



**A Review and Evaluation of the:
2001 National Threat Abatement Plan
for Dieback Caused by the Root-Rot
Fungus *Phytophthora cinnamomi***



An Australian Government Initiative



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The review and evaluation of the 2001 national 'Threat Abatement Plan for Dieback Caused by the Root-Rot Fungus *Phytophthora cinnamomi*' was commissioned by the Australian Government Department of the Environment and Heritage as a precursor to a revision of the goals, objectives and actions of the Plan [CPSM (2006) National Threat Abatement Plan for Disease in Natural Ecosystems Caused by *Phytophthora cinnamomi*: Goals, Objectives and Actions (Draft)].

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ABBREVIATIONS

ARC	Australian Research Council
CALM	Department of Conservation and Land Management, Western Australia
CPSM	Centre for Phytophthora Science & Management, Murdoch University, WA
DCC	Dieback Consultative Council of Western Australia
DEC	Department of Environment and Conservation, NSW
DEH	Australian Government Department of the Environment and Heritage
DEHSA	Department of the Environment and Heritage, South Australia
DPI	Department of Primary Industries, Victoria
DPIWE	Department of Primary Industries, Water and Environment, Tasmania
DRF	Dieback Response Framework
DRG	Dieback Response Group
DSE	Department of Sustainability and Environment, Victoria
DWG	Dieback Working Group
EPBC Act	Environment Protection and Biodiversity Conservation Act, 1999
HRZ	Hazard Risk Zone
NAPSWQ	National Action Plan for Salinity and Water Quality
NHT-RCC	National Heritage Trust – Regional Competitive Component
NIASA	Nursery Industry Accreditation Scheme Australia
NP	National Park
NPWS	National Parks and Wildlife Service, NSW
NPWSA	National Parks and Wildlife, South Australia
NRM	Natural Resource Management
NTAP	National Threat Abatement Plan
PTG	Phytophthora Technical Group
RBG	Royal Botanic Gardens (Sydney)
SCRIPT	South Coast Regional Initiative Planning Team
SHFT	Sydney Harbour Federation Trust
SoE	State of Environment
SOP	Standard Operating Procedure
TAFE	College of Technical and Further Education
TAPIT	Threat Abatement Plan Implementation Team
The Trust	National Heritage Trust
WTMA	Wet Tropics Management Authority, Queensland
WTWHA	Wet Tropics World Heritage Area, Queensland
WWF	World Wildlife Fund

1 INTRODUCTION

Australia's long history of geographic isolation has resulted in the evolution of plants and animals with a high level of endemism. Habitat modification and introduced species are the two main contributors to the decline of biodiversity in Australia, contributing to a poor record of species conservation. Half of worldwide mammal extinctions in the past 200 years have occurred in Australia¹.

Australia's native plants and ecological communities are threatened by the soil-borne plant pathogen, *Phytophthora cinnamomi*, for which it is estimated over 2000 plant species are known hosts². *P. cinnamomi* is present in all states and territories of Australia where it causes disease in an extremely diverse range of native, ornamental, forestry and horticultural plants. Described as a 'biological bulldozer', *P. cinnamomi* is destroying bushlands, heathlands, woodlands and forests, which are the habitat for rare and endangered flora and fauna species³. There are no known methods for eradication of areas infested with *P. cinnamomi*.

The threat *P. cinnamomi* poses to Australia's biodiversity led to its listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a key threatening process. Under the provisions of the Act a National Threat Abatement Plan for Dieback Caused by the Root-Rot Fungus *Phytophthora cinnamomi* was prepared and released in 2001⁴. The broad goals of the National Threat Abatement Plan (NTAP) were to:

- protect endangered or vulnerable native species and communities from *P. cinnamomi* and;
- prevent further species and communities becoming endangered by reducing the chance of exposure to the pathogen.

The goals of the NTAP were to be pursued through achieving the following five objectives:

(i) Promote recovery: To promote recovery of threatened species and ecological communities that are known or perceived to be threatened by *P. cinnamomi*.

(ii) Limit spread: To limit the spread of *P. cinnamomi* into areas where it may threaten species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.

(iii) Improve management: To improve the effectiveness and efficiency of the management of *P. cinnamomi* through appropriate research and monitoring programs.

(iv) Inform stakeholders: To inform Commonwealth, state and territory management agencies, landholders and the public about the Threat Abatement Plan's actions and outcomes.

(v) Coordinate management: To effectively coordinate management activities.

This report reviews the implementation of the NTAP in the period 2001 to 2005 and evaluates the outcomes for management of *P. cinnamomi* in natural ecosystems of Australia.

2 REVIEW OF IMPLEMENTATION OF NTAP FOR DIEBACK CAUSED BY PHYTOPHTHORA CINNAMOMI

The implementation of the NTAP was reviewed by examining the available documents, literature and websites, and by direct consultation with stakeholders.

The Threat Abatement Plan for P. cinnamomi

The Threat Abatement Plan's focus on strategic approaches to reduce the impacts of key threatening processes that jeopardise the long-term survival of native species and ecological communities. Under the EPBC Act, the role of the Australian Federal Government is to implement the Plan as it applies to Commonwealth areas, and seek the co-operation of the states, territories and other stakeholders to implement the Plan as it applies to them. However, the Senate Committee on the Environment, Communications, Information Technology and the Arts Inquiry (2004)⁴ reported that whilst NTAPs are statutory, they have limited application to Australian Government land and for lands of other tenure. The state and territory cooperation needed is currently limited by a lack of planning between the states and the community.

The Federal Government also supports the national effort by implementing key national level actions in the Plan, usually in partnership with other stakeholders. The NTAP for *P. cinnamomi* was launched without timelines or an indicative budget, and without responsible parties clearly identified. The objectives are not easily measurable and are written in such a way that it is difficult to determine if they were achieved or not.

The Department of Environment and Heritage (DEH) recognised that success will only come if all parties that are impacted by this pathogen co-operate in the implementation of the Plan⁵. The key national level actions that were identified as the responsibility of the Commonwealth Government in the NTAP for *P. cinnamomi* are listed under objective 5 were:

- to make funds available through the Endangered Species Program to support the further development of regional management programs
- where possible, integrate management on private and public lands with other regional biodiversity conservation measures through the development of regional partnerships
- convene a *P. cinnamomi* NTAP Implementation Team (TAPIT) to advise the Commonwealth Environment Minister on implementation of NTAP. The TAPIT would:
 - monitor the implementation of the Plan including reviewing the actions and broad priorities for funding, and highlighting gaps
 - report annually to the Commonwealth Minister for the Environment
 - ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the TAPIT will establish clear link with state-based *P. cinnamomi* Threat Abatement Teams (or their equivalent) and with relevant regional and local bodies which are responsible for management of *P. cinnamomi*
 - commission an independent review to evaluate progress made in the Plan's implementation before the term of the Plan expires
 - develop State of the Environment reporting indicators
 - oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties committed to developing codes of practice.

National implementation

The focus of funding projects from NTAP funds has changed since the Plan was released in 2001. Initially, stakeholders were able to submit proposals for funding for specific on-ground management projects, then priorities changed and DEH determined they would tender for projects that had national benefit and answered specific actions of the NTAP. Integrated delivery of the National Heritage Trust (the Trust) and National Action Plan for Salinity and Water Quality (NAPSWQ) funds are now driven by strategic and investment plans developed by 56 individual Natural Resources Management (NRM) Regions that cover Australia⁶.

The biggest hindrance to the implementation of the NTAP for *P. cinnamomi* was that the TAPIT was not established. This was listed as the first milestone/performance indicator of Stage 1 of the Plan and impacted on all actions of Objective 5.

National Projects

Whilst not meeting the targets of the Stage 1 Milestone a few national projects have addressed specific Actions in the Plan. The national projects that have received Federal funding are;

- The *P. cinnamomi* Advisory Committee was appointed by the Australian Government DEH in 2004 to assist with identification of projects of national priority for funding and, to help develop tenders for projects funded in 2004/2005 (part of Stage 1 Milestone).
- The 2004/2005 Australian Government DEH project "Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia" addressed Actions of Objective 2 and produced; A Review of Current Management⁷, The National Best Practice Guidelines⁸, Assessment for Threats to Ecosystems, Species and Communities: A Review⁹ and, Risk Assessment Models¹⁰.
- Evaluation and review (this project), and revision of 2001 NTAP for *P. cinnamomi*.

One action of the Stage 1 Milestone for Strategic Planning and Priority Setting in the 2001 NTAP for *P. cinnamomi* requires the states and territories to develop regional strategic plans. The status of strategic and operational Plans and the support provided by stakeholders for each state is shown in Table 1. There are many projects, new and ongoing, which have not been directly funded to implement the Plan but do address specific actions of the Plan. These are presented on a state-by-state basis.

Table 1: Strategic and Operational Plans for *P. cinnamomi* management in Australian states

State	Disease status	Strategic Plan	Operational Plans	Stakeholders involvement
WA	Widespread	Yes, in action	Established but largely untested	Considerable number of stakeholders involved
SA	Localised	Using NTAP		Minor engagement of stakeholders
TAS	Widespread	Using NTAP	In use for many years	Major stakeholders are engaged
VIC		Yes, in Draft form		
NSW	Disease is cryptic	No Plan	No Plan	Few non government stakeholders
QLD	Disease is cryptic, impact is localised	No Plan	Locally developed Plan (WTMA)	Few non government stakeholders

2.1 Implementation in Western Australia

State and national priorities for *P. cinnamomi* management have natural overlap so that actions undertaken in WA have addressed some of the actions of the NTAP (Table 2).

Since the state Government initiated Dieback Response Framework (DRF) was developed in 2004 key strategies have been implemented including the development of a dieback atlas, management guidelines for use on all land tenures and a whole-of-government policy on dieback management. A Biodiversity Conservation Strategy is currently being drafted and a state communication strategy was released in 2005.

2.2 Implementation in South Australia

In SA, all projects have been funded by the Trust (Table 3). This includes 5 projects on stopping the spread and reducing impact of *P. cinnamomi* by effective management, particularly in Mount Lofty Ranges. In addition, the Federal Government provides 50% of funding for the position of DEHSA's Plant Dieback Ecologist. There has been a large focus on raising awareness through education and extension.

2.3 Implementation in Tasmania

P. cinnamomi is regarded as one of the primary plant disease problems in Tasmanian reserves¹⁰. In line with the NTAP, Tasmania takes a regional approach to strategic planning for *P. cinnamomi* management. This approach was developed primarily for lands managed by Tasmanian Parks and Wildlife Service or Forestry Tasmania, and is based on the occurrence of national or state listed susceptible species and highly susceptible communities¹². Rather than develop their own Threat Abatement Plan, Tasmania directly utilises the NTAP to implement projects (Table 4) and risk assessments have been undertaken for selected priority areas¹¹. *P. cinnamomi* hygiene prescriptions are included within codes of practice and environmental management systems within industry in Tasmania.

2.4 Implementation in Victoria

The Trust funded Department of Sustainability and Environment (DSE) Strategic Plan Draft for *P. cinnamomi* management in Victoria (2001-2005) will provide a 3-year program for cross-tenure actions to curb the spread of *P. cinnamomi* and identify significant vulnerable areas of the state or territory for protection from infestation. A Dieback Steering Committee was formed to provide guidance to DSE in the development of the Strategic Plan. The strategy for curbing the spread includes the formulation and promotion of best practice management of *P. cinnamomi* in plant nurseries and other industries that have the potential to spread infested soil and water¹³. Parks Victoria commissioned the "Assessment of Guidelines for best Practice Management of *P. cinnamomi* in Parks and reserves across Victoria" completed in 2002. Currently there is research underway at Deakin University to develop methods to exploit the mechanisms of natural resistance to *P. cinnamomi*.

Other projects that are not directly attributed to the 2001 NTAP are listed in Table 5.

2.5 Implementation in New South Wales

P. cinnamomi management is undertaken in New South Wales by the Department of Environment and Conservation (which incorporates the Royal Botanic Gardens & Domain Trust and National Parks and Wildlife Service) and some local councils in the Sydney metropolitan area. While most of the vegetation of eastern NSW and the ACT has been classified and mapped in relation to vulnerability to *P. cinnamomi*, there are few other

management projects active in NSW (Table 6). Concern of this lack of action is voiced by a small group of stakeholders. The recent discovery that a wild population of the Wollemi Pine appears to be affected by *P. cinnamomi* may raise the profile of the pathogen in NSW.

2.6 Implementation in Queensland

The localised nature of *P. cinnamomi* limits the number of projects or actions for *P. cinnamomi* management. Driven by the Wet Tropics Management Authority (WTMA), an ongoing program of research has led to the development of draft operational guidelines for works within the identified high-risk zones of the Area¹⁴, which is based upon the management guidelines developed by the WA Dieback Working Group (DWG)¹⁵ guidelines. No formal measures currently exist that trigger the implementation of these hygiene guidelines. However, operational works can only be undertaken under a Wet Tropics Permit, issued by WTMA. A Best Practice Manual “Guide to Monitoring Phytophthora-related dieback in the Wet Tropics of North Queensland” was produced¹⁶ through the Rainforest Co-operative Research Centre.

The state government is concentrating its *P. cinnamomi* management efforts in Koombooloomba, Mount Lewis and all high mountain environments used for bushwalking, using the management principles of the 2001 NTAP¹⁷. Virulent outbreaks of patch death are relatively small and localised and the identification of boundaries between infected areas and those free of infection are problematic.

2.7 Implementation on Commonwealth Land

Management of *P. cinnamomi* on Commonwealth land has been carried out by the Sydney Harbour Federation Trust (SHFT) and by the Department of Defence in the Jervis Bay area south of Sydney (Table 7). The policy and objectives of the pro-active SHFT group state that *P. cinnamomi* will be managed according to the recommendations of the NTAP.

Table 2: Projects and actions carried out in **Western Australia** in relation to the NTAP for the management of *Phytophthora cinnamomi*. Those that are highlighted in grey are those projects or actions that are attributed directly to the 2001 NTAP.

Objective / Actions	Western Australia	Projects and actions 2001-2006
Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.		
<p>a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.</p>	<p>For the Action Plan for Fitzgerald River National Park management options were prioritised in 2004 for the 225ha Bell Track infestation. The disease front is encroaching on highly endemic flora and the habitat of a number of endangered and critically endangered fauna. To date action has included the restriction of human access; the realignment of a vehicle track; surface water diversions, and water erosion controls have been installed.</p>	
<p>b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened by the disease</p>	<p>SCRIPT are developing plans for the management of <i>P. cinnamomi</i> in areas that have regional and community significance.</p>	
<p>c Determine the seriousness of the threat and the level of management necessary to secure recovery</p>	<p>During 2005-2008 SCRIPT will undertake risk assessments on significant disease-free areas with ecological and community significance, and this will be extended to four other Regions vulnerable to <i>P. cinnamomi</i> (Avon Catchment Council, South-West Catchment Council, Swan Catchment Council and Northern Agricultural Catchments Council).</p>	
<p>d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i>. Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved and how the results and original material will be used.</p>	<p>Research by CALM has provided accurate estimates of the level of susceptibility of plant species to <i>Phytophthora</i> in the south-west indicating that <i>Phytophthora</i> is threatening more than 2300 species and subspecies of plants in this region – including 343 Declared Rare (threatened) Flora and over 2,000 rare and poorly known floras (Priority Flora).</p>	
<p>e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i>.</p>	<p>CALM has an established long-term germplasm storage facility where the initial focus of collections and seed storage was on those species at risk from <i>Phytophthora</i>. Monitoring, in 2005, of the first translocation of a <i>Phytophthora</i> susceptible critically endangered plants has shown that the first phase of has been successfully completed.</p>	
<p>f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities.</p>		
<p>g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.</p>		

Objective / Actions	Western Australia	Projects and actions 2001-2006
<p>Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.</p>		
<p>a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i>.</p> <p>b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.</p> <p>c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.</p> <p>d Limit the vectored dispersal into uninfected areas.</p> <p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p> <p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>		<p>A regional scale pilot project funded under the Commonwealth Government NHT-RCC for 2004-2005, undertaken by the SCRIPT NRM Region. The overarching goal was to protect, in the long term and regardless of land tenure, the biodiversity of areas assessed as significant, valued by the community and at risk from <i>P. cinnamomi</i>.</p>
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p> <p>b Develop experimental approaches to management including the integration of current management methods and review their effectiveness. In particular: encourage the development of new management techniques; and evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p>		<p>Since the late 1990s CALM officers have marked the boundaries of a number of fronts near the south coast. They are also monitoring areas sprayed with phosphite where rare flora occurs in the Stirling Ranges and near Albany (S Barrett, <i>pers. comm.</i>). On the south coast the boundaries of a number of fronts have been pegged at Gull Rock and Two Peoples Bay. Currently CALM officers are mapping the major infestation site at Bell Track in the Fitzgerald River National Park. This infestation was previously mapped in 1990/1991 (M Grant, <i>pers. comm.</i>).</p> <p>CALM have also established stable long-term research plots of <i>Banksia</i> woodland on the southern west coast. These areas of free draining sands are approximately 20ha in total and have been monitored for 16 years (C Crane, <i>pers. comm.</i>).</p> <p>In the jarrah forest, long-term monitoring sites were established in the mid 1990's (K McDougall, <i>pers. comm.</i>). Recent work has assessed the rates of extension in different ecological vegetation systems of the Jarrah Forest Bioregion¹⁸.</p> <p>At Cape Riche on the south coast there is a rate of spread trial underway.</p> <p>CPSM eradication projects (WA and Tas) funded through the NTAP.</p> <p>The Fitzgerald River National Park Action Plan.</p> <p>CALM's phosphite spraying program commenced in 1998 and now covers 24 sites in the southwest and more than 150ha annually.</p>

Objective / Actions	Western Australia	Projects and actions 2001-2006
<p>c Investigate further research directions and priorities and establish a cooperative research program for <i>P. cinnamomi</i>.</p>		<p>DCC identified research priorities. CPSM was developed with a holistic and long-term vision for research on diseases caused by <i>Phytophthora</i> in natural ecosystems by forming collaborations with key stakeholders.</p>
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the NTAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p>		<p>The DWG and WWF have undertaken some limited surveying of community awareness in 2004 (C Dunne, <i>pers. comm.</i>).</p>
<p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species' recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p>		<p>The DWG has developed detailed guidelines for bushland restoration¹⁹, and contributed to the production of "The Biological Bulldozer" which targets the entire community³. DWG provide specially tailored courses for each type of stakeholder group and in 2005 developed a TAFE training course in the use and application of phosphite. To date the Group has coordinated 4 Dieback Information Group forums; the last in 2005 had an attendance of over 160 stakeholders.</p>
<p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries.</p>		<p>DWG developed a Code of Practice to promote self regulation in the extractive industry^{20,21}.</p>
<p>d Develop, encourage & facilitate a uniform industry & operator training program for land managers and seek to have it adopted by relevant training institutions.</p>		<p>See DWG phosphite use and application training course (above).</p>
<p>e Develop and maintain a website available to all users e.g. the public, researchers and managers.</p>		<p>Both CALM and DWG has current information on managing dieback on their websites. DWG's website provides specific information for each of the following groups: political agencies, government agencies and utilities, NRM and Catchment Groups, Regional and local government, industry and non-government organisations.</p>
<p>Objective 5: To effectively coordinate management activities.</p>		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p>		<p>As part of WA's Dieback Response Framework, a business case study has been commissioned to quantify the benefits of investing in the amelioration of the threat, and conversely the risks of failing to invest or delaying investment²². This study will form the basis of a case for long-term & strategic investment to be put to the WA government, industry & community. The Study estimates values for natural environments of the south-west of WA.</p>
<p>b Support regional organisations, community and industry groups and land management agencies in collaboratively developing and implementing regional management plans.</p>		

Objective / Actions	Western Australia	Projects and actions 2001-2006
<p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAPIT (the Team) to advise the Commonwealth Environment Minister on implementation of NTAP.</p>		
<p>d To ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the Team will establish a clear link with state-based <i>P. cinnamomi</i> Threat Abatement Teams and with relevant regional and local bodies which are responsible for management of <i>P. cinnamomi</i>.</p>		<p>A State Communication Strategy was developed by the WA DWG and other stakeholders to develop a consistent message and provide recommendations to each stakeholder group on management.</p>
<p>e Before the term of the Plan expires an independent review will be commissioned to conduct a comprehensive evaluation of progress made in the Plan's implementation.</p>		<p>This project (CPSM)</p>
<p>f The Team will develop State of the Environment reporting indicators.</p>		<p>DoE has carried out some work developing SoE indicators.</p>
<p>g The Team will oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties developing codes of practice.</p>		

Table 3: Projects and actions carried out in **South Australia** in relation to the NTAP for the management of *Phytophthora cinnamomi*. South Australia does its yearly planning of their *P. cinnamomi* works based on the NTAP.

Objective / Actions	South Australia	Projects and actions 2001-2006
<p>Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.</p>		
<p>a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.</p>	<p>Management Plans and SOPs have been developed and implemented by key groups such as DEHSA, Transport SA, local councils, Electricity Trust of SA, SA Water Corporation, Friends of Parks groups²³ and forest industries. The Country Fire Service is also incorporating <i>P. cinnamomi</i> management into its fire fighting operations.</p>	<p>The PTG has inter agency membership that have technical knowledge of <i>P. cinnamomi</i> that was formed to maintain communication links and encourage a 'whole-of-government' approach to the management of <i>P. cinnamomi</i>. They produced the Phytophthora Management Guidelines to provide a framework for other organisation to develop their own management plans and operational procedures. They also guide the state's Ecologist - Plant Dieback (R Velzeboer) in a state-wide program to raise awareness and generate action to minimise the spread of <i>P. cinnamomi</i>. Their aims are: to contain and minimise the spread in infested areas, protect uninfested areas and prevent the introduction into uninfested areas, and to promote a "whole of community" approach.</p>
<p>b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened by the disease</p>	<p>The Trust funded phosphite trials at Kangaroo Island in 2003²⁴.</p>	
<p>c Determine the seriousness of the threat and the level of management necessary to secure recovery</p>		
<p>d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i>. Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved and how the results and original material will be used.</p>		
<p>e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i>.</p>		
<p>f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities.</p>		
<p>g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.</p>		

Objective / Actions	South Australia	Projects and actions 2001-2006
<p>Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.</p>		
<p>a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i>.</p>		<p>DEHSA have identified State Risk Areas based on the likelihood of <i>P. cinnamomi</i> becoming established²⁵.</p>
<p>b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.</p>		<p>As part of determining the appropriate Phytophthora Risk Management Zone (HRZ) for each Park the DEHSA SOP²⁶ requires the preparation of a Local Action Plan. These Plans outline the Management Zones of the reserve and determine the appropriate hygiene measures. The Local Action Plan at sites of high conservation value has the highest priority. Management strategies depend on the risk zone and proposed activities in that zone. Each council have detailed maps of HRZs in their area.</p>
<p>c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.</p>		
<p>d Limit the vectored dispersal into uninfected areas.</p>		
<p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p>		<p>Soil testing for <i>Phytophthora</i> has occurred and DEHSA maintains a state-wide database. There is a yearly sampling program and a plan to recheck current infection boundaries (Velzeboer <i>pers. comm.</i>).</p>
<p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>		<p>A Local Action Plan is made for each reserve containing confirmed <i>Phytophthora</i> location(s) in High Risk Management Zones²⁶. These Plans outline the Management Zones of the reserve and determine the appropriate hygiene measures. Local Action Plans for these sites have the highest priority for management action.</p> <p>The draft fire management plan for Flinders Chase National Park on Kangaroo Island²⁷ incorporates <i>P. cinnamomi</i> management. It uses the SOPs produced by NPWSA Fire Management Section relating to Earthmoving and Bushfire Management to manage for <i>P. cinnamomi</i> and requires that fire-fighting be undertaken with precautionary hygiene measures in place.</p>
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p>		
<p>b Develop experimental approaches to management including the integration of management methods and review their effectiveness. In particular: encourage the development of new management techniques; and evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p>		
<p>c Investigate further research directions and priorities and establish a</p>		<p>In 2005 DEHSA (The Ecologist - Plant Disease and the Phytophthora Working Group)</p>

Objective / Actions	South Australia	Projects and actions 2001-2006
<p>cooperative research program for <i>P. cinnamomi</i>.</p>		<p>compiled a list of research priorities to be discussed with research institutions.</p>
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the NTAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p>		
<p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p>		<p>There has been a large focus on raising awareness through education (workshops and presentations), extension and the production of extension materials such as newsletters, posters, brochures and information articles aimed at staff and volunteers from agencies, landholders and general public.</p> <p>Reynolds²³ produced detailed guidelines for volunteers and contractors undertaking work for Friends of Mount George. PTG has produced <i>P. cinnamomi</i> management guidelines for use across land tenure²⁵ which are a simplified version of the DEH SOP²⁶ to provide a framework for other organisations to develop their own SOPs.</p> <p>DEH produced a handbook for fire teams on Kangaroo Island with roles and responsibilities listed, equipment checklists, wash down assembly instructions, instructions for safe use of disinfecting solutions and wash down procedures²⁸. There are bushwalking²⁹ and plant propagation guidelines³⁰. In 2004, DEHSA produced a general information leaflet³¹, guides to <i>P. cinnamomi</i> in the Mount Lofty Ranges³² and the Murray Darling Basin³³. In 2005 Recreational Vehicles and Protected Areas in SA³⁴ was produced.</p>
<p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries to assist with this process.</p>		<p>DEH SOP²⁶ together with Transport SA³⁵ guidelines were designed to be an example to other organisations. Several other organisations have adopted the guideline whole or parts of it for their own use (e.g. ETSA³⁶).</p>
<p>d Develop, encourage and facilitate a uniform industry and operator training program for land managers and seek to have it adopted by relevant training institutions.</p>		<p>Training delivered mainly by DEHSA Ecologist - Plant Dieback (to DEHSA staff/contactors & to organisations outside DEHSA, tertiary students and community groups), & a proportion delivered by District Phytophthora Officer or Regional Ecologist. Training is not accredited.</p>
<p>e Develop and maintain a website available to all users e.g. the public, researchers and managers.</p>		
<p>Objective 5: To effectively coordinate management activities.</p>		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p>		
<p>b Support regional organisations, community & industry groups & land management agencies in collaboratively implementing regional plans.</p>		
<p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAPIT (the Team) to advise</p>		

Objective / Actions	South Australia	Projects and actions 2001-2006
<p>the Commonwealth Environment Minister on implementation of NTAP</p> <p>d To ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the Team will establish clear link with state-based <i>P. cinnamomi</i> Threat Abatement Teams and with relevant regional and local bodies which are responsible for management of <i>P. cinnamomi</i>.</p> <p>e Before the term expires an independent review will be commissioned to conduct an evaluation of progress made in the Plan's implementation.</p> <p>f The Team will develop State of the Environment reporting indicators.</p> <p>g In relation to Objective 4, Action 4 b, the Team will oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties committed to developing codes of practice.</p>		<p>DEHSA have dedicated personnel coordinate <i>P. cinnamomi</i> management activities within and between agencies</p>

Table 4: Projects and actions carried out in **Tasmania** in relation to the NTAP for the management of *Phytophthora cinnamomi*. Rather than develop their own Threat Abatement Plan, Tasmania directly utilises the 2001 NTAP to implement *P. cinnamomi* management projects.

Objective / Actions	Tasmania Projects and actions 2001-2006
Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.	
a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.	Strategic local management initiatives identified ³⁷ and partially implemented. This is an ongoing program. Non priority local management initiatives in response to development or other land management programs.
b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened by the disease	Limited implementation, phosphite research in buttongrass moorland vegetation and a few threatened species ecology projects.
c Determine the seriousness of the threat and the level of management necessary to secure recovery	Tasmanian strategic management areas securing large disease free areas, threatened species and plant communities at risk identified ¹² . Broad management recommendations were made for each area.
d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i> . Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved & how the results & original material will be used.	Dealt with under the recovery plans for threatened species. The Millennium seed bank project will address <i>Phytophthora</i> susceptible species & is delivering the seed bank component of this action.
e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i> .	No incentive program specifically addressing <i>Phytophthora</i> issue is in place. However, the forest and a non-forest conservation programs provide support and incentives for land managers and do consider <i>P. cinnamomi</i> issues in assessment of values.
f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities.	A method has already been applied to rank species and areas for protection from <i>P. cinnamomi</i> . The development of the National Risk Assessment Models will require alignment of Tasmanian's management program under the national system.
g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.	A number of codes of practice and management manuals have been produced (some prior to the NTAP) to provide decision support for land managers and developers.
Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.	
a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i> .	Risk assessment carried out for selected priority areas ¹²
b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.	Risk assessment carried out for selected priority areas ¹²
c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.	Risk assessment carried out for selected priority areas ¹²
d Limit the vectored dispersal into uninfected areas.	<i>P. cinnamomi</i> hygiene prescriptions are applied under codes of practice and

Objective / Actions	Tasmania	Projects and actions 2001-2006
<p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p> <p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>	<p>environmental management systems within some industries. Land managers such as the Parks and Wildlife Service have undertaken on ground works to control access, realign or harden tracks to reduce the spread of <i>P. cinnamomi</i>. Further implementation and auditing is required.</p>	<p>Limited application to date due to the significant resources required to do this.</p> <p>Partially implemented for the <i>P. cinnamomi</i> Management Areas and Reserves.</p>
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p> <p>b Develop experimental approaches to management including the integration of current management methods & review their effectiveness. In particular: encourage the development of new management techniques; & evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p> <p>c Investigate further research directions & priorities & establish a cooperative research program for <i>P. cinnamomi</i>.</p>	<p>Partially implemented. A buttongrass moorland study at Red Knoll and Bathurst Harbour established in 1998 (T Rudman, <i>pers. comm.</i>). Partially recoverable studies at Rocky Cape (heathland) and Melaleuca (buttongrass moorland) established in 1979.</p> <p>No substantial action undertaken.</p>	<p>1st collaborative research initiated in 2005 with CPSM, Murdoch University</p>
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the TAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p> <p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p> <p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries to assist with this process.</p>	<p>No action on a communication strategy</p>	<p>Some interpretative actions undertaken in particular development of onsite infestation interpretation signage in two reserves, along with integration of <i>P. cinnamomi</i> issues within standard interpretative material e.g. park brochures.</p> <p>Prior to the NTAP codes of practice were in place for quarries, mineral exploration & forestry. Under the NTAP, the Management Guidelines for reserves and the general Interim <i>P. cinnamomi</i> Management Guidelines have been prepared to facilitate planning & management across all industries. The Codes of Practice for the management are designed to promote consistency in the application of management practices by staff of key land management agencies¹¹. It provides 'best practice operational standards' for all activities & refers to other relevant codes, key resources & databases to aid in the</p>

Objective / Actions	Tasmania	Projects and actions 2001-2006
<p>d Develop, encourage and facilitate a uniform industry and operator training program for land managers and seek to have it adopted by relevant training institutions.</p>	<p>management of <i>P. cinnamomi</i>.</p> <p>No action</p>	
<p>e Develop & maintain a website available to all users -public, researchers & managers</p>		<p>DPIWE has updated its <i>P. cinnamomi</i> website, including access to distributional data.</p>
<p>Objective 5: To effectively coordinate management activities.</p>		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p>		<p>A strategic areas regional management plan is in place. Tasmania uses the NTAP and has not developed a state TAP.</p>
<p>b Support regional organisations, community & industry groups & land management agencies in collaboratively developing and implementing regional management plans.</p>		<p>Tasmanian strategic management areas securing large disease free areas, threatened species and plant communities at risk identified¹⁸.</p>
<p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAP Implementation Team (the Team) to advise the Commonwealth Environment Minister on implementation of NTAP</p>		
<p>d To ensure that clear lines of communication are established to promote & manage best practice actions, the Team will establish links with state-based Teams & with relevant regional & local bodies which are responsible for management.</p>	<p>Currently underway with CPSM</p>	
<p>e Before the term of the Plan expires an independent review will be commissioned to conduct a comprehensive evaluation of progress made in the Plan's implementation.</p>		
<p>f The Team will develop State of the Environment reporting indicators.</p>		<p>Reporting indicators recommended for Tasmanian SoE reporting.</p>
<p>g Re: Objective 4, Action 4b, the Team will oversee a uniform preamble for guidelines for all relevant industries & parties committed to developing codes of practice.</p>	<p>No action</p>	

Table 5: Projects and actions carried out in **Victoria** in relation to the NTAP for the management of *Phytophthora cinnamomi*.

Objective / Actions	Victoria	Projects and actions 2001-2006
<p>Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.</p>		
<p>a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.</p>		<p>Parks Victoria developed the 'Anakie Scrubber', a raised platform with a footwear bath containing disinfectant.</p>
<p>b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened</p>		
<p>c Determine the seriousness of the threat and the level of management necessary to secure recovery</p>		<p>A catchment scale model was developed to predict the distribution and impact of <i>P. cinnamomi</i> in the eastern Otways³⁸. Some mapping has been carried out in Wilson's Promontory, Otway and Angahook-Lorne National Parks³⁹.</p>
		<p>Infested areas within Brisbane Ranges National Park were mapped via symptomatic vegetation.</p>
<p>d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i>. Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved and how the results will be used.</p>		
<p>e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i>.</p>		
<p>f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities.</p>		
<p>g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.</p>		<p>Parks Victoria commissioned best practice guidelines for the management of <i>P. cinnamomi</i> in parks and reserves⁴⁰.</p>
<p>Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.</p>		
<p>a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i>.</p>		
<p>b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.</p>		
<p>c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.</p>		
<p>d Limit the vectored dispersal into uninfected areas.</p>		

Objective / Actions	Victoria	Projects and actions 2001-2006
<p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p> <p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>		
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p>		<p>Long-term studies have been undertaken in the Brisbane Ranges, Wilson's Promontory National Park, Grampians National Park⁴⁰ and Anglesea⁴¹. Longer term studies in the Brisbane Ranges and the Grampians have shown changes in the floristic composition do occur over time⁴⁰.</p>
<p>b Develop experimental approaches to management including the integration of current management methods and review their effectiveness. In particular: encourage the development of new management techniques; and evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p>		<p>Deakin University has studied the effect of phosphite in native vegetation, variation in isolates from native ecosystems, host-pathogen interactions, and the effects of <i>P. cinnamomi</i> on native fauna and the biology and ecology of <i>P. cinnamomi</i> in native ecosystems.</p> <p>University of Melbourne has examined the use of phosphite in horticulture, integrated management of <i>Phytophthora</i> in tropical horticulture, and the biochemistry of resistance.</p>
<p>c Investigate further research directions and priorities and establish a cooperative research program for <i>P. cinnamomi</i>.</p>		
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the NTAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p>		
<p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p>		<p>Brochures available in 'Information Series' on DPI website under Land for Wildlife - Threats to Wildlife Habitats⁴².</p> <p>Cinnamon Fungus Control Guidelines (Forestry)⁴³ - broad guidelines on hygiene, movement of soil and gravel, controlling drainage, and monitoring and reviewing effectiveness of control</p> <p>Guidelines for reducing the spread of <i>P. cinnamomi</i> during earth moving operations⁴⁴.</p>
<p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries to assist with this process.</p>		<p>Code of Forest Practices for Timber Production⁴⁵ which applies to public and private lands.</p>
<p>d Develop, encourage & facilitate a uniform industry & operator training program for land managers and seek to have it adopted by relevant training institutions.</p>		
<p>e Develop and maintain a website available to all users e.g. the public, researchers and managers.</p>		

Objective / Actions	Victoria	Projects and actions 2001-2006
Objective 5: To effectively coordinate management activities.		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p>		<p>Actions of the Victorian Strategic Plan (Draft) include mapping and planning for priority areas, and amendment of relevant land management systems¹³. This includes the formulation and promotion of best practice management in nurseries and other industries⁴⁶.</p>
<p>b Support regional organisations, community and industry groups and land management agencies in collaboratively developing and implementing regional management plans.</p>		<p>DSE has formed a Dieback Steering Committee to provide guidance to DSE in the development of the Strategic Plan¹³.</p>
<p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAPIT (the Team) to advise the Commonwealth Environment Minister on implementation of NTAP</p>		
<p>d To ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the Team will establish clear link with state-based <i>P. cinnamomi</i> Threat Abatement Teams (or their equivalent) and with relevant regional and local bodies which are responsible for management of <i>P. cinnamomi</i>.</p>		
<p>e Before the term of the Plan expires an independent review will be commissioned to conduct a comprehensive evaluation of progress made in the Plan's implementation.</p>		
<p>f The Team will develop State of the Environment reporting indicators.</p>		
<p>g In relation to Objective 4, Action 4 b, the Team will oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties committed to developing codes of practice.</p>		

Table 6: Projects and actions carried out in **New South Wales** in relation to the NTAP for the management of *Phytophthora cinnamomi*.

Objective / Actions	New South Wales	Projects and actions 2001-2006
<p>Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.</p> <p>a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.</p> <p>b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened by the disease</p> <p>c Determine the seriousness of the threat and the level of management necessary to secure recovery</p> <p>d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i>. Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved and how the results and original material will be used.</p> <p>e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i>.</p> <p>f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities. The method should include an understanding of the biogeography of susceptible species, ecological communities, critical and high-risk habitats and the disease caused by <i>P. cinnamomi</i> to these species and/or ecological communities. IUCN categories will be used as a basis for making decisions.</p> <p>g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.</p>		<p>A <i>P. cinnamomi</i> Management Strategy for Barrington Tops National Park in Draft form⁴⁷ with objectives to manage current infestation at Barrington Tops Plateau and to prevent spread to other NPWS estate with quarantine, hygiene, provision of alternative walking routes and calming areas, education and research .</p> <p>Management Plans for South East Forests NP and Werrikimbe NP include management actions to restrict the dispersal of <i>P. cinnamomi</i> in these Parks.</p> <p>Track closures, vehicle cleaning and limitations on visitor usage for <i>P. cinnamomi</i> management have been implemented in several National Parks (e.g. South East Forests National Park, Werrikimbe National Park).</p> <p>DEC have had a permit for trials with phosphite. Trials are taking place in Sydney Harbour and have been carried out at Barrington Tops National Park on pepper bush⁴⁷. Application of phosphite has been hampered by not having dedicated <i>P. cinnamomi</i> personnel to set up and monitor trials and to train Rangers in use and evaluation.</p> <p>Most of the vegetation of Eastern NSW and the ACT has been classified and mapped. Mapping of <i>P. cinnamomi</i> is being undertaken in Barrington Tops National Park, the north shore of Sydney Harbour but there is incomplete knowledge about species susceptible to <i>P. cinnamomi</i>, and no attempt so far to map vulnerable communities.</p> <p>The impact of <i>P. cinnamomi</i> on the endangered mallee <i>Eucalyptus imlayensis</i> is under investigation. <i>Ex situ</i> conservation is likely to be considered for the recovery of this species.</p>

Objective / Actions	New South Wales	Projects and actions 2001-2006
<p>Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.</p>		
<p>a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i>.</p>		
<p>b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.</p>		<p>In Barrington Tops National Park there is on-going sampling to determine where <i>P. cinnamomi</i> is on Plateau (particularly on tracks).</p>
<p>c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.</p>		
<p>d Limit the vectored dispersal into uninfected areas.</p>		
<p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p>		
<p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>		
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p>		<p>Permanently marked floristic quadrats were established in 2001-2002 in infested and healthy areas at Mt Imlay and Mt Sugarloaf in South East Forests National Park; quadrats are planned for Murramarang NP in June 2006 (K McDougall, pers. comm.).</p>
<p>b Develop experimental approaches to management including the integration of current management methods & review their effectiveness. In particular: encourage the development of new management techniques; and evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p>		
<p>c Investigate further research directions and priorities and establish a cooperative research program for <i>P. cinnamomi</i>.</p>		
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the NTAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p>		

Objective / Actions	New South Wales	Projects and actions 2001-2006
<p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p> <p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries to assist with this process.</p> <p>d Develop, encourage and facilitate a uniform industry and operator training program for land managers and seek to have it adopted by relevant training institutions.</p> <p>e Develop and maintain a website available to all users e.g. the public, researchers and managers.</p>		<p>Based on recommendations of the WA DWG in the Local Government Guidelines for WA¹⁵, guidelines were produced by Royal Botanic Gardens in reports to SHFT⁴⁸ and Department of Defence⁴⁹. Phytophthora Management Guidelines for NSW are currently being prepared by Dr Brett Summerell from the Royal Botanic Gardens & Domain Trust.</p> <p>Draft hygiene strategy for movement in and out of the known Phytophthora area within Barrington Tops National Park for NPWS staff, contractors and researchers⁵⁰.</p> <p>Public seminars were held in 2003 by RBG and Domain Trust in conjunction with the Australian Network for Plant Conservation to promote a better understanding of the problem, explore ways to slow the spread of <i>Phytophthora</i> and treat affected areas. The seminars were held in conjunction with SHFT, the Australian Network for Plant Conservation and the Australian Association of Bush Regenerators (G Bagwell pers. comm.).</p>
<p>Objective 5: To effectively coordinate management activities.</p>		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p> <p>b Support regional organisations, community and industry groups and land management agencies in collaboratively developing and implementing regional management plans.</p> <p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAPIT to advise the Commonwealth Environment Minister on implementation of NTAP</p> <p>d To ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the Team will establish clear link with state-based <i>P. cinnamomi</i> Threat Abatement Teams (or their equivalent) and with relevant regional and local bodies which are responsible for management of <i>P. cinnamomi</i>.</p>		<p>No personnel dedicated to <i>P. cinnamomi</i> management but a few people spend a small amount of their time on <i>P. cinnamomi</i>. Sydney Harbour DWG includes local, state and Commonwealth Government land managers in the Sydney Harbour area and has been formed to coordinate efforts to manage Phytophthora at a regional level⁵¹.</p>

Objective / Actions	New South Wales	Projects and actions 2001-2006
<p>e Before the term of the Plan expires an independent review will be commissioned to conduct a comprehensive evaluation of progress made in the Plan's implementation.</p> <p>f The Team will develop State of the Environment reporting indicators.</p> <p>g In relation to Objective 4, Action 4 b, the Team will oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties committed to developing codes of practice.</p>		

Table 7: Projects and actions carried out on **Commonwealth land** in relation to the NTAP for the management of *Phytophthora cinnamomi*.

Objective / Actions	Commonwealth land	Projects and actions 2001-2006
<p>Objective 1: To promote the recovery of threatened species and ecological communities that are known or perceived to be threatened by <i>P. cinnamomi</i>.</p>		
<p>a Develop and implement local management initiatives for ecological communities and threatened species where the disease is a known threat. Initiatives might consist of direct treatment with protective chemicals, vector-control strategies, education etc.</p>		<p>SHFT are incorporating <i>P. cinnamomi</i> 'best practice' in the planning of new walking tracks and upgrading of existing ones by designing the tracks with an environmental consultant with <i>P. cinnamomi</i> management in mind. The design was reviewed and the track construction overseen by scientists with extensive experience, followed by a self-initiated review of their performance in terms of current best practice⁴⁸.</p>
<p>b Develop or implement experimental management programs in areas of critical habitat for species or ecological communities perceived to be threatened by the disease</p>		<p>SHFT have made stormwater improvements at Georges Heights adjacent to Sydney Harbour National Park at Middle Head by reducing nutrients in runoff water, and reducing ponding and drainage into bushland (using bioswales, directly drainage into street drainage where possible, improving formal stormwater collection system). All work is carried out with <i>P. cinnamomi</i> hygiene protocols in place (G Bagwell <i>pers. comm.</i>).</p>
<p>c Determine the seriousness of the threat and the level of management necessary to secure recovery</p>		<p>The policy and objectives of the SHFT, set out in the comprehensive Plan⁴⁸ for the seven precincts, state that <i>P. cinnamomi</i> will be managed according to the recommendations of the NTAP, that best practice management procedures will be adopted and that access will be controlled where <i>P. cinnamomi</i> infestations occur. The Management Plans can be viewed at http://www.harbourtrust.gov.au/topics/mgmtplans.html.</p>
<p>d Based on the Recovery Plan (EPBC Act) identify which species should be conserved <i>ex situ</i>. Develop a plan that indicates which organisation will take responsibility for this work, how it will be achieved and how the results and original material will be used.</p>		<p>Mapping of <i>P. cinnamomi</i> is being carried out in the Jervis Bay area.</p>
<p>e Develop and use approaches including incentives to promote management on private and leasehold lands that contain or are adjacent to populations of threatened species or ecological communities threatened by <i>P. cinnamomi</i>.</p>		
<p>f Develop and implement an agreed national method for ranking regions/projects for the allocation of resources to protect and facilitate the expansion of existing populations of threatened species and ecological communities. The method should include an understanding of the biogeography of susceptible species, ecological communities, critical and high-risk habitats and the disease caused by <i>P. cinnamomi</i> to these species and/or ecological communities. IUCN categories will be used as a basis for making decisions.</p>		
<p>g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them.</p>		

Objective / Actions	Commonwealth land	Projects and actions 2001-2006
<p>Objective 2: To limit the spread of <i>P. cinnamomi</i> into areas where it may threaten threatened species and ecological communities or into areas where it may lead to further species or ecological communities becoming threatened.</p>		
<p>a Identify areas of high conservation value that are environmentally suitable for the establishment of <i>P. cinnamomi</i>.</p>		
<p>b Assess the level of risk of <i>P. cinnamomi</i> spreading to and infecting plant populations in these areas.</p>		
<p>c Identify potential routes of spread from currently infected areas to the nominated areas having a high conservation value and manage the spread.</p>		
<p>d Limit the vectored dispersal into uninfected areas.</p>		
<p>e Implement a monitoring program to ensure early detection of the pathogen in areas having a high conservation value.</p>		<p>SHT currently have a monitoring program for before, during and after certain projects which present a high risk of spreading <i>P. cinnamomi</i> into uninfested areas (G Bagwell pers. comm.).</p>
<p>f Develop and implement procedures for slowing or limiting the spread of <i>P. cinnamomi</i> in areas having a high conservation value.</p>		<p>SHFT visit specific work sites daily to ensure hygiene protocols in place and being followed.</p>
<p>Objective 3: To improve the effectiveness and efficiency of the management of <i>P. cinnamomi</i> through appropriate research and monitoring programs.</p>		
<p>a Establish monitoring studies of sufficient duration to determine the: long term impact of the pathogen, direct and indirect; and effectiveness of management measures in different environments and with different susceptible species.</p>		
<p>b Develop experimental approaches to management including the integration of current management methods and review their effectiveness. In particular: encourage the development of new management techniques; and evaluate effectiveness of hygiene procedures under different conditions in order to refine them.</p>		
<p>c Investigate further research directions and priorities and establish a cooperative research program for <i>P. cinnamomi</i>.</p>		
<p>Objective 4: To inform Commonwealth, state and territory management agencies, landholders and the public about the NTAP's actions and outcomes.</p>		
<p>a Determine the level of awareness in the community and attitude to <i>P. cinnamomi</i> management. Based on the information obtained develop a communication strategy.</p>		

Objective / Actions	Commonwealth land	Projects and actions 2001-2006
<p>b Prepare and distribute innovative education and extension material to promote understanding of the actions to be taken under this Plan, such as the use of phosphite, and quarantine and hygiene methods. The material should also be designed to increase the community's awareness of species recovery plans and the importance of dieback caused by <i>P. cinnamomi</i> as a 'key threatening process'.</p> <p>c State agencies to develop guidelines to assist key industries in developing industry specific codes of practice. Establish partnerships with key industries to assist with this process.</p> <p>d Develop, encourage and facilitate a uniform industry and operator training program for land managers and seek to have it adopted by relevant training institutions.</p> <p>e Develop and maintain a website available to all users e.g. the public, researchers and managers.</p>		<p>From Summerell's work³⁸ SHFT developed brief guidelines for bush regeneration, which were endorsed by the Sydney Harbour DWG (G Bagwell <i>pers. comm.</i>).</p> <p>Brief guidelines for bush regenerators developed by SHFT are based on information provided by the RBG and endorsed by the Sydney Harbour DWG (G Bagwell <i>pers. comm.</i>).</p> <p>Review of <i>P. cinnamomi</i> management practices in the construction of a walking track at Middle Head shows that SHFT employed best practice procedures as described by agencies in Australia with extensive experience in <i>P. cinnamomi</i> management⁵².</p> <p>SHFT put conditions on <i>P. cinnamomi</i> management guidelines into tender specification of contractors, as well as providing site induction and training in hygiene protocols for site supervisor, contractors and volunteers⁵².</p>
<p>Objective 5: To effectively coordinate management activities.</p>		
<p>a Ensure the continuation and further development of regional management plans for each state and territory.</p> <p>b Support regional organisations, community and industry groups and land management agencies in collaboratively developing and implementing regional management plans.</p> <p>c Environment Aust. will convene a <i>P. cinnamomi</i> TAP Implementation Team (the Team) to advise the Commonwealth Environment Minister on implementation of NTAP</p> <p>d To ensure that clear lines of communication are established that promote and manage best practice in on-ground actions, the Team will establish clear link with state-based <i>P. cinnamomi</i> Threat Abatement Teams (or their equivalent) and with relevant regional and local bodies which are responsible for management of <i>P. cinnamomi</i>.</p> <p>e Before the term of the Plan expires an independent review will be commissioned to conduct a comprehensive evaluation of progress made in the Plan's implementation.</p> <p>f The Team will develop State of the Environment reporting indicators.</p>		

Objective / Actions	Commonwealth land	Projects and actions 2001-2006
<p>g In relation to Objective 4, Action 4 b, the Team will oversee the development of a uniform preamble to the guidelines for use by all relevant industries and parties committed to developing codes of practice.</p>		

3 EVALUATION OF THE *P. CINNAMOMI* NTAP

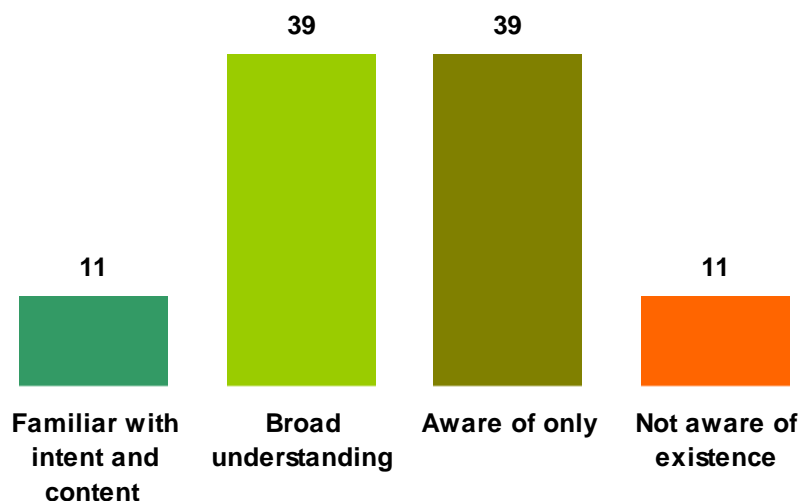
The effectiveness of the NTAP was evaluated by analysing the response to a questionnaire which was distributed to a wide range of stakeholders Australia-wide during the 2004/2005 Australian Government DEH project "Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia". These stakeholders were identified by the state representatives of the Project Reference Group as those that are directly involved in management of *P. cinnamomi*, or whose industry is impacted upon by *P. cinnamomi*. However, the response to the Best Practice component of the above project and to this NTAP questionnaire was poor. Of 340 questionnaires sent out there were 60 responses (16%) for the NTAP questionnaire. Of these, six respondents did not complete the questionnaire citing a lack of expertise in issues relating to *P. cinnamomi* management. This response generally stems from a lack of resources: i.e. the lack of time for overstretched staff to complete paperwork. However, in some cases the low response may be attributed to a lack of interest due to a poor understanding of the seriousness of the threat and the need to effectively manage the threat.

Question 1: Prior to 2001 and the release of the NTAP, did you/your organisation actively manage *P. cinnamomi*?

Half of the respondents (51%) had actively managed *P. cinnamomi* prior to the release of the NTAP.

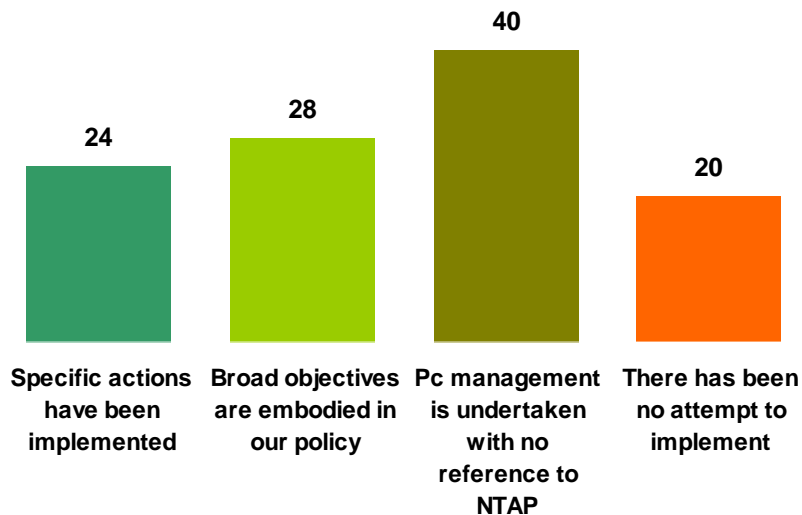
Question 2: What is your organisation's level of awareness of the NTAP?

This question gave the respondent a choice of four answers (see graph below), and 50% of respondents indicated they had a broad understanding or were very familiar with the intent and content of the NTAP.



Question 3: To what level has your organisation implemented the NTAP?

To ascertain the level of implementation of the NTAP, this question also gave the respondent a choice of four answers (see graph below). The results specify the number of responses, rather than number of respondents, as some respondents chose more than one answer.



More than half of the responses indicate that; currently the management of *P. cinnamomi* is undertaken with no reference to the NTAP or that there has been no attempt to implement the NTAP in the organisation. There were two local government agencies that did not perceive *P. cinnamomi* as a threat to their area and two other stakeholders considered that it is not their responsibility.

Some stakeholders indicated that they have received direction from other sources including: the DWG, DEHSA Phytophthora Management Guidelines, CALM's Management Guide, Phytophthora Management Guidelines for SA Water's Catchment Reserves, Nursery Industry Accreditation Scheme Australia (NIASA) best practice, and DEHSA's Phytophthora Threat Management. However a NSW Catchment Action Plan for one area has identified "Disrupted Natural Systems" as a priority in management for biodiversity threat mitigation.

Several respondents had implemented dieback plans before the release of the NTAP (for example; Alcoa, Beekeepers Association, Department of Sustainability and Environment, Tasmania's Hydro Consulting, South Australia's Department of Transport Energy, Department of Primary Industries, Water and Environment (DPIWE) and Wet Tropics World Heritage Area (WTWHA)), as a result broad objectives of the NTAP are embodied in these organisation's environmental management policies. Some stakeholders responded that they have implemented specific actions from the NTAP. For example, SCRIPT has produced a risk assessment, documentation of the disease and identification of "green" priority areas for protection.

A comment from a NSW government department indicates a potential gap in the NTAP - "The NTAP does not appear to give sufficient recognition to the concept that *P. cinnamomi* may play a secondary role in decline in NSW and some other areas. The NTAP does not recognise exclusion of low intensity fire regimes as a major factor associated with vegetation decline."

Question 4: What impediments, if any, are there to the implementation of the NTAP in your organisation or region?

This question allowed multiple answers and these results are the percentage of responses rather than number of respondents;

- poor understanding of the impact of *P. cinnamomi* in the region (73%)

- lack of support for *P. cinnamomi* management either from within the organisation, or from other stakeholders (58%)
- lack of resources (76%).

A poor understanding of the impact of *P. cinnamomi* in the region was recognised by a SA Government Department, who identified other stakeholders as the impediment, and by a WA stakeholder who acknowledges that few stakeholders fully appreciate what is at risk. In accordance with this, a WA's Industry stakeholder advises that constant education and awareness of the implications of non-compliance is needed. A WA Shire suggests that there is too much belief that only jarrah is affected and there is little understanding in the community/shire of wider biodiversity implications. A Perth based conservation group report a lack of information of dieback occurrence within their seed and cutting collection areas.

A Tasmania Government Department realises that the public's poor awareness impacts on the priority given by land managers or in NRM frameworks to management. The respondent claims that this is due to an inadequately documented impact of *P. cinnamomi* and the perception that *P. cinnamomi* is too difficult to manage or that the horse has already bolted - "plant diseases do not engender anywhere near the same public response as an animal disease affecting just one species!"

A Queensland Government respondent summed up the lack of understanding in Queensland: Due to the patchy nature of dieback in the rainforests of the Wet Tropics there was, and is, widespread confusion between the disease and death caused by *P. cinnamomi* and patch deaths resulting from other causes such as lightning strike, largely because of the scale of the phenomenon and the difficulty of unambiguous diagnosis. This problem is exacerbated by the cryptic nature of the disease in the Wet Tropics where its presence in the soil is very widespread but virulent outbreaks of patch death are relatively small and localised and the triggers for virulence are still unknown. The very high taxonomic diversity in the region at species, genera and family level and at the broad life-form level creates difficulty in establishing susceptible host indicator species or associations. The problem of classifying tropical rainforests on a floristic basis also creates problems in developing predictive models of susceptibility/vulnerability. As a result, the identification of boundaries between infected areas and those free of infection are problematic. This problem is made worse as it is not known where, or the spatial extent, of post epidemic areas where relatively few susceptible species may now be present.

Department of Sustainability and Environment see a lack of co-ordination within and between agencies and are addressing this through the Victorian Strategy. A NSW based conservation group reports that there is a poor level of commitment by various stakeholders in initiating and maintaining *P. cinnamomi* management options in their area. In WA, washdown facilities for beekeepers moving from forest areas to the northern sandplain have been suspended/abandoned due to clashes with minesite personnel who claim they were getting stung by bees left behind after washdowns.

Additional comments on the lack of resources include:

Tasmanian Government Department

P. cinnamomi is a complex problem requiring training and experience to observe and manage on the ground. Largely land managers need external assistance or the assistance of specialists within an organisation to assess and make decisions. Within Tasmania, the implementation of NTAP has been dependent on few experienced individuals in government that are the key to initiating and driving actions from the NTAP. Natural resource management is a highly competitive arena. There are inadequate funds to adequately address all land management problems at property, industry or government level. Education and training is inadequate currently for stakeholders to take responsibility. Costs of management

can be high and are long term which is a disincentive for government, industry and public alike.

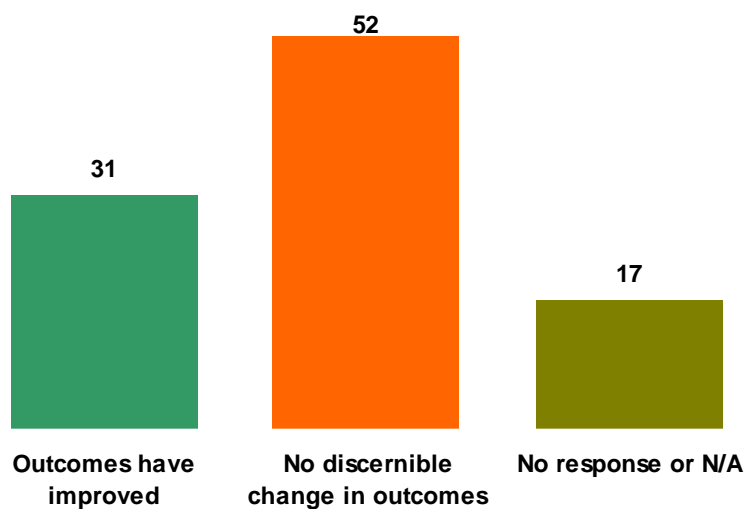
Tasmanian Industry

Practical implementation in the field is difficult because of lack of defined methods for management.

NSW Government Department

Easily accessible & understandable standard operating procedures (SOPs) for implementation at the operational level will result increased support from department personnel & contractors.

Question 5: How has the NTAP influenced *P. cinnamomi* management outcomes in your organisation or region?



More than half of the respondents indicated that there were no discernible changes in management outcomes since the release of the NTAP. A WA Government respondent recognises that there has been no clear directive from the Federal Government to coordinate the implementation of the NTAP. If any actions have been undertaken by different stakeholders, then that has been done independently of the NTAP. Greater strategic support is required by the Federal Government to see the implementation of the NTAP across all states and stakeholder groups. This would require some targets set to monitor and evaluate the progress of the NTAP implementation. A NSW Government Department also observed that the NTAP needs to be utilised. “With investment there is the potential for the NTAP to influence *P. cinnamomi* management outcomes”.

Of those who see a discernable change has occurred, some attribute it to the NTAP and others to other sources. In Tasmania, a notable improvement in cooperation has been facilitated by the NTAP coordination of independent state programs, aiding interstate liaison and cooperation, improving management systems for *P. cinnamomi* and improved best practice knowledge at state level. A cooperative research project between Tasmania and WA has been developed which would not normally have proceeded in Tasmania as a direct result of this coordination. A number of the actions from the NTAP (some in progress in Tasmania at the time of its adoption) have been implemented reinvigorating *Phytophthora* management systems by land managers. On ground action, however, has not seen increased funding and continues to be a priority. The NTAP is instrumental in driving *P. cinnamomi* management in state NRM strategies though this has not realised funding at this stage.

Improvements in management not attributed to the NTAP were reported by several stakeholders. A WA Industry stakeholder advised that outcomes improved through work of CALM, land care groups and hence increased awareness within industries. A consultant based in Tasmania states that improvements in outcomes in their area are not a direct result of the NTAP as there are many other sources of information to draw upon. A SA Government Department recognises that outcomes have improved due to enhanced awareness, as have a recreational group of WA (although they are not sure if this is as a result of the NTAP or from state-based information). With the implementation of management strategies (from sources other than the NTAP) the containment of *P. cinnamomi* in suspected areas has proved successful thus far for a SA Government Department.

WTWHA identify the step of listing *P. cinnamomi* as a key threatening process resulting in the raised level of concern for the phenomenon. Now dieback is seen as a recognised threat, the NTAP has given Alcoa's management procedures more credibility and urgency. However, the WA Beekeepers Association informs that outcomes are perceived to have improved at a massive opportunity cost of vastly reduced access to the melliferous resource by the commercial industry.

General comments

A WA consultant points out that 2 major goals of NTAP focus on manageability criteria in risk assessment rather than threatened species.

Queensland Government submission into the Senate Environment, Communications, Information Technology and Arts References Committee⁴ acknowledges that TAPS under the EPBC Act provide a national plan, however they are often not fully implemented. One observation made in Queensland is that although TAPS are statutory, they have limited applications, e.g. Commonwealth lands, and for all other lands they need state cooperation. TAPS start off well, in that they collect interested parties to develop draft plans, but the final plans are rarely well resourced and have not delivered measurable outcomes, due to lack of community or agency ownership. Having TAPS may increase the level of activity and accountability for Commonwealth activity but they may not affect state delivery on these species, unless they are picked up in species recovery plans and other activities. On the other hand, the Weeds of National Significance (WONS) strategies are non-statutory but they have delivered effective outcomes without increasing the burden to the Commonwealth. A strong factor behind the strength of the WONS strategies is the strategy development was community directed, resulting in strong community ownership. The implementation of these strategies has involved employment of strategy coordinators, some times for a number of species to increase community-based delivery, and creation of species management committees. If TAPS are to deliver outcomes similar to WONS strategies they need to be both better resourced and developed in a process that ensures they deliver actions across all land tenures, through cooperative arrangements with states^{4,56}.

4 FUNDING

The Australian Government has invested considerable amounts of funding through programs such as Australian Research Council (ARC), the first round of Trust funding, NAPSWQ, World Heritage funding and core funding for Threat Abatement Plans. These programs have yielded many benefits to the science, management and general awareness of *P. cinnamomi* in natural ecosystems. However, the *ad hoc* and short-term nature of the available funding precludes a strategic long-term approach to research and management necessary to i) determine the full extent of *P. cinnamomi* and its impact in Australia and ii) effectively abate the threat of the pathogen⁸.

Seven projects have been funded from core NTAP funds, which have led to partial implementation of the Plan (Table 8). This funding equates to approximately \$150,000/annum. Australian Government funds are not increasing proportionally with the increasing number of NTAPs, therefore the amount of money available to implement each NTAP is actually decreasing with time¹. Currently, funding for all eight of Australia's Key Threatening Processes is in the order of \$3M/year. This lack of resources is reflected in the deficiency of new information available for land managers.

Table 8: Projects funded by core NTAP funding since 2001

Project title	State	Department	Years funded	Amount funded
Preparation of a regional <i>Phytophthora</i> dieback control plan for Victoria	VIC	Department of Natural Resources and Environment	2001/2002	\$47,085
Community-based Effective Management of <i>Phytophthora cinnamomi</i> in South Australia	SA	Adelaide Hills Council, Alexandrina Council	2001/2002	\$79,200
Strategic Management of <i>Phytophthora</i> spp. on Kangaroo Island: the integration of established on-ground works with threatened species recovery	SA	National Parks and Wildlife South Australia - Kangaroo Island	2001/2002	\$40,000
Preparation of Strategic Plan - Conservation of Tasmanian plant species and communities threatened by <i>Phytophthora cinnamomi</i>	TAS	Department of Primary Industries	2001/2003	\$?
2 projects on education and extension	TAS, SA	(B Parkes, pers. comm.)		\$110,000
Management of <i>Phytophthora cinnamomi</i> for Biodiversity Conservation in Australia	WA	CPSM	2004/2005	\$358,000
The current project	WA	CPSM	2005	\$50,000

In the early years of the NTAPs, a reasonable proportion of funding was based on an open application process which limits the potential of a prioritisation framework to the subject matter and quality of applications received. In more recent years, more of the NTAP funding has been distributed through a tender process, although this has largely been for desktop studies for which the funds are insufficient to cover full implementation.

Another source of funding is the Trust. The Trust delivers funding through a variety of programs and the bulk of the 2nd round of Trust funding is being delivered through the NRM Regions. The NRMs are the mechanism by which the Commonwealth and state and territory Governments have, since approximately 2003, jointly provided support to regional natural resource management groups through the funding programs: i) the NAPSQ and; ii) the regional component of the Trust. Under the bilateral agreements, regional NRM bodies have been established in all states and territories and funding allocated to each based on an approved natural resource management plan and investment strategy. The delivery of \$1.4 billion NAPSQ and \$3 billion Trust funding through NRM Regions occurs via a model in which integrated delivery of the two funds is driven by strategic and investment plans

developed by the 56 individual NRM Regions that cover Australia (NRM website – About NRM Regions, accessed 03/10/05). It is essential for those regions significantly impacted by *P. cinnamomi* to clearly identify the issue in regional management strategies and investment plans. As *P. cinnamomi* is so widespread in the landscape it is likely that in many parts of Australia it will be a cross-regional issue, and a cross-regional response, in close collaboration with state and local Governments, will be necessary to ensure the effective use of resources to manage it in accordance with state strategies and the NTAP. A common criticism of Round 1 Trust funding was the piecemeal, small-scale and single-issue approach of many projects. Second Round Trust funding seems to be improving on this and funding programs such as the NHT- Regional Competitive Component which encourages large-scale integrated management¹.

The investment by state and local governments in *P. cinnamomi* science and management varies from state to state but is generally very low. Relatively modest investments by the WA and South Australian State Governments in appointing personnel with specific *P. cinnamomi* management roles has led to greater coordination of activities in those states, although funds for on-ground management funds are limited⁸. It is difficult to get a clear picture of current level of commitment to *P. cinnamomi* management from the amount of funds spent on on-ground management, as these costs are commonly not identified within District operational budgets (D Peters and T Rudman, *pers. comm.*) and may require external funding (R Velzeboer, *pers. comm.*).

It is estimated that the economic cost of *P. cinnamomi* to Australia is \$160M/annum from losses in agriculture, forestry and tourism³. Investment required for WA to address *P. cinnamomi* management and research priorities in 2004 was estimated to be \$6.7M initially, and then \$4.1M/annum. Current investment for *P. cinnamomi* research and management in WA is less than \$1M:

- The Centre for Phytophthora Science and Management has received \$1.95M from the Trust for projects between 2003 and 2008 to pursue 4 research areas.
- Alcoa invests approximately \$300,000/annum in a research/management program with CALM in forest rehabilitation and; in a range of small projects with the CPSM.
- CALM spends an estimated \$1.6M per year on *P. cinnamomi* management including detection, diagnosis, mapping, management plans, annual phosphite-spraying program at 24 sites, a fulltime Coordinator and Senior Research Scientist positions, and an active research program that encompasses collection and storage of germplasm and translocation projects.
- The SCRIPT NRM Group has received \$1.2M from NHT-RCC to undertake mapping and develop risk assessment methods, and apply them between 2004 and 2008. They manage an area of 5.4M ha most of which is vulnerable to *P. cinnamomi*.
- The DWG are a local initiative which were funded by First Round Trust, and currently receive approximately \$106,000/annum, primarily from the Trust, with supplementary funding from Alcoa and small amount of funding through consultancy work.

It has been acknowledged many times that funding is currently inadequate to effectively abate the threat of *P. cinnamomi* in Australian natural ecosystems^{3, 8, 53, 54, 55}.

5 REVISION OF THE NTAP

The Plan does not identify responsible parties, timelines, indicative budgets or potential sources of funding other than the limited NTAP funds. There has been no national coordination and only WA and SA have personnel with substantial and dedicated *P. cinnamomi* management responsibilities. Potential opportunities to integrate with other processes and prevent duplication of efforts are missed.

This review and evaluation precedes a revision of the goals, objectives and actions of this NTAP, which has been undertaken to overcome the problems that have inhibited the implementation of the Plan. The main problems have been identified as:

- Only a small number of actions have been fully addressed in particular states or regions. Of the Stage 1 Milestones identified in the NTAP none have been addressed.
- New approaches are deemed necessary due to the development of the national risk assessment and best practice guidelines (gaps in knowledge are easily identified).
- Other actions require modification as they were inadequately defined (e.g. Objective 1g Develop decision-support systems to help land managers decide on locally appropriate management methods and when to apply them).
- Developments in understanding of stakeholder concerns raised the need for some new specific actions (e.g. investigate methods to eradicate *P. cinnamomi* from infested sites).
- There is an overarching need to rationalise the number of actions and increase consistency between NTAPs.

Since the launch of the NTAP for *P. cinnamomi* little improvement in management has occurred, resulting in continued spread. The impacts of *P. cinnamomi* infestation are currently irreversible. Funds are still, and always will be, limited for management so the identification of areas of high conservation value that are currently uninfested is critical and the prevention of *P. cinnamomi* incursion is crucial for biodiversity conservation. The 2001 NTAP for *P. cinnamomi* does not have this focus.

6 CONCLUSION

This NTAP was the first attempt to manage *P. cinnamomi* at a national level using a comprehensive, integrated approach. However, implementation of the plan has been slow and ad-hoc. It has been recognised that the NTAP process is slow, the plans are not fully implemented due to resourcing constraints and they provide limited capacity for coordinated action⁵⁶. None of the Stage 1 Milestones of the NTAP for *P. cinnamomi* have been met, and most importantly, actions for coordinating management have not been initiated. NTAPs do not apply to all land types – whilst NTAPs are statutory, they have limited application to Australian Government land and for other land they need state co-operation which is limited by a current lack of cooperative planning with the states and community⁵⁶.

A revised NTAP for *P. cinnamomi* can provide guidance on how the Trust resources are allocated, but to achieve the best result there is a need to reduce duplication of work and wastage of resources. This can be accomplished by a national co-ordinator or team capitalising on what has been undertaken in individual states and co-ordinating efforts to best utilise limited resources:

- identifying links with state agencies and other stakeholders
- identifying links between NTAPs
- integrating with other Trust programs for more holistic approach to biodiversity management, and
- integrating with other natural resource management plans (e.g. Recovery Plans).

Feedback has indicated that there is a low awareness of NTAP meaning that greater promotion of the NTAP is required. Also, promotion of economic and biodiversity benefits of *P. cinnamomi* management is required for the greater community. The documentation and promotion of successful on-ground projects including the contribution of non-DEH funded work has been reviewed in this document and in the 2004/2005 Management of *Phytophthora cinnamomi* for Biodiversity Conservation in Australia project⁸.

Although legislation requires it, the NTAP should not just focus on rare/endangered species. A reactive response will result in additional species becoming endangered, a proactive response will prevent further habitats/species becoming threatened.

7 REFERENCES

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APPENDIX 1

List of stakeholders

Initial feedback on the stakeholder's knowledge of, and effectiveness of the 2001 NTAP was obtained from a questionnaire sent out to 350 stakeholders Australia wide accompanying the Best Practice document (O'Gara *et al.*, 2005b).

The first draft of this review was compiled with input from the NTAP reference group (Table 3.1), which was then sent out to 70 key stakeholders Australia wide for comment (Tables 3.1 and 3.2).

Table 3.1: The NTAP reference group who provided guidance and input into this project.

Name	Agency	State
Bramwells, Hugh	Department of Sustainability & Environment	VIC
Cahill, David	Deakin University	VIC
Coates, David	Department of Conservation and Land Management	WA
Dunne, Christopher	Dieback Working Group, Shire of Kalamunda	WA
Friend, Gordon	Department of Sustainability & Environment	VIC
Gadek, Paul	James Cook University	QLD
Hardy, Giles	Murdoch University, Centre for Phytophthora Science & Management	WA
McDougall, Keith	Department of Environment & Conservation	NSW/ACT
Rudman, Tim	Department of Primary Industries, Water & Environment	TAS
Shearer, Bryan	Department of Conservation and Land Management	WA
Smith, Ian	Department of Sustainability & Environment	VIC
Vear, Kevin	Department of Conservation & Land Management	WA
Velzeboer, Renate	Department of Environment & Heritage	SA
Worboys, Stuart	GHD Pty Ltd	QLD
Young, Joanna	SCRIPT	WA

Table 3.2: List of stakeholders that were consulted for the first draft of this document

Name	Agency	State
Bagwell, Gary	Sydney Harbour Trust	NSW
Barrett, Sarah	Department of Conservation and Land Management	WA
Biggs, Paul	Forest Products Commission	WA
Bilske, Des	Northern and Yorke NRM	SA
Bryce, Mark	Parks and Wildlife Service	TAS
Bugden, Bernie	Hawkesbury-Nepean Catchment Management	NSW
Churchill, Ben	Parks, Victoria	VIC
Clarke, Kate	Eyre Peninsula NRM	SA
Colquhoun, Ian	Alcoa World Alumina	WA
Cummins, Don	Department of Agriculture and Food	WA
Danks, Alan	Department of Conservation and Land Management	WA
Dear, Catherine	Roads, Vic	VIC
Doyle, Bill	City of Playford	SA
Drenth, Andre	Department of Primary Industries	QLD
Edkins, Rob	SCRIPT	WA
Elwell-Gavins, Vanessa	Natural Resource Management, south	TAS
Evans, Glenn	Hunter-Central Rivers Catchment Management Authority	NSW
Ford, Peter	Vic Forests	VIC
Freebury, Greg	Department of Conservation and Land Management	WA
Gellard, Jeanette	Kangaroo Island NRM	SA

Name	Agency	State
Gill, Malcolm	Department of Conservation and Land Management	WA
Good, Kym	Catchment Water Management Board	SA
Goosem, Steve	Wet Tropics Management Authority	QLD
Guest, David	University of Sydney	NSW
Haig, Alan	Dept Primary Industries, Water and Environment	TAS
Hills, D	Department of Agriculture and Food	WA
Hopton, Hugo	South East NRM	SA
Hyde, Ben	CSIRO	SA
Kesby, Noel	Southern Rivers Catchment Management Authority	NSW
King, Stu	Natural Resource Management, north	TAS
Lees, Stephen	Sydney Metro Catchment Management Authority	NSW
Malin, Nathan	WA Local Government Association	WA
McCarthy, Mick	EMRC, Mundaring Shire Council	WA
McCormack, David	Cradle Coast Authority	TAS
McDonald, Sharon	Vic Roads	VIC
Miller, Kat	World Wildlife Fund	WA
Murphy, Anna	Roads, Vic	VIC
Nicholas, Robyn	Department of Conservation and Land Management	WA
O'Neill, Danny	Catchment Management Authority Forum Secretariat	VIC
Peters, Desmond	Parks, Victoria	VIC
Pitt, Michael	Northern Rivers Catchment Management Authority	NSW
Reynolds, Tim	Department for Environment and Heritage	VIC
Rodgers, Nina	Municipal Association of Victoria	VIC
Ryan, Michael	Vic Forest	VIC
Scott, Eileen	University of Adelaide	SA
Sharp, Sarah	Environment ACT	ACT
Soteriou, Linda	Environment, WA	WA
Strelein, Greg	Department of Conservation and Land Management	WA
Summerell, Brett	Royal Botanical Gardens, Sydney	NSW
Taylor, R	WA Local Government Association	WA
Varcoe, Tony	Parks, Victoria	VIC
Walton, Craig	Department of Natural Resources and Mines	QLD
Wardlaw, Tim	Forestry Tas	TAS
Worthington, Rod	Office for Recreation and Sport	VIC
	Forestry SA	SA