs.

The NPWS must also carry out similar threat and habitat management actions at all sites on NPWS estate, i.e. the NPWS will:

- identify existing and potential threats (e.g. weed invasion, dumping, hybridisation);
- develop and implement threat and habitat management programs; and
- monitor populations on a regular basis to assess the effectiveness of threat and habitat management programs.

Those sites on NPWS estate include:

Code	Location	National Park
HA7a	Pitt Town; 1 km along Pitt Town/Dural Rd from junction of Cattai Rd	Scheyville NP
HA9b	Pitt Town; Reserve 88626, Avondale Rd	Scheyville NP
HA10b	Pitt Town; Avondale Rd, opposite no. 118	Scheyville NP
HA14	Scheyville NP; N of Pitt Town/Dural Rd and S of Long Neck Lagoon	Scheyville NP
HA16	Windsor Downs Nature Reserve	Windsor D NR

The assistance of community groups in implementing threat and habitat management programs or monitoring their success will be encouraged, especially where resources are limited (see section 15 for more details).

The negotiations are to be carried out by the NPWS. The implementation of any actions are to be carried out by the relevant public authority.

12.3.2 Informed environmental assessment and planning decisions are made

Consent and determining authorities will assess developments and activities, and will prepare environmental planning instruments which avoid and minimise impacts on the species.

In order to give this effect, consent and determining authorities will ensure that:

- developments and activities are assessed with reference to this recovery plan, environmental assessment guidelines (appendix 3) and any future advice from the NPWS regarding the distribution, threats, biology and ecology of *A. pubescens*;
- development consent issued on land in the vicinity of known populations, is sensitive to the species, given knowledge of threats; and

- any relevant environmental policies, management plans and Environmental Planning Instruments are prepared or reviewed with reference to the recovery plan and any future advice from the NPWS regarding the distribution and ecology of the species.

This action is to be carried out by Councils and Planning NSW in consultation with the NPWS.

13 Research

It is clear from the information in this Recovery Plan that studies of the genetic variability of *A. pubescens* will be essential for management of the species. There is also clearly a lack of other information on the biology, ecology and distribution of the species. Long-term management of *A. pubescens* will be based on sound principles once there is a better understanding of the biology and ecology of these aspects.

13.1 Objective

To understand the biology, ecology, health and distribution of the species including the range of genetic variation.

13.2 Criteria

A research program to investigate currently unknown aspects of biology, ecology, health and distribution is implemented and this information is used in management of the species.

13.3 Recovery Actions

13.3.1 Undertake studies into genetic variability

Preliminary studies of the genetic diversity of *A. pubescens* have been carried out at 10 sites of the species (Mountain Lagoon, Carysfield Park, Louisa Reserve, Rookwood Cemetery, Scheyville National Park, Prospect Reservoir, Menai, Yennora Wool Centre, Salter Rd Reserve and Weeroona Rd). The results of these studies indicate that the species is an extensively clonal species, and the number of individuals at sites is low (Moore *et al.* 1999). More sites should be sampled to confirm these results and to determine which sites should be priorities for conservation. The results of genetic studies should be examined in combination with studies into the breeding system of *A. pubescens*, to determine if an interaction is occurring between clonality and self-incompatibility to limit seed set, or whether pollination or resources is limiting seed set (Moore *et al.* 1999). This information will also allow identification and mapping of 'habitat which is critical to the survival of the species' as per section 270(2)(d) of the EPBC Act 1999 (Cth).

13.3.2 Investigate the cause of disease

The large number of individuals that appear to be suffering from an unknown plant disease which affects the leaves of plants, is potentially a large threat to the species. A survey should be undertaken at a number of sites to determine the nature and extent of the disease. This action should be undertaken by an appropriate institution that is involved in plant disease research. The NPWS will seek tenders for this research.

13.3.3 Research into other aspects of the species

Investigations should be directed towards the following areas:

- Population dynamics:

The degree of tolerance of *A. pubescens* to disturbance needs to be investigated. The species may require a certain amount of disturbance for recruitment. The proportion of recruitment by vegetative reproduction, relative to seed germination, should be investigated. This will allow predictions to be made about the genetic variability of populations over time.

- Breeding System:

There are many aspects of the breeding system that require investigation, such as the cause of the low seed set, whether there is any variation between individuals in relation to fruit production, the seed viability and whether there is any variation in seed viability relative to the age of the individual. These studies should be undertaken over a number of years so that it can be established whether environmental conditions are leading to variation in fruiting and seeding rates.

- Fire ecology:

The optimal fire characteristics of the species needs to be determined, in regard to fire frequency, intensity, duration and seasonality. The effects of fire on recruitment, establishment and survival need to be established. The tolerance of stems to fire should also be investigated. Once an optimal fire regime is established, fire management plans for sites should be developed. This information will also be important in determining the chances of survival of the species at sites that are prone to arson.

- Distribution/survey:

Mechanical damage is listed as one of the threats to *A. pubescens*. Damage often occurs simply from a lack of awareness about the presence of the species at a site. The incidence of this threat could be reduced if relevant landowners were made aware of the presence of *A. pubescens*. Councils should be aware of all sites of *A. pubescens* in their LGA, given their roles as consent authorities and land managers. The NPWS will encourage Councils to undertake surveys in their areas, so that the complete distribution of the species can be established. The NPWS will also encourage Councils to modify the section 149 Certificates of relevant properties to include a notice about the presence of *A. pubescens*, to increase knowledge of the species' presence.

The NPWS will encourage universities, other research institutions and trained members of the community to take part in these research programs. The NPWS will be responsible for the co-ordination of research programs and dissemination of results.

14 Community education, awareness and involvement

14.1 Objective

To develop the awareness and involvement of the broader community in the species and its conservation.

14.2 Criteria

Stakeholders are informed about the species and involvement of stakeholders in conservation programs is increased.

14.3 Recovery Actions

14.3.1 Encourage community involvement

The community includes members of community groups (such as conservation groups, Catchment Management Boards, Bushcare groups) and private landholders as well as public authorities such as the NPWS and Councils. This action is designed to involve all interested parties in the conservation of the species, including those people outside of government. This shall include indigenous community groups. Involvement of public authorities may be required, at least initially, to co-ordinate and authorise any actions. Interested stakeholders will benefit from an increased knowledge about management of threatened species and the satisfaction of participating in a conservation program. The involvement of stakeholders will also advantage the species, as actions can be undertaken in areas where resources may be limited.

The community may become involved in a variety of programs, depending on the particulars of the site and the stakeholders concerned. A potential area of involvement of the community is in the implementation of threat and habitat management programs and the monitoring of their success, which is an action that public authorities must undertake (see 12.3.1). A monitoring sheet that can be used by community groups is included as appendix 4.

This action will be co-ordinated by relevant public authorities as determined by sections 11 and 12 of this plan.

14.3.2 Provide advice and assistance to private landholders

A number of significant sites occur on private land. The NPWS will liaise with interested private landholders of these sites, to identify actual and potential threats and to negotiate the implementation of on-ground works to mitigate or reduce threats. Where possible and appropriate, the NPWS will encourage landholders to

enter into Voluntary Conservation Agreements (see action 11.3.3). The sites will also be monitored by the NPWS on a regular basis to assess the success of any on-ground works that have been implemented.

This action will be undertaken by the NPWS in conjunction with private landholders.

15 Re-assess conservation status

15.1 Objective

To re-assess the conservation status of the species.

15.2 Criteria

Assessment of the conservation status is undertaken, based on accurate information about the management of and threats to the species.

15.3 Recovery Actions

15.3.1 Maintain a database on the species

The NPWS will develop and maintain a database on the species. Information which will be added to the database will include data from threat and habitat management programs, monitoring programs and planning decisions. In this way, consent and determining authorities will be able to make informed planning and management decisions about the species.

15.3.2 NPWS to be advised of any consents or approvals which affect *A. pubescens*

When planning decisions are made by consent or determining authorities which affect populations of *A. pubescens*, this information will be forwarded to the NPWS. This includes information on decisions that protect habitat, as well as those that lead to reduction of habitat and/or individuals.

This action will be undertaken by all consent and determining authorities.

15.3.3 Re-assess conservation status of species

Once the reservation/protection status of sites is increased and threat and habitat management programs are being implemented, a re-assessment of the conservation status of *A. pubescens* will be undertaken using the criteria developed by Keith *et al.* (1997) or other appropriate criteria, and is to be carried out at the review of this plan, taking into account the actions achieved, any further loss or degradation of habitat and genetic information.

This action will be undertaken by the NPWS and referred to the NSW Scientific Committee.

16 Implementation and Costs

16.1 Implementation Schedule

Table 7 allocates responsibility for the implementation of recovery actions specified in this plan to relevant agencies. Refer to sections 11-15 for further details about these actions.

Table 7. Implementation of actions

Action	Description	Priority	Responsibility	Year of implementation				
				02/03	03/04	04/05	05/06	06/07
11.3.1	Identify sites that are a high priority to protect	1	NPWS	✓	✓			
11.3.2	Carry out negotiations with public auth.	1	NPWS	✓	✓	✓		
11.3.3	Liaise with private landholders	1	NPWS	✓	✓	✓	✓	✓
12.3.1	i. negotiate with public authorities ii. implement threat and habitat mgmt programs on public lands	1	i. NPWS	✓	✓	✓	✓	
		1	ii. public authorities	✓	✓	✓	✓	✓
12.3.2	Env. assessment and planning	1	Consent & det. authorities	✓	✓	✓	✓	✓
13.3.1	Genetic studies	1	NPWS to contract		✓	✓		
13.3.2	Disease studies	1	NPWS to contract	✓				
13.3.3	Other research	2	NPWS to co-ord.	✓	✓	✓		
14.3.1	Encourage community involvement	2	Public authorities	✓	✓			
14.3.2	Provide advice and assistance to private landholders	2	NPWS	✓	✓	✓	✓	✓
15.3.1	Maintain a database on species	1	NPWS	✓	✓	✓	✓	✓
15.3.2	NPWS advised of decisions that affect species	2	Consent & det. authorities	✓	✓	✓	✓	✓
15.3.3	Re-assess conservation status	2	NPWS					✓

16.2 Implementation Costs

Table 8 outlines implementation costs for the recovery actions identified in this plan.

Table 8. Implementation Costs

Action	Description	Cost of Implementation (per year)						Source of funding			
								NPWS		Public authorities (combined)	Unfunded ⁵
		02/03	03/04	04/05	05/06	06/07	Total	recurrent funds	program funds		
11.3.1	Identify sites that are a high priority to protect	2000	2000	-	-	-	4000	4000			
11.3.2	Carry out negotiations with public authorities	3000	3000	3000	3000		12000	12000			
11.3.3	Liaise with private landholders	1000	1000	1000	1000		5000		5000		
12.3.1	i. negotiate with public authorities ii. implement threat and habitat mgmt programs on public lands ¹	3000	3000	3000	3000		12000	12000		98000 ⁴	
		30500	30500	15250	15250	15250	106750	8750			
12.3.2	Env. assessment and planning	✓ ²	✓	✓	✓	✓	✓	✓		✓	
13.3.1	Genetic studies	-	2500	2500	-	-	5000				5000
13.3.2	Disease studies	3000	-	-	-	-	3000				3000
13.3.3	Other research	5000	5000	5000			15000				15000
14.3.1	Encourage community involvement	x ³	x	-	-	-	x	x		x	
14.3.2	Provide advice and assistance to private landholders	1000	1000	1000	1000	1000	5000		5000		
15.3.1	Maintain database	2000	1000	1000	1000	1000	6000	6000			
15.3.2	NPWS advised of decisions that affect species	✓	✓	✓	✓	✓	✓		✓	✓	
15.3.3	Re-assess conservation status	-	-	-	-	1000	1000	1000			
	TOTAL COSTS	47000	45500	28250	24250	19250	174750	43750	10000	98000	23000

¹ see sections 11 & 12 for relevant public authorities. Costs are based on estimated \$500 per site p.a. for years 1 and 2, and \$250 per site p.a. for years 3-5.

² ✓ = no direct cost ³ x = no additional costs. These activities are recurrent activities for public authorities

⁴ based on those components of POMs which relate to *A. pubescens* only. Average \$6100 per authority. ⁵ These actions are yet to receive secure funding

17 Preparation Details

This Recovery Plan was prepared by Sarah Burke, Senior Threatened Species Officer, NPWS, Central Directorate, in consultation with the *A. pubescens* Species Recovery Team.

17.1 Date of last amendment

No amendments have been made to date.

17.2 Review date

The plan will be reviewed and updated 5 years from the date of publication.

18 Contacts

18.1 Threatened Species Recovery Team

The Threatened Species Recovery Team for *A. pubescens* is coordinated by Central Directorate Threatened Species Unit, National Parks and Wildlife Service, PO Box 1967, Hurstville, 2220. Telephone (02) 9585 6678.

18.2 Other useful addresses

NPWS Lower Hawkesbury Area

PO Box 70 Pitt Town NSW 2756. Phone (02) 4572 3100.

Royal Botanic Gardens, Sydney

Mrs Macquaries Rd, Sydney NSW 2000. Phone (02) 9231 8111.

Mount Annan Botanic Garden

Mt Annan Drive, Mt Annan NSW 2567. Phone (02) 4648 2477.

Western Sydney Regional Organisation of Councils

PO Box 63 Blacktown NSW 2148. Phone (02) 9671 4333.

Nature Conservation Council

39 George St The Rocks NSW 2000. Phone (02) 9247 4206.

Greening Australia NSW Inc

142 Addison Rd Marrickville NSW 2204. Phone (02) 9560 9144.

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APPENDIX 1: LOCATIONAL INFORMATION FOR *A. PUBESCENS*

EXCLUDED RECORDS - OLD AND/OR INADEQUATE LOCATION					
DETAILS	no	ref	year	easting	northing
Auburn		678	1887	317900	6252600
Auburn		671	1889	317748	6251896
Auburn		1007	1921	319253	6250649
Bankstown		697	1957	313395	6248251
Bankstown		674	1925-49	315500	6248505
Bankstown		714	1946	316402	6248298
Bankstown		701	1963	317000	6247839
Bankstown		1006	1925	318000	6245500
Bankstown		683	1908-20	318500	6244999
Bankstown		686	1965	313749	6246250
Bankstown		693	1960	301002	6233009
Campbelltown		679, 699, 700	1892-1909	323000	6245100
Canterbury		681	1915	320246	6244156
Canterbury		702, 1008	1961	311000	6250241
Fairfield		684	1911	309246	6248002
Fairfield		685	1918	308998	6247009
Fairfield		677	1961	305996	6252651
Strathfield		669	1929	321000	6251248
Liverpool		713	1982	296003	6248492
Liverpool		691	1953	302500	6246255
Liverpool		Nash & Matthes	?	289500	6247700
Liverpool		689	1963	308848	6246152
Liverpool		687	1959	309905	6245607
Liverpool		692	1963	297102	6242000
Liverpool		NSW/254275	1966	309000	6243300
Liverpool		NSW/106855	1963	297102	6242000
Liverpool		670	1956	299603	6276751
Hawkesbury		NSW/60630	1960	269300	6290500
Hawkesbury		NSW/383859	1993	304600	6281100
Hawkesbury		NSW/380954	1974	302000	6282000
Hawkesbury		NSW/53064	1960	300400	6283800

EXCLUDED RECORDS - OLD AND/OR INADEQUATE LOCATION DETAILS					
		no	ref	year	eastings northings
Hawkesbury	Gravel Pits Rd Pitt Town (probably equivalent to other records in the area)		Nash & Matthes	?	303000 6281000
COULDN'T FIND / GONE - assumed cause for loss given in ()brackets; whether habitat remains given in [] brackets					
Auburn	nr SPCC air monitoring caravan & rlyw line, Lidcombe Hosp (developed for Hospital?) [no habitat seen]	1009		1984	319198 6248651
Bankstown	Remnant bushland adjacent to quarry, Quarry Close, Yagoona (weed invasion, mowing, senescence?) [very disturbed habitat]	SSMB96120502		1996	317530 6247200
Bankstown	Higgins St Reserve, Condell Park (weed invasion, mowing, senescence?) [very disturbed habitat]		Nash & Matthes	?	315400 6245000
Bankstown	Georges R, Milperra, 4.8km E of Liverpool (location is now golf course; not found here) [no habitat remains]	688		1967	312501 6242497
Canterbury	nr Salt Pan Ck, Riverwood, adj to rd to Riverwood Rubbish Tip (developed for M5) [no habitat remains]	30 704		1985	319200 6242500
Liverpool	Liverpool general cemetery (developed for cemetery?) [no habitat remains]	690		1966	307196 6244599
Liverpool	Green Valley, W of Liverpool, lot 8 Wilson Rd (residential development) [no habitat remains]	719		1988	302596 6246102
Fairfield	Cnr Bathurst St & Welcome St, Wakeley (residential development) [no habitat remains]	20	SPXEI0139350	1996	306200 6249900
Fairfield	Daniel St, Wetherill Park (residential development) [no habitat remains]		Nash & Matthes	?	305600 6252400
Fairfield	Smithfield Cemetery, Dublin St and Horsley Dr (developed for Cemetery?) [no habitat remains]		Nash & Matthes	?	307950 6252300
Hawkesbury	Schofields Rd, 500 m from junction with Old Pitt Town Rd (in Scheyville NP) (senescence? inaccurate location?) [habitat remains]		Nash & Matthes	?	303200 6280000

Planted Locations

Auburn	South Granville; various locations on Council land alongside Duck River, between Wellington Rd and Mona St. Grown from seed from The Crest of Bankstown.	D. Sheils (pers. comm.)	2002	316400	6251900
Bankstown	Georges River NP, adjacent to substation (<i>wrong soil type; local opinion is that it was brought in with dumped cuttings</i>)	Nash & Matthes ?		316200	6238800
Bankstown	Sandakan Rd, Revesby Heights, on private property. Grown from seedling supplied by Council (pre-TSC Act). Other planted sites are therefore likely in Council area.	R. Brewster	2001	317000	6239100
Blue Mtns	Woodford; at end of Waterhouse Rd (E of Weroona Rd) on road reserve (<i>most likely planted given wrong soil type and location in old garden</i>)	3 703	1999	266190	6264670
Canterbury	Earlwood; Girrahween Pk. One planted individual near amenities block.	1	2000	327300	6243700
Fairfield	Abbotsbury; a number of plants in three locations within Western Sydney Regional Park	L. Kaye (pers. comm.)	2002	302200	6251700
Gosford	Saratoga; lot 2 Weston St (<i>probably not naturally occurring but worth further investigation to confirm</i>)	1 SDXB01062203	2000	348050	6294800
Hurstville	Lugarno; Gannons Park. Probably grown from fill brought in to construct path	15 SJEH98021601	1998	319620	6238350
Strathfield	Strathfield; Frank Zions Reserve, Karuah St (planted from seed collected at Rookwood Cemetery)	SSMB99062200	1999	321120	6249880

DOUBTFUL IDENTIFICATIONS

Shoalhaven	Morton NP, on creek flats at the intersection of the Yalwal and Etrema Cks (<i>not found; may be a misidentification of A. irrorata</i>)	D. Black in 'Fitzroy Falls and Beyond'	259450	6141200
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APPENDIX 2: SITES WHERE A. PUBESCENS NO LONGER FOUND

LGA	popn ²	location	no.	ha	reference	tenure	easting	northing
Auburn	AU1	Auburn Botanic Gardens	10	<0.03	SPXEI0140109	Council	316400	6251600
Auburn	AU2	Auburn; Vales Lane, on vacant block	1	<0.03	SSYK02010901	private	317850	6252600
Auburn	AU3	Lidcombe; E of Minda Detention Centre, in railway corridor	50	<0.03	SPXEI0140155	RIC	319300	6248500
Auburn	AU4	Lidcombe; old Lidcombe Hospital site	1	<0.03	Council	private	318750	6249470
Auburn	AU5	Lidcombe; railway siding between Lidcombe and Flemington	50	0.1	Nash & Matthes	RIC	320400	6251000
Auburn	AU6	Regents Park; E of Park Rd, near Jenkins St	>40	<0.03	UBBS report	RIC	317300	6249600
Auburn	AU7	Regents Park; on west side of station	5	<0.03	SRA	SRA	317150	6248860
Auburn	AU8	Regents Park; W of Minda Detention Centre, in rail corridor	>100	?	UBBS report	RIC	318600	6248600
Auburn	AU9	Rookwood Cemetery	c.2000	18	696; SDMP99112300	DLWC	320249	6249359
Auburn	AU10	Rookwood; on rail corridor 100 m S of Arthur St overbridge	100	?	RIC	RIC	320400	6250800
Auburn	AU11	Rookwood; Weeroona Rd road reserve, S of Rookwood Cemetery	2	<0.03	SPXEI0140210	Council road	320600	6249100
Bankstown	BN1	Bankstown; at end of Brancourt Ave, adjacent to railway line.	<3	<0.03	SSMB96120500	Council	317560	6245530
Bankstown	BN2	Bankstown; on Stacey St between Frederick St and Greenacre Rd	15	0.4	SSMB02021100	RTA	318800	6246000
Bankstown	BN3	Bankstown; remnant adjacent to Bankstown Sth Public School, Stacey St	c.2	<0.03	SSMB96120505	Dept Education	318650	6243950
Bankstown	BN4a	Bass Hill; 336 Hector St	c.10	<0.03	SSMB9612050A	private residential	315220	6246750
Bankstown	BN4b	Bass Hill; Walshaw Reserve	6	<0.03	SSMB96120406	Council	315300	6246500
Bankstown	BN5a	Bass Hill; Carysfield Park, immediately N of Johnston Rd	200	7.5	SSMB97092300	Council	314800	6246700
Bankstown	BN5b	Bass Hill; Manuka Reserve	5	<0.03	SSMB96120403	Council	314600	6246620
Bankstown	BN6	Birrong; grounds of Birrong Girls High School, Cooper Rd	c.3	<0.03	SSMB96120508	Dept Education	317450	6248320
Bankstown	BN7	Birrong; on rail corridor 50 m N of Rodd St overbridge	c.50	?	RIC	RIC	317200	6247900
Bankstown	BN8	Birrong; on railway cutting near Wellington Rd/Auburn Rd intersection	>20	<0.03	UBBS report	RIC	317000	6248240
Bankstown	BN9	Birrong; Potts Hill Reservoir	c.10	<0.03	UBBS report	Sydney Water	317800	6248300
Bankstown	BN10	Chester Hill; Sydney Water pipeline corridor W of Barbers Rd	19	<0.03	UBBS report	Sydney Water	314200	6250700
Bankstown	BN11	Chullora; opposite Waste Transfer Station, Muir Rd	c.3	<0.03	SSMB96120503	SRA	319000	6248000
Bankstown	BN12	Condell Park; 20 Hunter St	<10	<0.03	SSMB9709230B	Council	316800	6245000
Bankstown	BN13	Condell Park; 35 Birch St	?	<0.03	Council	private	314800	6245000
Bankstown	BN14a	Condell Park; 41 Allingham St	?	<0.03	Council	private	315000	6244800
Bankstown	BN14b	Condell Park; 47 Allingham St	?	<0.03	Council	private	315000	6244800
Bankstown	BN15	Condell Park; reserve at 374 Marion St	1	<0.03	SSMB96120408	Council	315350	6245100
Bankstown	BN16	Condell Park; Wattawa Reserve	2	<0.03	Council	Council	316200	6244900

LGA	popn ²	location	no.	ha	reference	tenure	easting	northing
Bankstown	BN17a	Georges Hall; Louisa Reserve	250	0.34	SSMB97092303	Council	315100	6246300
Bankstown	BN17b	Georges Hall; The Crest of Bankstown Reserve	72	0.62	SSMB96120407	Council	314850	6246350
Bankstown	BN18	Georges Hall; Thornton Reserve	20	<0.03	SSMB96120405	Council	315130	6246080
Bankstown	BN19	Greenacre; Norfolk Reserve	140	0.06	SSMB97092306	Council	320750	6247750
Bankstown	BN20	Lansdowne; Lansdowne Park	200	1	721; 718R	Council	312700	6247849
Bankstown	BN21	Milperra; Ashford Reserve	5	<0.03	SSMB96120400	Council	313430	6243600
Bankstown	BN22	Milperra; Bankstown Golf Course, Ashford Ave	c. 2	<0.03	SSMB96120507	private recreation	313270	6243320
Bankstown	BN23	Milperra; Deepwater Park	<5	<0.03	SSMB97092301	Council	313200	6241300
Bankstown	BN24	Milperra; Kelso Park	1	<0.03	SSMB97092302	Council	314000	6241500
Bankstown	BN25	Milperra; University of Western Sydney, Bankstown Campus.	28	<0.03	SSMB96120506	DEET	314450	6242520
Bankstown	BN26	Padstow; Salt Pan Creek Reserve	<10	<0.03	SSMB97092307	Council	318900	6241700
Bankstown	BN27	Punchbowl; Punchbowl railway sheds, Carrisbrook Ave	c. 3	<0.03	SSMB96120504	RIC	319500	6244850
Bankstown	BN28	Revesby; along railway corridor at Doyle Rd overpass	<5	<0.03	RIC	RIC	317500	6241200
Bankstown	BN29	Revesby; Flood Reserve	<5	<0.03	SSMB96120402	Council	317100	6243050
Bankstown	BN30	Revesby; Montgomery Reserve	37	<0.03	SSMB97092305	Council	316800	6241100
Bankstown	BN31	Sefton; 201 Rodd St	<10	<0.03	SSMB9709230A	private residential	315600	6248100
Bankstown	BN32	Villawood; alongside Council-owned drain adjacent to Colgate-Palmolive	<5	<0.03	SSMB96120409	Council	312950	6248800
Bankstown	BN33	Villawood; Taubmans Factory, Birmingham Ave	<5	<0.03	SPXEI0140035	industrial	313800	6249500
Bankstown	BN34	Villawood; Thurina Park	1	<0.03	SSMB96120501	Council	313900	6247850
Bankstown	BN35	Villawood; Van Leer Factory, 25 Miowera Rd.	30	<0.03	SPXEI0139967;	industrial	313400	6249800
Bankstown	BN36	Yagoona Railway Station, adjacent to Hume Hwy overbridge	10	<0.03	SSMB96120509			
Baulkham Hills	BH1	Annangrove; W boundary of Annangrove Racquet Centre	10	<0.03	SDMP97012203	private	312100	6271250
Baulkham Hills	BH2a	Castle Hill; along edge of Gilbert Rd and in front of Castle Hill Pony Club	26	<0.03	SSMB97101306	Council	313400	6266770
Baulkham Hills	BH2b	Castle Hill; Pony Club, alongside club fence	3	<0.03	SSMB97101307	DLWC	313500	6266700
Blacktown	BL1	Prospect Reservoir (in the NW corner of the catchment)	290	0.07	SSMB99061103	Sydney Catchments Authority (SCA)	303400	6256500
Blacktown	BL2	Prospect Reservoir (near Pelican Point in the NE of the catchment)	110	0.03	SSMB99061104	SCA	306400	6256100
Blacktown	BL3	Prospect Reservoir (near the western perimeter of the water treatment works)	195	0.05	SSMB99061101	Sydney Water	304000	6254400
Blacktown	BL4	Prospect Reservoir (on N margin of the bypass channel near the Upper Canal)	216	0.06	SSMB99061102	Sydney Water	303700	6254500

LGA	popn ²	location	no.	ha	reference	tenure	easting	northing
Canterbury	CA1	Beverly Hills/Narwee N of Windarra St c.50ft from rd on side of M5 fwy	13	2	715R	RTA road	321250	6242200
Canterbury	CA2	Riverwood; between Iris Ave and M5 freeway	2	<0.03	Council	Council	319270	6242480
Fairfield	FA1	Bossley Park; Bossley Park Sports Complex, 74-84 Prairievale Rd	2	<0.03	SSMB99061801	Council	303740	6250200
Fairfield	FA2	Bossley Park; Bossley Road Reserve	15	<0.03	SPXEI0139281	Council	304200	6251200
Fairfield	FA3	Bossley Park; Derwent Place Reserve	22	1.5	SPXEI0139241; SSMB99061107	Council	303400	6251800
Fairfield	FA4	Bossley Park; Salter Road Reserve (Marconi Park)	110	0.03	SSMB97082200; SPXEI0139240	Council	304100	6250700
Fairfield	FA5	Bossley Park; small remnant on The Horsley Dr	5	<0.03	SPXEI0139275	Council	304330	6251770
Fairfield	FA6	Bossley Park; Warragamba Crescent Park	2	2	SSMB99061106	Council	303800	6251800
Fairfield	FA7	Horsley Park; between Redmayne Rd and The Horsely Dve	20	<0.03	SPXEI0139206	private	302000	6253700
Fairfield	FA8	Prairiewood; Fairfield Indigenous Flora Park, adjacent to Christie St	24	<0.03	SSMB99061108	Council	306200	6250750
Fairfield	FA9	Prairiewood; in car park at Fairfield Showground	2	<0.03	SDMPI0001763	Council	306000	6250270
Fairfield	FA10	Smithfield; vacant lot adjacent to cemetery, cnr of Victoria & Dublin Sts	4	<0.03	SJAL10007085	private (church)	307825	6252380
Fairfield	FA11	Villawood; N side of Villawood Railway Station	c.60	?	UBBS report	RIC	312700	6249000
Fairfield	FA12a	Wakeley; cnr Smithfield Rd & Richards Rd	40	<0.03	SPXEI0139334	Council road	306000	6252000
Fairfield	FA12b	Wakeley; opposite corner of Richards and Smithfield Roads	40	<0.03	SPXEI0139325	Council road	306000	6252000
Fairfield	FA13	Wakeley; NW side of Box Rd, opposite Gundagai Cr	5	<0.03	SPXEI0139320	private	306000	6249800
Hawkesbury	HA1	McGraths Hill; lot 204 Windsor Rd near Curtis Rd	?	?	SSYK01020918	industrial	299200	6277400
Hawkesbury	HA2	Mountain Lagoon; Mtn Lagoon Rd, 8.7km NE of Bilpin to E of rd	4300	0.9	662-5,672,706-8,1005	DLWC	276200	6295150
Hawkesbury	HA3	Mulgrave (no further details provided)	?	?	SVG19905312A	?	298900	6276800
Hawkesbury	HA4	Mulgrave, near cnr Railway Rd North and Park Rd	25	<0.03	SVG19809290G	industrial	299500	6276200
Hawkesbury	HA5	Oakville; 184 Old Stock Route Rd. Back of Kirkstone Nursery; private land.	55	<0.03	8514-HOR	private rural	301400	6277900
Hawkesbury	HA6	Oakville; E side of Old Stock Route Rd, just S of Garfield Rd (HCC land leased by Pony Club)	?<20	<0.03	SSMB97092501	Council	300900	6276900
Hawkesbury	HA7a	Pitt Town; 1 km along Pitt Town/Dural Rd from junction of Cattai Rd (= between Llewellyn Ck and Old Stock Rte Rd. In Scheyville NP)	c.40	<0.03	NSW211534	NPWS	299000	6278200
Hawkesbury	HA7b	Pitt Town; 1 km along Pitt Town/Dural Rd from junction of Cattai Rd (= between Llewellyn Ck and Old Stock Rte Rd. Road verge)	c.400	0.26	NSW211534; SSMB9906110C	Council road	303550	6281900
Hawkesbury	HA8a	Pitt Town; along Pitt Town/Dural Rd between Cattai Rd and Airstrip Rd; on nine properties and on road verge	c. 200	c. 3	SSMB9906110D	9 rural and Council road	302800	6282100

LGA	popn²	location	no.	ha	reference	tenure	easting	northing
Hawkesbury	HA8b	Pitt Town; in bush adjacent to 1 Redfern PI	?-20	<0.03	SSMB97092502	private rural	302600	6282200
Hawkesbury	HA9a	Pitt Town; Avondale Rd, lots 1-6 (on all 6 sites)	5000	12	SSMB9906110A	private rural	304000	6281400
Hawkesbury	HA9b	Pitt Town; Reserve 88262, Avondale Rd (Scheyville NP)	8000	5.7	SSMB99061109	NPWS	304000	6281100
Hawkesbury	HA10a	Pitt Town; Avondale Rd, on road verge	c. 20	<0.03	SSMB9906110F	Council road	303900	6280800
Hawkesbury	HA10b	Pitt Town; Scheyville NP, Avondale Rd (opp. # 118)	c. 40	<0.03	SSMB9906110F	NPWS	303900	6280800
Hawkesbury	HA11	Pitt Town; cnr Old Pitt Town Rd & Airstrip Rd	2000	1	SSMB9906110B	private rural	302900	6281400
Hawkesbury	HA12	Pitt Town; Old Pitt Town Rd, 300 m N of jctn with Old Stock Route Rd. Roadside verge	104	0.04	NSW210447; SSMB9906110E	Council road	302500	6281300
Hawkesbury	HA13	Pitt Town; Pitt Town/Dural Rd E of Airstrip Rd turnoff in raceway land	?	?	8513-HOR	private rural	303100	6282200
Hawkesbury	HA14	Scheyville NP; N of Pitt Town Dural Rd & S of Long Neck Lagoon	1500	20	SSMB99061800	NPWS	303500	6282300
Hawkesbury	HA15	Scheyville; Old Pitt Town Rd, on rd verge, 600m S of Scheyville Rd jctn	8	<0.03	SSMB9906110G	Council road	303300	6278750
Hawkesbury	HA16	Windsor Downs Nature Reserve	5	<0.03	SSMB9906110H	NPWS	297100	6275200
Holroyd	HO1	Guildford; 10 Cross St, opposite Arabic Baptist Church	1	<0.03	SSYK01010905	private?	313600	6251790
Holroyd	HO2	Guildford; edge of drain corner of Berwick and Beauford St	2	<0.03	UBBS report	Sydney Water	313000	6252500
Holroyd	HO3	Guildford; North Pde	1	<0.03	SSMB98061100	Sydney Water	313700	6251280
Holroyd	HO4	Merrylands W; S side of lower canal	<10	<0.03	UBBS report	Treasury	311200	6253700
Holroyd	HO5	Merrylands; Sherwood Rd, N side of lower canal	c.20	?	UBBS report	Treasury	311800	6253500
Holroyd	HO6	Yennora; Yennora Wool Centre, Denniston Avenue	150-200	?	SPXEI0139760	industrial	312400	6251600
Liverpool	LV1	Green Valley; Green Valley Public School	144	1.3	SSMB99061700	Dept Education	302800	6246500
Liverpool	LV2	Green Valley; S side of North Liverpool Road, near Henty Creek	10	<0.03	SSMB99061700	Council res & road	303290	6246880
Liverpool	LV3	Holsworthy; N end of Military Reserve	106	<0.03	SSMB990611600	Dept Defence	307870	6240180
Liverpool	LV4	Kemps Ck; 60 Brenda Rd	25	<0.03	SDMP99111108	private (rural)	294900	6246300
Liverpool	LV5	Kemps Ck; cnr of Elizabeth Dve & Devonshire Rd	1	<0.03	717	private rural	295596	6248506
Liverpool	LV6	Kemps Creek; corner Cross Street & Devonshire Rd	2	<0.03	SDMP97073001	private rural	295690	6248400
Liverpool	LV7	Pleasure Pt	50	<0.03	UBBS report	private 7b env prot	313800	6238800
Liverpool	LV8	Prestons; Maxwells Ck at Lyn Pde junction	20	<0.03	SSYK01010906	private	304600	6243400
Liverpool	LV9	Prestons; near Wonga and Jemma Rds, 6 properties, including old 2FC record	?-1000	?	680	industrial & fed govt	304649	6242094
Parramatta	PA1	Carlingford; Cox Pk, located adjacent to fenceline	2	<0.03	SSYK0105170A	Council	319350	6259740
Parramatta	PA2	Guildford; behind Girl Guide's Hall near SydWat pipeline	3	<0.03	UBBS report	Sydney Water	313320	6251640
Parramatta	PA3	Guildford; Campbell Hill Pioneer Park (East & West)	5	<0.03	SPXEI0140055	Council	314600	6250400
Parramatta	PA4	Rosehill; rail corridor at Rosehill Station, on W side of line	4	<0.03	RIC	RIC	316800	6255500

LGA	popn ²	location	no.	ha	reference	tenure	easting	northing
Parramatta	PA5	South Granville; Duck River Reserve	70	?	SSMB99061701	Council	316100	6250700
Rockdale	RK1	Bardwell Valley Golf Course	2	<0.03	SSMB99072200	Council	326460	6242880
Strathfield	ST1	Flemington; 26 Henley Rd	1	<0.03	SSMB00082800	private	321340	6250770
Strathfield	ST2	Greenacre; Cocks Creek Reserve, Sylvanus St	1	<0.03	Council	Council	321350	6246400
Strathfield	ST3a	Rookwood; Australia Post site, Weeroona Rd	260	<0.03	Council	Aust Post	321100	6249600
Strathfield	ST3b	Rookwood; Energy Australia properties east of Weeroona Rd	<5	<0.03	SPXEI0140217	Energy Australia	321000	6249400
Strathfield	ST3c	Rookwood; rail corridor, cutting near Weeroona Rd.	?	?	SPXEI0140218	RIC	321100	6249700
Strathfield	ST4	Strathfield; Hudson Park Golf Course	1	<0.03	SSMB99061702	Council	320800	6250650
Sutherland	SU1	Menai; cnr Bishop Rd and Owen Jones Way	110	0.2	7829R; 722; 723	Council	316200	6233400
Sutherland	SU2	Menai; Old Illawarra Rd opp Lawson Pl	15	<0.03	RTA studies	DLWC	315870	6232880
Wollondilly	WD1	Oakdale; Wineshop Rd, past bend on southern roadside	c.100	0.1	Council	Council	271600	6225820
Wollondilly	WD2a	Oakdale; Barkers Lodge Rd, on N cnr of Russells Ln	4	<0.03	Council	Council	269910	6224940
Wollondilly	WD2b	Oakdale; Barkers Lodge Rd, opposite and adjoining #1760	c.20	<0.03	Council	Council and private	269870	6224830
Wollondilly	WD2c	Oakdale; W side of Barkers Lodge Rd, c.200 m S of Russells Lane junct	c.10	<0.03	Sydney Water	Council	269880	6224710
Wollondilly	WD3a	Oakdale; E end of Russells Lane, c.150 m W of Binnalong Rd	c.20	0.1	Council	Council	271860	6224660
Wollondilly	WD3b	Oakdale; W side of Binnalong Rd, just S of Russells Lane	c.5	<0.03	Council	Council	271990	6224500
Wollondilly	WD3c	Oakdale; Wild Oaks Rd, opposite lot 4	c.10	<0.03	Council	Council and private	272070	6224460
Wollondilly	WD4a	Belimba Park; 225 Binnalong Rd	c.10	<0.03	Sydney Water	private	272480	6224870
Wollondilly	WD4b	Belimba Park; 79 & 85 Kundabung St	c.12	<0.03	Sydney Water	private	272340	6225140
Wollondilly	WD5	Belimba Park; 25 & 27 Kundabung St	c.10	<0.03	Council	Council and private	272580	6225580

APPENDIX 3: SPECIES PROFILE AND EIA GUIDELINES

THREATENED SPECIES INFORMATION

Acacia pubescens

(Vent.) R. Br.

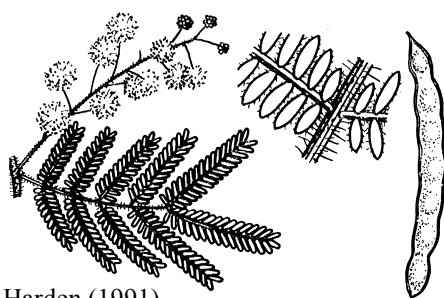
Common name: Downy Wattle

Conservation Status

Acacia pubescens is listed as a vulnerable species on Schedule 2 of the New South Wales *Threatened Species Conservation Act* 1995. *Acacia pubescens* is also listed as a vulnerable species on Schedule 1 Part 2 of the Commonwealth *Endangered Species Protection Act* 1992.

Description

Acacia pubescens is in the family Fabaceae (Mimosoideae). It is a spreading shrub 1-4m high with brilliant yellow flowers, bipinnate leaves and conspicuously hairy branchlets.



Harden (1991)

Distribution

It is restricted to the Sydney area. The distribution is concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. The eastern limit of its range is at Bardwell Valley, while the north-

western and south-western limits are at Mountain Lagoon and Oakdale respectively. *Acacia pubescens* occurs at 151 known sites, in 14 local government areas including Auburn, Bankstown, Baulkham Hills, Blacktown, Canterbury, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Rockdale, Strathfield, Sutherland and Wollondilly (NSW NPWS 2003).

Recorded occurrences in conservation reserves

There are five sites of *Acacia pubescens* within conservation reserves, at Scheyville National Park and Windsor Downs Nature Reserve (NSW NPWS 2003).

Habitat

Acacia pubescens occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone. The species occurs in open woodland and forest, in a variety of plant communities, including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland (NSW NPWS 2003).

Ecology

The longevity of the species is unknown, but clonal species have been known to survive for many decades (NSW NPWS 1999). The species flowers from August to October (Benson & McDougall 1996). Pollination of *Acacia* flowers is usually by insects and birds (Tame 1992, Auld 1996). The pods mature in October to December (Benson & McDougall 1996). *Acacia pubescens* is a clonal species and recruitment is more commonly from vegetative reproduction than from seedlings. The percentage of pod production and seed fall for this species appears to be low (NSW NPWS 2003). *Acacia* species generally have high seed dormancy and long-lived persistent soil seedbanks (Auld 1996). It is thought that the species needs a minimum fire free period of 5-7 years to allow an adequate seedbank to develop (Thomas 1994).

Threats

Known threats to the species include habitat loss, habitat degradation (through weed invasion, mechanical damage, rubbish dumping, illegal track creation, and inappropriate fire regimes), disease and hybridisation (NSW NPWS 2003).

Management

Management actions should involve protection and enhancement of habitat, removal of hybrids and removal and management of other threats.

Recovery Plans

An approved Recovery Plan has been prepared for *Acacia pubescens*.

For Further Information contact

Threatened Species Unit Conservation Programs and Planning Division, Central Directorate NSW NPWS PO Box 1967, Hurstville NSW 2220 Phone 02 9585 6678. www.npws.nsw.gov.au

References

- Auld T.D. (1996). Ecology of the Fabaceae in the Sydney region: fire, ants and the soil seedbank. *Cunninghamia* 4(4): 531-552.
- Benson D. & McDougall L. (1996). Ecology of Sydney plant species Part 4: Dicotyledon family Fabaceae. *Cunninghamia* 4(4): 553-752.
- Harden G.J. (1991). *Flora of New South Wales*. University of N.S.W. Press, Kensington, N.S.W.
- NSW NPWS (2003). Recovery Plan for *Acacia pubescens*. NSW NPWS, Hurstville.
- Tame T. (1992). *Acacias of southeast Australia*. Kangaroo Press, Kenthurst, NSW.
- Thomas J. (1994). Effects of hazard reduction burning on a grassy woodland remnant in Western Sydney. Unpublished MSc thesis, School of Geography, University of NSW, Sydney.

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Acacia pubescens

(Vent.) R. Br.

Common name: Downy Wattle

The following information is provided to assist authors of Species Impact Statements, development and activity proponents, and determining and consent authorities, who are required to prepare or review assessments of likely impacts on threatened species pursuant to the provisions of the *Environmental Planning and Assessment Act 1979*. These guidelines should be read in conjunction with the NPWS *Information Circular No. 2: Threatened Species Assessment under the EP&A Act: The '8 Part Test' of Significance* (November 1996).

Survey

Surveys for *A. pubescens* can be conducted at any time of year. It can be distinguished from other bipinnate wattles in the region by its conspicuously hairy branchlets. As it is a clonal species, counting the number of individuals at a site can be difficult. Alternative survey methods include counting the number of stems or clumps of stems, or estimating the extent of the population.

Life cycle of the species

The life cycle of the species is not well understood. One factor that is known to influence the life cycle is fire. If a proposal is likely to result in frequent fires, then this may lead to declines in the population, since an adequate seedbank will not be able to develop between fire events.

Threatening processes

Key threatening processes that have been listed under the *Threatened Species Conservation Act 1995* that are relevant to this species include "Clearing of native vegetation" and "High frequency fire resulting in the disruption of life cycle processes in plants and animals and

loss of vegetation structure and composition".

Threatening processes that have been identified as being relevant to this species should also be considered. These include habitat loss, hybridisation with other bipinnate Acacias and habitat degradation through weed invasion, mechanical damage, rubbish dumping, illegal track creation and arson (NSW NPWS 2003).

Viable local population of the species

The NPWS has assumed that any *A. pubescens* individuals within 300 m of each other are part of the same population (D. Keith, NPWS pers. comm.). The thresholds for viability of local populations of *A. pubescens* have not been determined. It should be noted that *A. pubescens* is known to be tolerant of quite high levels of some disturbances, such as mechanical damage. Small population sizes may not be a relevant factor in viability assessments, as most recruitment is from vegetative reproduction. Therefore, populations should be considered viable unless there is evidence to the contrary.

A significant area of habitat

Genetic studies have shown that numerous plants over a large area (eg one hectare) may all be one individual (NPWS 2003). Therefore, the significance of sites cannot be based on numbers of plants or stems without genetic testing. Other factors that can be used to determine the significance of a site include whether the population is setting seed, the size and connectivity of the habitat, the security of the site, the quality of the habitat (e.g. level of weed infestation) in comparison to other sites in the locality, the number of other sites

in the locality and whether the site is at the edge of the range of the species.

Isolation/fragmentation

The threat of inbreeding depression (resulting from isolation of sites) may not be an issue for *A. pubescens*, as recruitment usually occurs vegetatively and seed production is known to be low.

Fragmentation may be a significant issue for the species, as the current distribution of the species is highly fragmented. Management of *A. pubescens* habitat and any proposals should aim to maintain the continuity of habitat between individuals within sub-populations, and avoid artificially creating new sub-populations.

Regional distribution

The species is confined to the Sydney Basin Bioregion. Within this region, *A. pubescens* occurs at a number of scattered sites.

Limit of known distribution

The distribution is concentrated around the Bankstown-Fairfield-Rookwood area

For Further Information contact

Threatened Species Unit Conservation Programs and Planning Division, Central Directorate NSW NPWS PO Box 1967, Hurstville NSW 2220 Phone 02 9585 6678. www.npws.nsw.gov.au

References

NSW NPWS (2003). Recovery Plan for *Acacia pubescens*. NSW NPWS, Hurstville.

and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon (see map in recovery plan, NPWS 2003). Further surveys may identify additional sites outside these areas.

Adequacy of representation in conservation reserves or other similar protected areas

Only five sites occur within conservation reserves, at Scheyville National Park and Windsor Downs Nature Reserve. The species is therefore not considered to be adequately represented in conservation reserves. However, a large percentage of sites (66%) occur on lands owned by public authorities, which in some cases provides a certain level of protection (NSW NPWS 2003).

Critical habitat

Critical habitat cannot be declared for *A. pubescens* as it is not listed on Schedule 1 of the TSC Act. Therefore, this issue does not need to be considered.

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APPENDIX 4: MONITORING SHEET FOR ACACIA PUBESCENS

Date:	Site code (from Recovery Plan):
Recorder(s):	
Location:	

Population details:

Number of adult clumps:
Number of seedlings:
Area covered by population:
Changes from last visit:
Breeding status: buds flowering fruiting
If fruiting, degree of fruiting: abundant sparse % of population with fruit:

Population health:

Leaves diseased: no yes incidence: 1–2 plants widespread other:
Galls present: no yes incidence: 1–2 plants widespread other:
General comments:

Threat and habitat management:

Weeds: abundance: main species:
Other threats present: dumping trampling inappropriate fire regimes hybridisation
other:
Previous management actions undertaken:
Success of actions:
Further actions required:

Other comments:

APPENDIX 5: SUMMARY OF ADVICE BY NSW SCIENTIFIC COMMITTEE

Under Section 66A of the TSC Act 1995 (NSW), recovery plans must include a summary of advice by the NSW Scientific Committee, details of the amendments made and reasons for any departure from that advice. The Scientific Committee's comments on the draft Recovery Plan for *Acacia pubescens* and details of the amendments made, are tabled below:

Section	Advice	Response
3	Questioning relevance of ROTAP listing	Deleted
4.1	Include up to date version of botanical description of <i>A. pubescens</i> from RBG	Completed
5	Site at Oakdale is native according to RBG	Completed
5.1	Explanation of 'plants' – does it mean ramets	Completed
5.1	Definition of a 'population' needed	Completed
5.3	Include the provenance of <i>in situ</i> and <i>ex situ</i> plantings if known	Not known
6.3	Update species names given name changes	Completed
9.2.2	<i>A. baileyana</i> is not a noxious weed	Completed
10.3 & 11.2	More explanation required on the number of sites to be targeted for protection and management	Completed
11, 12	Some rewording of objectives and performance criteria required	Completed
15.3.3	Re-assessment of conservation status should also include any further loss or degradation of habitat and genetic data	Completed
16.2	Costings for research are too low	NPWS only facilitating research, not undertaking it
Ref's	Remove two unused references	Completed
Various	Various editorial comments	Completed



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