HSA
HART, SIMPSON and ASSOCIATES PTY LTD
ENVIRONMENTAL CONSULTANTS
Consultants to Industry and Government

21 Rankin Rd
Shenton Pk,
W.A. 6008
Tel: (09) 382 2086
Fax: (09) 382 1395

ROADSIDE CONSERVATION COMMITTEE

HOW TO IDENTIFY DIEBACK ON ROADSIDES

Prepared by

Hart, Simpson and Associates Pty Ltd

for

Roadside Conservation Committee

July 1990

SUMMARY.

Dieback is a soil-borne fungal disease which is causing serious damage to native vegetation in southern Western Australia. It is spread mainly by human activities which transport infected soil and roots, and controlling this spread is the only practical control available.

Roadsides are particularly susceptible to dieback because they are often disturbed by road works, service corridors and activities on adjacent land.

This report

- gives instructions on how to identify possible dieback infections on roadsides,
- provides information on how to assess the importance of a possible infection, and
- provides a means of recording possible infections.

TO USE THE PROCEDURES DESCRIBED HERE:

1. Read Sections 1, 2 and 3 on why dieback is important and to understand the biology of the fungi.
2. Complete Form 1 using the information supplied in Section 4.
3. If you think dieback is present, complete Form 2 using the information supplied in Section 5.
4. Send the completed forms to

ROADSIDE CONSERVATION COMMITTEE
P.O. BOX 104
COMO 6151

CONTENTS

1. INTRODUCTION.

Dieback due to the root rot fungi of the genus Phytophthora is a serious threat to the conservation of many native plant communities in Western Australia. The fungi kill a wide range of species, and cause severe damage to some vegetation types. By damaging vegetation, they also affect water catchments, recreational and aesthetic values attached to areas of native vegetation, and the fauna.

The dieback fungi live in the soil, and are spread by water or by the movement of infected soil and roots. Infection of new sites is usually due to human activity. There is no practical treatment available, and the only effective management option available is to control the spread of the fungi by human activities.

Roadsides are highly susceptible to dieback infection because they are often disturbed by human activities.

The Roadside Conservation Committee has recognised the importance of dieback in the conservation of roadside vegetation. This report has been prepared as part of its response to the problem.

This report

- provides information on the importance of dieback,
- describes how to identify possible dieback infections on roadsides from damage to the vegetation,
- describes how to assess the significance of these possible dieback infections, and
- provides a means of recording possible infections.

It is necessary to isolate the fungus from samples of soil or plants to prove that a Phytophthora is the cause, and this cannot be done without access to a laboratory. However, there is an urgent need for information on possible dieback infections in road reserves. The procedures described here are designed to be used by interested persons with knowledge of the local flora and vegetation. Some training is necessary to make full use of this package. Contact the Roadside Conservation Committee if you are interested.

2. THE IMPORTANCE OF DIEBACK, AND ITS CONTROL.

The dieback fungi are the cause of plant diseases all over the world, both in native vegetation and in horticultural situations. They are the cause of particularly serious diseases in the native vegetation of southern Western Australia.

At least six species occur in native vegetation in southern Western Australia. Phytophthora cinnamomi is the best known because it attacks Jarrah trees and is causing a significant economic loss ("Jarrah Dieback"). Despite the attention focussed on Jarrah Dieback, the Jarrah is not as severely affected as many other species. Some communities such as Banksia woodlands and some heathlands may be lost because the major species making up the communities are all killed.

The other Phytophthora species appear to be less destructive, but much less is known about them. There is evidence that they occur over a wider area than P. cinnamomi, and at least in some situations they can be very destructive in native vegetation. It must be assumed that all the species of Phytophthora are equally serious.

The dieback fungi are important because the damage appears to be permanent. The fungi are not native and do not show any balance with the local flora. After infection all susceptible hosts may be killed, and plants which germinate in the infected area are killed because spores of the fungi survive for many years. Susceptible species may become locally extinct and the vegetation will be altered permanently. Not all species are affected, and the fraction of susceptible species in the vegetation varies greatly with the type of vegetation and the situation, so that the impact of infection varies from severe to almost nothing.

Dieback is known to occur in native vegetation from Kalbarri in the north to Mt Arid in the south-east, but may well occur outside this area (Figure 1). It is extremely common along the south coast from Augusta to east of Albany, common on the Swan Coastal Plain north to the Moore River, and common in the Jarrah forest. It is uncommon on the coastal plain north of the Moore River. In the Karri forest it has little impact and is rarely seen. At this stage it is not known to extend far inland, and not outside a line through Eneabba, Northam, Katanning and Ravensthorpe.

Dieback has an impact on native fauna by the destruction of habitat, and by the removal of particular plant species which may be essential for the survival of an animal species. For example, Honey-possums may be dependent on one or two species for most of their nectar in one season, and if these species are killed most of the animals will die. Where animal species are completely dependent on one species, such as insects dependent on one host for egg-laying, they will become extinct if the host is lost.

Dieback spores are spread by moving water, by the movement of infected soil or roots, and by the active swimming of spores. Spread in moving water can be rapid and spectacular, but it can only take place once an infection has been introduced. Most new infections are initiated after the movement of infected soil and roots by human activities such as earthmoving, road works, firebreaks, fencing, drilling, rubbish dumping, potted plants, and even mud on boots. The natural spread of the fungi by spores swimming through the soil water is very slow and only effective over short distances. This mechanism allows existing infections to expand, but rarely causes completely new infections. Infections may be spread by animals, but this is not common.

There is no practical treatment for infections in native vegetation. The only effective management action which can be taken is to control the spread of dieback by human activities. Roadsides are very prone to infection because they are so often disturbed by human activities.

In summary, dieback is important to roadsides because:

- Dieback may damage the vegetation and fauna.
- The damage may be permanent.
- Roadsides are particularly prone to infection.
- There is no treatment known for the disease.
- The only practical management option available is to prevent new infections being initiated and to limit the spread of existing infections.

3. THE BIOLOGY OF THE DIEBACK FUNGI.

The dieback fungi are members of the genus Phytophthora. There are about 50 species around the world and all cause plant diseases. None are native to southern Western Australia. The name "Phytophthora" means "plant destroyer", and is very appropriate. The species include P. infestans which caused the Irish Potato Famine, and P. cinnamomi which attacks thousands of species around the world including cycads, gymnosperms, monocotyledons and dicotyledons. Some have a narrow host range, such as P. citrophthora which attacks citrus, while others have a very broad host range, such as P. cinnamomi.

The Phytophthora are soil fungi which attack mainly plant roots. They have a preference for wet conditions and moderately high temperatures, but have proved to be very adaptable. Their fungal body, called a mycelium, consists of microscopic threads which are not able to survive in the open in dry conditions and are never visible on the ground surface. They do not produce toadstools, but being fungi, they are able to produce spores. Three types of spores can be produced:

1. Very small spores (zoospores) which swim towards the roots of new hosts in response to chemicals from the roots. These spores are formed when the soil is wet enough and temperatures are reasonably high, which favours new infections. They are short-lived and fragile but produced in large numbers, and are the mechanism for the spread of the disease from one plant to the next. They can also be carried along in moving water.

2. Larger spores (chlamydospores) which are tough and long-lived within dead roots. They are produced under unfavourable conditions and are the resistant resting phase of the fungus. They may be transported in soil or roots and then cause a new infection when they encounter favourable conditions and germinate.

3. Large spores (oospores) which may be produced sexually. These are the toughest of all and can survive hostile conditions for long periods inside dead roots.

The dieback fungi are primarily disease organisms which require a host, but they survive well in dead roots. It is also likely that they survive in association with some hosts where they do not kill the host, but little is known about this ability in native vegetation. In some cases they appear to have no impact on the host plant.

The ability to survive in dead roots for many years allows the fungi to persist in an area when the hosts have been killed. The fungi are able to attack any new host plants which germinate, until no new hosts occur.

It is not known exactly how the fungi kill their hosts, but they do invade the host roots and kill them. In extreme cases they invade the trunk. Death may be slow if the host is able to resist the infection, but is extremely rapid if the host is highly susceptible. Hosts are known to use various defence mechanisms, but it is not known why species within the same group are so variable in their tolerance to infection. For example, most Banksias are extremely susceptible but some species are not.

The ability of the fungi to attack their hosts may be dependent on the physiological condition of the host and the environmental conditions. Only a day or two is required for the formation of spores, and new hosts can be infected if there are suitable conditions for only a few days.

A good understanding of the biology of the fungi is required for proper application of the procedures for recognising infections and for assessing the importance of any infections.

4. HOW TO TELL IF DIEBACK IS PRESENT.

Dieback cannot be recognised by looking for any visible sign of the fungus itself, and the isolation and identification of the fungi requires laboratory facilities.

Possible dieback infections are recognised by looking for symptoms in the vegetation which could be caused by the fungi. Dieback is only one possible cause of plant damage and deaths, however, dieback can be inferred by looking for plant damage of a particular type.

Four factors are examined to infer the presence of dieback:

1. The species affected.

2. The distribution of the affected individual plants.

3. The drainage, soils and topography.

4. The presence of a vector which may have introduced dieback.

These factors need to be considered in isolation and then together because they are often inter-related. Each of these factors is discussed below in detail, and they are then combined to produce a standard format for examining any one site.

THE SPECIES AFFECTED.

The plant species affected by P. cinnamomi are fairly well known, but less is known about the species affected by the other Phytophthora. At this stage it is assumed that all species affected by P. cinnamomi are also affected by the other species, but additional species may also be affected.

The major groups affected are given in Table 1.

In general the Monocotyledons are not affected except for a few genera, of which the most important locally are Xanthorrhoea and Patersonia.

TABLE 1. PLANT GROUPS OR SPECIES KNOWN TO BE AFFECTED BY DIEBACK.

Severely affected.

The Proteaceae, probably all genera and most species, particularly the Banksia,

The Epacridaceae, probably all genera and most species,

The Papilionaceae, probably all genera and most species,

The Hibbertia,

Moderately affected.

The Myrtaceae, but not all genera and species,

Xanthorrhoea preissii,

Macrozamia riedlei,

Patersonia occidentalis,

Podocarpus drouyniana, and

Some Acacia species.

The Rutaceae may also be a major group affected.

Not all species within these groups are necessarily affected, or show the same impact. The most severely affected group is the Proteaceae, and the Banksia are the most affected. The Epacridaceae and Papilionaceae are the next most severely affected groups. Even within the Banksia there is considerable variation between species. Relatively resistant species include B. littoralis, the prostrate species, and B. telmatiaea. It is premature to state that these species are resistant to all Phytophthora species under all conditions, and any unusual number of deaths should be regarded as suspicious.

The Myrtaceae are less likely to be affected than the Proteaceae, Epacridaceae and Papilionaceae. Many species of the Myrtaceae appear to be resistant, and there is great variation within genera. For example in the Eucalyptus, Jarrah is moderately susceptible but some species appear to be resistant, including Wandoo, Powderbark Wandoo (E. accedens) and Marri. Many genera of the Myrtaceae appear to be relatively resistant, including Melaleuca, Agonis, Astartea and Callistemon, although species have been known to be infected under some conditions.

No grasses are affected, although Phytophthora can grow on the roots of some species in laboratory conditions.

Many exotic species are affected, including avocados, chestnuts, soya beans, lupins, pines and azaleas.

The species affected is a very useful thing to look at, but there are two difficulties:

There is uncertainty about many species because of the difficulty of proving that species are actually infected. There is a large literature on the isolation of Phytophthora from plants under laboratory or nursery conditions, but it is not known if these results are relevant to the field situation, particularly locally.

Plant deaths in native vegetation can be caused by many factors other than dieback. The possible factors include fire, grazing, logging, salt, drought, rising water table, falling water table, drainage, fertilisers, herbicides, frost, physical disturbance, old age, flooding, insect damage and other diseases.

THE DISTRIBUTION OF AFFECTED INDIVIDUAL PLANTS.

Dieback spreads by water, by human-assisted spread of soil, or by natural spread from host to host. As a result, the plant deaths normally occur in definite patterns related to the spread of the fungus.

The distribution of recently affected plants is normally clumped in lines or groups. Figure 2 shows a range of possibilities. The edge of an infected area is often represented by a "front" where plants are dying or recently dead. This front may be abrupt and obvious or very vague and convoluted.

Dead plants eventually rot away or their remains are removed by fire, and old deaths are often not obvious or useful in first recognising the presence of dieback.

- Lines or groups of deaths are much more likely to be caused by dieback than odd scattered individuals in otherwise healthy vegetation.

In no case can dieback be ruled out solely on the basis of the pattern of the affected individuals. The density of susceptible individuals must be considered as well as the susceptibility of the site and the age of the infection. The extremes are represented by a spectacular concentration of sudden deaths, and only odd dying or unhealthy individuals at wide spacings.

The pattern of deaths can be confused by differences between the species of Phytophthora. P. cinnamomi usually has more obvious fronts because it affects more species and spreads more readily than the others. The other species typically form more diffuse fronts.

- Look for the presence of old deaths.

If new deaths are found and the area behind the apparent front contains the remains of susceptible species no longer present there, then this is strong evidence that dieback is the cause. Natural vegetation patterns are normally stable, and species do not die out from an area. Exceptions are short-lived species, particularly those promoted by fire or other disturbance. This pattern of old deaths is particularly easy to see with Banksia tree species.

- It is difficult to detect dieback where the natural vegetation has been disturbed by some other factor.

The detection of dieback should not be attempted if the vegetation has been burnt recently because too many deaths will be due to the fire.

- Look for the appropriate symptoms.

The recognition of infected individuals can be difficult. Severely affected individuals showing obvious and characteristic symptoms are often killed abruptly and in large numbers. Where species are only mildly affected or the conditions are not suitable for a rapid invasion, the infected individuals may show varying degrees of stress and be scattered rather than concentrated. The stress is usually represented by yellowing and death of leaves leading to thinning of the canopy, but this may be difficult to detect.

Dieback was named "dieback" because the Jarrah dies back from the tips, but many species such as the Banksia drop leaves from the bottom up. In general larger plants show a more gradual decline, but the rate of decline is determined primarily by the susceptibility of the species and the severity of the attack. Under conditions which greatly favour attack by the fungus even relatively resistant species may be killed abruptly. Highly susceptible species may be killed so quickly that the leaves retain a green colour for some time after death.

TOPOGRAPHY, SOILS AND DRAINAGE.

Dieback is most likely to occur where the topography, soils or drainage cause saturated soils or flooding to occur. Figure 3 shows the sites which are most prone to infection:

- On the edges of watercourses, lakes or drainage lines, and in any area prone to flooding,
- On soils with surface or buried impervious layers,
- In drains, and
- Below areas where there is heavy run-off, such as rock outcrops.

The Phytophthora are able to make use of small flooded areas and to complete their life-cycle in a short time. Any site prone to flooding for a short time is prone to infection. For example, two species of Phytophthora have been recovered from River Gums (Eucalyptus camaldulensis) showing dieback in river beds near Alice Springs. The occasional floods are sufficient.

The Phytophthora are not restricted to flooded sites. Provided that there are sufficient highly susceptible hosts present, the fungi are able to invade extremely dry and well-drained sites. For example, on the typical deep and dry sands of the south coast and the Swan Coastal Plain P. cinnamomi infections are severe and common. These infections are worst in the south where rainfall is higher, particularly in spring/summer, but they are still severe at least as far north as Wanneroo.

It is likely that there is no limit to the distribution of these fungi provided that there are susceptible species and favourable conditions due to topography, soils or drainage at some time.

THE PRESENCE OF A VECTOR.

The presence of a vector which could have introduced dieback can help in assessing the probability that dieback is present. There is a strong correlation between dieback and the vectors of water and human activities. Likely vectors are:

- Flowing water,
- Road works, particularly where soil or other materials have been brought to the site,
- Use of tractors and earthmoving machinery for firebreaks, operation of quarries or borrow pits, fencing, timber getting, land clearing, drainage or other activities,
- Drilling for water,
- Use of vehicles on unsealed roads or tracks where the vehicles may pick up soil from creek crossings or other wet spots,
- Off-road vehicles,
- Dumping of rubbish,
- Mineral exploration involving drilling or the use of machinery such as backhoes,
- Intensive use of an area by domestic stock, and
- Heavy foot or animal traffic, particularly in areas where soils are sticky.

Other vectors are possible, and any activity which could transfer soil is a potential vector.

The assessment of vectors must be related to the time since infection. Dieback has been present in Western Australia for at least 70 years, and the vector which introduced the disease to a site may not be apparent. The presence of a vector such as recent earthmoving is most useful when the infection is new.

The lack of an obvious vector is only weak evidence that dieback is not present.

COMBINING ALL THE FACTORS TO MAKE A DECISION

The factors discussed allow a decision on the probability that dieback is present at a site.

A standard format for considering each factor is given in Form 1. Form 1 asks a series of questions which can be assessed to provide a final conclusion.

Sometimes the conclusion is obvious and reliable, but sometimes the evidence will be ambiguous. In some cases no conclusion will be possible, and the site cannot be assessed for the presence of dieback by using the procedure described here.

Accurate use of Form 1 requires local knowledge of the vegetation and training is required to make proper use of the procedures described here. The routine and accurate identification of dieback is a specialised field requiring considerable training and experience, and a final assessment that dieback due to a Phytophthora is present can only be made after isolation of the fungus in the laboratory.

Form 1 should be used even where it is difficult to come to a decision because there is still a lot to be learnt about the extent and impact of dieback in different areas. This information is needed to develop comprehensive and effective management programmes.

5. WHAT TO DO IF DIEBACK IS THOUGHT TO BE PRESENT.

The isolation and identification of the dieback fungi is a difficult and expensive step, and it is essential that only important sites are tested. Possible sites have to be given a priority rating for follow-up testing.

This priority can be assessed by using Form 2. The factors considered are:

1. The size and age of the infection,
2. The severity of damage to the vegetation,
3. The chance that the infection will be spread,
4. Whether important conservation features are at risk,
5. Whether road works or other actions are planned, and
6. The known distribution of dieback in the area.

The use of some of the items in Form 2 is described here:

THE EXTENT OF AN INFECTION.

This is mapped as the maximum extent of plant deaths. All areas between plant deaths should be regarded as infected unless sufficient healthy susceptible plants prove otherwise, and a buffer should be allowed around the area of deaths to allow for plants which are infected but not showing signs of the disease. This buffer will vary from almost nothing in vegetation with a high density of susceptible species to 20m or more where the impact is poorly expressed. Areas downslope and downstream from apparent infections should be regarded as infected unless it is clear from healthy plants that they are not infected.

THE AGE OF AN INFECTION.

Where it is possible to see the origin of an infection, it can be assumed that the infection spreads uphill or along the ground without the assistance of flowing water at one metre per year. The presence of old dead plants, such as tree stumps where there are no longer trees, may be useful because this shows that the disease has been present long enough for the trees to have died and rotted away or been burnt out completely.

THE SEVERITY OF THE DAMAGE.

This is measured by the number of species affected and the density of affected individuals. In extremely susceptible vegetation on the south coast as many as 90% of all individuals may be killed, while in low impact situations there may be only odd individuals of one species. Often it is not known which species are susceptible, and sometimes all susceptible individuals may have been removed.

THE CHANCE THAT THE INFECTION WILL BE SPREAD.

The presence of vectors, the topography and the susceptibility of the adjacent vegetation determine the chance that an infection will be spread.

PRESENCE OF VALUABLE CONSERVATION FEATURES.

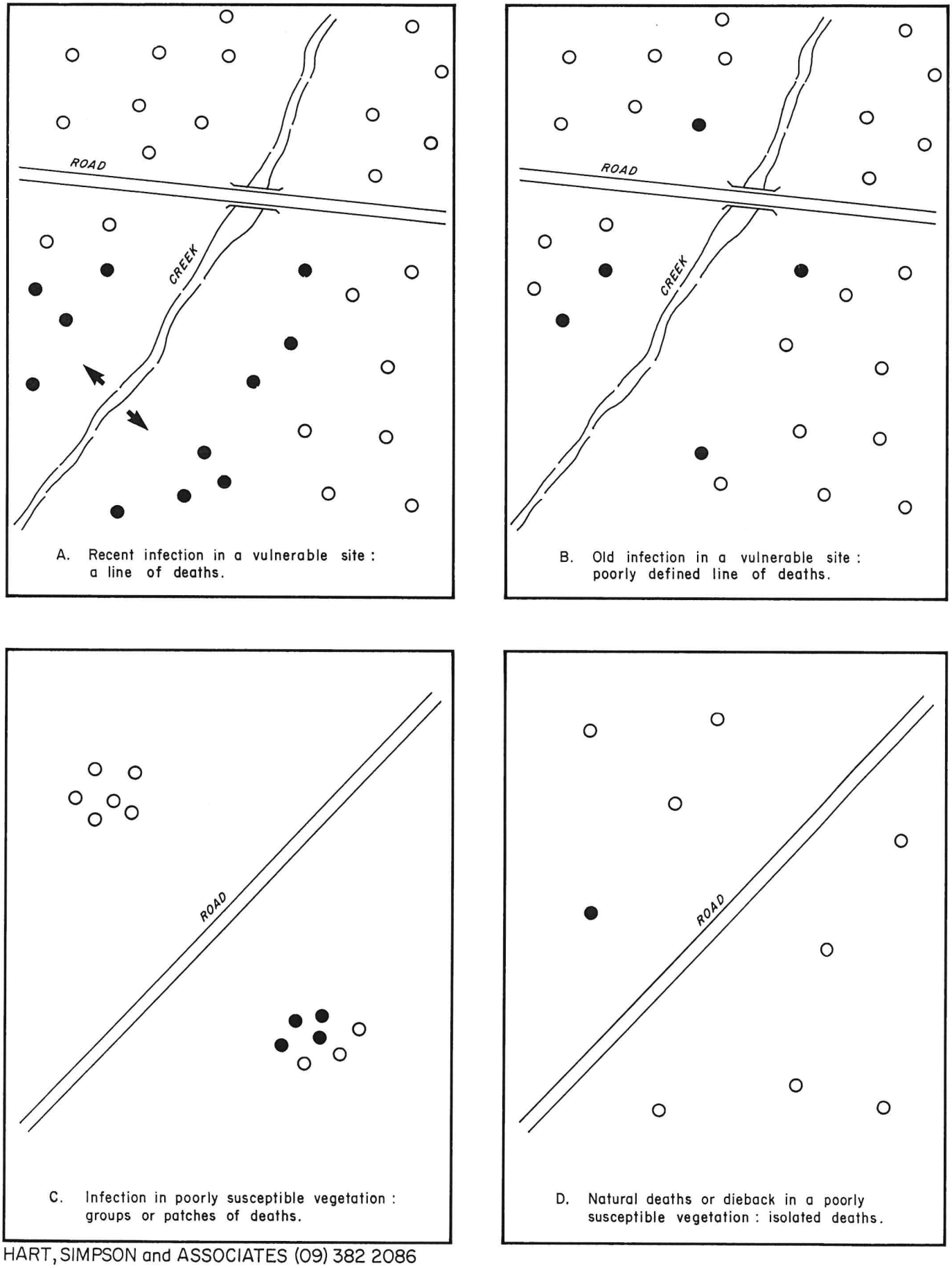
Local knowledge is required or information must be obtained from sources such as CALM or the Local Authority. The value attached to a site may derive from regional values such as the presence of Declared Rare Flora, or from local values such as a vegetation type which is rare locally.

WORKS PLANNED FOR THE SITE.

Road or other works planned for the site may determine the priority for receiving further attention. A possible infection in a sensitive area where road works are planned is more likely to receive action than a definite infection in an area where no works are planned. Discuss this with the Local Authority.

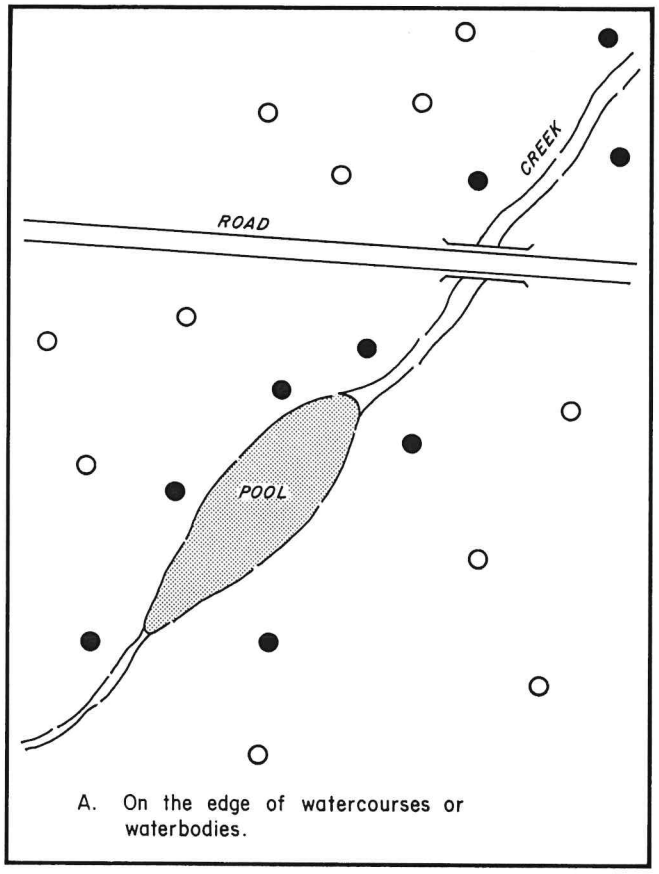
HART, SIMPSON and ASSOCIATES (09) 382 2086

FIGURE 1. KNOWN RANGE OF DIEBACK.

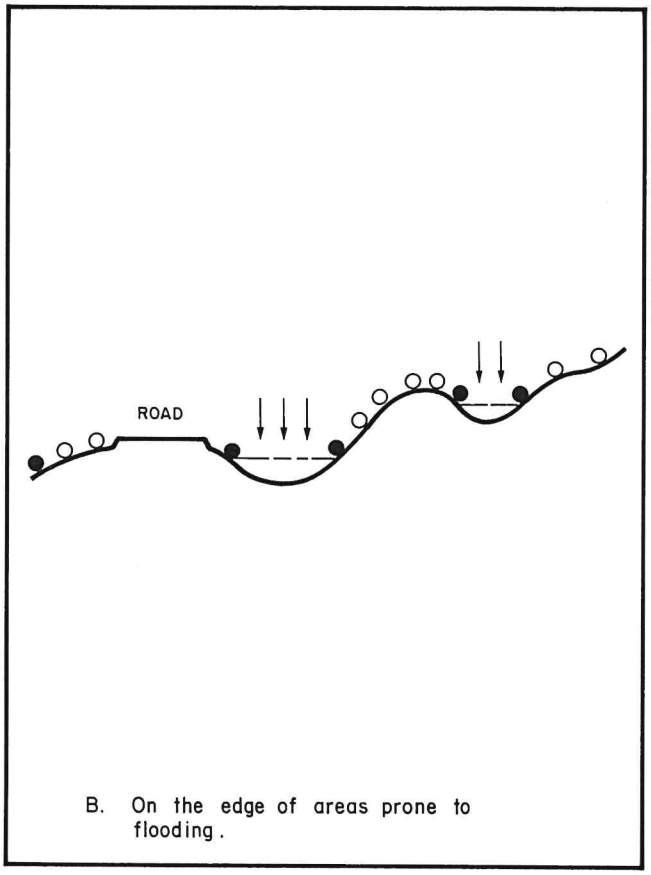


HART, SIMPSON and ASSOCIATES (09) 382 2086

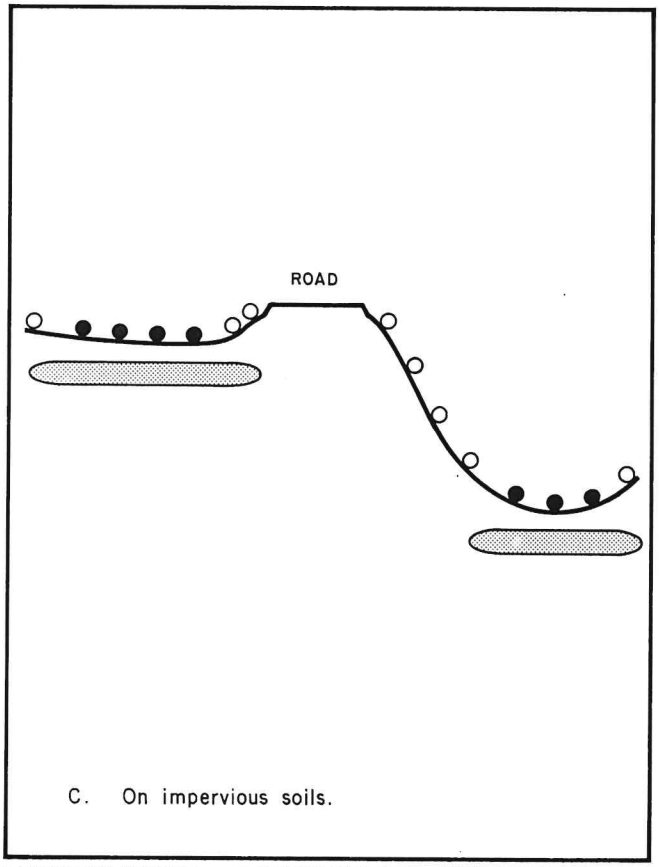
FIGURE 2. POSSIBLE PATTERNS OF DIEBACK IMPACT
Susceptible species : alive (O), dead (●).



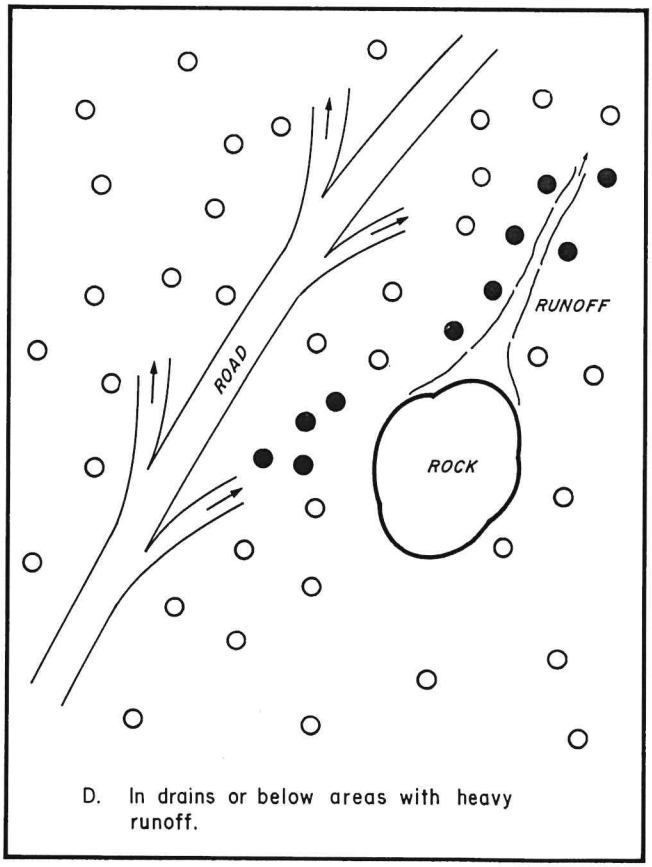
A. On the edge of watercourses or waterbodies.



B. On the edge of areas prone to flooding.



C. On impervious soils.



D. In drains or below areas with heavy runoff.

HART, SIMPSON and ASSOCIATES (09) 382 2086

FIGURE 3. SITES MOST PRONE TO DIEBACK INFECTION
Susceptible species : alive (O), dead (●).

ROADSIDE CONSERVATION COMMITTEE

FORM 1. IDENTIFICATION OF POSSIBLE DIEBACK.

Why is this site being examined?

Dieback suspected ☐ formal survey ☐ FORM 1 No ☐

Observer _____ Date _____

1. Location.

Name of road _____ SLK _____

Length of road described here _____ Side of road ____

Nearest named point _____ SLK _____

Distance from that point _____ Direction _____

2. Susceptible species, symptoms and numbers.

Species affected and symptoms	1	2-10	Many	%

Susceptible species not affected	1	2-10	Many	%

Do the species affected imply that dieback is present?

Yes ☐ No ☐ Uncertain ☐

Describe the vegetation:

(continued)

3. Pattern of affected individuals.

Is the pattern of affected individuals in?

Lines ☐ Patches/Groups ☐ Isolated ☐

	Yes	No
Have individuals been killed suddenly?		
Are individuals unhealthy but still alive?		
Are the affected individuals separated by healthy ones?		
Are old deaths present?		

Does the pattern imply that dieback is present?

Yes ☐ No ☐ Uncertain ☐

4. Topography, soils and drainage.

Describe the site:

Are any of the following present?

Watercourses	
Lakes/swamps	
Rock outcrops	
Areas prone to flooding	
Soils with impervious layers	
Drains	
Excessive water due to run-off	

Is there a feature of the topography, soils or drainage which would promote dieback infection?:

Yes ☐ No ☐ Uncertain ☐

(continued)

5. Vector.

Describe the land use and degree of disturbance on the roadside and adjacent:

Are the following possible vectors present?

Water flowing onto the site ☐

Use of tractors or earthmoving machinery ☐

Heavy use by stock or people ☐

Road works ☐ Imported soils ☐

Drilling ☐ Off-road vehicles ☐

Vehicles in wet spots ☐ Rubbish dumping ☐

Mineral exploration ☐

Other (specify):

Is there an obvious vector present?

Yes ☐ No ☐ Uncertain ☐

6. Other causes. What else could have caused the plant damage?

7. Conclusion.

Do you think dieback is present?

Yes ☐ No ☐ Uncertain ☐

The evidence is

Strong ☐ Moderate ☐ Uncertain ☐

Has Form 2 been completed? Yes ☐ No ☐

(End of Form 1.)

ROADSIDE CONSERVATION COMMITTEE

FORM 2. IMPORTANCE OF A POSSIBLE DIEBACK INFECTION.

To be completed if dieback is thought to be present, and then attached to the Form 1.

Form 2 No. ☐

Observer _____ Date _____

Form 1 completed? Yes ☐ No ☐ Form 1 No. ☐

1. Location. (This should be identical to Form 1.)

Name of road _____ SLK _____

Length of road described here _____ Side of road ____

Nearest named point _____ SLK _____

Distance from that point _____ Direction _____

2. How extensive is the apparent infection (metres or hectares)?

(Attach a sketch map if possible.)

3. Age of the infection.

1-2 years ☐ 2-10 years ☐

More than 10 years ☐ Impossible to say ☐

What evidence is there?

4. The severity of the damage.

Severe ☐ Moderate ☐ Low ☐ minor ☐

(continued)

5. The chance the infection will be spread.

Is the infection likely to be spread by

Water ☐

Machinery ☐

Natural only ☐

Other (specify):

6. Conservation features at risk.

Are the following at risk if dieback is present?

Declared Rare Flora ☐ Conservation reserves ☐

Other species of interest ☐

Rare or restricted vegetation ☐

Valuable roadside vegetation ☐

Valuable adjacent vegetation ☐

Site of local interest ☐

Other (specify):

7. Quality of the roadside vegetation.

How wide is the roadside vegetation?

The general quality is:

Excellent ☐ Moderate ☐ Fair ☐ Bad ☐

(continued)

8. Adjacent natural vegetation not in the road reserve.

Is adjacent natural vegetation present? Yes ☐ No ☐

Who owns it?

Describe the adjacent vegetation:

How extensive is the adjacent vegetation (metres or hectares)

The general condition of the adjacent vegetation is:

Excellent ☐ Moderate ☐ Fair ☐ Bad ☐

9. Roadworks or other actions are planned for the site.

What works are planned for the site?

What is the chance that they would spread dieback without proper management?

High ☐ Moderate ☐ Low ☐ Uncertain ☐

10. Dieback at other sites in the general area.

Is dieback known or suspected nearby? Where?

(End of Form 2.)