D I E B A C K P R O T E C T I O N P L A N

MOORA DISTRICT

1990-1994

FOREWORD

Over the past four years, the strategies and policies outlined in the South Coast Dieback Protection Plan were adopted by the Moora District to guide operations in their area.

A review of progress made has been completed, and a Dieback Protection Plan for the Moora District has now been prepared to cover the next five years, 1990 to 1994.

The achievements since 1986 have been significant and have depended on the keenness, hard work and expertise of many Departmental staff, drawn from several Branches. In particular, the inputs by K Gillen, K Borland, T Hill, M Fitzgerald and D Rose are acknowledged.

Syd Shea
EXECUTIVE DIRECTOR

MOORA DISTRICT DIEBACK PROTECTION PLAN 1990-1994

CONTENTS

PREFACE

This dieback protection plan describes:

(i) the current knowledge of dieback distribution and impact in the Moora District.

(ii) strategies for dieback protection including the determination of priority areas for management.

This dieback protection plan has been written for the guidance of departmental officers, and to meet the requirements of Sections 33(3) and 56(1) of the Conservation and Land Management (CALM) Act (1984) which provide for "necessary operations (to be) undertaken... to restore the natural environment, and to protect... the... indigenous flora and fauna". This plan will be made freely available to state and local government authorities, to mining and other industrial groups, and to community groups, tertiary institutions and the general public on request.

THE DIEBACK PROBLEM IN THE MOORA DISTRICT

The Moora District

The Moora District (Figure 1) takes in the southern part of the Greenough Region between Lancelin and Dongara on the west coast and inland to the Great Northern highway. The District contains numerous Nature Reserves and National Parks and extensive tracts of vacant crown land, including large areas which are covered by outstanding recommendations for conservation status.

The district is administered from the Moora office where the District Manager, a Wildlife Officer and a Reserve Officer are based. Three National Park Rangers are located in Cervantes.

What is dieback?

Dieback is the common name given to the disease caused by the microscopic soil-borne fungus Phytophthora. The fungus produces small motile spores (zoospores) which are spread in water, and large spores (oospores) which will survive in soil and plant material. The spores infect plant roots and as the fungus establishes it rots the roots. Plants such as banksias die rapidly after infection, but trees such as jarrah often die gradually, hence the common name for the disease - "dieback". The Phytophthoras which cause dieback in the Moora District are discussed in detail in the section titled "State of Knowledge of Dieback in the Moora District".

Why is dieback a serious threat to the Moora District?

Firstly, the fungus can attack at least 1,000 plant species worldwide in many different families. The Proteaceae (eg. Grevillea, Banksia), Myrtaceae (eg. Eucalyptus, bottlebrush, myrtles) and Epacridaceae (the heaths), which together dominate many of the plant communities in the Moora District, are highly susceptible. Numerous members of these families are endemic to the Moora District.

Secondly, the Moora District contains habitats in which the fungus can become established, multiply and spread. These habitats characteristically experience moist soil conditions for at least part of the year and support plant species susceptible to dieback disease. They include seasonal swamps, wetlands, the floodplains and banks of rivers and creeks, and roadside drains and culverts. The fungus can also become established in upland habitats which experience perched water tables. While susceptible habitats occur throughout much of the Moora District, they are most common in the higher rainfall areas.

Thirdly, eradication is virtually impossible once the fungus is well established. Every effort must therefore be made to protect flora in the very substantial areas still free of the disease. The most effective protection is to ensure that the fungus is not introduced to uninfected areas.

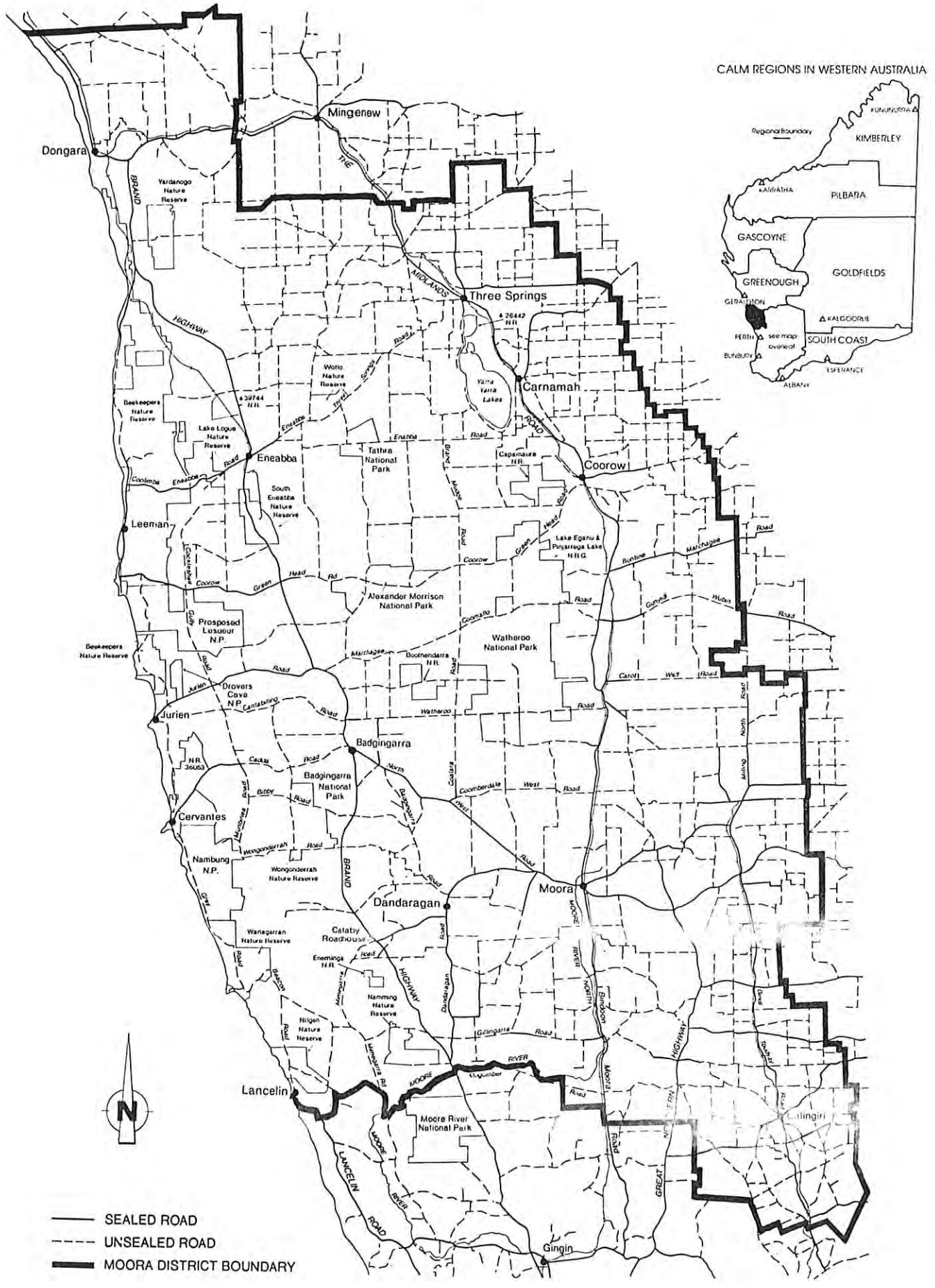

Figure 1. The Moora District

How is dieback spread?

Human activities and natural processes that disturb and move soil and water containing Phytophthora spores have the potential to spread dieback. Spores have been transported over considerable distances in soil adhering to motor vehicles, earthmoving equipment and other machines, and when infected materials have been used in road construction and maintenance. Natural water movement, such as stream flow, subsurface flow and seasonal fluctuations in water tables, has also dispersed spores and caused new outbreaks of dieback. Less frequently, the spread of dieback has been traced to the movements of animals and bushwalkers, the planting of infected seedlings and the use of infected water for reticulation and other purposes.

STATE OF KNOWLEDGE OF DIEBACK DISEASE IN THE MOORA DISTRICT

The Moora district has been surveyed over the last four years for evidence of dieback disease. The strategies and policies outlined in the South Coast Dieback Protection Plan were adopted by the District to guide operations during this period.

As a result of these surveys six Phytophthora species have been isolated from patches of dying vegetation in the Moora District. They are Phytophthora cinnamomi, P. citricola, P. megasperma var megasperma, P. megasperma var sojae, P. drechsleri and P. nicotianae var parasitica. Their known distributions have been mapped (Figure 2).

Phytophthora cinnamomi

Phytophthora cinnamomi is widely distributed in the south west of Western Australia having been introduced to the State since European settlement. It is believed to be the most destructive and the most infectious of the Phytophthoras known to occur in Western Australia. It destroys the structure and diversity of forests, woodlands and heath by killing most of the overstorey and shrub layer in infected areas.

Until mid 1989 it was believed that the most northerly site of P. cinnamomi infection was on the eastern edge of Moore River National Park. It was thought that P. cinnamomi was not found further north because climatic and other environmental and biological factors were unfavourable. The discovery of a new P. cinnamomi infection 5 kilometres west of Eneabba in Lake Logue Nature Reserve, along the banks of Eneabba Creek has changed this perception.

The physiography of the site of infection is typical of that part of the northern sandplains. It is characterised by a lack of topographic relief and by the presence of numerous small lakes and wetlands. This lack of relief and a soil profile of sand overlying a clay rich horizon has assisted the localised spread of the infection by allowing the seasonal ponding of water.

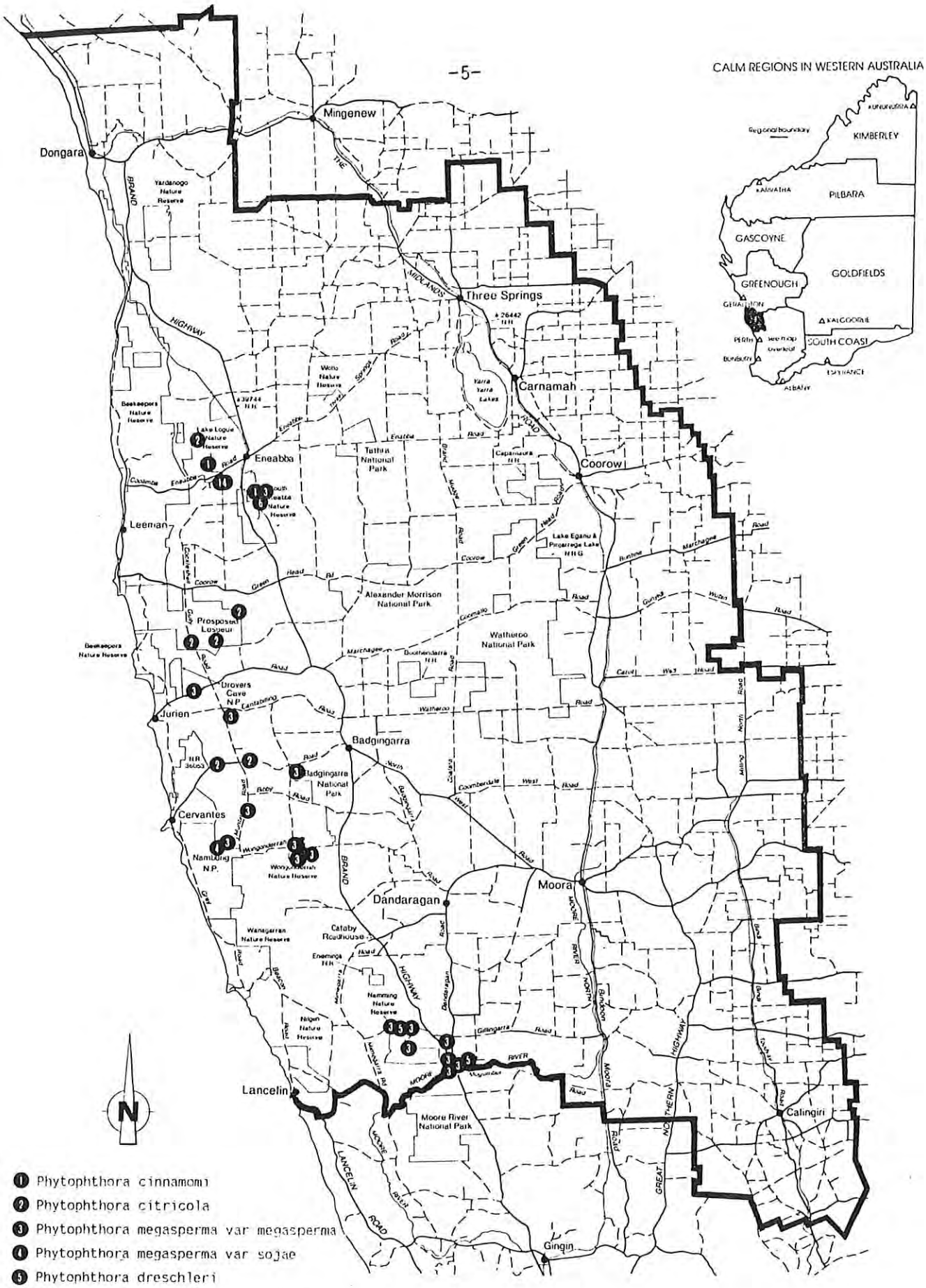

Figure 2. The known distribution of the six Phytophthora species found in the Moora District.

The infection has caused widespread plant deaths up to 50 metres from the creek line and scattered deaths beyond. Assessment of the infection suggests that it may be up to 2 years old. It is likely therefore, that the infection has spread further downstream as a result of seasonal flooding. The exact upstream extent of the infection has not yet been established.

Following CALM advice of the discovery of dieback in Lake Logue Nature Reserves, AMC Mineral Sands Ltd promptly commenced a dieback survey of its existing and proposed mining areas near Eneabba. The survey identified three sites of dieback infection of which two were found to be caused by P.cinnamomi in association with other Phytophthora species. The remaining site is infected with P. megasperma var megasperma. The Company is maintaining its dieback survey program and is developing a dieback protection plan for its mine site.

The first site of dieback infection is located outside the mining areas, in a culvert off Erindoon Road. P.cinnamomi has been isolated with P.megasperma var sojae. The site covers a very small area and plant deaths are few.

At the second site, located within the mine site area south of Eneabba, P.cinnamomi has been isolated with P.nicotianae var parasitica. While the site occupies a small area, plant deaths are extensive. It appears that drainage from workshop areas has facilitated the establishment of dieback at the site.

The investigation of the P.cinnamomi disease sites near Eneabba produced the following data:

Number of infected sites: 3
Range: Lake Logue Nature Reserve, Erindoon Road, AMC mine site.
Vegetation types: Banksia heath.
Species killed: Banksia menziesii*, B sphaerocarpa*, B hookerana, B lanata, Conospermum triplinervium*, Astroloma sp., Petrophile drummondii*, Casuarina humilis, Stirlingia latifolia, Calothamnus villosus*, Verticordia prolifera, Thryptomene saxicola, Lambertia multiflora
Topography: seasonal wetlands, seasonally wet road verges, drainage area.

(* pathogen isolated by direct root plating)

A concerted effort must be made to restrict the further spread of P. cinnamomi.

Other Phytophthora species

Five other Phytophthora species have been isolated from diseased sites in the Moora District. We must assume that, like P. cinnamomi, these species have been introduced into the State since European settlement. Since 1986, twenty nine infected sites have been identified. Infections range in extent from a single roadside plant death to multiple deaths in large, interconnected and seasonally inundated flood-plains. It is not uncommon to isolate two Phytophthora species from the same infected site.

Data are:

Phytophthora megasperma var. megasperma

Number of infected sites: 16
Range : Reagans Ford to Jurien Bay Road
Vegetation types affected; Banksia low woodland, Banksia low woodland over low heath, Banksia low woodland over sedges, low heath.
Species killed: Banksia attenuata*, B. menziesii, B. ilicifolia*, B. prionotes*, B. sphaerocarpa, B. grandis, Leucopogon conostephioides*, Adenanthos cygnorum*, Isopogon buxifolius*, Eremaea sp.* (large star fruit), Scholtzia involucrata*, Phlebocurya ciliata*, Xanthorrhoea preissii, Petrophile linearis, Hibbertia subvaginata, Stirlingia latifolia, Patersonia occidentalis, Conospermum stochaedis, Dryandra sp.
Topography: seasonally wet road verges, low-lying areas and large swamp complexes.

Phytophthora citricola

Number of infected sites: 7
Range: Wongonderrah Road to Woodada Gas Field.
Vegetation types affected: Banksia low woodland, Banksia low woodland over low heath, Xanthorrhoea heath.
Species killed: Banksia attenuata*, B. menziesii*, B. prionotes*, Conospermum stochaedis*, Stirlingia latifolia*, Adenanthos cygnorum, Hibbertia sp., Jacksonia sp*.
Topography: seasonally wet road verges or low lying areas.

Phytophthora drechsleri

Number of infected sites: 3
Range: Mogumber Road to Wongonderrah Road
Vegetation types affected: Banksia low woodland, scattered banksias over sedges.
Species killed: Banksia attenuata*, B. ilicifolia*, Leucopogon conostephioides*.
Topography: seasonally wet road verges or low-lying areas.

Phytophthora megasperma var. sojae

Number of infected sites: 2
Range: Nambung National Park to Erindoon Road
Vegetation types affected: low heath
Species killed: Banksia prionotes*.
Topography: seasonally inundated flood plain

(* pathogen isolated by direct root plating)

Phytophthora nicotianae var parasitica

Number of infected sites: 1
Range: AMC mine site, Eneabba
Vegetation types affected: Banksia heath
Species killed: Banksia hookerana, B.lanata, Lambertia multiflora
Topography: drainage area

Even though we know little about the distribution and potential impact of these species, some consistent patterns have already emerged:

1. Many infections have expressed symptoms beside roads surfaced with gravel, or can be linked to them by gullies and ephemeral swamps. For example, Namming Nature reserve is ringed by infected seasonal swamps that lie alongside major gravelled roads, while none of the large swamps in the centre of the reserve appear to be infected.

2. The initial impact is not as severe as that caused by P. cinnamomi.

   (a) The mortality rate, even in the most susceptible species, is not necessarily high. However, this rate may increase cumulatively after successive winters. For example, at two infections in Wongonderrah Springs and Namming Nature Reserves, the mortality rate in the Banksia attenuata/Banksia menziesii overstorey is now approaching 100%, three years after disease symptoms were first noticed.

   (b) The host range currently seems to be smaller than that anticipated for P. cinnamomi, even though it includes the same spectrum of families: Proteaceae, Epacridaceae, Myrtaceae, Dilleniaceae and Papilionaceae.

3. Surface water or seasonally wet conditions have been a factor common to all sites. Free water promotes both the rapid dispersal of zoospores and the synchronised infection of many roots on each plant. These conditions occur infrequently yet cause explosive disease expression and spread. Waterlogged plants are predisposed to infection as their stressed and weakened roots leak ions and amino acids into the soil and so attract fungal zoospores.

Management Implications

The five Phytophthora species found in the Moora District may have established because they have different strategies and requirements for infection and survival. For example, three of the five species, including P. megasperma var. megasperma, P. megasperma var. sojae and P. citricola, readily form a thick-walled, desiccation-resistant oospore. In WA, P. cinnamomi does not commonly have this capability. They may also differ in their sensitivity to antagonistic soil microflora, temperature extremes, and the water status and physiology of the host plant.

These species of Phytophthora are capable of causing significant damage to native vegetation, but seem to be restricted to areas that are prone to seasonally wet conditions. To responsibly manage the existing and proposed National Parks and Nature Reserves contained within the Moora District, CALM must assume that all banksia woodlands and heaths are highly susceptible and, unless protected will be severely damaged by disease. It is therefore necessary for CALM to treat all species of Phytophthora with equal respect and to restrict and control activities on CALM lands which are likely to spread the disease.

POLICY FOR DIEBACK PROTECTION

The Department of CALM's Policy on Dieback (1982) includes seven policies dealing with dieback protection which can apply to this District. The aims of the policies are to:-

(a) prevent the introduction of dieback into disease-free areas; and

(b) minimize spread in the areas where the disease already occurs.

These policies are:

1. A system of essential roads and firebreaks which are to be retained will be defined, based wherever possible on existing roads and firebreaks. Other roads and firebreaks will be closed.

2. Construction of new roads and firebreaks will take place only where essential. Where new roads and firebreaks are necessary, they will be located and constructed so as to minimize the risk of disease introduction or the impact of additional spread.

3. Offroad vehicular access on Departmental lands will be prohibited. Offroad access for management purposes (eg, fire control) will also be strictly controlled and will be based on a consideration of hygiene requirements where this is possible.

4. Before any operations are permitted the following factors will be evaluated:

   i. the need for the work proposed;
   ii. hygiene measures required;
   iii. risk of introducing the dieback fungus;
   iv. landform;
   v. vegetation;
   vi. likely impact;
   vii. consequences of impact on land use.

   Evaluation will be based on a Seven Way Test which incorporates the above seven factors. A decision to accept, reject or modify the proposed activity will be made only after the relevant factors have been evaluated, using the Seven Way Test.

5. If a decision to proceed is made, existing hygiene practices, as specified in the Dieback Hygiene Manual, will be used. If necessary, new procedures will be developed.

6. Road and firebreak maintenance will be carried out in accordance with the guidelines given in the Dieback Hygiene Manual and such specific prescriptions as are required in special circumstances.

7. Research will be undertaken, as far as practicable, on dieback spread, control, susceptibility of plant communities and risk of infection.

STRATEGIES FOR DIEBACK PROTECTION

The department will adopt the following strategies for the dieback protection of Nature Reserves and National Parks in the Moora District:

1. Priority areas for protection from dieback will be identified.

2. Dieback protection plans for specific Parks and Reserves will be prepared through interim guidelines for necessary operations.

3. Regular monitoring of disease areas will continue.

4. Community awareness of the disease will be fostered.

5. Dieback mapping will continue.

6. Dieback research will be continued.

7. Staff training will be undertaken and extended to other organisations.

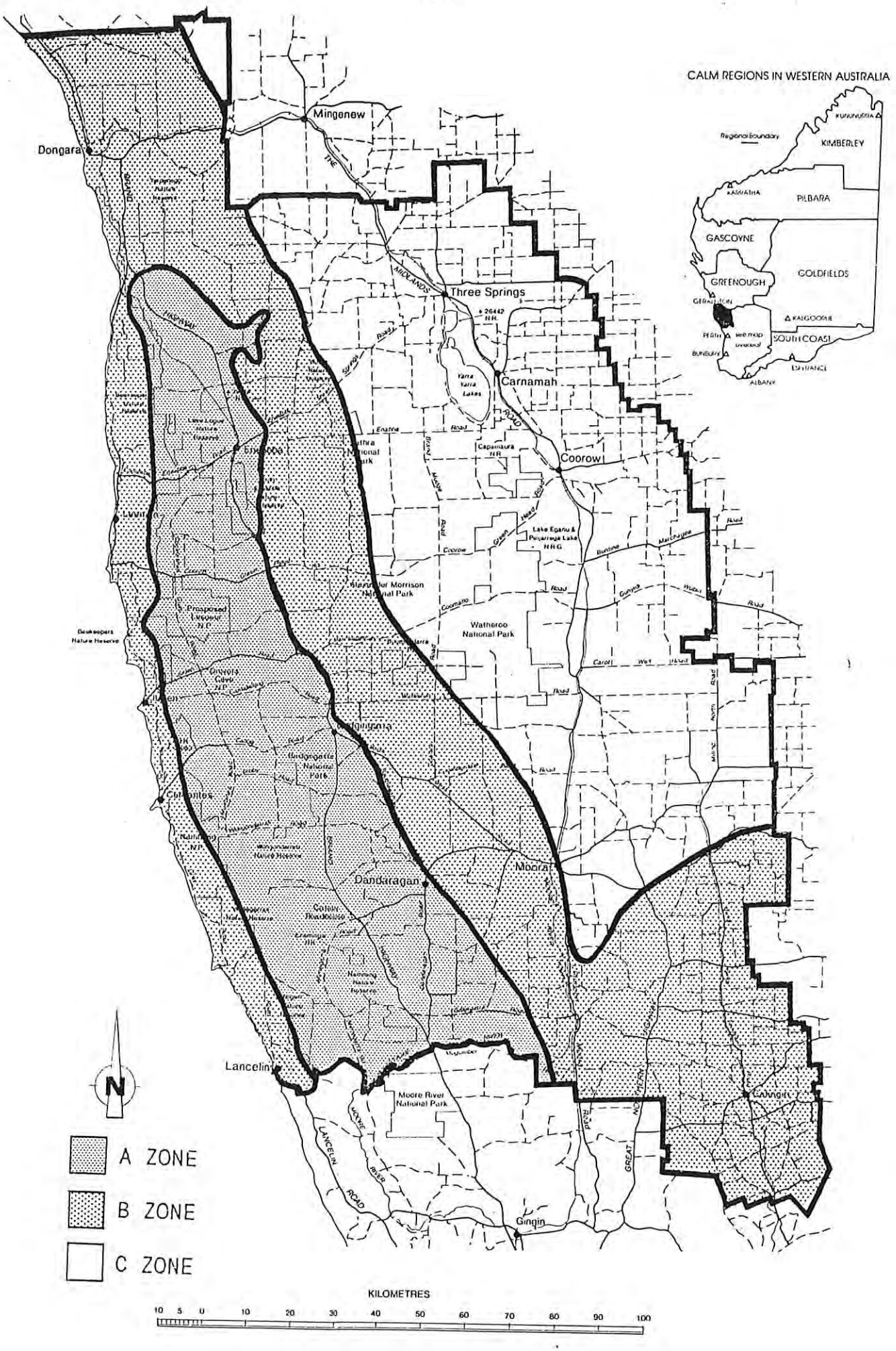

Figure 3. The Moora District divided into three dieback hazard zones.

Each of these points is elaborated upon below:

1. Identification of Priority Areas

Based on our current understanding of the dieback disease, the Moora District has been divided into three dieback hazard zones (Figure 3) using the following criteria.

A Zone - High Rainfall
- Known infections
- High hazard sites
- High public use
- Management capability

B Zone - Lower rainfall
- No known infections
- Moderate/Low hazard sites
- Limited public use
- Minimal management capability

C Zone - Low rainfall
- No known infections
- Low hazard
- Nominal public use
- Nominal management capacity

Ongoing research and investigation into dieback disease may lead to the refinement of the criteria used to define dieback hazard zones.

Effective dieback protection will be applied to all CALM managed lands and lands covered by outstanding recommendations for conservation status. Most energy however will be concentrated on the existing and proposed National Parks and Nature Reserves contained within the A Zone, with highest priority being given to:-

Nambung National Park
Badgingarra National Park
Drovers Cave National Park
Mount Leseuer Area
Hill River Nature Reserve
Namming Nature Reserve
Lake Logue Nature Reserve
Eneminga Nature Reserve
South Eneabba Nature Reserve
Unamed Nature Reserve 39744

These areas have been given highest priority because they:

- contain or are in close proximity to dieback infections.

- contain large numbers of susceptible species, some of which are Declared Rare Flora under the Wildlife Conservation Act.

- have high levels of public use or are adjacent to high use public roads.

- have CALM staff in close proximity to carry out necessary work and implement this protection plan.

Other areas will be elevated to the high priority group if circumstances change.

2. Preparation of Dieback Protection Plans

Interim Guidelines for Necessary Operations are operational plans approved by the Policy Directorate.

These documents include;

- vesting

- an area description;

- environmental and fire protection requirements;

- recreational access and activity;

- current dieback status and proposed management actions to limit the spread and introduction of the disease, including interagency arrangements with other organisations such as Department of Land Administration and Environmental Protection Authority.

In developing these guidelines, recreational access and fire protection need to be considered and integrated with the need for dieback protection. Interim guidelines will be completed for priority areas and then for the remainder of CALM lands.

3. Monitoring

Regular monitoring of known disease areas will continue using the following techniques:

(i) Recording of observations of location and impact by research and field staff to increase knowledge of disease behaviour.

(ii) Aerial photography has been completed for Nambung National Park and Wongonderrah Nature Reserve. If interpretation shows this is a successful technique then follow-up photography will be undertaken to record disease activity over time.

(iii) Maps of disease areas will be updated periodically.

4. Developing Community Awareness

Information will continue to be provided to the community and various groups including apiarists, mining interests, wildflower pickers and local and state government authorities whose activities could influence the introduction or spread of the disease. Close liaison will be maintained with mining companies operating within this district. Access roads will be signposted as required.

5. Dieback Mapping

Dieback mapping will be used for monitoring disease behaviour and planning hygiene and protection strategies. Depending on the purpose of the mapping the following methods will be used:

- ground survey along roads and firebreaks
- broadscale mapping by ground survey
- aerial photography of special areas

6. Research

Research Aims:

(a) Ongoing monitoring of known infected areas will continue with sampling being used to establish a database of susceptible (indicator) species, susceptible vegetation types, cumulative impact and rate of spread.

(b) Investigation of new infections, at the discretion of the district.

(c) Development of control measures to eliminate spot infections.

(d) Development of hazard tables for vegetation types.

(e) Assessment of the effectiveness of aerial photography for interpretation purposes.

(f) Assessment of vegetation for resistance to disease which may be used for rehabilitation of affected sites.

(g) Identification of different impacts of different species of Phytophthora and the management required.

(h) Environmental manipulation to make sites less susceptible.

7. Provision of Training

Departmental staff will continue to be trained in:

(a) disease biology and recognition of dieback affected plants in the field and sampling procedures.

(b) use of the Seven Way Test guidelines and Necessary Operations checklist.

(c) use of the Dieback Hygiene Manual.

(d) general dissemination of information to the public.

(e) hazard mapping.

CALM will also offer appropriate training programmes to other authorities and groups whose activities and operations on natural lands have the potential to introduce and spread dieback.

CONCLUSION

CALM will implement this plan on lands both under its own management and on lands covered by outstanding recommendations for conservation status. The plan will be appropriately applied to the management of dieback disease caused by Phythophthora and any other fungal pathogens which may be either introduced or recognised as a threat to the existing and proposed National Parks and Nature Reserves of the Moora District.

This plan will be widely distributed to other organisations with management interest in this area. A co-operative approach will be necessary if we are to reduce the spread of disease into this botanically rich and beautiful region.

RESULTS ACHIEVED DURING PERIOD 1986 - 1988

- Nambung National Park and Watheroo National Park - Interim Guidelines approved.
- Badgingarra National Park, Alexander Morrison and Tathra National Park - Interim Guidelines in draft form.
- Six Phytophthora species identified as disease agents north of Moore River.
- Ground interpretation of Nambung National Park, Wongonderrah Nature Reserve and Namming Nature Reserve disease areas completed.
- Aerial photography for interpretation completed for Nambung National Park and Wongonderrah Nature Reserve.
- Disease areas in Nambung National Park, Wongonderrah Nature Reserve, Badgingarra N.P., Namming N.R. and Lake Logue N.R. signposted.
- Liaison with mining companies over exploration and proposed mining operation in Cooljarloo Mineral Sands Field, Mt Lesueur and Eneabba.
- Liaison with petroleum exploration companies over seismic surveys in Perth Basin.
- Establishment of wash down facilities in Nambung National Park and Moora.

ACTION PLAN FOR IMPLEMENTATION OF STRATEGIES

STRATEGY	RESPONSIBILITY	PRODUCTS/OUTCOMES	TIME FRAME
1. IDENTIFICATION OF PRIORITY AREAS	DISTRICT		
1a) Broadscale dieback hazard zones	District	. Map of dieback hazard zones in the Moora District.	Completed subject to review
1b) Identification of priority area	District	. List of priority areas.	Completed, subject to amendment.
2. PREPARATION OF PROTECTION PLANS	District with Env. Protection Branch support. Fire Prot & Woodvale Research	. Interim Guidelines for Necessary Operations:	
		- Nambung National Park	Completed
		- Badgingarra National Park	Draft
		- Mt Leseuer Area	1990
		- Hill River Nature Reserve	1991
		- Drovers Cave National Park	1991
		- Eneabba Narture Reserve	1990/91
		- Lake Logue Nature Reserve	1990
		- Reserve 39744	1990/91
		- Eneminga Nature Reserve	1991
		- Namming Nature Reserve	1990/91
3. MONITORING	District & Interpreters	. Indicator species list	Ongoing
		. List of susceptible veg types	Ongoing
		. Data on rates of spread	Ongoing

ACTION PLAN FOR IMPLEMENTATION OF STRATEGIES

STRATEGY	RESPONSIBILITY	PRODUCTS/OUTCOMES	TIME FRAME
4. DEVELOPING COMMUNITY AWARENESS	District supported by Env. Protection, Research and Public Affairs Branch	. Signage	Ongoing
		. Press releases	Ongoing
		. General liaison	Ongoing
		. Mining liaison	Ongoing
		Information:	
		- Beekeepers Notes	Completed
		- Dieback Brochure	1990
		- Wildflower Picker Notes	1990
		- 4 W.D. Clubs	1990
5. DIEBACK MAPPING	District and Interpreters	Specific area maps	Ongoing
6. RESEARCH	District, Env. Protection and Research Branches	. Susceptible Species list	Ongoing
		. Susceptible Veg. types list	Ongoing
		. Rate of spread data	Ongoing
		. Spot Infection control methods	Ongoing
		. Hazard tables	Ongoing
		. Aerial plots interpretation	Ongoing
		. Resistant veg. types for rehabilitation	Ongoing
		. Biology of other Phytopthora's	
		. Impact assessments	Ongoing
7. TRAINING	District & EP	Training programs for	Ongoing
		- staff	
		- industrial groups	
		- others	