NSW and National Recovery Plan

Prostanthera askania

Recovery Plan

January 2006

Australian Government

Department of
Environment and Conservation (NSW)

Published by the Department of Environment and Conservation (NSW)

43 Bridge Street
(PO Box 1967)
Hurstville NSW 2220
Tel: 02 95856678
www.nationalparks.nsw.gov.au

Requests for information or comments regarding the recovery program for *Prostanthera askania* should be directed to:

The Director-General, Department of Environment and Conservation

c/-
Biodiversity Conservation Section
Metropolitan Branch
Environment Protection and Regulation Division
Department of Environment and Conservation
PO Box 1967
Hurstville, NSW 2220
Ph: (02) 9585 6678

Cover illustration: *Prostanthera askania*
Photographer: D. Stephenson

This recovery plan should be cited as following:

Department of Environment and Conservation (NSW) (2006) Prostanthera askania *recovery plan.* Department of Environment and Conservation (NSW), Hurstville, NSW.

ISBN 1 74137 757 9

Prostanthera askania recovery plan

Executive summary

This document constitutes the formal National and New South Wales State recovery plan for *Prostanthera askania*, and as such considers the conservation requirements of the species across its known range. It identifies the future actions to be taken to ensure the long-term viability of *P. askania* in nature and the parties who will carry out these actions.

Prostanthera askania is listed as endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and as endangered on Schedule 1 of the NSW *Threatened Species Conservation Act 1995*. It is a shrub in the family Lamiaceae that grows in a very restricted geographic range of less than 12 km in the Gosford - Wyong area of New South Wales. Currently only 10 populations are known and, in total, these occupy an area of less than 15 hectares. No part of any population occurs within a conservation reserve. More than 90% of the total number of known plants and the two largest known subpopulations occur on private land.

The natural habitat of *P. askania* has already been extensively cleared since European settlement and the remaining populations are fragmented. The major threat to *Prostanthera askania* is the further loss of plants and populations, and loss and fragmentation of remaining habitat, as a consequence of clearing and development for residential, industrial and rural uses. Other threats or potential threats include roadside maintenance activities, inappropriate fire regimes. bush rock removal, weed invasion; recreational activities, dumping of rubbish and garden waste; grazing, infection by the root-rot fungus (*Phytophthora cinnamomi*); climate change and alteration of stream hydrology.

This recovery plan for *Prostanthera askania* was prepared by the Biodiversity Conservation Section of the Environment Protection and Regulation Division's Metropolitan Branch in accordance with the requirements of the *Threatened Species Conservation Act* 1995 (TSC Act), and the Commonwealth *Environment Protection and Biodiversity Protection* Act 1999. The plan was prepared in consultation with a reference group consisting of stakeholders responsible for the management of public lands that have occurrences of *Prostanthera askania* and specialists in the biology and ecology of the species.

The overall objective of this recovery plan is to ensure the long-term survival of *P. askania* in the wild by promoting the *in-situ* conservation of the species across its natural range. Specific recovery objectives include:

- to conserve *Prostanthera askania* using land-use and conservation planning mechanisms;
- to identify and minimise the operation of threats at sites where *Prostanthera askania* occurs;
- to develop and implement a survey and monitoring program that will provide information on the extent and viability of *Prostanthera askania*;
- to provide the community with information that assists in conserving *Prostanthera askania*;
- to raise awareness of the species and involve the community in the recovery program; and
- to conduct research that will assist future management decisions.

It is intended that this recovery plan will be implemented over a five-year period. The cost to implement the plan over that period is estimated to be approximately $80,000 plus as yet undetermined costs for planning and implementing on-site management.

Lisa Corbyn
Director-General

Bob Debus MP
Minister for the Environment

Acknowledgments

The following people and their respective organisations are thanked for their contribution to the preparation of this recovery plan or for their assistance in the recovery effort for *P. askania* :

- Deborah Stevenson, Martin Bremner, Tricia Hogbin, Robert Humphries, Sarah Burke and other staff of the Biodiversity Conservation Section Metro, DEC.
- Gillian Towler, Louisa Murray and Barry Conn of the Botanic Gardens Trust (BGT), DEC. The BGT also gave permission for the reproduction in this plan of illustrations and photos from their website and scientific journal *Telopea*.
- Peter Cuneo, Tracey Armstrong, Debra Little and Brett Summerell (BGT).
- Chris Lacey (formerly NSW NPWS Central Threatened Species Unit) who compiled the initial review of species population data and first draft of the species profile and Jedda Lemmon (formerly NSW NPWS Central Conservation Assessment and Data Unit) who prepared the potential habitat model (figure 3) for *Prostanthera askania.*
- David Tierney, Julie Garratley, Jane Jacobs and Scott Duncan (Wyong Shire Council), Rachel Lonie (Gosford City Council), Alf Britton and Adam Fawcett (Forests NSW), Stephen Bell, Robert Payne, Robert Miller, Danny O'Brien and Sirka Siltanen, for providing additional location information, knowledge or advice.
- Ed and Kathy Manners, Alan and Bronwyn Meek and Paul Ellis-Grenier for allowing access to their properties.
- Wyong Shire Council for undertaking on-ground threat abatement works at *P. askania* sites.
- The Australian Government Department of the Environment and Water Resources (previously the Environment and Heritage) Natural Heritage Trust Program for funding the preparation of this recovery plan.

Table of Contents

List of tables

List of figures

Appendices

1 Introduction

Prostanthera askania is a spreading shrub belonging to the Lamiaceae family. The species is endemic to the Gosford - Wyong area of New South Wales, where it occurs over a very restricted geographic range of less than 12 km in the upper reaches of creeks which flow into Tuggerah Lake or Brisbane Water. The species is not known to occur in any conservation reserve and the natural habitat of *P. askania* has been extensively cleared since European settlement and remaining habitat is limited, fragmented and often degraded. Several threatening processes have been recorded operating at *P. askania* sites. The main threats result directly or indirectly from continued urban and rural residential and industrial expansion.

This document constitutes the formal NSW and National recovery plan for *Prostanthera askania* and as such considers the requirements of the species across its known range. The recovery plan describes the current conservation status and summarises current biological and ecological knowledge of the species, documents past and current management actions undertaken, and details a program for the next five years to promote the recovery of the species.

2 Legislative context

2.1 Legal status

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

The consequences of listing a species under the TSC Act and the EPBC Act include that:

- consideration must be given to the species when assessing the impacts of developments and activities, with the aim of minimising adverse impacts
- other actions that are likely to result in the harming or picking of that species or damage to its habitat must be licensed; and
- a recovery plan must be prepared in the case of the TSC Act and may be prepared in the case of the EPBC Act.

2.2 Recovery plan preparation

The TSC Act provides a legislative framework to protect and promote the recovery of threatened species, endangered populations and endangered ecological communities in NSW. Under this legislation the Director-General of the Department of Environment and Conservation (NSW) has a responsibility to prepare recovery plans for all species, populations and ecological communities listed as endangered or vulnerable on the TSC Act schedules. Similarly, the EPBC Act requires the Commonwealth Minister for the Environment to ensure that there is approved conservation advice in place for each nationally-listed species and community. The Commonwealth Minister may also require the preparation of a recovery plan for nationally-listed species and communities or adopt plans prepared by others, including those developed by state agencies. Both Acts include specific requirements for the matters to be addressed by recovery plans and the administrative process for preparing recovery plans.

This recovery plan has been prepared to satisfy the requirements of both the TSC Act and the EPBC Act and therefore will be the only recovery plan in operation for the species. It is the intention of the Director-General of DEC to forward the final version of this recovery plan to the Commonwealth Minister of the Environment for adoption, once it has been approved by the NSW Minister for the Environment.

The *TSC Act* requires that, when preparing a recovery plan, consideration must be given to any species knowledge or interests that indigenous people may have in the species and the measures to be contained in the plan. The *EPBC Act* requires that in the preparation of a recovery plan regard must be had to the role and interests of indigenous people in the conservation of Australia's biodiversity. *P askania* occurs in the area of the Darkinjung Local Aboriginal Land Council and in that of interest to the Guringai Tribal Link Aboriginal Corporation. These and other indigenous groups yet to be identified may have knowledge of or an interest in the species or in this recovery plan. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

2.3 International obligations

In making a Commonwealth recovery plan, regard must be had to assisting in the cooperative implementation of Australian's international environmental responsibilities and meeting Australia's obligations under relevant international agreements, which include;

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- Convention on Biological Diversity, ratified by Australia in 1993
- the Global Strategy for Plant Conservation.

The actions proposed within this plan are consistent with Australia's obligations under these international agreements.

2.4 Recovery plan implementation

The TSC Act requires that a public authority must take appropriate measures to implement the actions in a recovery plan for which they have agreed to be responsible. Public authorities identified as responsible for the implementation of recovery plan actions are required by the TSC Act to report on measures taken to implement those actions. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the plan.

The public authorities relevant to this plan are:
- the NSW Department of Environment and Conservation (DEC)
- the NSW Department of Infrastructure Planning and Natural Resources (DIPNR)
- the NSW Department of Lands
- the NSW Rural Fire Service (RFS)
- the Hunter/Central Rivers Catchment Management Authority
- Gosford City Council
- Wyong Shire Council
- Energy Australia
- Forests NSW.

Consequently, the actions outlined for each of these public authorities must be implemented as described in the Plan and public authorities that manage land that supports *P. askania* must, as the responsible land manager, manage the site in accordance with this plan.

The EPBC Act specifies that a Commonwealth agency must not take any action that contravenes a recovery plan and states that the Commonwealth must implement a recovery plan on Commonwealth lands. No occurrences of *P. askania* are currently known from Commonwealth lands.

2.5 Relationship to other legislation

The TSC Act and the EPBC Act interact with other NSW and Commonwealth legislation and planning instruments in a number of ways. Legislation which is also relevant to threatened species protection, management and recovery in NSW includes :
- *Environmental Planning and Assessment Act 1979*
- *National Parks and Wildlife Act 1974*
- *Native Vegetation Act 2003*
- *Rural Fires Act 1997*
- *Rural Fires and Environment Assessment Legislation Amendment Act 2002*
- *Local Government Act 1993*
- *Forestry Act 1916*
- *Forestry and National Parks Estate Act 1999*

2.6 Key threatening processes

The EPBC Act and the TSC Act provide for the identification and listing of key threatening processes. A key threatening process (KTP) is a process that threatens, or has the capability to threaten, the survival or evolutionary development of species, populations or endangered ecological communities. Several key threatening processes, as well as a number of other factors or activities which are identified in section 10.1, are recognised as threatening the survival of *P. askania*.

Six key threatening processes currently listed under the *TSC Act 1995* are likely to, or may potentially, threaten *P. askania*, as discussed in section 10.1. These KTPs are:
- *'Clearing of native vegetation'*, as defined by NSW Scientific Committee (2001), which has drastically reduced and fragmented the habitat of *P. askania*
- '*High frequency fire resulting in the disruption of life cycle process in plants and animals and loss of vegetation structure and composition*', which is likely to threaten the viability *of P. askania* populations
- '*Bushrock removal*'
- '*Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands'*
- *'Anthropogenic climate change'* and
- *'Infection of native plants by* Phytophthora cinnamomi*'.*

Three key threatening processes listed under the EPBC Act are likely to, or may potentially threaten *P. askania*. These KTPs, essentially the same as some of those listed under the TSC Act, are:
- *'land clearance'*
- *'loss of climatic habitat caused by anthropogenic emissions of greenhouse gases'* and
- *'dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)'*.

2.7 Critical habitat

The *TSC Act 1995* makes provision for the identification and declaration of critical habitat. Under the *TSC Act 1995*, critical habitat may be identified for any endangered species, population or ecological community occurring on NSW lands. Once declared, it becomes an offence to damage critical habitat (unless the action is exempted under the provisions of the *TSC Act 1995*) and a species impact statement is mandatory for all developments and activities proposed within declared critical habitat, unless the impact is deemed trivial or negligible by the Director General of the Department of Environment and Conservation.

To date, critical habitat has not been declared for *P. askania* under the *TSC Act 1995*. However, this recovery plan identifies (in sections 5, 6 and 7 and Appendix 1) the habitat features and locations that would contain habitat that is critical to the survival of the species, as required by the *EPBC Act 1999*. It is not currently considered a high priority to nominate critical habitat for *P. askania*, as no demonstrable conservation outcome would accompany its identification and declaration. Action 1.6 of this Recovery Plan provides a mechanism for reconsidering the need for critical habitat nomination by the third year of implementation of the plan.

3 Conservation status

Prostanthera askania is listed as endangered at both state (TSC Act) and national (EPBC Act) levels. At the time of the determination (NSW Scientific Committee 1998) the species was considered to be at risk of extinction as a consequence of the following factors:

- restricted geographic range;
- small total population and small numbers in each constituent population;
- threatened by land clearing; and
- no populations represented in conservation reserves.

4 Taxonomy and description

4.1 Taxonomy – what is the subject of this plan?

Prostanthera is a genus – within the family Lamiaceae - of about 100 species which occur only in Australia (Harden 1992). Prostantheras are known generally as "mint bushes" because of the aromatic foliage of many species and they are related to a number of well-known, commercially cultivated plants in other genera of the family, such as lavender, mint, thyme, oregano and sage, which are used in cooking and for perfumes.

Prostanthera askania B.J.Conn was defined as a taxon and named by Conn (1997). It had previously been referred to and was first listed on Schedule 2 of the Threatened Species Conservation Act 1995 as *Prostanthera* sp. Strickland State Forest. It has also been called *Prostanthera* sp. 6 and *Prostanthera* sp. G (e.g. in *Flora of New South Wales* volume 3 (Harden 1992). It has also frequently been referred to in keys and other publications (e.g. in *Students flora of north-eastern New South Wales* (Beadle 1984) and *Flora of the Sydney region* (Carolin and Tindale 1994) as *Prostanthera incisa* var. *pubescens.*

The collection location of the type specimen (NSW402642) - a private wildlife sanctuary previously known as 'Askania Park' at one time and 'Forest of Tranquillity' at another[1] - was the derivation of the specific epithet as well as an informal common name, Tranquillity Mintbush. It has also been referred to by the common names Strickland Mint-bush (e.g. in Environment Australia 2001) and Cut-leaf Mint-bush.

4.2 Description

Prostanthera askania is illustrated in Figure 1. The following is a summary of the full description of the species, which can be found in Conn (1997):

- Erect, spreading to openly branched shrub, 1-2.5 m high, rarely scrambling to 3 m. Leaves and branches strongly and unpleasantly aromatic, especially when crushed.
- Branches subterete, moderately covered with long (usually 1.5-3 mm), spreading hairs, usually sparsely scattered with glands.
- Leaves ovate, 12-40 mm long, 8-24 mm wide; apex obtuse; base ± attenuate to truncate; margins deeply toothed with teeth 5-10 mm long, directed slightly forward; surfaces 'dusty' green, paler below, covered with long, spreading hairs, sparsely glandular; petiole 2-8 mm long, similarly hairy.
- Flowers in a terminal botryoid, each 4-10-flowered. Prophylls (bracteoles) persistent, 2.4-4 mm long. Calyx dull green, hairy, with tube 1.5-2.5 mm long and lobes 1.8-3.5 mm long. Corolla 12-14 mm long, pale mauve to blue-mauve, markings absent. Stamens inserted 1.5-2 mm above base of corolla, filaments 2-2.2 mm long. Anthers appearing to be without basal appendage.

[1] currently known as 'Australian Rainforest Sanctuary'

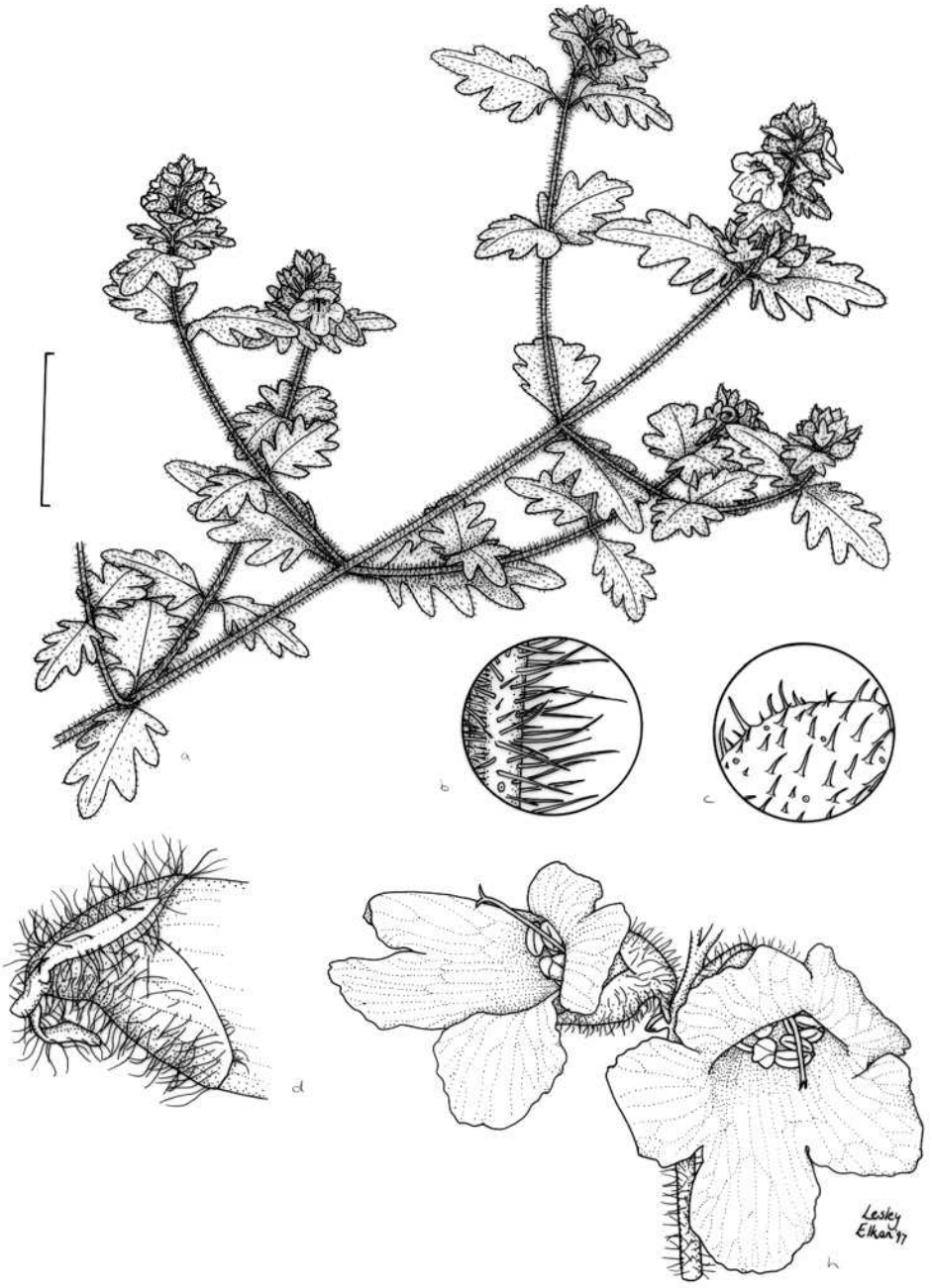

Figure1. *Prostanthera askania.*

a, flowering branchlet**; b,** details of branchlet showing spreading, multicellular hairs and hemispherical sessile glands. **c,** detail of indentum and hemispherical sessile galnds of leaf surface. **d,** detail of calyx and prophylls.
Scale bar: a = 30 mm; b & c = 3 mm; d = 4 mm.
(Drawings by Lesley Elkan, reproduced with permission of the Botanic Gardens Trust).

5 Distribution and abundance

5.1 Definitions: populations and subpopulations

With one exception, in this recovery plan discrete groups of *Prostanthera askania* plants that are not separated from other discrete groups by more than one kilometre are considered together as a single **population**[2]. The exception is the separation of two groups of sites which, despite occurring just within one kilometre of each other, have been considered as separate populations because they occur in different major catchment systems. Following this reasoning, 10 populations of *P. askania* have been recognised. Each population has been identified uniquely by using the prefix 'Pa' followed by a unique number (e.g 'Pa_01', 'Pa _02', etc.).

A **subpopulation** is defined as discrete group of *P. askania* plants that is separated from other groups within the same population by an arbitrary distance of 200 metres or more. Thirteen known subpopulations have thus been defined for *P. askania* (see Appendix 1). Where a population consists of multiple subpopulations, each subpopulation has been identified uniquely by an alphabetic suffix -'a', 'b', 'c', etc. - to the population identifier (e.g 'Pa _01a', 'Pa _01b', etc.).

5.2 Current and historical distribution

Prostanthera askania is endemic to the Gosford – Wyong area of the Central Coast region of NSW (Figure 2). It is known reliably from only 13 subpopulations within 10 populations, which occur in the upper reaches of creeks that flow into Tuggerah Lakes and Brisbane Water. It has a very limited extent of occurrence of less than 50 km^2 and a linear geographic range of less than 12 kilometres. Within this area the species is known to physically occupy an area of less than 15 ha.

Recent surveys (December 2003) have reconfirmed the location of eight populations of the species in the catchments of Ourimbah Creek, Narara Creek, Dog Trap Gully, Chittaway Creek and Berkeley Creek. A further two populations are known from the Erina – Fires Creek catchment. The species may also have occurred historically in West Gosford.

P. askania occurs in the local government areas of Gosford and Wyong. All populations are within the area of responsibility of the Hunter/Central Rivers Catchment Management Authority.

Appendix 1 lists and summarises attributes of the currently known populations. References to subpopulation identifiers throughout this plan correspond to those in Appendix 1. Given concerns that the publication of specific locational details for populations of *P. askania* may compromise its conservation, detailed location descriptions and grid references will not be made publicly available. Public authorities, land managers, or others with valid reasons for requiring the data, may request such information by contacting the Department of Environment and Conservation.

5.3 Population size and structure

The population size of a species is considered to be the total number of mature individuals (IUCN 1994). However, most estimates made of population sizes of *Prostanthera askania* fail to distinguish between mature and immature individuals. Hence, the total number of mature *P. askania* individuals across all known sub-populations remains unknown. Furthermore, even total numbers of individuals - mature and immature plants together - in most populations of the species are unknown, since few populations have been systematically surveyed or comprehensively censused, and many sites have not received a documented visit for some time – some not within the past decade. Hence, there may have been significant changes in plant numbers since the last estimates were made. In addition, the apparently clonal nature of *P. askania* makes it extremely difficult to differentiate individual plants (genets), so there has been poor consistency in what has been counted or estimated at each subpopulation or on each occasion.

The number of *P. askania* individuals across all 10 recognised populations is therefore unknown, but is estimated to be between 6600 and 10200 plants. This figure includes an estimated 5000-7000 plants that are less than one year old since regenerating from fire and have not reached reproductive maturity (subpopulation Pa_05a). In the other populations, comprised largely of reproductively mature individuals, population size varies from only a single individual to thousands of plants, although the majority of populations support a low number of plants (Table 1). Six of the ten populations consist of fewer than 100 plants, and only three populations support greater than 150 mature plants, of which only one comprises more

[2] Following Keith *et al.* (1997), and consistent with Australian usage, this plan uses the terms 'total population' and 'population' instead of the terms 'population' and 'subpopulation', respectively, adopted by the International Union for the Conservation of Nature and Natural Resources (IUCN 1994). Hence, in this plan 'total population' defines the total population of *P. askania* across its extent of occurrence and 'populations' are defined as "geographically or otherwise distinct groups in the total population between which there is little [genetic] exchange, typically less than one migrant per year". A migration in the case of plant species is considered to be the movement of seed propagules or pollen between populations, though it is suggested that the dispersal of propagules is more important to the viability of plant populations, because pollen does not usually contribute to rescue or recolonisation events. Since in the case of *P. askania* there is inadequate information on a species with which to assess the extent to which genetic material is exchanged, a 'population' is defined, using the rule of thumb suggested by Keith *et al.* (1997), as a "geographic discontinuity" of more than one kilometre.

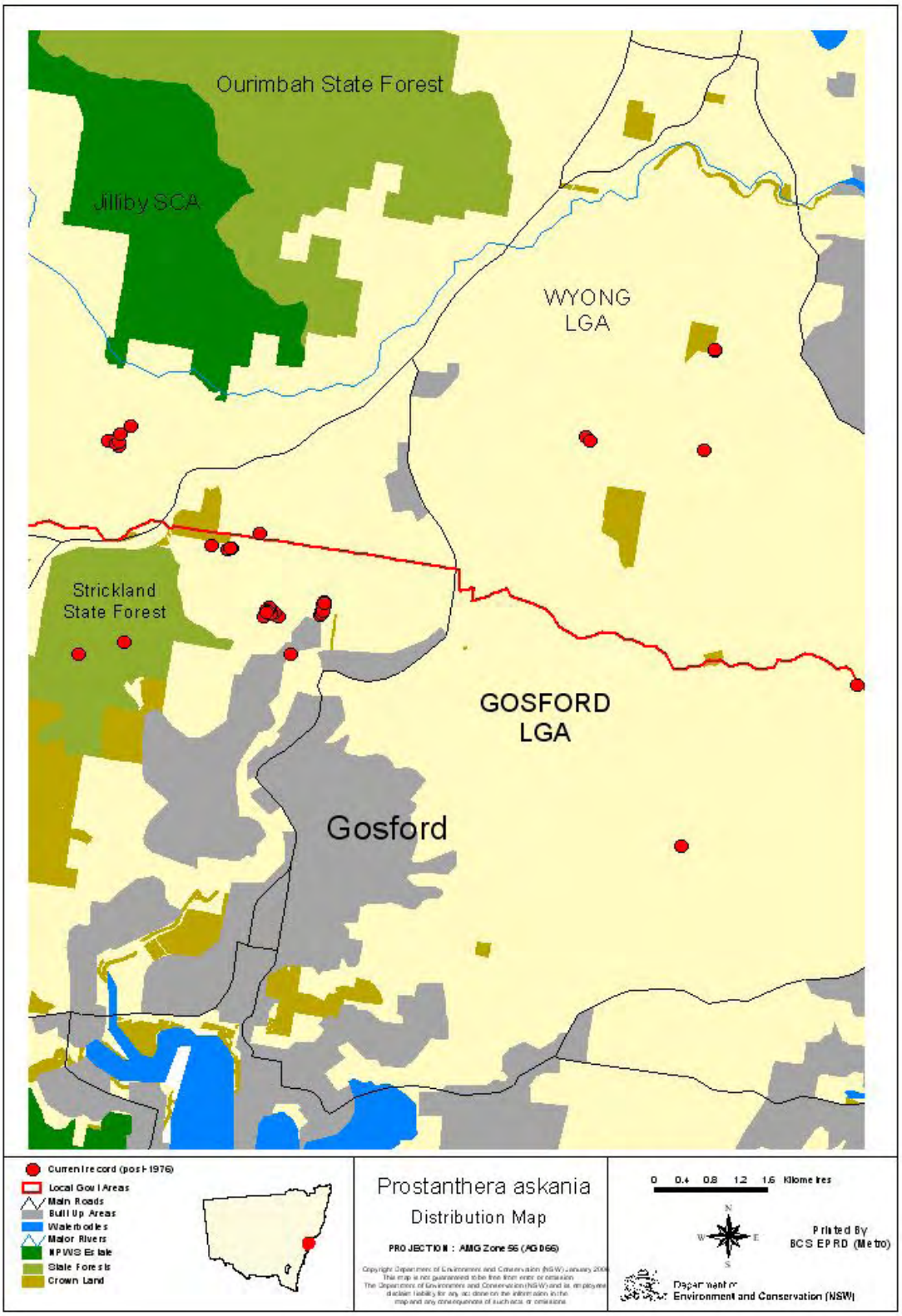

Figure 2. Geographic distribution of *Prostanthera askania.*

than 1000 plants. In addition, the majority of populations occur over a small area, with most occupying an area of less than 0.5ha. Only three populations have an area of occupancy greater than one ha. These data are summarised in Table 1.

Table 1: Size class distribution for the known extant populations of *P. askania*

Size class#	Number of populations	Population identifier
≤ 5	2	Pa_06, Pa_07
≥ 5 ≤ 100	4	Pa_02, Pa_03, Pa_09, Pa_10
≥ 101 ≤ 500	2	Pa_01, Pa_08
≥ 501 ≤ 1000	0	
≥ 1001 ≤ 5000	1	Pa_04
≥ 5000 ≤ 7500	1	Pa_05*

estimates of number of mature *and* immature plants.

* includes 5000-7000 immature plants less than 1 year old

6 Land tenure, management and zoning

Table 2 shows the distribution of *P. askania* subpopulations by tenure, land manager and local government zoning. Where a subpopulation extends across two (or more) different tenures, it has been recorded as two (or more) separate sites.

While the majority of known populations occur on public lands of various types (Council reserves, Crown Land or State Forest), all or part of six of the 13 known subpopulations occur on private freehold lands (Table 2); these include the area occupied by the two largest subpopulations which comprise more than 90% of the total number of known plants.

6.1 Conservation reserves

Prostanthera askania has not been recorded from any national park, nature reserve, state conservation area or other type of gazetted conservation reserve managed by DEC.

6.2 State forest

Two populations (Pa_02, Pa_03) occur in Strickland State Forest which is zoned FMZ 2 (Special Management Area) under Forests NSW's Forest Management Zoning (FMZ) system. As such it is an informal reserve created by the Minister for Forests, and constitutes part of the CAR[3] reserve system. It is managed under a management plan for biodiversity and heritage conservation, education and recreation purposes.

6.3 Crown Land

One population (Pa_10) is on Crown Land, occurring partly on a Crown road reserve and partly on an adjoining Crown reserve. The Crown road reserve is managed by the Department of Lands. The Crown reserve is dedicated for the purposes of both public recreation (as Reserve 73397) and timber (as Reserve 62269). Management for the purpose of public recreation is devolved to Wyong Shire Council, while management for the purpose of timber is the responsibility of Forests NSW. The reserve is zoned 6a for 'Open Space (Recreation)' As Crown Land it is not classified under the Local Government Act.

Another population (Pa_09) occurs partly on the verge of Brush Road, Fountaindale, on a Crown road reserve managed by Wyong Shire Council.

6.4 Council lands

6.4.1 Gosford LGA

Three subpopulations occur on land owned by Gosford City Council zoned 6a for 'Open Space (Recreation)'. These include the Alan Street reserve (Pa_05b); Katandra Reserve (Pa_06); and a reserve on The Ridgeway, Holgate (Pa_07). Part of the Alan Street reserve population (Pa_05b) is on Council-owned land zoned 6e for 'Open Space (Proposed)' under the Gosford Planning Scheme Ordinance. These lands are classified as community land under the Local Government Act.

A fourth subpopulation (Pa_05a) occurs west of Siletta Road partly on Council-owned land recently created as a public reserve, but which is currently zoned 7a ('Conservation') and classified as operational land under the Local Government Act.

6.4.2 Wyong LGA

Wyong Shire Council owns a reserve on Berry's Lane, Fountaindale, zoned 7a ('Conservation'), on which one population (Pa_08) occurs. This land is classified as community land under the Local Government Act.

In addition, the Council controls and manages the Crown Lands (Crown reserve and Crown road reserves) referred to in section 6.3.

[3] Comprehensive, Adequate and Representative. The Commonwealth, State and Territory Governments agreed to the development of National Forest Reserve Criteria, in accordance with the National Forest Policy Statement. The Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee (known as JANIS) produced a report outlining the criteria. Called "Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate And Representative Reserve System for Forests in Australia," the report sets out the components of the Comprehensive, Adequate And Representative (CAR) reserve system. These components are commonly referred to as the JANIS criteria. The criteria are linked to the International Union for Conservation of Nature (IUCN) guidelines for Protected Area Management Categories.

6.5 Freehold land

Of the 13 *P. askania* subpopulations, six occur wholly or mostly on private freehold land (Pa_01, Pa_04a, Pa_04b, Pa_04c, Pa_05a, Pa_09). These are all properties in areas zoned 7a for 'Conservation' in both Gosford and Wyong LGAs. This zoning, however, does not preclude many types of development or activity (see section 10.1.1). Furthermore, the meaning of the zoning primary purpose, 'Conservation', and the allowable developments or activities within the zone differs between the two local government areas.

These populations constitute more than 90% of the total number of known plants and include the two largest subpopulations (Pa_05a and Pa_04b).

Table 2: Tenure, land manager and zoning for all known *Prostanthera askania* sites.

Tenure - Land manager Zoning – purpose[§]	Council-managed land category	No. sites*	Subpopulation identifier
Private property – Gosford LGA			
7a 'Conservation' a,		3	Pa_04a, Pa_04b, Pa_05a‡
Private property – Wyong LGA			
7a 'Conservation' [b]		3	Pa_01, Pa_04c, Pa_09
Council reserve – Wyong Shire Council			
7a 'Conservation' [b]	Community	1	Pa_08
Council reserve – Gosford City Council			
7a 'Conservation' [a]	Operational	1	Pa_05a‡
6a 'Open space (Recreation)' [a]	Community	3	Pa_05b‡, Pa_06, Pa_07
6e 'Open space (proposed)' [a]	Community	1	Pa_05b‡
Crown Land - Wyong Shire Council			
Crown reserve – 6a 'Open space (Recreation)' [b]	-	1	Pa_10‡
Road reserve – 7c?	-	1	Pa_09‡
Crown Land – Department of Lands			
Road reserve – 7c?	-	1	Pa_10‡
State forest – Forests NSW			
Conservation/recreation [c]		2	Pa_02, Pa_03

* where a subpopulation extends across two different tenures or zoning it has been recorded as two separate sites
‡ subpopulation occurs across more than one tenure or zoning
§ as identified in the
[a] Gosford City Council Interim Development Order 122 or Gosford Planning Scheme Ordinance, or
[b] Wyong Shire Council Local Environmental Plan 1991, or,
[c] Forests NSW Forest Management Zoning system.
The meaning of the zoning primary purpose and the allowable developments or activities within the zone differs between local government areas.

7 Habitat

7.1 Landform, geology and soil

Prostanthera askania is found primarily on the rolling hills, footslopes and valley flats of the Erina Hills physiographic region. It usually occurs on the lower areas of undulating to moderately steep slopes of the colluvial Watagan and erosional Erina soil landscapes. However, the species has also been found on ridge tops where moister forest types carry across the ridge. It also occurs on alluvial soils of the Yarramalong soil landscape, adjacent to, but not immediately in, drainage lines dissecting the Watagan and Erina landscapes (Murphy 1993).

The Watagan and Erina landscapes are derived from the Narrabeen Group of sandstone, siltstone, claystone and conglomerate. Outcropping boulders of sandstone are found at several *P. askania* locations. The alluvial Yarramalong soil landscape is formed from more recent (Quaternary) geological processes.

Topsoils on which *P. askania* grows include loams, sandy clay loams and alluvial sands (Murphy 1993), however, the specific soils occurring at sites have not been assessed.

7.2 Climate[4] and altitude

The climate of the area is warm temperate with a maritime influence. Average annual rainfall at Gosford is 1320 mm. Rainfall is generally higher and more reliable during summer although soil moisture availability tends to remain high throughout the year (Edwards 1979). Temperatures are generally mild with relatively low ranges (from

[4] Bureau of Meteorology data at October 2003

10 to 13.5°C) between monthly maxima and minima. The mean of maximum daily temperature at Gosford is highest in January at 27.4°C and lowest in July at 17.4°C. Mean minimum daily temperature is highest in February at 17.1°C and lowest in July at 4.5°C. Average monthly humidity (at 9 a.m.) ranges from 62% in October to 82% in June.

Summer winds are usually from the south or south-east, and there is a tendency for onshore north-easterly winds on the coast in the afternoon. Winter winds are predominantly from the south or south-west.

The altitudinal range of *P. askania* is 10 to 130 metres above sea level, although the majority of occurrences are below 100 m a.s.l.

7.3 Associated vegetation

The species occurs in moist sclerophyll forest and warm temperate rainforest communities, as well as the ecotone between them. These communities are generally tall forests with a mesic understorey. *Syncarpia glomulifera* subsp. *glomulifera* (Turpentine), *Allocasuarina torulosa* (Forest Oak), and *Eucalyptus acmenoides* (White Mahogany) are characteristic of the wet sclerophyll community, but the canopy species present can be highly variable (Bell 2002). At most known *Prostanthera askania* sites *S. glomulifera* and *Eucalyptus saligna* (Sydney Blue Gum) occurs, but canopy species at various sites also include *E. agglomerata* (Blue-leaved Stringybark), *E. pilularis* (Blackbutt), *Corymbia maculata* (Spotted Gum) and *E. siderophloia* (Grey Ironbark), with the presence of the latter three species indicating a drier variant of the moist sclerophyll forest. Canopy species at rainforest sites are also variable and include *Doryphora sassafras* (Sassafras), *Cryptocarya obovata* (Pepperberry), *C. glaucescens* (Jackwood), *C. microneura* (Murrogun), *S. glomulifera*, *Ceratopetalum apelatum* (Coachwood), *Synoum glandulosum* subsp. *glandulosum* (Scentless Rosewood), *Acmena smithii* (Lilly Pilly), *Acacia irrorata* (Green Wattle), *Tristaniopsis collina* (Mountain Water Gum), *Callicoma serratifolia* (Black Wattle), *Archontophoenix cunninghamiana* (Bangalow Palm), *Glochidion ferdinandi* (Cheese Tree) and *Sloanea australis* (Maiden's Blush) (NSW NPWS 2000a, Conn 1997).

Assemblages of understorey species vary considerably at each site and reflect a mix of moist forest/rainforest species determined by localised habitat conditions, prior and current disturbance regimes (e.g. fire, weed invasion, proximity to access tracks, natural tree falls) and the successional stage of the community. In many instances *Prostanthera askania* forms dense clumps and so in some instances it constitutes one of the dominant understorey species within the community.

Prostanthera askania occurs in vegetation communities mapped in the Lower Hunter and Central Coast Regional Environmental Strategy (LHCCREMS) as Coastal Narrabeen Moist Forest (Map Unit 6), Coastal Wet Gully Forest (MU 1), Coastal Warm Temperate – Subtropical Rainforest (MU 1a) and Coastal Narrabeen Shrub Forest (MU 22) (NSW NPWS 2000a).

Known sites in the Wyong LGA occur in vegetation communities mapped more recently by Bell (2002) as Coastal Ranges Moist Layered Forest (MU 35), Narrabeen Warm Temperate – Subtropical Rainforest (MU 42) and Narrabeen Hunter Ranges Gully Dry Rainforest (MU 41).

More detailed vegetation mapping for the Gosford LGA has recently been completed (Bell 2004): known sites occur in communities mapped as Coastal Narrabeen Moist Forest (MU E6a) and Coastal Warm Temperate Rainforest (MU E1ai).

7.4 Potential habitat

Potential habitat using the dataset of *P. askania* records available at the time was modelled and mapped (figure 3) by NSW NPWS (2000b). Model performance indicators suggested that the model was not particularly robust, probably as a result of the low number of available records and the low accuracy of several of the records used.

Until this potential habitat model is revised using the most recent and audited dataset, potential habitat of *P. askania* for the purposes of environmental impact assessment should thus be considered to be any of the following vegetation communities, as mapped in their respective projects, within Gosford or Wyong local government areas:

- Coastal Narrabeen Moist Forest (Map Unit 6), Coastal Wet Gully Forest (MU 1), Coastal Warm Temperate – Subtropical Rainforest (MU 1a) or Coastal Narrabeen Shrub Forest (MU 22) as mapped in the Lower Hunter and Central Coast Regional Environmental Strategy (LHCCREMS) (NSW NPWS 2000a); or
- Coastal Ranges Moist Layered Forest (Map Unit 35), Narrabeen Warm Temperate – Subtropical Rainforest (MU 42) and Narrabeen Hunter Ranges Gully Dry Rainforest (MU 41) as mapped for the Wyong local government area by Bell (2002); or
- Coastal Narrabeen Moist Forest (Map Unit E6a) and Coastal Warm Temperate Rainforest (MU E1ai) as mapped for the Gosford local government area by Bell (2004).

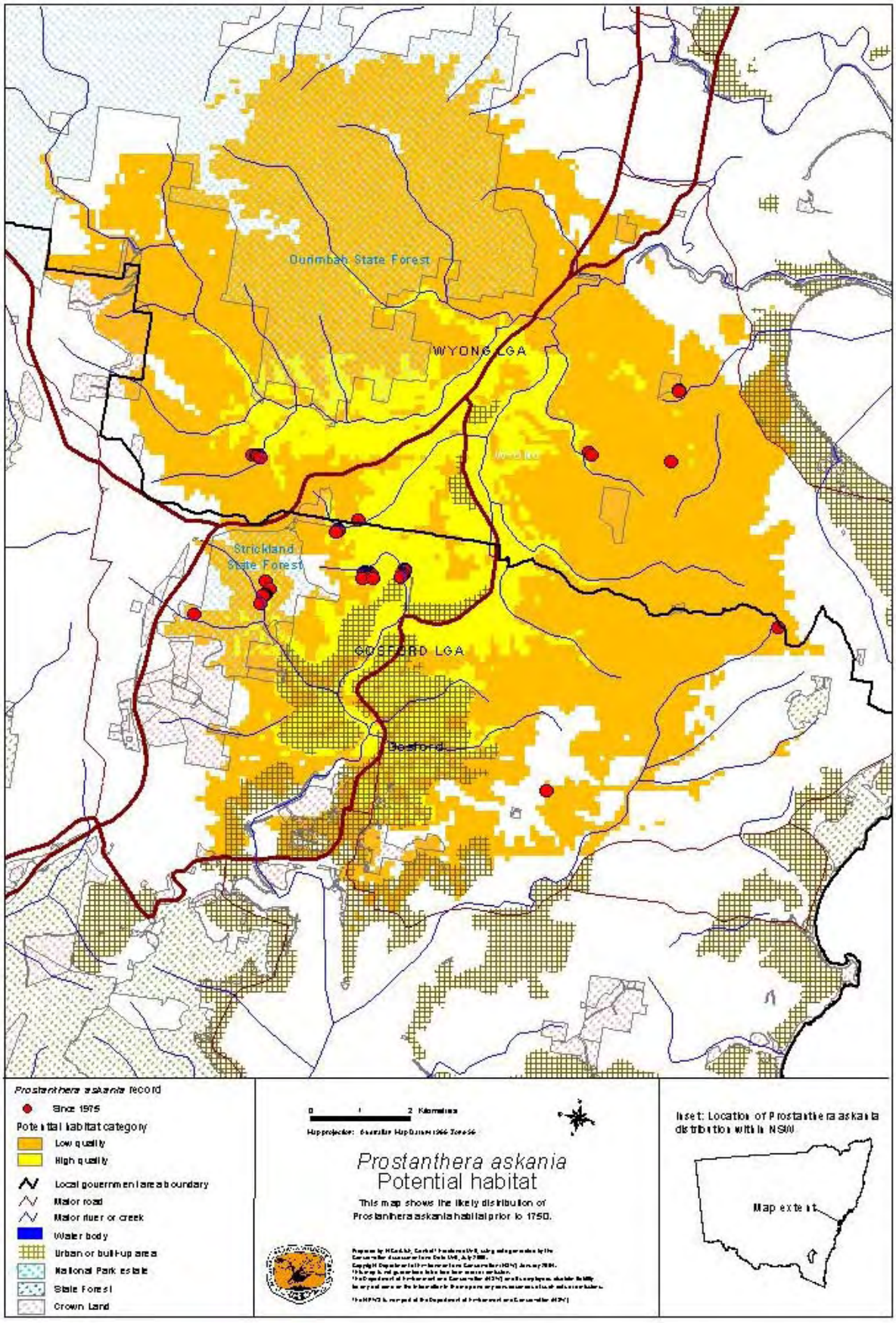

Figure 3. Potential habitat of *Prostanthera askania*
(modelled by NSW NPWS 2000b using the dataset of *P. askania* records available in the year 2000 overlain with current accurate records)

8 Biology and ecology

The level of information known about the biology and ecology of *P. askania* is limited and only broad assumptions can be made regarding many aspects.

8.1 Habit

Prostanthera askania is an erect but spreading and sometimes scrambling, openly-branched shrub that grows from 1-3 metres high (Conn 1997). It often forms dense clumps and also shows a tendency at some sites to propagate vegetatively (see section 8.3.1).

8.2 Longevity

The life-span of this species is not known. However, *Prostanthera askania* appears to be a colonising species that takes advantage of increased light following natural canopy-cover disturbance within the moist forest and rainforest habitats in which it occurs, so while *P. askania* individuals may persist in low light conditions, they are likely to senesce in such conditions (C. Pennay[5], pers. comm., N. Corkish, pers. obs.).

The longevity and viability of *P. askania* seed in the soil is not known.

8.3 Reproductive biology

Little is known about the reproductive biology of *Prostanthera askania*. Some basic aspects of the species' reproductive biology (growth, flower and fruit production) are currently being studied (D. Tierney[6], pers. comm.). Further work is required on the reproductive biology and ecology of the species to inform successful *in situ* habitat management actions.

8.3.1 Vegetative reproduction

Vegetative reproduction from subsurface epicormic buds (suckering) has not been documented for *P. askania*. However, the species appears in several locations to propagate vegetatively by 'stem-layering', by which prostrate branches take root where they remain in contact with the soil N. Corkish[7], pers. obs.). The age at which the species is capable of this is not known.

8.3.2 Reproductive maturity

The age at which *P. askania* is capable of flowering and producing seed is not known. Preliminary research has not identified a relationship between flowing and age, but a positive relationship between plant size and flowering has been established (D. Tierney, pers. comm.). Some other *Prostanthera* species appear to flower at a young age (e.g. in *P. junonis*, plants were estimated to be flowering within the first 3 years (Tierney and Gross 2001).

8.3.3 Phenology

Knowledge of the period, regularity and duration of flowering and fruit production in *P. askania* is incomplete, and the factors which influence flowering and fruiting are unknown. Conn (1997) documented the flowering of *P. askania* as taking place from June–December, primarily in the period September–December, and it is known that the timing of both flowering and fruiting can be variable. For instance, the flowering period for the species was observed to be very short during 1999 and 2000 (C. Lacey[8], pers. obs.), with flowers present for just two to three weeks during November. In contrast, in the 2003-2004 season, there was a peak over spring with flowering extending into mid summer (D. Tierney, pers. comm.).

Fruiting is considered by Conn (1997) to take place from July–December. In the 2003-2004 season most fruit (in a few populations which were studied) set from late spring to summer (D. Tierney, pers. comm.).

8.3.4 Breeding system

Prostanthera flowers are morphologically hermaphrodite, having both male and female organs present in each flower. However, the breeding system of *P. askania* is not understood and it is not known whether *P. askania* is exclusively capable of self-pollination. Studies into a congener *P. junonis* (Tierney and Gross 2001) showed it was capable of self-pollination, although seed set and seed viability were lower in selfed seed compared with that resulting from open-pollinated flowers.

8.3.5 Pollination

Several species of insect have been observed visisting the flowers of *P. askania*, however these have not been identified (C. Lacey, NSW NPWS, pers. obs.). These have included "common" moth species, oriented as if nectar feeding (D. Tierney, pers. obs.).

8.3.6 Seed ecology

Only preliminary observations regarding the persistence of fruit on *P. askania* plants is available. In the 2003-2004 season most fruit in a few studied populations dropped in March within 4-6 weeks of seed set, suggesting that the species maintains no aerial seed bank (D. Tierney, pers. comm.).

[5] C. Pennay, former Threatened Species Officer, NSW NPWS

[6] D. Tierney, Environmental Systems Officer, Wyong Shire Council

[7] N. Corkish, Threatened Species Officer, DEC (NSW)

[8] C. Lacey, former Threatened Species Officer, NSW NPWS

At present there is virtually no knowledge of the success or mode of dispersal of seed of *P. askania.* Information regarding seed dispersal, seed longevity and viability, seed dormancy and germination is unavailable. These are considered to be critical aspects of the species' biology requiring investigation.

8.4 Disturbance ecology

Observations of plants often in canopy gaps or adjacent to tracks and of regeneration following fire suggests that *Prostanthera askania* may be a colonising species that takes advantage of increased light following natural canopy-cover disturbance within the moist forest and rainforest habitats in which it occurs. Seedling recruitment may be linked to the breaking of seed dormancy by light as a result of such disturbances such as forest canopy openings and understorey fire. Reduced competition for other resources may also stimulate regeneration vegetatively or from seed.

The species appears to be present in only small numbers at sites where low light conditions prevail or that are subject to high levels of weed invasion. Occasional *P. askania* individuals do persist in low light conditions, but are likely to senesce in the absence of a disturbance regime that is conducive to recruitment. Observations of the species indicate that it is outcompeted by invading weed species such as lantana which occupies a similar environmental niche (C. Pennay, NSW NPWS, pers. obs.).

P. askania is likely to be fire-sensitive given the moist forest habitats it occupies, however, its fire ecology is currently unknown. A large pre-fire adult population in moist *Syncarpia glomulifera* forest was killed by fire in October 2002, but appears to be successfully regenerating, apparently from seed (N. Corkish, pers. obs. of subpopulation Pa_05a), between 6 and 16 months following fire, which suggests that either a soil-stored seedbank or a heavy crop of seed on the adult plants (aerial seedbank) was present immediately before the fire. Continued monitoring and further studies are required, however, to draw firm conclusions regarding the species' response to fire.

There have been no systematically-recorded observations of the effects of fire frequency, intensity or seasonality on *P. askania* or its soil seed bank. It is not known if *P. askania* plants are capable of surviving by suckering after a fire of great enough intensity to destroy all above ground parts of the plant. Nor is it known what intensity of fire, if any, the *P. askania* soil seed bank – if it maintains one - is capable of surviving. Research into the fire response of the species (including its soil seed bank) is considered to be a critical aspect of the species' biology requiring investigation.

While occasional disturbances may actually favour the persistence of *P. askania* in some locations, it can be reasonably assumed that frequent disturbances (as a consequence of grazing, slashing, fire or other activities that destroy the above ground parts of the plant and prevent seed production) may lead to local extinctions of the species in the long term. This will occur if the disturbances are of a frequency that prevents the plants that regenerate from developing to a stage where they are capable of producing seed and/or vegetatively reproducing in response to a subsequent disturbance. In addition, a long-term absence of disturbance may be detrimental to population persistence given that growth appears to be enhanced by disturbance events or canopy gaps. The critical fire or other disturbance frequencies for survival have not yet been determined, however interim recommended minimum and maximum fire intervals are provided in section 10.1.7.

9 Previous recovery actions

9.1 Threatened species data collation and audit

The Department of Environment and Conservation Biodiversity Conservation Section Metro has conducted a literature review, and checked and audited NSW herbarium, NSW NPWS Atlas of Wildlife and Forests NSW records.

9.2 Profile and environmental impact assessment guidelines

A species profile and environmental impact assessment guidelines have been prepared for *P. askania* (Appendix 2). The aim of these documents is to assist in the assessment of potential impacts on the species during the preparation and review of assessments under Parts 4 and 5 of the EP&A Act and Part 6 of the TSC Act.

9.3 Establishment of a recovery team

A recorvery team has not been established for *P. askania*. However, consultation has occurred with members of a recovery plan reference group, comprising representatives of relevant public authorities which will be responsible for the planning for and/or management of this species and scientists who have special knowledge of the species.

9.4 In situ protection

Threat abatement works involving weed removal are being implemented at one Council-owned *P. askania* site (Pa_08), as part of Wyong Council's

bush regeneration program. Council intends to monitor the site for weeds annually.

9.5 Ex situ protection

Numerous cuttings of *P. askania* have been collected, propagated and planted with varying success by the Botanic Gardens Trust (BGT). These cuttings were sourced from at least two, possibly three, different wild populations. Propagated plants have survived between 1 and 14 years.

No seed collections appear to have been made to date. One reason may have been that the seed of *Prostanthera* species is difficult to collect and maintain in storage (P. Cuneo[9], pers. comm.). The genus is a target group for research on seed viability and the requirements for successful conservation storage, and in this context *P. askania* is a candidate, subject to funding, for the Seedquest NSW program to be carried out by the BGT in partnership with the "Millennium Seedbank" program of the United Kingdom's Royal Botanic Gardens at Kew (P. Cuneo, pers. comm.).

The BGT does not have, nor does it intend to collect, cutting or seed material to cover the range of geographical, morphological or genetic variability across the total population of the species (P. Cuneo, pers. comm.).

9.6 Survey, research and monitoring

The following survey, research and monitoring activities have been implemented:

- The majority of *P. askania* populations known at the time were surveyed in January 2001 by Chris Pennay of the then NSW NPWS Central Threatened Species Unit. At each site population size and area were estimated, and habitat information and potential threats were noted. Assessment of some other populations is currently being undertaken by DEC.
- NSW NPWS (2000b) mapped predicted habitat for *P. askania* in the Lower Hunter and Central Coast region (figure 3).
- Research to collect basic growth and reproduction data (flowering and fruit production) commenced in Spring 2003 at two sites in Wyong LGA.
- Monitoring of seedling recruitment, survival and growth is proposed for subpopulation Pa_05a, but is subject to agreement by the private land-holder.

[9] P. Cuneo, Manager, Natural Heritage, Botanic Gardens Trust, DEC (NSW)

9.7 Lower North East Regional Forest Agreement

The Lower North East Regional Forest Agreement resulted in the issue of a Threatened Species Licence (TSL) to Forests NSW as part of the Integrated Forestry Operations Approvals. Under that licence, Forests NSW must meet a number of conditions that relate to surveying for or protecting *P. askania* before or during harvesting or other specified forestry activities on State forest or other Crown timber lands.

10 Management issues

The management and conservation of *Prostanthera askania* requires the development of a recovery program which considers:

(i) the factors that threaten the survival of *P. askania*;
(ii) limits to current knowledge;
(iii) the social, political and organisational parameters that may affect the success or otherwise of the program;
(iv) any special knowledge or interests that indigenous people may have in the species or the measures in the plan; and
(v) the economic factors which may influence the plan's implementation.

This section addresses these points as well as community awareness of the species; consideration of a translocation and *ex-situ* conservation program; and consideration of the ability of the species to 'recover'.

10.1 Threatening activities and processes

The threats operating at *P. askania* sites are described below. The main threats to the survival of *P. askania* are habitat loss and fragmentation due to clearing and other modifications, including that resulting from roadside maintenance activities and inappropriate fire regimes. Other threats or potential threats include bush rock removal, weed invasion, recreational activities, dumping of rubbish and garden waste, grazing, infection by the root-rot fungus (*Phytophthora cinnamomi*), climate change and alteration of stream hydrology.

10.1.1 Clearing for residential, industrial or rural purposes

Clearing of native vegetation is listed as a key threatening process for many threatened species, populations and ecological communities – including *P. askania* – under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 01/17 and the

relevant Commonwealth Threatened Species Scientific Committee listing advice[10]. It is considered to be the major threat to the survival of *P. askania*. Clearing results not only in the removal or destruction of vegetation, but also encompasses the alteration of habitat causing changes to habitat structure and floristic composition, which may occur through road/track construction, mechanical fuel hazard reduction activities, or slashing and herbicide spraying along road verges.

Clearing of native vegetation in the Gosford – Wyong area has occurred over many years and continues to occur for residential, industrial and rural development. Population growth in this area is likely to place *P. askania* under increasing pressure from such development. Clearing of native vegetation in the area of occurrence of the species has almost certainly directly destroyed populations of *P. askania*. At least one subpopulation in the Gosford suburb of Niagara Park is thought to have become locally extinct following clearance of native vegetation for residential subdivision (R. Payne, pers. comm.).

Clearing in the Gosford – Wyong area has also resulted in the fragmentation of *P. askania* habitat, with populations and subpopulations of the species separated by severely modified or totally cleared areas. Fragmentation impacts may include the creation of small isolated populations with limited gene flow between them, leading to inbreeding depression and reduced potential to adapt to environmental change. In addition, small isolated populations may be subject to local extinction from stochastic (random) events. Fragmentation may also lead to the loss or severe modification of the interactions between *P. askania* and other species, including those interactions – such as with pollinators – that are important for the survival of the species. The hostility of the surrounding cleared or modified environment is a major factor in limiting movement of organisms between patches. Furthermore, the physical environment within patches themselves may be altered as a result of creation of edges and associated anthropogenic influences.

All or part of six known subpopulations occur on private freehold property (see Table 2). While these properties are all in areas zoned for "conservation", protection against destruction or disturbance of these populations is not guaranteed, as in both the Gosford and Wyong LGAs certain developments may be carried out with or without the consent of Council.[11] In these zones, permissible activities can include recreation areas (without consent in Gosford City), agriculture, dwellings, communications and utility facilities, roads, dams and other constructions. Councils should consider the options for rezoning such sites to afford more secure environmental protection for these populations. In addition, to mitigate both direct and indirect impacts on the species, Councils should consider features which could be incorporated into the design and implementation of developments that are to be constructed upslope of, or proximate to, *P. askania* sites. Vegetated buffers should be retained around *P. askania* sites to maintain the integrity and connectivity of its habitat.

Liaison with the owners of these properties is required to prevent inadvertent clearing or detrimental modification of habitat for the species. In potential habitat where *P. askania* is currently unrecorded, it is important that consent and determining authorities are aware of the need for targeted survey for the species when assessing the impacts of a development. As *P. askania* may only be present in very small numbers or even only in the form of soil-stored seed, the species could easily be missed during flora surveys conducted as part of the development assessment process.

In addition to directly impacting upon *P. askania* through habitat loss and fragmentation, such development and associated increases in human population can directly and indirectly affect the species by otherwise contributing to habitat degradation and modifying the environmental conditions experienced at those sites. Such impacts can result from factors including:

- increased pedestrian and vehicular access to sites, resulting in greater likelihood of trampling, rubbish and garden waste dumping, weed infestations, bush rock removal and transmission of the root-rot fungus (*Phytophthora cinnamomi*);
- more frequent fire as a consequence of bushfire hazard reduction works and arson;
- altered overland flows (and associated problems with sedimentation and erosion); and
- changed soil pH and nutrient levels.

These management issues are discussed in more detail in the following sections. On-going active management (including bush regeneration, fencing and liaison with residents to prevent dumping and other inappropriate activities) may be required to mitigate the indirect impacts of these developments on the species.

10.1.2 Roadside and powerline easement maintenance and mechanical methods of bushfire fuel hazard reduction

At least four *P. askania* subpopulations (Pa_03, Pa_08, Pa_09, Pa_10) occur, at least partially, on

[10] see Australian Government Department of the Environment and Water Resources website http://www.environment.gov.au/biodiversity/threatened/ktp/clearing.html

[11] as identified in the Gosford City Council Interim Development Order No.122 (as at 22 June 2001) or Gosford Planning Scheme Ordinance, or Wyong Shire Council Local Environmental Plan 1991 (as amended 2 February 2001)

road verges managed by Wyong Shire Council or Forests NSW. Slashing, mowing, trittering and possibly the spraying of herbicides, are practised at some of these locations; annual grading occurs along the access road into Strickland State Forest (Pa_03) and may occur at some of the other sites also. Mechanical methods of bushfire fuel hazard reduction may also be carried out at some sites, especially where they are proximate to assets such as buildings or fence lines.

One of these sites (Pa_10) is also largely under powerlines managed by Energy Australia. Slashing of vegetation underneath these appears to have occurred recently (N. Corkish, pers. obs.) resulting in destruction of the aboveground parts of most adult plants. However, several seedlings or newly-emergent vegetative growth were observed alongside scattered older plants which escaped mechanical damage.

It is possible that *P. askania* may tolerate infrequent distrubances of this nature, but the species is unlikely to be able to survive repeated mechanical damage from mowing, slashing or grading, as discussed in section 8.4. Until further information regarding the response of the species to multiple disturbances is gained, it is important that mowing, slashing and grading are excluded from *P. askania* sites and that all Council and powerline utility staff and contractors responsible for planning and implementing such activities are made aware of the occurrence of the species.

The mitigative actions for *P. askania* identified in the Threatened Species Hazard Reduction List (TSHRL) must be incorporated as a condition of any approved bush fire hazard reduction works carried out according to the Rural Fire Service's *Bush Fire Environmental Assessment Code for Asset Protection and Strategic Fire Advantage Zones*. Currently, the Threatened Species Hazard Reduction List requires that no slashing, trittering or tree removal for bush fire hazard reduction work occurs in *P. askania* habitat. To ensure that this condition is applied to *P. askania* it is essential that the Atlas of NSW Wildlife (the source of TSHRL records) contains precise locations (better than or equal to 100 metres) for all populations of the species.

10.1.3 Bush rock removal

Bush rock removal is recognised as a key threatening process for several threatened plant species under the NSW *Threatened Species Conservation Act 1995* (TSC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 99/25 (NSW Scientific Committee 1999) and the NPWS fact sheet 'Bushrock removal: a key threatening process' (NSW NPWS 1999). As *P. askania* often occurs in areas where Hawkesbury sandstone outcrops, removal of bush rock is considered to be one of the threats to the survival of *P. askania*. Legal or illegal bush rock removal in such areas may destroy plants and degrade the habitat of the species. Bush rock removal is prohibited from National Parks and Wildlife Service estate and from Crown Land.

The impact of this threat could be minimised through land-holder, neighbour and community education. Gosford and Wyong Councils should also consider the inclusion in local environmental plans of provisions regulating bush rock collection.

10.1.4 Weed invasion

Weed invasion is considered to be a threatening process at several *P. askania* sites (D. Tierney, pers. obs., N. Corkish, pers. obs.). Lantana (*Lantana camara)* is the most commonly recorded weed species at *P. askania* sites and is considered to be the most important weed requiring management. Crofton weed (*Ageratina adenophora*), small-leaved privet (*Ligustrum sinense*), large-leaved privet (*Ligustrum lucidum*) and camphor laurel (*Cinnamomum camphora*) have been observed at or in close proximity to *P. askania* sites (R. Payne, pers. obs., N. Corkish, pers. obs.). Under the Noxious Weeds Act 1993, Crofton weed (*Ageratina adenophora*) is declared noxious in the Gosford and Wyong control area.

The management of weeds at *P. askania* sites will require targeted bush regeneration efforts. These efforts should aim to restore, maintain and expand suitable habitat for the species. It is important that land managers are aware that weed control measures have the potential to impact negatively on *P. askania*. Caution should be applied when using herbicides to control environmental weeds within or near the habitat of *P. askania*, as its tolerance to herbicides is unknown. Manual weed management techniques may be appropriate.

10.1.5 Recreational activities

Recreational activities pose a threat to the health and survival of *P. askania* populations at some sites in Council reserves. These have the potential to damage *P. askania* plants and degrade its habitat through physical damage, alteration of understorey structure and composition, and soil compaction.

In particular, the Niagara Park Council reserve subpopulation (Pa_05b) is exposed to contact with both walkers and bicycle riders who have formed semi-permanent tracks within the subpopulation. Ironically, it may be this disturbance which has stimulated and allowed the persistence of the species, since the understorey has been kept open. Gosford City Council will need to consider options for management of such activities within this reserve.

10.1.6 Rubbish dumping

Dumped rubbish including green waste, household rubbish and old cars have been observed at *P. askania* sites (N. Corkish, pers. obs.). The dumping of such materials has the potential to damage *P. askania* and degrade its habitat through burial, physical damage and soil compaction. Rubbish dumping also has the potential to introduce weed propagules to a site and encourage weed growth by altering pH and nutrient levels in the soil.

The impact of dumping could be minimised through increasing efforts in law enforcement, through land-holder, neighbour and community education and regular removal of rubbish and garden waste from *P. askania* habitat.

10.1.7 Inappropriate fire regimes

Due to its urban setting, the community and political pressure for more frequent hazard reduction in the bushland remnants of the Gosford – Wyong area is increasing; as well, arson can be another growing problem in such bush-urban interface areas. Together, these factors increase the likelihood of more frequent fire.

High frequency is recognised as a key threatening process for many threatened plant species, populations and ecological communities under the NSW *Threatened Species Conservation Act 1995* (TSC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 00/06 (NSW Scientific Committee 2000b). In the absence of specific evidence to the contrary, it must be assumed that *P. askania* will be adversely impacted by frequent fires (see section 8.4). Currently, the *Bush Fire Environmental Assessment Code* (Threatened Species Hazard Reduction List) requires that no fire occurs more than once every 25 years in *P. askania* habitat. While this interval is consistent with the fire interval guidelines developed by the NSW National Parks and Wildlife Service (NSW NPWS 2002) for wet sclerophyll, this minimum fire interval may not be appropriate for rainforest, in which *P. askania* also occurs. NSW NPWS (2002) recommends that fire be avoided in such vegetation. However, as discussed in sections 8.2 and 8.4, circumstantial evidence suggests that a long-term absence of disturbance may be detrimental to population persistence, so *P. askania* may be threatened by too infrequent fire or other disturbance.

Table 3 contains the recommended fire frequencies for *P. askania* sites by vegetation type and is adapted from the "Fire Interval Guidelines for Broad Vegetation Types" (NSW NPWS 2002). It should also be noted that, to allow for seed production and the accumulation of a soil seedbank, it is recommended that an additional period of three years in each of which seed production occurs should be added to all minimum fire intervals in this table. It is also strongly recommended that any short inter-fire intervals (at or below the minimum threshold for the type) be followed by a longer interval with at least this additional period of three reproductive years. Recurrent burning at or below the minimum threshold (i.e. several successive short intervals) is likely to lead to a critical decline if the species is sensitive to frequent disturbance; conversely repetition of long intervals may have the same effect if it is sensitive to infrequent fire (NSW NPWS 2002).

Table 3: Recommended fire interval guidelines for *Prostanthera askania*

Vegetation type	Min. fire interval*	Max. fire interval	Notes
Rainforest	N/A	N/A	Fire should be avoided
Wet Sclerophyll forest	25 years	60 years	Avoid crown fires at lower end of interval range

* three productive years should be added to this minimum fire interval to allow for seed production and the accumulation of seedbank
Source: NSW NPWS (2002)

Public authorities which approve bush fire hazard reduction activities should use the biological and ecological information summarised in this recovery plan, as well as any new data that becomes available in the future, to consider the immediate and cumulative impact of such activities on *P. askania* and to periodically assess the adequacy of the mitigative conditions applied to bush fire hazard reduction works under the *Bush Fire Environmental Assessment Code.*

10.1.8 Grazing and other farming activities

While the six subpopulations known to occur on private freehold property are all in areas zoned for "conservation", grazing of livestock can be carried out on those properties with the consent of Council. Additionally, grazing of stock without consent is thought to occur on land in the vicinity of some *P. askania* populations.

Grazing may impact directly on the species through grazing, or lead to degradation of vegetation structure and floristics though trampling, erosion and the spread of weeds. Land-holders may be unaware of the presence of *P. askania* on their property and the impact that grazing activities could be having on it. Liaison with these land-holders is required to raise their awareness of the species and the potential impact of intense grazing, and to facilitate the implementation of protection measures, such as fencing to exclude livestock and machinery.

10.1.9 Infection by *Phytophthora cinnamomi*

Infection of native plants by *Phytophthora cinnamomi* is listed as a key threatening process for many threatened species, populations and ecological communities under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 02/27 (NSW Scientific Committee 2002b) and the Commonwealth *Threat abatement plan for dieback caused by the root-rot fungus* Phytophthora cinnamomi (Environment Australia 2001)[12]. *P askania* is listed in that threat abatement plan as one of five nationally-endangered NSW species threatened and susceptible to *P. cinnamomi*, although there is no published research evidence regarding the species' susceptibility (Brett Summerell[13], pers. comm.). However, *Prostanthera* species are very susceptible to this root pathogen and, in some areas, can be short lived (Miller 1993). It can be considered a threat to *P. askania* due to the growing potential for spread of the pathogen because of human activities in the increasingly populated Gosford – Wyong area. Road and track construction, vehicular access, vegetation clearing, development and adjacent development, drainage works and pedestrian visitation are all potential vectors for infection.

10.1.10 Climate change

Human-induced climate change is listed as a key threatening process for many threatened species and ecological communities under both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 00/24 and the relevant Commonwealth Threatened Species Scientific Committee listing advice[14]. Given the fragmented nature of the total population of *P. askania*, it is considered a threat to the survival of *P. askania* as this fragmented habitat may limit the ability of organisms to survive climate change through dispersal (NSW Scientific Committee 2000a).

10.1.11 Hydrological change

Alteration to the natural flow regimes of rivers and streams is recognised as a key threatening process for several threatened plant species, populations and ecological communities under the NSW *Threatened Species Conservation Act 1995* (TSC Act). For further information about this key threatening process see the NSW Scientific Committee Determination Advice 02/12 (NSW Scientific Committee 2002a). Altered flow patterns due to urban development may be the cause of riparian zone stream bank erosion which appears to be directly affecting the habitat of *P. askania* at one site (Pa_05b). The alteration of the water regime may also permit establishment and spread of semi-terrestrial weed species at this and other sites.

10.1.12 Inappropriate plantings of horticulturally grown plants

Prostanthera askania is known to have been cultivated by at least one commercial nursery and cuttings propagated in the same catchment as wild populations which were different from the source of the propagules. Such activities carry the risk of genetic mixing within the wild populations, which has been known to produce inbreeding or outbreeding declines in population numbers of other plant species. It could also increase the potential introduction of soil pathogens into the populations. As the exact locality of the source of propagated material may be unknown, the planting of propagated *P. askania* plants in the vicinity of the wild populations should be actively discouraged. Information needs to be provided to local nurseries outlining these concerns.

10.2 Limits to current knowledge

Our ability to manage a threatened species is dependent on our knowledge of the biological and ecological requirements of that species and the circumstances which threaten population persistence. As outlined in section 8, we currently have little understanding of the reproductive biology and population ecology of *P. askania*. Greater understanding of a number of aspects will assist in the effective management of this threatened species, particularly if we are to conserve the species in the long-term. In addition, increased understanding will assist the decision making of consent and determining authorities to make informed judgements as to its conservation requirements.

Future investigations should target aspects (outlined below) which are relevant to the practical management of the species and its habitat:

Targeted survey

Systematic survey targeted in areas of likely habitat – sheltered aspects and lower slopes, for example – within the potential habitat of the species is required to obtain further information on its distribution and conservation status and better understanding of its habitat characteristics.

[12] see Australian Government Department of the Environment and Water Resources website http://www.environment.gov.au/biodiversity/threatened/publications/tap/phytophthora/index.html

[13] B. Summerell, plant pathologist, Mount Annan Botanic Garden, Botanic Gardens Trust, Department of Conservation and Environment (NSW)

[14] see Australian Government Department of the Environment and Water Resources website http://www.environment.gov.au/biodiversity/threatened/ktp/greenhouse.html

Life history
Investigations of the longevity and reproductive biology of *P. askania* are required, including the age of maturity of the species.

Seed ecology
Investigation of the nature of the *P. askania* soil seed bank is required. This should include determination of the period that the soil seed bank remains viable and identification of seed dormancy and germination mechanisms. Investigations into seed dispersal mechanisms are also required.

Fire ecology
A quantitative assessment of the response of mature plants and the soil seed bank to different fire regimes is required, including natural and altered fire regimes.

Competition from exotics
Investigation is required into the role of exotic plant species in the potential decline of the species.

Genetic investigation
Investigation is required of the level of vegetative reproduction in populations and the triggers for this type of reproduction.

While not essential to the practical management of the species, further genetic investigations across the natural range of *P. askania* would greatly improve our understanding of the species' population structure and consequently, could inform land-use and recovery planning decisions.

Phytophthora cinnamomi
In accordance with the Commonwealth threat abatement plan, the significance of *P. cinnamomi* as a threat to *P. askania* and the level of management necessary to mitigate it should be investigated. Such research should be designed to quantify the disease's importance relative to other threats to the species in question.

10.3 Community awareness

An increased awareness of *P. askania* is required to ensure that the species is appropriately considered in statutory environmental planning and impact assessment processes, and to facilitate the implementation of threat abatement works. The target groups for awareness raising initiatives are:

- public authorities;
- affected private landowners; and
- the general community.

Public authorities with consent, determining or environmental planning responsibilities under the EP&A Act require an understanding of the species, particularly its known locations, habitat requirements and sensitivity to impacts. Initiatives to assist these authorities in meeting their statutory obligations regarding the conservation of *P. askania* habitat include:

- preparation and distribution of a species profile and environmental impact assessment guidelines; and

- inclusion of all known site locations on the NPWS Atlas of NSW Wildlife.

The informed support of the private landowners whose land contains *P. askania* is essential to the success of the recovery program. Liaison with affected landowners will be implemented through this Recovery Plan to facilitate such support.

The third target audience for awareness raising initiatives is the general community. While some programs, for example those run by Forests NSW and the Friends of Strickland, have been successful at a local level, community awareness needs to occur at a larger scale. Initiatives should aim to enhance the social benefits of the recovery program and include:

- preparation of press releases to highlight the implementation of key recovery actions; and
- involvement of community members in the implementation of recovery actions.

10.4 Translocation and ex-situ conservation

10.4.1 Translocation

Translocation is defined as the deliberate transfer of plants or regenerative plant material, from an *ex situ* collection or natural population, to a location in the wild, including existing or new sites or those where the taxon is now locally extinct. It is often raised as a possible method of conserving threatened flora. The process, benefits and costs of translocation have recently been reviewed by Vallee *et al.* (2004).

Translocation requires long-term commitment, is expensive and often prone to failure. Many previous attempts at translocating threatened flora have failed for reasons which include the unsuitability of recipient sites, poor information in relation to the species biology, ecology, and genetic variation, and a lack of ongoing commitment to site maintenance and monitoring. Given the high cost and risk associated with the technique, translocation should only be considered as a last resort when all other management options are deemed inappropriate or have failed. As stated by Vallee *et al.* (2004), 'where possible, resources will be more effective when directed towards conserving existing populations *in-situ* through habitat protection and/or habitat rehabilitation measures and through the control of threatening processes'.

Translocation is not currently considered necessary for the survival of *Prostanthera askania* as the *in-situ* conservation measures proposed in this recovery plan are expected to meet the conservation needs of the species. Furthermore, primarily due to the uncertainty of success and the risks associated with translocation, the technique should not be considered by consent/determining authorities to be an appropriate means of ameliorating the impact of a development proposal on the species (Vallee *et al.* 2004). In addition, the use of translocation as an mitigative measure should not be considered when determining the potential impact of a development (i.e. translocation does not decrease the significance of an impact) (Vallee *et al.* 2004).

10.4.2 Ex-situ collection

As indicated in section 9.5, the Botanic Gardens Trust does not have, nor does it intend to collect, cutting or seed material to cover the range of geographical, morphological or genetic variability across the total population of the species.

10.5 Roles and interests of indigenous people

P. askania is known to occur in the area of one Local Aboriginal Land Council, the Darkinjung, and in the area of interest to the Guringai Tribal Link Aboriginal Corporation. Strickland SF is utilised by the Mirring Womens Group. These groups were provided with a copy of this plan and invited to comment. DEC is not aware of any specific indigenous interest in, or use of, *P. askania* and indigenous communities with an interest in the actions proposed in this recovery plan have not yet been identified. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region.

10.6 Ability to recover

10.6.1 Rarity

It is not known whether *Prostanthera askania* is naturally uncommon or whether it has suffered minor or substantial declines in population size. It can be reasonably assumed however, that the extensive clearing of moist sclerophyll forests and rainforests around Gosford and Wyong since European settlement has had a substantial impact on the distribution and total population size of the species. The low number of plants at many extant sites and the high number of threats operating on the species indicate that the species is likely to still be in decline.

10.6.2 Viability

The viability of a species can be broadly defined as the ability of that species to be self-replacing in nature. There is currently little information as to the viability of the *P. askania* populations identified in this recovery plan. In the absence of a detailed assessment demonstrating otherwise (and including consideration of the potential *P. askania* soil seedbank), all *P. askania* populations and sites should be assumed to be viable.

10.6.3 Likelihood of recovery

'Recovery' in the context of this plan is to promote the recovery of *P. askania* to a position of viability in nature, by ensuring the continued and long-term survival of the species in the wild.

The likelihood of recovery of *P. askania* in this context is high provided the recovery actions outlined in this recovery plan are implemented, monitored and amended as required.

11 Proposed recovery objectives, actions and performance criteria

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

This plan consists of six specific recovery objectives that will each contribute to the overall objectives:

- conserve *P. askania* using land-use and conservation planning mechanisms;
- implement a survey and monitoring program that will provide information on the extent and viability of *P. askania*;
- identify and minimise the operation of threats at sites where *P. askania* occurs;
- provide the community with information that assists in conserving the species;
- raise awareness of the species and involve the community in the recovery program; and
- promote research questions that will assist future management decisions.

Specific recovery actions and performance criteria follow.

11.1 Recovery objective 1: To conserve *P. askania* using land-use and conservation planning mechanisms

Only a small proportion of sites of *P. askania* (those within Strickland SF) occur on land that is managed primarily for conservation purposes. This objective aims to enhance the protection afforded to sites through the following legislative mechanisms:

- conservation agreements and covenants under the NP&W Act and *Conveyancing Act 1919*;
- joint management agreements and property management plans under the *Threatened Species Conservation Act*,
- property vegetation plans under *the Native Vegetation Act* and catchment action plans under the *Catchment Management Authorities Act 2003*;
- environmental planning instruments under Part 3 of the EP&A Act and development standards;
- classification of land as community land under the *Local Government Act* and subsequent consideration of the species in plans of management for such land;
- environmental impact assessment under the EP&A Act; and
- consideration of a critical habitat declaration under the TSC Act.

Action 1.1a: ***The DEC Environment Protection and Regulation Division (DEC EPRD) will advise private land-holders of the presence of* P. askania *on their land and of the opportunities and advantages of entering into conservation agreements or other covenants.***

Action 1.1b: ***The DEC Environment Protection and Regulation Division (DEC EPRD) will advise relevant public authorities and public utilities (Energy Australia) of the presence of* P. askania *on lands under their control or management.***

Performance Criterion 1.1: ***Within six months of the implementation of this recovery plan, all land owners or managers of land supporting* P. askania *will be notified by DEC EPRD, of the presence of the species, and private land-holders will be advised of the advantages of entering into a conservation agreement or covenant.***

Action 1.2: ***The Department of Infrastructure Planning and Natural Resources (DIPNR) will refer to this recovery plan and its objectives and any future advice from DEC regarding the distribution, habitat, biology and ecology of the species, when preparing any new relevant environmental planning instruments (EPIs) or reviewing any existing relevant EPIs.***

Performance Criterion 1.2: ***Each relevant environmental planning instrument prepared or reviewed by DIPNR is prepared or reviewed in accordance with this action.***

Action 1.3: ***Councils will prepare or review local environmental plans (or equivalent, such as the Gosford IDO and PSO) and development control plans with reference to this recovery plan and its objectives and any future advice from DEC regarding the distribution, habitat, biology and ecology of the species.***

Councils should consider the options for rezoning such sites to afford more secure environmental protection for *P. askania* populations. In particular, Wyong Shire Council should consider revising the zoning of Crown reserve 73397.

In addition, to mitigate both direct and indirect impacts on the species, Councils should consider features which could be incorporated as development controls into the design and implementation of developments that are to be constructed upslope of, proximate to, or between *P. askania* sites. Sufficient vegetated buffers should be retained around and between *P. askania* sites to maintain the integrity and connectivity of its habitat.

Performance Criterion 1.3: ***Each relevant local environment plan and development control plan is prepared or reviewed in accordance with this action.***

Action 1.4: ***Gosford City Council will ensure that the part of Lot 2 in DP 605752 identified in DCP No.136 as "lands to be created as a public reserve" is classified as community land so as to be consistent with that purpose.***

Performance Criterion 1.4: ***The stated land is classified as community land within 6 months of implementation of this recovery plan.***

Action 1.5: ***DEC Environment Protection and Regulation Division (EPRD) will liaise with the Department of Lands and Wyong Shire Council, regarding a review of the management and current reservations of Lot 95 in DP 755263 (being Crown reserve 62269 for timber and Crown reserve 73397 for public recreation) and the adjacent Crown road reserve, with a view to reserving and managing them primarily for environmental protection.***

Such a review should include a land assessment in accordance with Part 3 of the *Crown Lands Act 1989* and consideration by the reserves' managers (Wyong Shire Council) of the preparation of plan(s) of management for the reserves. The land assessment and preparation of such plan(s) should occur with reference to this recovery plan and any future advice provided by DEC regarding the biology and ecology of and threats to the species. Site-specific information to be incorporated into these each plan of management should include:

- *P. askania* numbers, condition and location details;
- an assessment of existing and potential threats to *P. askania* at the site;
- details of threat abatement measures to be implemented to address these threats;
- description of measures and a process that ensures that road maintenance and other field staff and contractors are aware of the location of *P. askania* plants and the measures to be taken to manage them; and
- details of a monitoring program to assess the effectiveness of threat abatement measures.

Performance Criterion 1.5: ***The Department of Lands reviews, in liaison with DEC and Wyong Shire Council, the current reservations of Lot 95 in DP 755263 with a view to reserving it primarily for environmental protection within 3 years of adoption of this recovery plan.***

Action 1.6: ***DEC will consider the need for declaration of critical habitat by the third year of implementation of this recovery plan.***

Performance Criterion 1.6: ***DEC will consider the need for and prepare a submission to the Minister regarding declaration of critical habitat by the third year of implementation of this recovery plan.***

11.2 Recovery objective 2: Implement a survey and monitoring program

Action 2.1: ***DEC Environment Protection and Regulation Division (EPRD) will coordinate surveys to assess the size, characteristics and conservation and threat status of known* P. askania *populations and habitats.***

Performance Criterion 2.1: ***Surveys of all known* P. askania *populations carried out and documented within three years, subject to land-holder approval.***

Action 2.2: ***DEC Environment Protection and Regulation Division (EPRD) to organise surveys of potential habitat.***

Performance Criterion 2.2: ***At least one survey in potential habitat to be conducted annually for* P. askania.**

Action 2.3: ***DEC Environment Protection and Regulation Division (EPRD) will design and facilitate a monitoring program that will enable long-term monitoring of the population dynamics and viability of selected populations. This will include research into the longevity of the species, seed dispersal and seed longevity, the species' reproductive biology, long-term response to natural and altered fire regimes and the role of exotic plant species in the potential decline of the species.***

Performance Criterion 2.3: ***A long-term monitoring program to be designed by year three and implemented by year five, following adoption of this recovery plan.***

11.3 Recovery objective 3: To identify and minimise the threats

operating at sites where the species occurs

Actions under this objective aim to identify and manage these threats through the implementation of appropriate in-situ threat abatement measures in accordance with management plans and site management statements.

Action 3.1: ***DEC Environment Protection and Regulation Division (EPRD), in consultation with land-holders, will prepare site management statements for* P. askania *sites located on freehold land.***

DEC Environment Protection and Regulation Division (EPRD), in consultation with land-holders, will assess the condition of sites located on freehold land and prepare site management statements that detail the specific threat abatement measures required at those sites.

Performance Criterion 3.1: ***Site management statement prepared, subject to land-holder approval, for each site on freehold land, within three years of the adoption of this recovery plan.***

Action 3.2: ***DEC Environment Protection and Regulation Division (EPRD) will encourage and assist land-holders to seek funding for and carry out threat abatement measures on freehold land in accordance with the site management statements prepared under Action 3.1.***

Performance Criterion 3.2: ***Funding secured and threat abatement measures for relevant sites implemented in accordance with site management statements within five years, subject to land-holder approval.***

Action 3.3: ***Wyong Shire and Gosford City Councils will prepare a plan of management for each area of community land on which* P. askania *occurs.***

Under the *Local Government Act* each area of community land directly affected by this recovery plan (i.e. where *P. askania* is present) must be categorised as a 'natural area' and a separate plan of management must be prepared for each area. Each plan of management must identify objectives and performance targets that take into account Council's obligations under this recovery plan. It must also incorporate the core objectives for management of land categorised as a natural area: these include goals to conserve biodiversity and maintain ecosystem function and to provide for the restoration and regeneration of the land.

Relevant community land on which known populations of *P. askania* currently occurs is:

- the following Gosford City Council-owned or -managed land:
  - Alan Street reserve, Niagara Park, including Lots 57 and 58 in DP 713715;
  - Katandra Reserve, including Lot 3022 in DP 714469;
  - Lot 5 in DP 711148 on The Ridgeway, Matcham;
  - that part of Lot 2 in DP 605752 referred to in Action 1.4 once it has been categorised as community land.
- the following Wyong Shire Council-owned or -managed land:
  - reserve including Lot 5 in DP 808955 off Berrys Lane, Fountaindale;

Performance Criterion 3.3: ***Wyong Shire and Gosford City Councils will prepare a plan of management for each area of community land on which* P. askania *occurs within three years of the adoption of this recovery plan or for populations subsequently found within three years from notification of the presence of the population.***

Action 3.4: ***Councils will incorporate site-specific protection measures for* P. askania *into plans of management for community land on which it occurs and implement these measures.***

Planning and implementation of such measures should occur with reference to this recovery plan and any future advice provided by DEC regarding the biology and ecology of and threats to the species. Site-specific information to be incorporated into each plan of management should include:

- *P. askania* population numbers, condition and location details;
- an assessment of existing and potential threats to *P. askania* at the site;
- measures to be implemented to address these threats; and
- details of a monitoring program to assess the effectiveness of threat abatement measures.

Where a plan of management has already been prepared that does not address the matters listed above, that plan will be amended to address these matters.

Performance Criterion 3.4: ***Site-specific protection measures for currently known populations to be incorporated into plans of management for community land within three years from the adoption of this recovery plan. Site-specific protection measures for populations subsequently found to be incorporated into plans of management for community land within three years from notification of the presence of the population.***

Action 3.5: ***Wyong Shire Council and Gosford City Council will plan and implement site-specific protection measures for* P. askania *populations on***

Council-managed operational land or roadside sites within their respective local government areas. Energy Australia will plan and implement site-specific protection measures for* P. askania *populations under powerlines.

Excluding the land that is subject to the implementation of Action 1.4, *P. askania* is currently known from only two Council-managed operational land or roadside areas. These are sites Pa_09 and Pa_10 which occur in Wyong LGA. However, the species may be found at other sites in the future. The maintenance of powerlines by Energy Australia impacts on the population at site Pa_09.

Planning and implementation of such measures should occur with reference to this recovery plan and any future advice provided by DEC regarding the biology and ecology of and threats to the species. Site-specific information to be incorporated into these plans should be guided by that outlined in Appendix 4 and should include:

- *P. askania* numbers, condition and location details;
- an assessment of existing and potential threats to *P. askania* at the site;
- measures to be implemented to address these threats;
- description of procedures that ensures that road maintenance, powerline utility and other field staff and contractors are aware of the location of *P. askania* plants and the measures to be taken to manage them;
- measures to manage habitat for the species at specific roadside locations;
- a program to monitor and evaluate the effectiveness of the proposed identification, protection and regeneration measures.

In the interim, mowing, slashing and grading should be excluded from *P. askania* sites and all Council and powerline utility (Energy Australia) staff and contractors responsible for planning and implementing such activities should be made aware of the occurrence of and measures to protect the species.

Performance Criterion 3.5: ***Site-specific protection measures for currently known roadside sites prepared and implemented within three years. For populations which are subsequently found through survey, site-specific protection measures will be prepared and implemented within three years of notification of the presence of the population.***

Action 3.6: ***Forests NSW will plan and implement site-specific protection measures for* P. askania *populations in Strickland State Forest.***

Planning and implementation of such measures should occur with reference to this recovery plan, the Threatened Species Licence and any future advice provided by DEC regarding the biology and ecology of and threats to the species. Site-specific information to be incorporated into this planning should include:

- *P. askania* numbers, condition and location details;
- an assessment of existing and potential threats to *P. askania* at the site;
- details of threat abatement measures to be implemented to address these threats;
- description of measures and a process that ensures that road maintenance and other field staff and contractors are aware of the location of *P. askania* plants and the measures to be taken to manage them; and
- details of a monitoring program to assess the effectiveness of threat abatement measures.

Performance Criterion 3.6: ***Site-specific protection measures for populations in Strickland State Forest prepared and implemented within three years.***

Action 3.7: ***Councils, the Department of Infrastructure Planning and Natural Resources (DIPNR) and other consent or determining authorities will assess developments and activities with reference to this recovery plan, environmental impact assessment guidelines and any future advice from DEC regarding the distribution, habitat, biology and ecology of and threats to* Prostanthera askania.**

Environmental impact assessment guidelines, provided in Appendix 2, will be updated periodically. Targeted surveys for the species should be carried out when assessing the impact of a development, in areas of potential habitat of *P. askania* where the species is currently unrecorded. Features to mitigate both direct and indirect impacts on the species could be incorporated into the design and control of developments that are to be constructed upslope of, or proximate to, *P. askania* sites. Sufficient vegetated buffers should be retained around sites containing *P. askania* sites to maintain the integrity of its habitat. The extent and design of the buffers required to achieve this will be site-specific, depending on factors such as aspect and slope, drainage patterns and adjacent land uses.

Performance Criterion 3.7: ***Each relevant development or activity is assessed with reference to this recovery plan, the environmental impact assessment guidelines and any future advice from the DEC regarding the distribution, habitat, biology and ecology of the species.***

11.4 Recovery objective 4: To provide public authorities and the community with information that assists in conserving the species

The prompt and effective distribution of information on *P. askania* and its habitat is an important component of ensuring that the conservation requirements of the species are appropriately considered in land-use planning decisions. Actions under this objective use the following mechanisms to aid the dissemination of information about the species:

- verification and distribution of accurate location records to relevant parties
- updated potential habitat model, species profiles and environmental impact assessment guidelines prepared.

Action 4.1a: ***DEC will update the Atlas of NSW Wildlife dataset and ensure that verified* Prostanthera askania *records are entered with precise georeferences (better than or equal to 100 metres).***

Action 4.1b: ***DEC will ensure that such records are available to approval and certifying authorities (including the Department of Lands, RFS and relevant Councils) and incorporated into relevant datasets, including the Threatened Species Hazard Reduction List of the Bush Fire Environmental Assessment Code.***

Performance Criterion 4.1b: ***Precise location records from the Atlas of NSW Wildlife are made available to relevant authorities within four months of verification or discovery.***

Action 4.2: ***DEC Environment Protection and Regulation Division (EPRD) to re-model potential habitat using the most recent dataset of* P. askania *records.***

Modelled habitat will improve targeting of new surveys for the species to appropriate habitats.

Performance Criterion 4.2: ***P. askania potential habitat to be re-modelled and mapped within six months.***

Action 4.3: ***DEC EPRD Biodiversity Conservation Section will update the species profile and environmental impact assessment guidelines for the species to incorporate information acquired during the implementation of this recovery plan.***

Performance Criterion 4.3

Species profile and environmental impact assessment guidelines for the species updated as required.

Action 4.4: ***DEC Environment Protection and Regulation Division (EPRD) will review the mitigative conditions for* Prostanthera askania *on the Threatened Species Hazard Reduction List of the Bush Fire Environmental Assessment Code.***

DEC will use the available biological and ecological information to reassess the immediate and cumulative impact of bush fire hazard reduction works on *P. askania* and the adequacy of the mitigative conditions required to be applied under the *Bush Fire Environmental Assessment Code.*

Performance Criterion 4.4: ***The mitigative conditions for* P. askania *on the Threatened Species Hazard Reduction List TSHRL reviewed in year 4 or 5 of the implementation of this recovery plan.***

Action 4.5: ***Public authorities will inform the DEC EPRD of decisions that it considers will affect* P. askania *or its habitat.***

Public authorities will inform DEC EPRD if planning or development decisions are made that will affect *P. askania* or its habitat. This includes information on decisions that protect habitat, as well as those that lead to a reduction in habitat and/or individuals. For the purposes of this action public authorities are taken to include the following:

- the NSW Department of Infrastructure, Planning and Natural Resources
- Gosford City Council
- Wyong Shire Council
- the NSW Department of Lands
- the NSW Rural Fire Service
- Energy Australia
- Forests NSW.

The Rural Fire Service will implement this action, with respect to bush fire hazard reduction, by ensuring that there is adequate access by DEC EPRD to temporal and spatial data from the Bushfire Risk Information Management System (BRIMS).

Performance Criterion 4.5: ***DEC EPRD informed of all decisions that affect the species or its habitat.***

11.5 Recovery objective 5: To raise awareness of the species and involve the community in the recovery program

In order to enhance the social benefits of the recovery program for *P. askania* and assist in its implementation, actions under this objective aim to raise awareness of the recovery plan and involve the community in its implementation.

Action 5.1: ***DEC Environment Protection and Regulation Division (EPRD) will consult with the Darkinjung Local Aboriginal Land Council, the Guringai Tribal Link Aboriginal Corporation and, if identified, other interested Aboriginal groups or individuals to seek special knowledge about*** **P. askania** ***and to consider the roles and interests of indigenous communities in the region.***

Performance Criterion 5.1 ***DEC EPRD will consult with these parties within the first year of implementation of this recovery plan.***

Action 5.2: ***The DEC Environment Protection and Regulation Division will distribute information on the progress of the recovery program to raise awareness of the program and encourage community involvement in it.***

The NPWS will prepare an annual newsletter which includes information about the *P. askania* recovery program. The newsletter will be distributed to affected land-holders, public authorities, community groups and interested individuals.

Performance Criterion 5.2: ***Newsletter produced and distributed annually.***

Action 5.3: ***The DEC Environment Protection and Regulation Division (EPRD), Forests NSW and Councils which manage land that supports*** **P. askania** ***will raise awareness of, and encourage community involvement in, the recovery program, where resources allow.***

Under this action, the DEC EPRD, Forests NSW and Gosford City and Wyong Shire Councils, will raise awareness of the recovery program among the community, and will encourage involvement in the implementation of recovery actions, including survey, monitoring and bush regeneration. This action may be facilitated by the support by Councils for the formation of "friends" groups for Council-managed reserves.

Performance Criterion 5.3: ***Community involvement in the implementation of recovery actions increases.***

Action 5.4: ***The DEC Environment Protection and Regulation Division (EPRD) will assist community groups and local government in preparing funding applications to undertake recovery for*** **P. askania.**

Community groups, if provided adequate funding and appropriate support, would be able to assist in the implementation of threat abatement works (Recovery objective 3).

Performance Criterion 5.4: ***At least one funding application prepared by community group and/or local government to undertake threat abatement works within the habitat of P. askania.***

11.6 Recovery objective 6: To promote investigations into the ecology and biology of the species in order to provide information to assist future management decisions

As outlined in section 10.2, there are a number of potential research questions that could assist in the management of *P. askania*. However, given the absence of funds to conduct this research, this plan advocates the promotion of potential research questions rather than funding the research in itself.

Action 6.1: ***DEC Environment Protection and Regulation Division (EPRD) to promote potential research projects as identified in this recovery plan.***

The EPRD will liaise with tertiary and other research institutions to encourage and facilitate research into the species consistent with the priorities outlined in section 10.2.

Performance Criterion 6.1: ***All universities and other research institutions within the Newcastle, Central Coast and Sydney areas contacted regarding potential research areas by the end of the second year of the implementation of this recovery plan.***

Action 6.2: ***Mount Annan Botanic Gardens will consider*** **P. askania** ***as a candidate, as part of the SeedQuest NSW program, for research on seed viability and the requirements for successful conservation storage.***

Performance Criterion 6.2: **P. askania** ***formally considered by Mt Annan Botanic Gardens for research in the SeedQuest NSW program.***

12 Implementation

The cost to implement the plan is approximately $80,000 over five years, plus as yet undetermined costs for planning and implementing on-site management on private, Council and Crown Lands as these costs are yet to be determined. Of this total, approximately $55,000 is expected to be provided as in-kind contributions by the Department of Environment and Conservation with an additional $25,000 required to implement actions that are currently unfunded. Additional funds will be sought from sources including the Natural Heritage Trust, Environmental Trust, industry sponsors, the NSW State Biodiversity Program, Threatened Species Network, Threatened Species Appeal and DEC annual provisions for implementation of threatened species programs.

Table 4 details the costs and identifies the parties responsible for the implementation of specific recovery actions.

13 Social and economic consequences

13.1 Social consequences

Negative social impacts are not envisaged as the implementation of the recovery plan is not expected to affect public land usage to any great extent, and modification of private land management patterns will occur at the land manager's discretion. Continued liaison with the local community, affected land-holders and public authorities will address and minimise any unforeseen negative social impacts arising from the implementation of this plan.

Indeed, it is expected that the implementation of this recovery plan will have positive social impacts on the local communities involved and, in particular, on the owners and managers of *P. askania* habitat. The implementation of recovery actions (including bush regeneration, site monitoring and surveys) will provide benefits to the environment and/or enhance the general well-being of the community and individuals involved.

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

13.2 Economic consequences

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

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

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

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

14 Biodiversity benefits

The conservation and study of *P. askania* will benefit the maintenance of ecological processes and conservation of other species that share the same habitat.

Increased awareness of *P. askania* resulting from the implementation of this recovery plan will raise the profile in the community of all threatened species. This in turn will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

15 Preparation details

This recovery plan was prepared by Nick Corkish and finalised by Sarah Burke of the Department of Environment and Conservation (NSW), Metropolitan Region, Biodiversity Conservation Section, with the information, advice and assistance of those acknowledged at the beginning of this plan.

16 Review date

This recovery plan is to be formally reviewed and updated by the by the Department of Environment and Conservation (NSW) five years from the date of its publication.

Table 4. Estimated costs, funding source and responsible parties for implementing the actions identified in the *Prostanthera askania* recovery plan

Action	Action description	Priority	Responsible party	DEC fund source	Cost estimate ($/year)					Total Cost ($)
					Yr 1 2004-05	Yr 2 2005-06	Yr 3 2006-07	Yr 4 2007-08	Yr 5 2008-09	
1.1	Notify land-holders	1	DEC (EPRD)	DEC in-kind	700	-	-	-	-	700
1.2	Preparation/review of EPIs	1	DIPNR	-	#	#	#	#	#	-
1.3	Preparation/review of LEPs and DCPs	1	GCC, WSC	-	#	#	#	#	#	-
1.4	Classify land as community land	2	GCC	-	#	#	#	#	#	-
1.5	Review of Crown Land reservations	2	DEC (EPRD) with Lands	DEC in-kind	-	1050	-	-	-	*
1.6	Critical habitat consideration	2	DEC (EPRD)	DEC in-kind	-	-	1050	-	-	1050
2.1	Surveys of known populations	1	DEC (EPRD)	DEC in-kind	3050	3050	-	-	-	6100
2.2	Targeted survey within potential habitat	1	DEC (EPRD)	Unsecured	2100	2100	2100	2100	2100	10,500
2.3	Design and implement monitoring program	1	DEC (EPRD)	DEC in-kind	3500	3500	4600	4600	4600	20,800
3.1	Site management statements for private property	1	DEC (EPRD)	Unsecured	2100	2100	-	-	-	4200
3.2	Threat abatement funding assistance for private property sites	1	DEC (EPRD)	Unsecured	*	*	*	*	*	*
3.3, 3.4	Prepare plans of management with site-specific protection measures for community land	1	GCC, WSC	-	*	*	*	*	*	*
3.5	Prepare, implement site-specific protection measures on Council-managed operational and roadside land		GCC, WSC, Energy Australia	-	*	*	*	*	*	*
3.6	Prepare, implement site-specific protection measures in Strickland State Forest		Forests NSW	-	*	*	*	*	*	*
3.7	Environmental impact assessment	1	GCC, WSC, DIPNR, Lands	-	#	#	#	#	#	-
4.1	Verify, update & distribute location records	1	DEC (EPRD)	DEC in-kind	1100	√	√	√	√	1100
4.2	Model potential habitat	1	DEC (EPRD)	Unsecured	2100	-	-	-	-	2100
4.3	Update species profiles and EIA guidelines	1	DEC (EPRD)	DEC in-kind	-	-	-	700	-	700
4.4	Review Threatened Species Hazard Reduction List conditions	1	DEC (EPRD)	DEC in-kind	-	-	-	-	1750	1750
4.5	DEC informed of planning decisions	2	GCC, WSC, DIPNR, Lands, RFS	-	#	#	#	#	#	-
5.1	Consultation with Aboriginal interests	1	DEC (EPRD)	Unsecured	1500	1500	1500	1500	1500	7500
5.2, 5.3, 5.4	Community awareness & involvement	2	DEC (EPRD),	DEC in-kind	3500	3500	3500	3500	3500	17,500
			GCC, WSC, Forests NSW	-	#	#	#	#	#	-
6.1	Promote research	2	DEC (EPRD)	DEC in-kind	700	700	700	700	700	3500
6.2	Consider as subject for SeedQuest program	2	DEC (BGT)	DEC in-kind	#	#	#	#	#	-
Total costs				Unsecured	7800	5700	3600	3600	3600	**24300**
				DEC in-kind	12550	11800	9850	9500	10550	**54250**
				TOTAL	**20350**	**17500**	**13450**	**13100**	**14150**	**78550**

Key to abbreviations, terms and symbols in costing table:

BGT – Botanic Gardens Trust, **DEC** – Department of Environment and Conservation (NSW), **DIPNR** – Department of Infrastructure Planning and Natural Resources, **EPRD** – DEC Environment Protection & Regulation Division, **GCC** – Gosford City Council, **Lands** – Department of Lands (NSW), **RFS –**Rural Fire Service (NSW), **WSC –** Wyong Shire Council.

Priority rankings: 1 - Action critical to meeting plan objectives, **2** - Action contributing to meeting plan objectives, **3** – Desirable but not essential action.

DEC in-kind funds represent the salary component of permanent DEC staff and recurrent resources. Salary for in-kind contributions is calculated at $350 per day, which includes officer salary and on-costs, provision of office space, vehicles, administration support and staff management. Note that other agencies also contribute in-kind resources which have not been included in the above table. **Unsecured** funds will be sought from sources including DEC annual operational provisions for the implementation of threatened species programs, the Natural Heritage Trust, Environmental Trust, industry sponsors, the NSW State Biodiversity Program, Threatened Species Network, Threatened Species Appeal and DEC annual provisions for implementation of threatened species programs.

- No direct cost (either cost of action is negligible or action is a statutory responsibility of the responsible party); √ - No additional costs (included in the cost of other actions); ***** - Amount to be determined by the responsible party.

References

Beadle, N.C.W. (1984) *Students flora of north eastern New South Wales: Part V.* Botany Department, University of New England: Armidale.

Bell, S.J. (2002) *The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles.* Final report to Wyong Shire Council, December 2002.

Bell, S.J. (2004) *The natural vegetation of the Gosford Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles*. Final report to Gosford City Council.

Carolin, R.C.W. and Tindale, M.T. (1994) *Flora of the Sydney region.* 4th edn. Reed Publications, Chatswood.

Conn, B.J. (1997) Four rare and/or threatened new species of Prostanthera Section Prostanthera (Labiatae) from New South Wales. *Telopea* 7(3):231-244.

Edwards, K. (1979) Rainfall in NSW. *Soil Conservation Service Technical Handbook No.3.* Soil Conservation Service of NSW, Sydney.

Environment Australia (2001) *Threat abatement plan for dieback caused by the root-rot fungus* Phytophthora cinnamomi.

Fairley, A. & Moore, P. (2000) *Native plants of the Sydney district: an identification guide.* Kangaroo Press, East Roseville.

Harden, G. (ed) (1992) *Flora of NSW Vol 3.* NSW University Press.

IUCN (1994). *IUCN Red List Categories.* IUCN Species Survival Commission, Kew.

Keith, D.A., Chalson, J.M. & Auld, T.D. (1997) *Assessing the status of threatened plants: a new methodology and an application to the vascular flora of New South Wales.* Final report to Environment Australia, Endangered Species Program Project No. 450.

Miller, R. (1993) Grafting prostantheras. *Lasianthos* 1. Association of Societies for Growing Australian Plants Prostanthera & Westringia Study Group, October 1993.

Murphy, C.L. & Tille, P.J. (1993) *Soil landscapes of the Gosford – Lake Macquarie 1:100 000 sheet.* Map. Department of Conservation and Land Management, NSW.

NSW NPWS (1999) *Bushrock removal: a key threatening process.* NPWS Fact Sheet.

NSW NPWS (2000a) *Vegetation survey, classification and mapping: Lower Hunter and Central Coast Region: a project undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy*. CRA Unit Sydney Zone, National Parks and Wildlife Service.

NSW NPWS (2000b) *Mapping potential habitat of threatened flora species occurring in the Lower Hunter and Central Coast Region.* NSW NPWS CRA Unit, Sydney Zone.

NSW NPWS (2002) *Fire interval guidelines for broad vegetation types.* Unpublished report prepared by the NSW National Parks & Wildlife Service.

NSW Scientific Committee (1998) "Final determination to list *Prostanthera askania* as an Endangered species" in *NSW Scientific Committee Determination Advice 98/16*, 12 June 1998.

NSW Scientific Committee (1999) *Final determination to list 'Bushrock removal' on Schedule 3 of the TSC Act.*

NSW Scientific Committee (2000a) *Final determination to list 'Anthropogenic climate change' on Schedule 3 of the TSC Act.*

NSW Scientific Committee (2000b) *Final determination to list 'High frequency fire resulting in the disruption of life cycle process in plants and animals and loss of vegetation structure and composition' on Schedule 3 of the TSC Act.*

NSW Scientific Committee (2001) *Final determination to list 'Clearing of native vegetation as a key threatening process' on Schedule 3 of the TSC Act.*

NSW Scientific Committee (2002a) *Final determination to list 'Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands' on Schedule 3 of the TSC Act.*

NSW Scientific Committee (2002b) *Final determination to list 'Infection of native plants by Phytophthora cinnamomi' on Schedule 3 of the TSC Act.*

Tierney, D.A., & Gross, C.L. (2001) *Prostanthera junonis* Conn (Lamiaceae): is recovery possible? *Pacific Conservation Biology* 7: 118-123.

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M., and Rossetto, M. (2004) *Guidelines for the translocation of threatened plants in Australia.* 2nd ed. Australian Network for Plant Conservation, Canberra.

Appendices

Appendix 1: Prostanthera askania general location details and population-specific information

Appendix 2: Species profile and environmental impact assessment guidelines

Appendix 3: Site management statement proforma for *Prostanthera askania*

Appendix 4: Summary of advice from NSW Scientific Committee

Appendix 1: *Prostanthera askania* general location details and population-specific information

Given concerns that the publication of specific location details for populations of *P askania* may compromise conservation, such information will not to be publicly available. Public authorities, land managers, or others with reasonable need for the data may request that information by contacting the Threatened Species Unit or may obtain the information from the DEC Atlas of NSW Wildlife.

Sub-population	LGA	Location	Total number estimate[#]	Date of last estimate	Tenure	Manager	Development zone[§]	Council land category	Comments	Mapped vegetation
Pa_01	Wyong	Ourimbah: Lot 3 DP 600570	150-300	Dec 2003*	Private freehold[‡]	Private	7a Conservation [b]	n/a		Coastal Ranges Moist Layered Forest & Narrabeen Warm Temperate-Subtropical Rainforest
		Ourimbah: Lot 2 DP 1035920 'Australian Rainforest Sanctuary'	?		Private freehold[‡]	Private	7a Conservation [b]	n/a	Freehold currently managed as private wildlife/forest sanctuary.	Narrabeen Warm Temperate-Subtropical Rainforest & Narrabeen Hunter Ranges Gully Dry Rainforest
Pa_02	Gosford	Strickland SF: SW section, in headwaters of western branch of Narara Creek	72	Nov 2003	State Forest FMZ 2	SFNSW	6b Open Space (Special Purposes) [a]	n/a		Coastal Narrabeen Moist Forest
Pa_03	Gosford	Strickland SF: beside access road & walking trail	24	Nov 2000	State Forest FMZ 2	SFNSW	6b Open Space (Special Purposes) [a]	n/a		Coastal Warm Temperate Rainforest
Pa_04a	Gosford	Niagara Park: off Mangrove Road, in headwaters of Dog Trap Gully	30?	Jun 2002	Private freehold[‡]	Private	7a Conservation [a]	n/a		Coastal Narrabeen Moist Forest
Pa_04b	Gosford	Niagara Park: off Glen Road, in headwaters of Dog Trap Gully	1000-2200	Dec 2003	Private freehold[‡]	Private	7a Conservation [a]	n/a	Largest known mature population. Clearing and lantana proximate.	Coastal Narrabeen Moist Forest
Pa_04c	Wyong	Ourimbah: Lot 24 Glen Road; headwaters of tributary of Dog Trap Gully	1	Jan 2001	Private freehold[‡]	Private	7a Conservation [b]	n/a	Only single plant observed amidst thick lantana. Also subject to vehicular and foot traffic damage.	Coastal Narrabeen Moist Forest
Pa_05a	Gosford	Niagara Park: west of Siletta Road	5000-7000	Dec 2003	Private freehold[‡]	Private	7a Conservation [a]	n/a	Majority of area of large post-fire seedling population. includes 5000-7000 immature plants less than 1 year old.	Coastal Narrabeen Moist Forest
					Council reserve	Gosford CC	7a Conservation [a]	Operational	NW extension on to council land	Coastal Warm Temperate Rainforest
Pa_05b	Gosford	Niagara Park: Alan Street reserve	150-290	Dec 2003	Council reserve[‡]	Gosford CC	6a Open Space (Recreation) [a]	Community	Southern 2/3 of subpopulation	Coastal Narrabeen Moist Forest
					Council reserve[‡]	Gosford CC	6e Open Space (Proposed) [a]	Community	Northern 1/3 of subpopulation	Coastal Narrabeen Moist Forest
Pa_06	Gosford	Holgate: Katandra Reserve	1-2	Apr 1986	Council reserve	Gosford CC	6a Open Space (Recreation) [a]	Community		Coastal Narrabeen Moist Forest
Pa_07	Gosford	Matcham: off The Ridgeway	3-5	Feb 2003	Council reserve	Gosford CC	6a Open Space (Recreation) [a]	Community	Close to boundary with private property zoned 7a	Coastal Narrabeen Moist Forest
Pa_08	Wyong	Fountaindale: off Berrys Lane	120	Nov 2003	Council reserve	Wyong SC	7a Conservation [b]	Community	Population mostly in Council reserve; also partly in road reserve (Council?) and/or private freehold?	Coastal Ranges Moist Layered Forest
Pa_09	Wyong	Glenning Valley: Brush Road	50-75	Nov 2003	Private property[‡]	Private	7a Conservation [b]	n/a	Growing along fence line inside private property. Property has VCA but not over Pa population. Population extends to adjoining Council road easement under powerlines.	Coastal Ranges Moist Layered Forest
					Crown road reserve[‡]	Wyong SC	Road in zone 7a Conservation [b]	n/a		Coastal Ranges Moist Layered Forest
Pa_10	Wyong	Glenning Valley: Rutherford Dve	40-60	Nov 2003	Crown road reserve[‡]	Dept of Lands	Road in zone 7c?	n/a	Population extends from Crown road reserve (extension of Rutherford Drive), managed by Dept. of Lands, and extends west onto Crown Land (Lot 95 DP 755263), which is reserved for both public recreation (R73397) and timber (R62269), with management devolved to Council. May extend even further west onto adjoining lots (one of which is council land).	Coastal Ranges Moist Layered Forest
					Crown reserve[‡]	Wyong SC	6a Open Space (Recreation) b	n/a		Coastal Ranges Moist Layered Forest

estimates of number of mature *and* immature individuals

* assessment made from adjoining property

‡ subpopulation occurs across more than one tenure or zoning

§ as identified in the [a] Gosford City Council Interim Development Order 122 or Gosford Planning Scheme Ordinance, or
[b] Wyong Shire Council Local Environmental Plan 1991, or,
[c] State Forests of NSW Forest Management Zoning system.

The meaning of the zoning primary purpose and the allowable developments or activities within the zone differs between local government areas even where the zone name is the same.

Appendix 2: Species profile and environmental impact assessment guidelines

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

THREATENED SPECIES INFORMATION

Prostanthera askania

Conn

Common name(s): **Strickland mintbush, Tranquillity mintbush**

Family: **Lamiaceae**

Prostanthera askania was named and described by Conn (1997) and has been previously known as *Prostanthera incisa* var. *pubescens*, *Prostanthera* sp. G (Harden 1992) and *Prostanthera* sp. 'Strickland State Forest' (TSC Act 1995).

Conservation status

Prostanthera askania is listed as an **endangered species** on Schedule 1 of the New South Wales *Threatened Species Conservation Act* 1995 (TSC Act). *Prostanthera askania* is also listed as a nationally **endangered species** under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

Description

Prostanthera askania, sometimes called Strickland or Tranquillity Mintbush, is a member of the family Lamiaceae. It is an erect but spreading and sometimes scrambling, openly-branched shrub that grows from 1-3 metres high (Conn 1997). The branches and leaves are strongly aromatic and densely covered with long, spreading hairs (Harden 1992). Leaves are ovate (12-25mm) long, dull dusty green in colour, with deep incisions forming lobe-like teeth, which are directed forwards. Flowers are pale mauve to mauve and only occur for a relatively short period, usually during spring.

Photo: NPWS

Distribution

Prostanthera askania occurs over a very restricted geographic range (less than 12 km) in the upper reaches of creeks that flow into Tuggerah Lake or Brisbane Water within the Wyong and Gosford local government areas. Recent surveys (December 2003) have reconfirmed the location of eight populations of the species in the catchments of Ourimbah Creek, Narara Creek, Dog Trap Gully, Chittaway Creek and Berkeley Creek. A further two populations are known from the Erina – Fires Creek catchment. The species may also have occurred in West Gosford. The 10 known populations occupy an area of less than 15 ha in total.

Recorded occurrences in conservation reserves

Prostanthera askania has not been recorded within the reserve estate.

Known populations occur within on lands managed by Gosford City and Wyong Shire Councils, Strickland State Forest, and on private property, including the 'Australian Rainforest Sanctuary', a privately owned wildlife reserve.

Habitat

Prostanthera askania occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes on Narrabeen sandstone and alluvial soils derived from it. The species occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic

NSW NATIONAL PARKS AND WILDLIFE SERVICE

understorey. *Syncarpia glomulifera* subsp. *glomulifera* (Turpentine), *Allocasuarina torulosa* (Forest Oak), and *Eucalyptus acmenoides* (White Mahogany) are characteristic of the wet sclerophyll community, but the canopy species present can be highly variable (Bell 2002). At most known *Prostanthera askania* sites *Syncarpia glomulifera* and *Eucalyptus saligna* (Sydney Blue Gum) occurs, but canopy species at various sites also include *E. agglomerata* (Blue-leaved Stringybark), *E. pilularis* (Blackbutt), *Corymbia maculata (*Spotted Gum) and *E. siderophloia* (Grey Ironbark), with the presence of the latter three species indicating a drier variant of the moist scherophyll forest. Canopy species at rainforest sites are also variable and include *Doryphora sassafras* (Sassafras), *Cryptocarya obovata* (Pepperberry), *C. glaucescens* (Jackwood), *C. microneura* (Murrogun), *S. glomulifera*, *Ceratopetalum apelatum* (Coachwood), *Synoum glandulosum* subsp. *glandulosum* (Scentless Rosewood), *Acmena smithii* (Lilly Pilly), *Acacia irrorata* (Green Wattle), *Tristaniopsis collina* (Mountain Water Gum), *Callicoma serratifolia* (Black Wattle), *Archontophoenix cunninghamiana* (Bangalow Palm), *Glochidion ferdinandi* (Cheese Tree) and *Sloanea australis* (Maiden's Blush) (NSW NPWS 2000, Conn 1997).

Assemblages of understorey species vary considerably at each site and reflect a mix of moist forest/rainforest species determined by localised habitat conditions, prior and current disturbance regimes (e.g. fire, weed invasion, proximity to access tracks, natural tree falls) and the successional stage of the community. In many instances *Prostanthera askania* forms dense clumps and when it does so may constitute one of the dominant understorey species within the community.

Prostanthera askania occurs in vegetation communities mapped in the Lower Hunter and Central Coast Regional Environmental Strategy (LHCCREMS), as Coastal Narrabeen Moist Forest (Map Unit MU 6), Coastal Wet Gully Forest (MU 1), Coastal Warm Temperate—Subtropical Rainforest MU 1a) and Coastal Narrabeen Shrub Forest (MU 22) (NSW NPWS 2000). Known sites in the Wyong LGA occur in communities mapped more recently by Bell (2002) as Coastal Ranges Moist Layered Forest (MU 35) and Narrabeen Warm Temperate—Subtropical Rainforest (MU 42). Known sites in the Wyong LGA occur in communities mapped more recently by Bell (2002) as Coastal Narrabeen Moist Forest (Map Unit E6a) and Coastal Warm Temperate Rainforest (MU E1ai)

Ecology

Prostanthera askania may be a colonising species that takes advantage of increased light following natural canopy-cover disturbance within the moist forest and rainforest habitats in which it occurs. Population sizes may therefore fluctuate naturally with time following disturbance. The species appears to be present in only small numbers at undisturbed sites where low light conditions prevail, or at sites that are subject to high levels of weed invasion by Lantana. Occasional *P. askania* individuals do persist in low light conditions, but are likely to senesce in the absence of a natural disturbance regime that is conducive to recruitment. Observations of the species indicate that it is outcompeted by invading weed species such as Lantana (C. Pennay, NSW NPWS, pers. obs.) as it occupies a similar habitat niche to that species.

Prostanthera askania is likely to be fire-sensitive given the moist forest habitats it occupies, however, its fire ecology is currently unknown. A large pre-fire adult population in moist *Syncarpia glomulifera* forest was killed by fire in October 2002, but appears to be successfully regenerating, apparently from seed (N. Corkish, pers. obs.), between 6 and 16 months following fire, which suggests either a persistent soil-stored seedbank or a heavy crop of seed on the adult plants immediately before the fire. Continued monitoring and further studies are required, however, to draw firm conclusions regarding the species response to fire.

Little is known about the reproductive biology and ecology of *P. askania*. Flowering usually occurs in spring, however, it is known that the timing of both flowering and fruiting can be variable. Several species of insect, including ants, have been observed foraging on the flowers of *P. askania*, however these have not been identified (C. Lacey, R. Payne, pers. obs.). Further work is required to clarify these aspects.

Prostanthera askania also appears in some locations to propagate vegetatively by 'stem-layering' where prostrate branches take root where they remain in contact with the soil. This characteristic and the species' tendency at many sites to form dense clumps make the counting of individual plants within populations difficult.

Threats

The main threats to the survival of *P. askania* are habitat loss due to clearing and other modification, including roadside maintenance activities, and inappropriate fire regimes. Other threats or potential threats include climate change; habitat degradation from bush rock removal, competition by weeds and dumping of rubbish and garden waste; and grazing and associated trampling.

Key Threatening Processes currently listed under the Commonwealth EPBC Act or in Schedule 3 of the NSW TSC Act 1995 (NSW) that are relevant to *Prostanthera askania* are:

- "Clearing of native vegetation" (TSC Act) or "Land clearance" (EPBC Act).

Vegetation loss, fragmentation and modification may directly or indirectly impact on populations of *Prostanthera askania* in a number of ways (see the NSW Scientific Committee Determination Advice 01/17 and the relevant Commonwealth Threatened Species Scientific Committee Listing Advice for further information about this key threatening process).

Loss and fragmentation of *Prostanthera askania* habitat has occurred as a result of vegetation clearing or modification for urban expansion and industrial development in the Gosford – Wyong area. Direct physical damage to or destruction of plants, or alteration of habitat causing changes to habitat structure and floristic composition, may also occur through road/track construction, slashing and herbicide spraying along road verges or from rubbish dumping, mechanical fuel hazard reduction activities, and motor/bicycle or foot traffic.

- "High frequency fire resulting in the disruption of lifecycle processes in plants and animals and loss of vegetation structure and composition" (TSC Act).

Multiple fires in close succession may limit the ability of the species to recruit new individuals into a population, or for plants to build-up a seedbank sufficient in size to maintain the population through the next fire. Sustained high frequency can also lead to a reduction in vegetation structure and subsequent changes in microclimate, affecting the suitability of the habitat for species like *P. askania* which appear to require moister, sheltered aspects (see the NSW Scientific Committee Determination Advice 00/06 (2000b) for further information about this key threatening process).

- "Anthropogenic climate change" (TSC Act) or "Loss of climatic habitat caused by anthropogenic emissions of greenhouse gasses" (EPBC Act).

P. askania may be adversely affected by changes to habitat or fire regimes caused by climate changes resulting from or accelerated by human activities (see the NSW Scientific Committee Determination 00/24 and the relevant Commonwealth Threatened Species Scientific Committee Listing Advice for further information about this key threatening process). Species such as P. *askania*, with very restricted distributions and fragmented populations, may be especially susceptible to reductions in the bioclimatic range caused by climate change.

- "Bushrock removal" (TSC Act).

As *P. askania* often occurs in areas where Hawkesbury sandstone outcrops, legal or illegal bush rock removal in such areas may destroy plants and degrade the habitat of the species (see the NSW Scientific Committee Determination Advice 99/25 and the NPWS fact sheet 'Bushrock removal: a key threatening process' for further information about this key threatening process).

- "Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands" (TSC Act)

Altered drainage flow patterns due to urban development may be the cause of riparian zone degradation which appears to be directly affecting the habitat of the species stream bank erosion at one site. The alteration of the water regime may also permit establishment and

spread of semi-terrestrial weed species (see the NSW Scientific Committee Determination Advice 02/12 for further information about this key threatening process).

- "Infection of native plants by *Phytophthora cinnamomi*" (TSC Act) or "Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)" (EPBC Act)

P. askania occurs in the vicinity of known *P. cinnamomi* infestations or in habitat that may be vulnerable to *P. cinnamomi* infestation. The species may therefore be adversely affected by *P. cinnamomi* either because of direct infestation or degradation of habitat (see the NSW Scientific Committee Determination Advice 02/27 and the relevant Commonwealth Threat Abatement Plan for further information about this key threatening process).

Other threats to the species include:

- competition through weed invasion, in particular, weeds such as lantana (*Lantana camara*), crofton weed (*Ageratina adenophora*), asparagus fern (*Protoasparagus aethiopicus*) and wandering Jew (*Tradescantia albiflora*)
- grazing and associated trampling.

Management

Management of *Prostanthera askania* should attempt to:

- minimise habitat loss and degradation by retaining and managing vegetation remnants containing the species to reduce fragmentation of and improve connectivity between and within populations.
- prevent frequent fires from impacting on the populations
- ensure that roadside and powerline easement maintenance and weed control activities are planned and conducted sensitive to the presence of the species and avoid damaging individual plants as well as potential habitat for the species.
- address current habitat degradation issues such as weed invasion (especially lantana *Lantana camara*) and access-related issues (eg. BMX/trail bikes).

Recovery Plans

A recovery plan has been prepared for *Prostanthera askania.*

For further information contact

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

References

Bell, S.J. (2002) *The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles*. Final report to Wyong Shire Council, December 2002. Unpublished.

Conn, B. (1997) Four rare and/or threatened new species of *Prostanthera* Section *Prostanthera* (Labiatae) from New South Wales. *Telopea* 7(3):231-244.

Harden, G. (ed.) (1992) Flora of NSW Vol 3. NSW University Press.

NSW NPWS (2000) *Vegetation Survey Classification and Mapping in the Lower Hunter and Central Coast.* A report to the Lower Hunter & Central Coast Regional Environment Management Strategy Committee, April 2000.

Prostanthera askania

Conn

Common names: **Tranquillity mintbush, Strickland mintbush**

The following information is provided to assist authors of species impact statements, development and activity proponents, determining and consent authorities, and others 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

Survey for *Prostanthera askania* may be undertaken at any time of the year. A combination of leaf characteristics and habit should enable the species to be identified in the absence of flowers. However, the species is most readily observed during its flowering season (primarily between September to December) when plants produce many pale mauve to blue mauve flowers. *P. askania* may be confused with *P. incisa* with which it has affinities. However *P. incisa*, while moderately to densely hairy, has short curled hairs as opposed to long spreading hairs and the leaves of *P. incisa* have much shorter teeth than those of *P. askania.*

Potential habitat for *P. askania* occurs in the following vegetation communities within Gosford and Wyong:

- Coastal Narrabeen Moist Forest (MU 6), Coastal Wet Gully Forest (MU 1), Coastal Warm Temperate-Subtropical Rainforest (MU 1a) or Coastal Narrabeen Shrub Forest (MU 22) (NPWS 2000)
- Coastal Ranges Moist Layered Forest (MU 35), Narrabeen Warm Temperate-Subtropical Rainforest (MU 42) and Narrabeen Hunter Ranges Gully Dry Rainforest (MU 41) (Bell 2002)
- Coastal Narrabeen Moist Forest (MU E6a) and Coastal Warm Temperate Rainforest (MU E1ai) (Bell in prep).

Survey should not necessarily be confined to areas of intact native vegetation. *P. askania* plants have been recorded growing in highly disturbed environments such as along roadsides and fence lines.

Where new sites are located, site details including plant numbers, habitat and location should be recorded and forwarded to the DEC.

Life cycle of the species

The ecology of *P. askania* is described in the recovery plan (DEC 2006) and summarised in the species profile.

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

- Loss of individuals

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

- Loss and fragmentation of habitat

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

- Modification of habitat

Urban development in close proximity to *P. askania* sites is likely to cause modification of habitat through altered

NSW NATIONAL PARKS AND WILDLIFE SERVICE

hydrological conditions, soil pH and nutrient levels, weed invasion, potential introduction of plant pathogens and altered fire frequency. Subsequent increases in pedestrian and/or vehicular traffic through sites may result in trampling, soil compaction, erosion and rubbish dumping. Other proposals that result in the regular slashing, grazing, spraying (herbicides and pesticides) or burning of *P. askania* habitat are also likely to result in the modification of that habitat.

- Damage to the soil seedbank

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

- Altered fire regimes

Proposals that result in the frequent burning (ie successive fires <10 years apart) of sites are considered likely to impact upon recruitment of the species. Recommended fire frequencies for the species are provided in the recovery plan (DEC 2006).

Threatening processes

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

- *Clearing of native vegetation;*
- *High frequency fire resulting in the disruption of life cycle processes in plants and animals and the loss of vegetation structure and composition;*
- *Infection of native plants by Phytophthora cinnamomi;*
- *Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;*
- *Bush rock removal; and*
- Anthropogenic climate change.

Other threatening processes include slashing and herbicide spraying to maintain paddocks and road verges, grazing and trampling by livestock, weed invasion and the modification of habitat associated with adjacent urban development such as bushfire hazard reduction works, rubbish dumping (including green waste, household rubbish and construction materials) and stormwater runoff.

Viable local population of the species

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

A significant area of habitat

Assessment of habitat significance for *P. askania* requires consideration of the following:

- number of *P. askania* plants present (including consideration of the soil seed bank);
- proportion of the local population present;
- location in relation to the current distributional limits of the species;
- size, condition and connective importance of the habitat;
- uniqueness of habitat; and
- management potential including the likelihood of ameliorating any existing threatening processes.

The DEC considers that all viable populations occupy a significant area of habitat until such time as adequate and representative examples are conserved across the species' range.

Isolation/fragmentation

P. askania habitat has been fragmented by clearing for agriculture, urban development as well as road construction and maintenance across its range. The distance between populations of *P. askania* that will result in genetic isolation is unknown because the species' pollen vectors are unknown. Seed dispersal is localised, so interaction via this mechanism is unlikely.

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

Regional distribution of the habitat

The known distribution of *P. askania* is confined to the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation of Australia (Thackway & Cresswell 1995).

Limits of known distribution

The known distribution of *P. askania* extends from Katandra Reserve in the Gosford local government area north to Fountaindale in the Wyong local government area. The western limit of its distribution occurs within the headwaters of creeks that drain east from Strickland and Ourimbah State Forests.

Adequacy of representation in conservation reserves or other similar protected areas

P. askania is not considered to be adequately represented in conservation reserves.

Critical habitat

Critical habitat has not been declared for *P. askania.*

For further information contact

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

References

Bell, S.J. (2002) *The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: vegetation community profiles.* Unpublished report to Wyong Shire Council.

Bell, S.J. (in prep.) *The natural vegetation of the Gosford Local Government Area, Central Coast, New South Wales.* Unpublished report to Gosford City Council.

NSW National Parks and Wildlife Service (2000) Vegetation survey, classification and mapping. Lower Hunter and Central Coast Region. Unpublished report for the Lower Hunter and Central Coast Regional Environment Management Strategy. CRA Unit, Sydney Zone, NPWS, Hurstville.

The Department of Environment and Conservation (NSW) (2006) *Prostanthera askania Recovery Plan*. DEC (NSW), Hurstville.

Thackway, R. & Cresswell, I.D. (1995). *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program.* Version 4.0. Australian Nature Conservation Agency, Canberra.

Appendix 3: Site management statement proforma

Site Management Statement

Prepared by: ...……..

Date: …….

Site details:

Site Name: ……

Site Code: …….

Location: ……..

……...

……...

AMG Zone: …… Easting: ……..…..….. Northing: ……...……..

Land owner/manager contact details

Name: ……..

Phone number(s):
…….

Postal address: ……..

……...

Parcel details:

Portion/Parish or Lot/DP no.: Tenure:

Street address:

LGA: Zoning:

Current landuse:

Population details:

No. adults: Count: [ ] Estimate: [ ]
Lowest estimate =…….…...….Best estimate =…….…….Upper estimate =…….…….…

No. seedlings: Count: [ ] Estimate: [ ]
Lowest estimate =…….…...….Best estimate =…….…….Upper estimate =…….…….…

Area of Occupancy: …….……...Accurate: [ ] Estimate: [ ]

Reproduction: Buds: [ ] Flowers: [ ] Fruit: [ ]

Detailed **site map** attached: Yes / No **Photographs** taken:……

Habitat: ……...

……...

……..

……..

……..

……..

Dominant associated species: ……...

……..

……..

……..

……..

……..

……..

……..

Threats: May include weed invasion (specify species, abundance and % cover); trampling/grazing; isolation/fragmentation; erosion; inappropriate fire regimes; inappropriate access; rubbish dumping

……..

……...

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

……..

Previous management actions (describe apparent success): ……

……..

……..

……..

……..

……..

Threat abatement actions required: ……

……..

……..

……..

……..

……..

……..

……..

Recommended monitoring and evaluation program: ……

……..

……..

……..

……..

……..

……..

……..

Timetable for implementation of actions and monitoring: ……

……..

……..

……..

……..

……..

……..

……..

……..

……..

Appendix 4: Summary of advice from NSW Scientific Committee

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

Advice	**Response**
Acknowledged that there is little knowledge of the life history and ecology of the species, so ongoing research is vital.	No amendment necessary
Strongly recommended that the actions in the plan are implemented and that the budget is adhered to and funded, particularly Recovery Objective 1 in relation to conserve habitat using land use and conservation planning mechanisms.	No amendment necessary
The actions in the plan include surveys of known and potential habitat. These surveys need to be complemented with detailed research into a number of life history and ecological features, including the longevity of the species, seed dispersal and seed longevity, an understanding of its reproductive biology, long term response of the species to natural and altered fire regimes and the role of exotics in its potential decline.	Section 10.2 amended and action 2.3 amended to include these research areas.