

THE
DEPARTMENT OF CONSERVATION
LAND MANAGEMENT
WESTERN AUSTRALIA

**“Phytophthora cinnamomi and the disease caused by it –
a protocol for identifying protectable areas and their
priority for management.”**

Invitation for public comment

Environmental Protection Authority

June 2000



AN INVITATION TO COMMENT

PROTOCOL FOR THE IDENTIFICATION AND MANAGEMENT OF PHYTOPHTHORA CINNAMOMI 'PROTECTABLE AREAS' IN WESTERN AUSTRALIA

The Environmental Protection Authority (EPA) invites interested individuals and organisations to make a submission on the document entitled '*Phytophthora cinnamomi and the Disease Caused by it: A Protocol for Identifying 'Protectable Areas' and their Priority for Management*' (the protocol) as part of its process of considering the proposed protocol and providing advice to the Minister for the Environment.

The Dieback Consultative Council, which is Western Australia's peak body for considering and pursuing new initiatives in relation to the wider issue of dieback management in Western Australia, has recently submitted the protocol to the Minister for the Environment. The Minister has requested the EPA to provide environmental advice to her on the protocol, under Section 16 of the Environmental Protection Act.

It is proposed that the final protocol, if accepted by the Minister, will be:

- applied and implemented by CALM and its successor agencies for all operations and developments on land under its control;
- taken into account by the EPA in the assessment of new proposals; and
- promoted to landholders throughout Western Australia as the basis for management of the *Phytophthora* dieback threat.

The protocol and related documentation, as well as the EPA's recent news release, are provided as one package within this document.

The package comprises:

1. The EPA's News Release of June 2000 inviting submissions;
2. "*Phytophthora cinnamomi and the disease caused by it—a protocol for identifying protectable areas and their priority for management.*" as submitted to the Minister for the Environment by the Dieback Consultative Council (March 2000).
3. *CALM Policy Statement Number 3 : 'Management of Phytophthora cinnamomi and the disease caused by it'*; and
4. *Background to the Revision of CALM Policy Statement Number 3: Management of Phytophthora and Disease Caused by It* : Background paper prepared by F.D Podger & K R Vear (July 1998).

Submissions close at 5pm on Friday 14 July 2000.

The EPA encourages submissions on the protocol to assist the EPA in preparing its advice to the Minister, which will be in the form of a public report.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach.

It is useful if you indicate any suggestions you have to improve the protocol.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Submissions may be fully or partially utilised in compiling a summary of the issues raised or where complex or technical issues are raised, a confidential copy of the submission (or part of it) may be sent to other government agencies or involved individuals such as the members of the Dieback Consultative Council.

The summary of issues will be included in the EPA's public report providing advice to the Minister under Section 16 of the Environmental Protection Act.

Why not a group submission?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues.

Joint submissions may help to reduce the work for an individual or group, as well as increase the pool of ideas and information.

If you form a small group (up to ten people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues or the specific details of the protocol. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to improve the protocol.

When making comments on specific elements of the protocol;

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that the issues raised are clear. A summary of your submission is helpful.
- Refer each point to the appropriate section, chapter or recommendation in the protocol.
- If you discuss different sections of the protocol, keep them distinct and separate, so there is no confusion as to which section you are considering.
- Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name,
- your address,
- date, and
- whether you want your submission to be confidential.

The closing date for submissions is 14 July 2000.

Submissions should be addressed to:

Environmental Protection Authority
8th Floor, Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Mr Graeme French

Item 1:

EPA News Release of June 2000 inviting submissions

Invitation for Public Comment:

**Protocol for the Identification and Management of *Phytophthora cinnamomi*
'Protectable Areas' in Western Australia**

The Environmental Protection Authority called for public submissions today on a new protocol for managing dieback, the disease caused by the fungus *Phytophthora cinnamomi*.

The EPA is inviting public comment on the new protocol document entitled '*Phytophthora cinnamomi* and the Disease Caused by it: A Protocol for Identifying 'Protectable Areas' and their Priority for Management' as part of its process of considering the proposed protocol and providing advice to the Minister for the Environment.

The Dieback Consultative Council, which is Western Australia's peak body for considering and pursuing new initiatives in relation to the wider issue of dieback management in Western Australia, has recently submitted the protocol to the Minister for the Environment. The Minister has requested the EPA to provide environmental advice to her under Section 16 of the Environmental Protection Act.

It is proposed that the final protocol, if accepted by the Minister, will:

- be applied and implemented by CALM and its successor agencies for all operations and developments on land under its control;
- be taken into account by the EPA in the assessment of new proposals; and
- be promoted to landholders throughout Western Australia as the basis for management of the *Phytophthora* dieback threat.

EPA Chairman Bernard Bowen said "Phytophthora dieback and its current and potential direct and indirect threat to Western Australia's unique and internationally significant biodiversity is a matter which is of concern to the broad community. Additionally *Phytophthora* dieback disease is listed under Commonwealth legislation as a key threatening process. A National Threat Abatement Plan is being prepared and will require adequate resourcing and implementation to manage this threat.

"Obtaining the full range of perspectives from the scientific community and interested organisations and individuals is an important step in finalising the approach which the government takes to managing the *Phytophthora* threat while continuing to carry out essential activities and developments such as forest management, tourism, recreation and the protection of biodiversity. The issues dealt with by the protocol are significant in an ethical as well as a technical sense and have implications for the way in which the State intends to meet national and international agreements relating to sustainable development and the conservation of biological diversity" he said.

"The protocol, when approved, will also have implications for the way that all lands currently managed by CALM are managed with respect to the Phytophthora threat."

Copies of the protocol and related documentation provided to the EPA by the Dieback Consultative Council are available as one package from the EPA's Perth office, with public comment being sought by Friday 14 July 2000.

The EPA encourages submissions on the protocol to assist the EPA in preparing its advice to the Minister, which will be in the form of a public report.

Item 2

“Phytophthora cinnamomi and the disease caused by it –a protocol for identifying protectable areas and their priority for management.”

Protocol submitted to the Minister for the Environment by the Dieback Consultative Council (March 2000).

PHYTOPHTHORA CINNAMOMI AND DISEASE CAUSED BY IT

A PROTOCOL FOR IDENTIFYING 'PROTECTABLE AREAS' AND THEIR PRIORITY FOR MANAGEMENT

1. INTRODUCTION

(Reference : Review of Dieback in Western Australia. F.D. Podger, S.H. James & M.J. Mulcahy)

The slow moving epidemic of destructive root disease in native plants in Western Australia known as "dieback" is caused by the fungal pathogen *Phytophthora cinnamomi*. The pathogen was probably introduced by European settlers after 1828 with planting stock of domestic fruit trees.

Areas vulnerable to the pathogen are confined to the South-West Land Division of Western Australia and the NW and SE extensions of the 600mm rainfall isohyet. Outside this area, unless under irrigation, the pathogen cannot establish. More than 20% of the remnant vegetation in the South-West Land Division is now infested. The epidemic is of major significance to the flora of Western Australia and is considered a biological disaster of global significance.

There is little prospect that an affordable and effective cure will be delivered in the foreseeable future despite the continuing search for a practical solution. Management strategies need to be based upon an assumption that the autonomous element of spread of the epidemics will continue unabated and that *Phytophthora cinnamomi* might ultimately occupy all land suited to it. The uphill rates of spread are variable but experience suggests that it is rarely less than 1 meter per year. Downhill rates of spread can be much greater but are generally unpredictable.

The best available broadly applicable management stratagem is to continue to target the human vectored spread of the pathogen and to constrain as far as is possible the establishment of new centres of infestation in 'protectable areas'. These are uninfested areas of a size and shape so located in the landscape that a significant

remnant will remain after a period of 2 or 3 decades of the uncontrollable autonomous encroachment of the pathogen.

Infested areas and those about to become engulfed by the autonomous spread of the pathogen that contain declared rare flora, threatened ecological communities or the susceptible habitat of threatened fauna, may be protected with repeated treatments of phosphite. The high cost of treating areas with phosphite precludes its broad scale use. Industry and community groups should be encouraged to identify areas of value that derive a benefit from being treated with phosphite. CALM has developed a protocol that deals with the identification of areas to be treated with phosphite and for priority setting for allocation of available resources. The protocol deals with management action necessary to define areas that are protectable from controllable movement of infested soils and plant tissue onto susceptible plant communities that are environmentally vulnerable. The management of conservation values of infested areas and those that are not protectable areas are addressed elsewhere.

The uniform application of the stratagem of identifying "protectable areas" and ensuring hygienic human access to them across the 17 million hectares of remnant vegetation in the South-West Land Division and the NW and SE extensions of the 600mm rainfall isohyet is beyond the resources of the State. The Government and the DCC has therefore endorsed the recommendations of the report of the Western Australian Dieback Review Panel [WADRP]. Recommendation 1 states:-

"That Government adopts a dieback management strategy which identifies significant protectable areas (those for which the values at risk are significant and the benefits of hygiene likely to be sustained for more than a few decades), prioritises them and concentrates available resources on rigorous application of hygiene for their protection."

This protocol focuses on identifying 'protectable areas' and their protection by ensuring hygienic human access to minimise the risk of establishing new centres of infestation within them. The protocol was developed in consultation with the Dieback Consultative Council, the body formed to advise the Hon. Minister for the Environment on the

problem of dieback in Western Australian. This protocol is suitable for application on both publicly and privately managed lands.

2. PRINCIPLES

The following principles, on which this protocol has been developed, are entirely consistent with the WADRP report.

1. All conservation lands are of value.
2. Given that demand will exceed the available resources, the need is for the available resources to be directed to best effect on the most valuable areas.
3. Avoid the imposition of restrictions on legitimate access where such restrictions will confer little benefit to protection.
4. Recognition of the need for the exercise of professional judgement.
5. The need for conformity with the Department of Conservation and Land Management's Policy No. 3 " *Phytophthora* and disease caused by it" 1998. The management strategies in this policy include :-

1. *Establish and maintain a set of protocols, founded on science and logic, which guide land managers in identifying and managing "protectable areas" and prioritise the allocation of available resources for protecting them.*
2. *Implement an ongoing management system of hygienic access to "protectable areas" which incorporates the following elements :-*
 - a) *Preparation by accredited Interpreters of up-to-date maps of the distribution of P. cinnamomi based on the detection and analysis of the disease symptoms characteristic of root rot disease caused by P. cinnamomi in native plants.*
 - b) *The identification of "protectable areas", which are free of the evidence of infestation by P. cinnamomi, and which are amenable to being protected from the establishment of new centres of infestation arising from the activities of man through the imposition of hygienic management practises.*
 - c) *The formulation, documentation and implementation of plans for hygienic human access to all Protectable areas, and*

- d) The implementation of appropriate monitoring and review programs.
3. Provide and maintain appropriate management guidelines and training programs.

3. VULNERABLE AREAS

On account of its periodic requirements for free soil moisture and intolerance of long periods of warm dry soils, not all parts of the State of Western Australia are vulnerable to the plant pathogen *Phytophthora cinnamomi*.

Disease in native plants susceptible to the pathogen *Phytophthora cinnamomi* is confined to that part of the South-West Land Division and extensions to the NW and SE that receive in excess of 600 mm per annum rainfall or altered sites receiving higher effective rainfall or are natural water gaining sites situated between the 400mm and 600mm isohyets. Sites with calcareous soils such as the Spearwood dune system are not considered to be vulnerable.

4. PROTECTABLE AREAS

"Protectable areas" are defined as uninfested areas not at risk within a timeframe of 2 or 3 decades of complete invasion by the spread of the pathogen from:-

- a) Existing infestations located above them in the landscape, and
- b) Adjoining infestations that may spill over and engulf them.

Protectable areas meet the following criteria :-

- Are vulnerable areas and landforms with a rainfall greater than 600mm per annum or altered sites receiving higher effective rainfall or are natural water gaining sites situated between the 400mm and 600mm isohyets.

- Are determined to be free of the pathogen *Phytophthora cinnamomi* by a qualified plant disease Interpreter on the basis that no plant disease symptoms normally attributed to *P. cinnamomi* are evident among the species known to be susceptible to the pathogen.
- Are positioned in the landscape and are of sufficient size such that a qualified plant disease Interpreter judges that the spread of the pathogen will not autonomously engulf more than a significant remnant within 2 or 3 decades. In some instances this may be as small as a few hectares. The Interpreter will also need to take account of the location of an area in relation to its proximity to free public access.

5. PRIORITY FOR MANAGEMENT

Currently no means exist for eradicating the pathogen once it is introduced to a site nor of controlling its autonomous spread to the full extent of the pathways presented by normal root to root contact amongst plants or the movement of the zoospores in ground and surface water-flows. Nor is it possible to restrain the vectored spread of the pathogen by native animals and ignorant or unprincipled humans. Once introduced into an area *Phytophthora cinnamomi* can persist indefinitely as sub-lethal infestations on partially resistant plants or regeneration of susceptible individuals that periodically attempt to re-colonise a site.

Management action is best focused on minimising the human assisted spread of the pathogen that may lead to new centers of infestation within "protectable areas".

A comprehensive survey for identifying "protectable areas" across the Southwest Land division is beyond the State's resources. Priority should therefore be assigned to imminently threatened declared rare flora, threatened

ecological communities and the habitat of threatened fauna and areas proposed for access and development which involve the risk of movement of the pathogen from infested to any unidentified "protectable areas".

All "protectable areas" are considered to be of value. Highest priority for the application of measures that promote systems of hygienic human access should be given to those areas of highest conservation value.

Figure 1 illustrates the steps used :-

- a) To determine site vulnerability to *Phytophthora cinnamomi*,
- b) To identify "protectable areas", and
- c) To determine priority for management action.

Table 1 lists factors to be considered when managing *Phytophthora cinnamomi* on "protectable areas".

Figure 1 and Table 1 accommodate :-

- a) WADRP recommendation no. 3 that recognises the need for the "*objective identification of protectable areas and for their prioritisation and management*", and
- b) A recognition that management action can only be implemented according to the available resources.

Setting of priority for management should be based on three categories of estimated risk of infestation and threat:-

- a) High priority for management – Those areas with very high conservation values at risk of infestation and threat of serious damage e.g. declared rare flora, threatened ecological communities or habitat of threatened fauna.

- b) Medium priority for management – Other areas scheduled for human access which involves risk of infestation and potential for serious damage.
- c) Low priority for management - Areas not at immediate risk of infestation or at threat of serious damage.

Judgements as to matters of risk of infestation and degree of potential damage require professional consideration of a large number of factors in complex combinations both current and in the medium term future. They do not lend themselves to prescriptive definition and vary as mosaics of such small scale that mapping them is not practicable. They are factors that must be taken into account in the preparation of management plans.

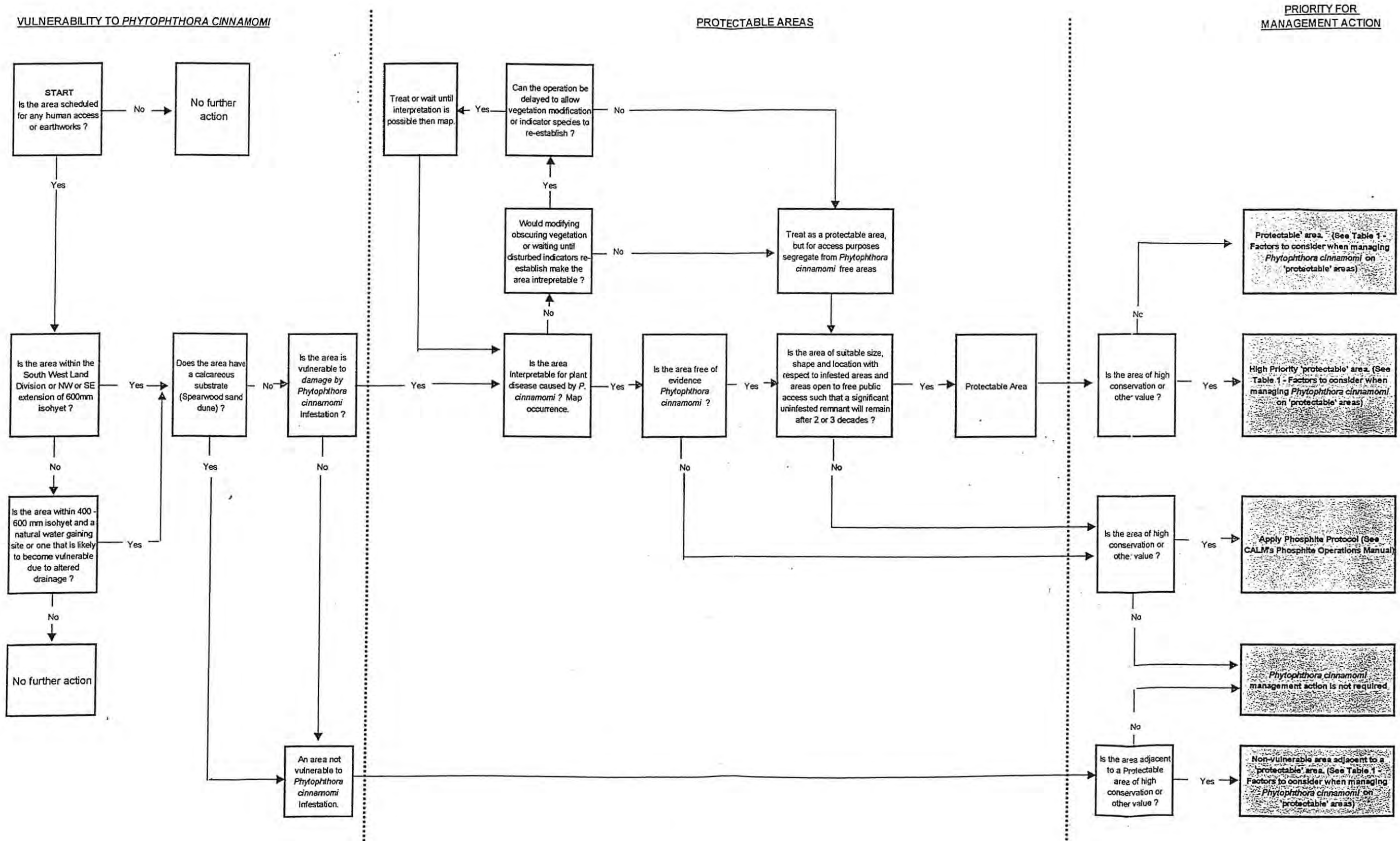
Table 1: Factors to consider when managing *Phytophthora cinnamomi* on 'protectable areas'.

Area	Management Factors to Consider ¹
<u>Protectable Areas</u> Sites with environmental, conservation, social or economic values which may be diminished by <i>P. cinnamomi</i>	1. Proposed buffers and other neighbouring areas should be examined during survey and planning of access and hygiene. 2. Consider the need to contain drainage. 3. Use <i>P. cinnamomi</i> free materials on adjacent areas and 'protectable' areas and road works through buffers. 4. Discourage activities during periods when very moist soil conditions prevail. 5. Design and maintain roads to minimise soil movement and contain drainage. 6. Manage to maintain control over human access. 7. Ensure all human access is clean on entry ². 8. Where practicable use <i>P. cinnamomi</i> free water ³. 9. Use only <i>P. cinnamomi</i> free planting stock. 10. Educate users on <i>P. cinnamomi</i> biology & management.
<u>High Priority Protectable Areas</u> High value areas eg. existing and proposed conservation reserves or protected areas (covenants). Areas supporting threatened flora or fauna, or threatened ecological communities.	1. Discourage developments or activities that increase risk of infestation. 2. Plus items 1 – 10 above. 3. Use protective chemicals (such as phosphite) as appropriate.

1. These factors should be supported by more detailed industry codes of practise.
2. 'Clean on entry' is defined as all vehicles, machines, and equipment and in some cases boots to be free of potentially infested soil and plant tissue.
3. There are serious practical limitations to this when fighting bushfires.

FIGURE 1. FLOWCHART FOR DETERMINING VULNERABILITY TO DAMAGE BY *PHYTOPHTHORA CINNAMOMI*, DELINEATION OF 'PROTECTABLE AREAS' AND THEIR PRIORITY FOR MANAGEMENT

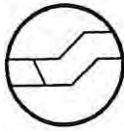
[1. An uninfested area, located so as to be amenable to protection from infestation through control on human access and hygienic entry and is of a size and shape that will not be completely overrun in a timeframe of 2-3 decades. May include uninterpretable areas.]
[2. Other areas may retain high conservation, cultural or landscape values that require management action]



Item 3

CALM Policy Statement Number 3 :

'Management of Phytophthora cinnamomi and the disease caused by it'



POLICY STATEMENT No.3

MANAGEMENT OF *PHYTOPHTHORA* AND DISEASE CAUSED BY IT

Revised : December 1998

PREAMBLE

This document replaces Department of Conservation and Land Management (CALM) Policy Statement No.3 of January 1991 and should be read in conjunction with other Policy Statements and the background paper :-

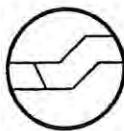
“ Management of Phytophthora and disease caused by it: A revision of Department of Conservation and Land Management Policy Statement No.3 of January 1991”
prepared by F D Podger & K R Vear July 1998

INTRODUCTION

1. CALM has a responsibility to monitor the health of native plants, ecological communities and fauna habitat and to respond according to need on a case by case basis.
2. At least 8 distinct species of *Phytophthora* recur at various places in native plant communities of Western Australia. Whilst the potential importance of several of them still require some further elucidation, *Phytophthora cinnamomi* represents by far the greatest ongoing threat to conservation and other benefits to society which native plant communities provide. This policy therefore concentrates on *P. cinnamomi*.

MANAGEMENT OBJECTIVES

1. Progressively identify uninfested protectable areas and manage human access to them so that the role of humans as vectors in establishing new centres of infestation is reduced to the lowest possible level.
2. Manage already infested and unprotectable areas in a manner which sustains an appropriate level of environmental and social benefits.

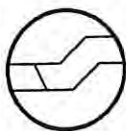


3. Implement, as a component of broader management programs to protect threatened flora, threatened ecological communities and the habitat of threatened fauna, a program for the use of the protective chemical phosphite.
4. Implement programs of interagency research and liaison which are closely linked with :-
 - management requirements, and
 - other Western Australian, interstate, Commonwealth and international institutions involved in research and management on *Phytophthora*.
5. Encourage community interest and participation particularly through support of the Dieback Consultative Council (DCC) and its Regional Coordination Groups.

MANAGEMENT STRATEGIES

A. MANAGEMENT OF UNINFESTED AREAS WHICH ARE PROTECTABLE

1. Establish and maintain a set of protocols, founded on science and logic, which guide land managers in identifying and managing protectable areas and prioritise the allocation of available resources for protecting them.
2. Implement a long term management system of hygienic access to protectable areas which incorporates the following elements :-
 - The use of accredited Interpreters, supported by the Vegetation Health Service, to prepare up-to-date maps of the distribution *P. cinnamomi* through the detection and analysis of disease symptoms in native plants characteristic of disease caused by *P. cinnamomi*.
 - The progressive identification of protectable areas, which are free of the evidence of infestation by *P. cinnamomi*, and which are amenable to being protected from the establishment of new centres of infestation arising from the activities of people through the imposition of hygienic management practices.
 - The documentation, implementation and regulation of plans for hygienic human access to all protectable areas, and



- The implementation of appropriate monitoring and review programs.
- 3. Provide protection, as appropriate, through phosphite application.
- 4. Provide and maintain appropriate management guidelines and training programs.

B. MANAGEMENT OF LANDS ALREADY INFESTED WITH *PHYTOPHTHORA CINNAMOMI* OR THOSE THAT ARE NOT PROTECTABLE

1. Develop and maintain a set of protocols, founded on science and logic, which establish guidelines for identifying and managing infested and unprotectable areas and for setting priorities among management options for them.
2. Where appropriate provide protection through the application of phosphite.
3. Provide appropriate management guidelines and training programs.

C. PROTECTION OF THREATENED FLORA, THREATENED ECOLOGICAL COMMUNITIES AND THE THREATENED FAUNA BY THE USE OF A SCHEDULE OF TIMED APPLICATIONS OF THE PROTECTIVE CHEMICAL PHOSPHITE

1. Develop and maintain a set of protocols founded on science and logic which :-
 - guide land managers in identifying threatened flora, threatened ecological communities and the habitat of threatened fauna that may benefit from protection through phosphite application, and
 - may be used to establish realistic priorities for use of available resources.
2. Implement and monitor a program using scheduled applications of the protective chemical phosphite for protection of threatened flora, threatened ecological communities and the habitat of threatened fauna.

D. RESEARCH AND LIAISON

As a component of broader programs of research and liaison :-

1. Implement coordinated programs of research and collaboration, which are closely linked to management requirements, and involve other



Western Australian, interstate, Commonwealth and international land management and research institutions.

2. Through interaction with the *Phytophthora* Research Advisory Group establish clear research priorities and agreed allocation of those priorities amongst relevant institutions.
3. Provide appropriate levels of support to the Dieback Consultative Council, its Regional Coordination Groups, and the team responsible for the implementation of the National Threat Abatement Plan for *Phytophthora spp.*

E. ENCOURAGE COMMUNITY INTEREST AND PARTICIPATION

1. Encourage community interest and participation particularly through support of the Dieback Consultative Council (DCC) and its Regional Coordination Groups.
2. Provide appropriate levels of information to the public on the matters related to *P. cinnamomi* and disease caused by it.

Responsibility for the maintenance and review of this policy rests with the Executive Director.

Syd Shea
EXECUTIVE DIRECTOR

December 1998

Item 4

***Background to the Revision of CALM Policy Statement Number 3:
Management of Phytophthora and Disease Caused by It.***

Background paper prepared by F.D Podger & K R Vear (July 1998).

BACKGROUND TO THE REVISION OF CALM POLICY
STATEMENT No.3 "MANAGEMENT OF *PHYTOPHTHORA* AND
DISEASE CAUSED BY IT"

F.D. Podger & K.R. Vear - July 1998

HISTORICAL BACKGROUND

Since 1921 it has been evident that an increasing number of patches of formerly healthy jarrah forest has become afflicted with a lethal disease now known as "jarrah dieback" ('JDB').

Until 1964, the cause of this malady had been the subject of contending speculation. In that year proof of the role of the plant pathogen *Phytophthora cinnamomi* as the cause of 'JDB' was established. At the same time, it was recognised that this exotic microbe was also intimately associated with similar damage in other plant communities of sclerophyllous natives, whether jarrah was dominant, a minor component only, or not present at all. The period of intensive research which followed is ongoing and has resulted in revised perceptions of the nature of the pathogen and of the diseases which result from its interactions with the enormously diverse native vegetation of southwestern Australia.

P.cinnamomi is a soil-borne micro-organism of foreign origins. It almost certainly entered Western Australia for the first time on soil around the roots of cultivated plants, shortly after European settlement in 1827. Until the effective implementation by Australia of quarantine of import of exotic soil and plant products there must have been innumerable introductions at many points of entry around the continent and its redistribution within the country over a period of some 150 years.

P.cinnamomi has now extended its largely unfettered colonisation of the southwest by both human movement of infested soils and autonomous spread, the latter largely by growth of the pathogen in the root systems of highly susceptible native plants. This epidemic of colonisation, which has produced a complex mosaic of infested and uninfested areas, is now well on its way toward the middle stages of its ultimate potential to occupy all of those sites which are environmentally suited to its establishment, survival and multiplication. Such

sites are very widely distributed over some 20% or more of the natural vegetation in areas throughout that part of the Southwest Land Division which receives mean annual rainfall in excess of 800mm and occur sporadically at lower rainfall.

Within the 600-800mm rainfall zone the occurrence of *P.cinnamomi* is also widespread but much less extensive. In this zone severe damage to native vegetation is largely confined to water-gaining sites or to years of abnormally high summer rains. In these circumstances localised patches of the vegetation may periodically suffer severe damage with intervals of recovery during dryer periods.

In areas receiving <600mm dieback due to *P.cinnamomi* is restricted to circumstances where localised hydrological effects, such as the shed from granite bosses or rising ground water tables associated with upslope land clearance in the catchment, cause effective rainfall to substantially exceed the regional patterns.

There is no record of *P.cinnamomi* in regions receiving <400mm.

NATURE OF THE EFFECT OF THE PATHOGEN ON CONSERVATION AND COMMERCIAL VALUES

The effect of *P.cinnamomi* upon the health of plant communities, and upon the species in them, varies greatly. In many places, lethal root-disease destroys the structure of many native communities, reduces their floristic diversity, decimates their primary productivity and destroys habitat for much dependant native fauna, particularly its value as protection against feral predators. In some places the pathogen causes little damage at all. Unfortunately the extent of susceptible communities in vulnerable environments is much greater than that of communities which occur in environments which are inherently unfavourable to the pathogen.

No simple or single relationships exist between the presence of *P.cinnamomi* and the development of disease because of :-

- a) the considerable variability which exists within and between native plant species in their responses to the presence of *P.cinnamomi*,
- b) the differential influence of temporal and spatial variation in environmental forces,

However, within the spectrum of variable disease, response of numerous hosts to particular environmental circumstance, at least four specific nodes can be recognised. These are due to either distinct processes or to different stages in the development of disease which occur upon and after the arrival of the pathogen and its persistence in previously uninfested areas. Each of these circumstances presents a different problem which require separate sets of management response. It is now evident that among the variety of plant communities which occur within that part of the South West Land Division which receives more than 800mm mean annual rainfall the four sets of distinctive consequences are :-

1. No apparent disease at all: this applies *inter alia* to those areas of karri and wandoo forest which contain no floristic elements of the dry sclerophyll (jarrah) forest type and to plant communities on the Spearwood Dune System of the Swan Coastal Plain and pedogenically related landscapes.
2. An extremely destructive epidemic of root rot: this applies within the highly susceptible understorey elements of the dry sclerophyll forest in *Banksia* woodland and in heathland on podsols, podsollic and lateritic landform. It is characterised by :-
 - a) devastation soon after the first arrival of the wave front of infestation,
 - b) steady extension of epidemic disease soon after arrival of the pathogen,
 - c) complete or near complete elimination of important structural elements of the plant community.
 - d) a relative insensitivity of the degree of damage to variation in soil characteristics.
3. A much more variable epidemic occurs within the dominant tree component of the jarrah forest. This is characterised by :

- a) a much more erratic and often protracted onset of mortality ranging from early localised onset of mass collapse (similar to type above) through delayed and patchy mortality to no apparent effect at all on health of the jarrah over-storey.
- b) high sensitivity to subtle differences in soils characteristics particularly those effecting drainage.

All variants in the response of jarrah are coincident with, or preceded by, mass deaths in susceptible elements of the under-storey. In jarrah, their behaviour varies from that characteristic of epidemics of disease due to invasion by an exotic organism to which the vegetation has not been previously exposed to that typical of long established endemic disease.

- 4. Where *P.cinnamomi* has been long established (some 50 years or more) in sites formerly dominated by jarrah/banksia forest and has been very heavily impacted *P. cinnamomi* behaves in a manner characteristic of endemic pathogen. The forest is often replaced by an open woodland of marri/parrot bush. Periodic outbreaks of mortality in parrot bush (*Dryandra sessilis*) follow, with subsequent regeneration by seed. At this late stage, *P.cinnamomi* causes more muted disease than at the wave front.

RATIONALE OF THE NEED FOR A REVISION OF POLICY.

Statements of policy, protocols for management, and manuals of practise first developed in the early 1970's have been periodically revised to take account of advances in knowledge and wider managerial experience.

Prior to the present document the most recent statement of policy was encapsulated in CALM Policy Statement No. 3. "*Phytophthora* Dieback" of January 1991.

The objective of that statement read :-

"To prevent the introduction, spread or intensification of the plant iseases caused by *Phytophthora* species throughout the state, with particular emphasis on the southwest... (and to monitor for *Phytophthora*)....activity in the remainder of the state, especially in tropical areas."

In 1996 an independent review [the WA Dieback Review (Podger *et al*)] was conducted for the government, a process of public input completed, and an appraisal of the recommendations of the review panel completed by CALM.

CALM has now accepted that eradication and prevention of the establishment of new centres of infection is not a realisable objective, even were it both a socially acceptable strategy of denial of human access for any purpose and involved an eradication program of native animals which vector the pathogen. Similarly insurmountable problems of scale and cost would attend efforts to map and treat the thousands of kilometres of invasion front now established within 17 million ha of remnant native vegetation in the Southwest Land Division.

Further, despite intensive research and extensive field tests over three decades, the delivery of ameliorative treatments (which might favourably modify those environmental influences responsible for destructive interaction between plant species which are susceptible to the pathogen) though biologically well founded has so far proved to be impracticable.

Earlier concerns that other species of *Phytophthora* might cause similarly severe and extensive damage are largely unsubstantiated. *P. citricola* and *P. drechsleri* are known to cause very minor damage despite their widespread distribution. Several taxa within each of the species complexes usually assigned to "*P. megasperma*" or "*P. cryptogea*" are generally restricted to seasonally inundated sites. Records of *P. nicotianae* are few and derived almost entirely to native plants in cultivation. Whereas research to clarify the role of "*P. cryptogea*" and "*P. megasperma*" is ongoing, the current revision of policies is focussed on *P. cinnamomi*.

A further question, of now reduced concern, is the extent to which species of *Phytophthora* might threaten native vegetation in tropical latitudes. Nowhere on earth has any species of *Phytophthora* proved to be a serious pathogen of undisturbed native vegetation in the wet-dry tropics (E.g. the Kimberley and Northern Territory) or in the arid zone (E.g. Hamersley and McDonnell Ranges.). There are no records of *Phytophthora* species from any source other than irrigated crop culture in

these climatic regions within W.A. and none at all of *P.cinnamomi*. This assessment does not however preclude effort to diagnose the cause of any unusual disease in naturally occurring native plant ecosystems that might occur in the future in these regions.

As a result of these processes it is now accepted that Policy No 3 of 1991 is founded on outdated concepts and is both unaffordable and unattainable and should be revised.

CHOICE AMONG POLICY ALTERNATIVES

Three alternative strategies, other than to retain the existing and extremely optimistic policy No 3 of June 1991, are available.

a. The first alternative

"Acceptance of the inevitability of defeat and liquidation of material assets"

is argued by very few and is extremely unlikely to be socially acceptable.

b. A second alternative

"Prohibition of all human access"

is expected to be attractive to a very small minority. Apart from its impracticality it has serious adverse socio-economic consequences.

c. The third alternative

"Adoption of attainable objectives within a framework of socially affordable cost"

will of necessity prove less optimistic than the present policy and will require improved methods of priority setting and greater operational efficiencies including the removal of unnecessary constraints on access and a simplification of operational guidelines.

ESSENTIAL ELEMENTS OF A NEW POLICY.

1. Focus effort principally on *P.cinnamomi* ?

Whereas it is now recognised that at least eight distinct species of *Phytophthora* (*P. boehmeriae*, *P. cinnamomi*, *P. citricola*, *P. cryptogea*, *P. drechsleri*, *P. gonapodyides*, *P. megasperma* & *P. sojae*) occur at various places in native plant communities of Western Australia (and that the potential importance of several of them still require some further elucidation). *P. cinnamomi* represents by far the greatest ongoing threat to conservation and other benefits to society which native plant communities provide. This policy should concentrate therefore on *P. cinnamomi*.

2. A uniform policy across the State ?

The policy should apply uniformly across the South West Land Division only. There is no problem to address in the Eremaea or the wet/dry tropics. Furthermore the distinction in Policy No 3 between lands north and south of the Preston River should be abandoned together with guidelines based upon it. The scientific basis for that distinction has never been apparent and there is little evidence that it has been beneficial.

CLARITY OF CONCEPTS AND TERMINOLOGY

1. The existing confusion in the use of terms and their conceptual basis needs urgent address. This includes tautological and counter-intuitive usage and extends to an entrenched lexicon, which inhibits rather than promotes understanding of underlying principles and processes.
2. Use of the term '7 way test' implies some form of mathematical calculation and encourages a false sense of prescriptive rigour. It is in fact no more than a checklist based on flawed concepts and terminology. It would be better to refer to a set of guidelines for consideration of factors, which should normally be taken into account in planning operations.

3. Much of the classification for hygiene purposes is now seen to be superfluous. A particular example is the confusion of risk and hazard. The former is a vital consideration for planning hygienic access. The latter refers only to a forecast of the probable level of damage should *P.cinnamomi* establish in an area not yet colonised by it. Hazard is determined by both site factors and host susceptibility. Even in the same place it differs depending upon the plant species under consideration. Hazard for jarrah for example may vary greatly over an area, which is of uniformly high hazard for species of *Banksia*. Furthermore it has been clearly demonstrated that it is unreasonable to expect that even trained and experienced interpreters should be able to diagnose hazard with any degree of reliability at all. Its use should be abandoned.
4. The matter of reform of terminology will not be simple due to more than 20 years of indoctrination and recital. An organised program of retraining is required.