CONSULTANTS REPORT ON

PHYTOPHTHORA CINNAMOMI

IN THE AREA OP

GEOPEKO EXPLORATION ACTIVITIES

NEAR BIRCH'S INLET AND ELLIOTT BAY, S.W. TASMANIA

BY

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SUMMARY

1. *Phytophthora cinnamomi*, a microscopic fungus, is capable of destroying a large part of the native vegetation in that part of S.W. Tasmania to the west of the mountain arc through the Ironbound, Arthur, Frankland, Wilmot and Prince of Wales Ranges.

2. The fungus is already established at a number of points through the south west and is increasing its distribution. This increase is by natural extension of existing infection centres and by the establishment of new centres where infested soil is moved by a variety of agencies chiefly heavy machinery, but almost certainly also by bushwalkers and native fauna e.g. wombats and sulphur crested cockatoos. In its licence areas, Geopeko is now an important factor in this spread. Much of the core infection almost certainly predates Geopeko activity.

3. Despite the widespread occurrence of *P. cinnamomi* there are large areas apparently still virtually free of infection e.g. the lower Olga, Maxwell, lower Denison and Percy Catchments. There are also significant disease free enclaves within areas of high infection levels.

4. On the basis of existing knowledge of the distribution of *P. cinnamomi* the area can be divided into two zones. The first a geographically central zone, which is the main area of current activity by Geopeko, can be considered to be now virtually unprotectable and sensibly requiring no restrictions upon movement of men or materials. The second zone is a composite of areas to the north west and east which for the present should be considered to be

virtually free of infection. Survey, at least at a reconnaissance level, should be conducted prior to entry to these areas. The boundaries of the zones are defined in the text.

5. Requirements for quarantine or hygiene in either of the zones (for the purpose of protecting largely uninfected areas in Zone 2 or significant enclaves within the badly affected Zone 1) may prove difficult. The precise boundaries of areas to be protected would need to be defined and sites where the practical requirements for the cleaning of equipment can be met would need to be identified.

6. Geopeko's environmentally responsible practise of washing down machinery at Birch's Inlet before its entry to the south west is known not to be contributing significantly to the control of *P. cinnamomi*. However, there is merit in continuing this practice as a measure of protection against the risk that other unspecified diseases might also be introduced.

BASIS OF CONSULTANCY

At the outset of this consultancy, it was agreed verbally:

A. Between responsibe officers of Geopeko Exploration and the Tasmanian National Parks and Wildlife (N.P.W.S.) that:

1. The consultant, Dr. F.D. Podger, B.Sc.(For.) W.A.; Dip. For. (Canb.); M.Sc.(For.) (Melb.); Ph.D. (Auckland), was competent to conduct a survey of the distribution of *Phytophthora cinnamomi* and to report and recommend upon measures the Company might take to minimise any associated deleterious effects of their activity.
2. The survey be at reconnaissance level.
3. The survey party include an officer of the N.P.W.S.

B. Between Dr. Podger and Geopeko:

1. That there would be no fees for Dr. Podger's services during the survey which would be conducted during leave of absence from CSIRO.
2. The report emerging from the survey is not to be presented anywhere as having official status with or carrying the endorsement of CSIRO.
3. The scientific content of the report would remain the property of Dr. Podger for the purposes of scientific publication and should not be cited in publication without his prior permission.
4. All costs associated with the survey, including transport, personal accident insurance, accommodation, provisions and production of the report be met by Geopeko.

5. That Geopeko would make available to the N.P.W.S. one of the two copies of the report supplied to them. Dr. Podger would hold two copies, one for the information of CSIRO and one for his own records.

BACKGROUND TO THE PROBLEM

Detection by Isolation

Phytophthora cinnamomi is a microscopic fungus invisible to the unaided eye, and producing no visible structures at sexual reproduction. It can be detected only by isolation into pure culture on agar gels and identified microscopically after manipulation of several kinds.

In the absence of symptoms, it is necessary to trap the fungus by baiting with susceptible plant material e.g. lupin roots or leaves. Since even the largest and most efficient laboratories can examine thoroughly only a hundred or so samples (each ca 500g) in a week, it is rarely possible to state more than that the given level of sampling revealed either the presence or the "apparent absence" of the fungus.

Detection by Symptoms

The surveyor, however, is greatly assisted where the plant communities are highly susceptible and where conditions are known to favour destructive activity by the fungus. The most important conditions are high soil moisture, good aeration, warm soil temperatures and low levels of microbial antagonism in the soil. These conditions generally obtain in the sedgeland and shrublands of the south west lowlands. Symptoms characteristic of *P. cinnamomi* are to be found in a number of native plants (see Plates 1-4).

The absence of symptoms does not automatically establish the absence of the fungus since there is always a lag period between first introduction of the fungus and disease expression. This may be as short as 2 months in summer in low sedgelands or more than a year in taller scrub.

It is also known that *P. cinnamomi* may be present without causing disease among susceptible plants in tall forest. This may be due to the effects of heavy canopy in reducing solar radiation so that soil temperatures do not reach the critical threshold for infection i.e. ca 15°C for some hours.

Detection - in Summary

The detection of *P. cinnamomi* in tall closed vegetation is time-consuming and difficult. Its detection in lowland (below 400 m) sedgland heath and scrub is relatively simple; an experienced observer can obtain a good general picture of the broad distribution of *P. cinnamomi* from low flying aircraft or on foot, in a relatively short time. He can also be reasonably confident (without being certain) that large areas of sedgeland and scrub are free of infection.

Proof that P. cinnamomi is the Problem

There is a very substantial body of experimental proof both in field and glasshouse studies that the effects shown in Plates 1-6 are directly due to *P. cinnamomi*. This work is currently being prepared for publication as official CSIRO - N.P.W.S. collaborative work by Drs. Podger and Brown.

Vectors

The most notable feature of the south west environment is the very high probability that new introductions will survive. Dessication is the worst enemy of *Phytophthora* and that is rare in the south west sedgelands. Miniscule amounts of soil will carry *Phytophthora*. The risk is of course greatest with heavy machinery, but anything which moves soil is a potential vector. There is good reason to believe, but

yet no experimental proof, that native animals and birds are likely vectors, particularly burrowers such as wombats and ground feeders such as sulphur-crested cockatoos. In this context, the ultimate contamination of the whole island would seem to be inevitable.

Values at Stake

Given that one accepts the argument that delaying the inevitable has value there is a case for endeavouring to slow the spread of *P. cinnamomi*.

P. cinnamomi damages a great part of the flora so that a floristic impact is obvious. Many of these plants are at the base of food chains, e.g. root feeding yabbies which are the food base for a complex predator chain. Another case of particular interest is the dependence of the orange bellied parrot on *Phytophthora* susceptible *Boronia* species during a critical phase of the breeding season.

Undisturbed temperate rainforests appear not to be vulnerable because of the effects of dense canopy in depressing soil temperature below critical levels for infection. However, the spread of *P. cinnamomi* presents a potential threat to regeneration of rainforest following wildfire. Soils are then warm enough and very wet and many rainforest species are highly susceptible (see Plates 5-6).

METHOD OF SURVEY

Dr. Podger and Mr. J. Bayley-Stark, an officer of N.P.W.S. carried out the survey in the week 23-28 February, 1983 from the base camp on Sassy Creek south of Wart Hill.

The survey may be considered as having occurred in 4 stages:

1. Helicopter transect Mt. Discovery to Table Top.
2. Preliminary ground inspections Wart Hill.
3. Selected transects between forest and heath.
4. Bombardier travel Wart Hill Camp to Conder River.

Helicopter Transect 23/2/83

From Queenstown airport, a routine supply run by chartered helicopter was modified to take a low elevation passage over heathlands north of McQuarie Harbour, along the eastern shore of Birchs Inlet to the hut on the southern shore of Birchs Inlet, then eastwards to the middle slopes of Mt. Discovery, along the western flank of the D'Aguilar Range and up its eastern flank toward Mt. Lee. The path was then southward following tracks to the east of Thirkell Hill, westward to the landing strip at Moores Valley and southward to Table Top before landing at Wart Hill Camp. Landings to take soil samples were made at seven points as shown on the map (Figure 2).

Preliminary Ground Inspections - Wart Hill 24/2/83

Ground inspections were made between Wart Hill Camp and Wart Hill in company with Mr. John Pemberton of Geopeko who explained the pattern and methods of exploration.

As it was very soon evident from stages 1-2 that *P. cinnamomi* was extensively distributed over much of the area where machinery had

traversed it was determined that the survey should concentrate on the position in areas where tracks had been cut for geological sampling by parties on foot.

Selected Transects between Forest and Heath 24-26/2/83

The transects of variable length were selected to cover a range of types from rainforest through woodland and scrub to sedgeland heath.

They were:

1.	Near N 13500 E 9700	250 metres	7 samples.
2.	Near N 13600 E 9325	350 metres	5 samples.
3.	Near N 13000 E 9325	200 metres	5 samples.
4.	Near N 13100 E 9400	150 metres	4 samples.
5.	Near N 13400 E 10650	275 metres	5 samples.
6.	Near N 13300 E 10360	150 metres	4 samples.
7.	Near N 15250 east edge forest, Moores track,		4 samples.

Bombardier Traverse 27/2/83

Samples in diseased and healthy communities were taken along the track between Wart Hill and Conder River. All samples were processed by standard methods at Hobart.

RESULTS

The broad picture of the results of this survey are illustrated in Plates 1-4 and Figure 1 which is a composite of the results of the present survey and of separate surveys for HEC and N.P.W.S.

There are large areas of heathland which are probably free of infection. These are notably the eastern shores of Birchs Inlet, the northern end of the D'Aguilar Range, the catchments of the Percy, Maxwell, Denison and Lower Olga Rivers and on Point Hibbs.

There is very extensive patchy infection associated with tracks and bulldozer activity in the southern and eastern D'Aguilar Range, Thirkell Hill, Moores Valley, Wanderer River, Wart Hill and on to the coast at Copper Creek.

The position in the upper Wanderer and Giblin Rivers is unknown.

Areas of dead and dying shrubland (Plate 2-4) sampled were found always to be infected. No *P. cinnamomi* was recovered from samples taken from vegetation free of typical symptoms (e.g. Plate 1).

The fungus was recovered at elevations around 400 m in both this and the HEC surveys. It is known to damage sedgeland heath at 600 m elevation in the north west of Tasmania.

It is not possible to determine when or how *P. cinnamomi* entered the area, but the evidence of patterns of distribution and stage of deterioration of the affected communities suggesting continuing local redistribution from sources established prior to Geopeko and probably as early as the B.H.P. and Union Oil exploration in the region.

The evidence is very strong that the fungus is introduced and that it is the cause of the problems. The prospects for conservation are bleak.

RECOMMENDATIONS

Until such time as more definitive surveys are available it should be recognised by the respective parties responsible for mineral exploration and environmental protection.

That two distinct situations obtain in the region and that they can be reasonably distinguished geographically

i.e. A - there is a severely infected core area in which general hygiene is no longer warranted or practicable.

and B - there are areas believed to be largely free of infection which may benefit from hygiene procedures.

The core area may be defined as being inside lines drawn north eastward from the mouth of the Wanderer River to the southern shores of Birchs Inlet, thence eastward through Mt. Discovery to Sir John Falls on the Gordon River, thence southward along the Badger Ridge through Table Top to the north east corner of Elliott Bay.

It is also possible that enclaves of particular environmental values might be amenable to protection provided that suitable strategic points are available for cleaning of machinery. These might include for example heathlands along the coast and areas such as the Edwardian River.

Decisions of this kind would require more detailed local investigation.

As a general rule it would be advantageous to minimise as far as possible, recreational touring by exploration staff and others on motorised transport.

The present practice of washing down machinery before departure southward from Birchs Inlet has only small value for environmental protection from *P. cinnamomi*, but its continuation would represent a positive and environmentally responsible action against the risk that other pathogens, which cannot be specified, might otherwise be introduced.

ACKNOWLEDGEMENTS

I am grateful to officers of Geopeko, particularly John Pemberton for friendly hospitality at Wart Hill and for the professional manner in which they have discharged the obligations undertaken by Geopeko.

Jamie Bayley Stark of NPWS made detailed vegetation notes at the sampling sites and cheerfully shared the backpack loads and the heat.

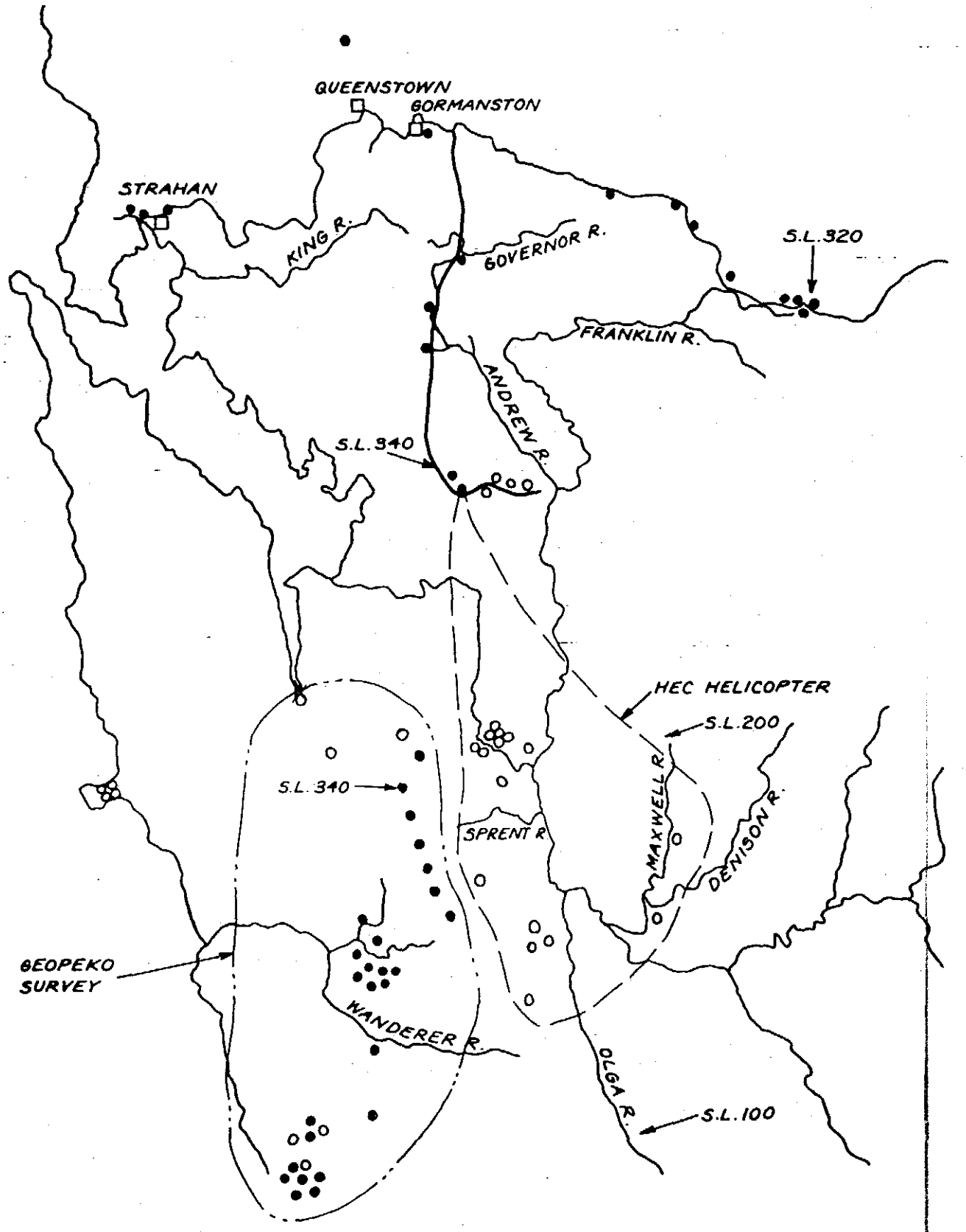
Geoff Tyson, NPWS, provided prints from the photographs he took for me on our return to the area of the HEC survey.

I wish also to record my very clear impression of the genuine concern for the environment of the Geopeko geologists with whom I have dealt in this survey.

FIGURE 1 Location of the Geopeko and related HEC Lower Gordon Surveys. Note the association of *P. cinnamomi* distribution with roading and recent mining exploration activity and its apparent absence from relatively undisturbed areas e.g. Point Hibbs, Sprent, Olga, Maxwell, Denison.

LOCATION PHYTOPHTHORA SURVEYS

——— HEC ROAD
– – – HEC HELICOPTER
—·—·— GEOPEKO
● PHYTOPHTHORA INFESTED
o NO PHYTOPHTHORA



Plates 1-6 were taken from in the HEC survey but are typical of effects to be seen throughout the south west lowlands.

PLATE 1 Healthy shrubland in south west Tasmania typical of sites free from *Phytophthora* infection. The shrubby clumps are healthy *Cenarrhenes nitida, Agastachys odorata* and *Banksia marginata.*

PLATE 2 *Phytophthora* damaged shrubland. The blackened clumps at left midfield and right rear are *Agastachys odorata.* The yellow and brown tones indicate dying and dead *Sprengelia incarnata, Melaleuca squamosa,* etc. Near Mt. Darwin, Crotty Road.

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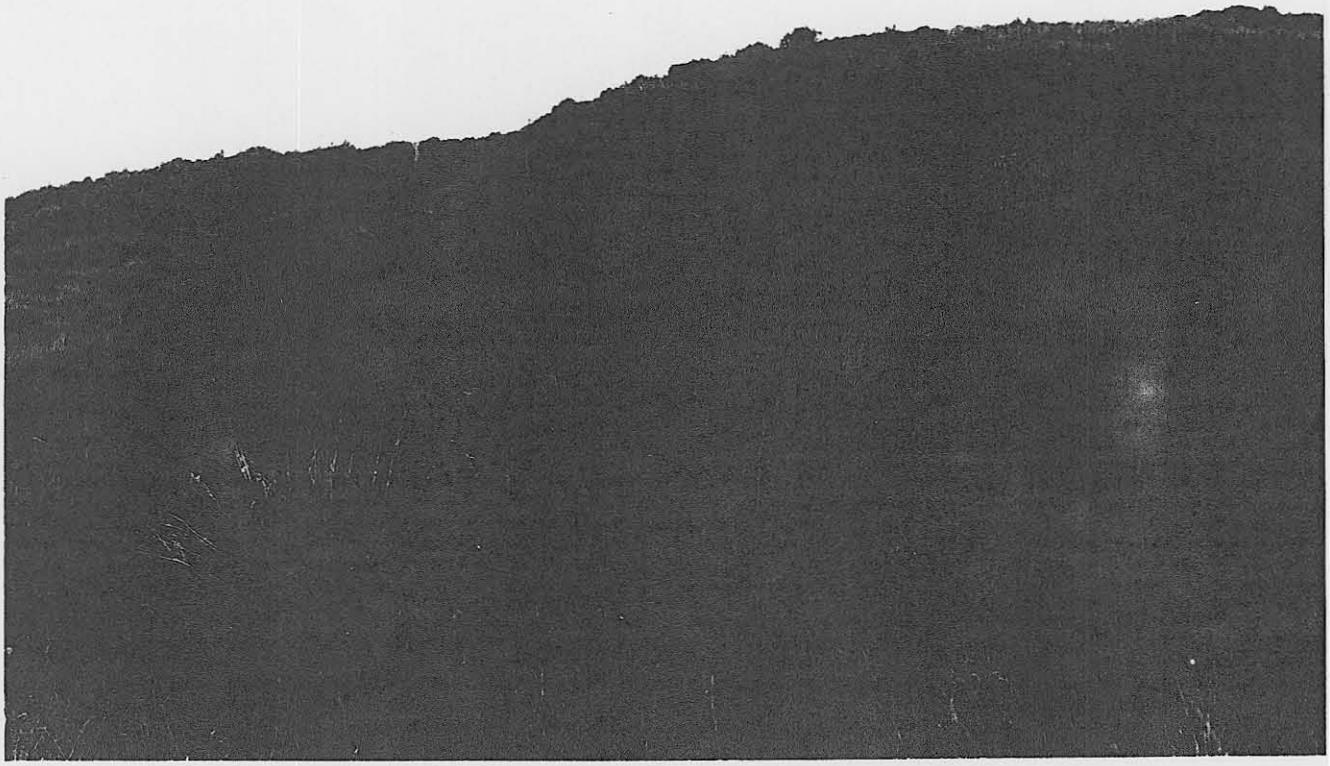

PLATE 3 Mass death of *Sprengelia incarnata* along the road verge of the Lyell Highway at 320 m a.s.l.

PLATE 4 Symptoms of active attack by *Phytophthora cinnamomi* on *Agastachys odorata*, Crotty Road, south west Tasmania.

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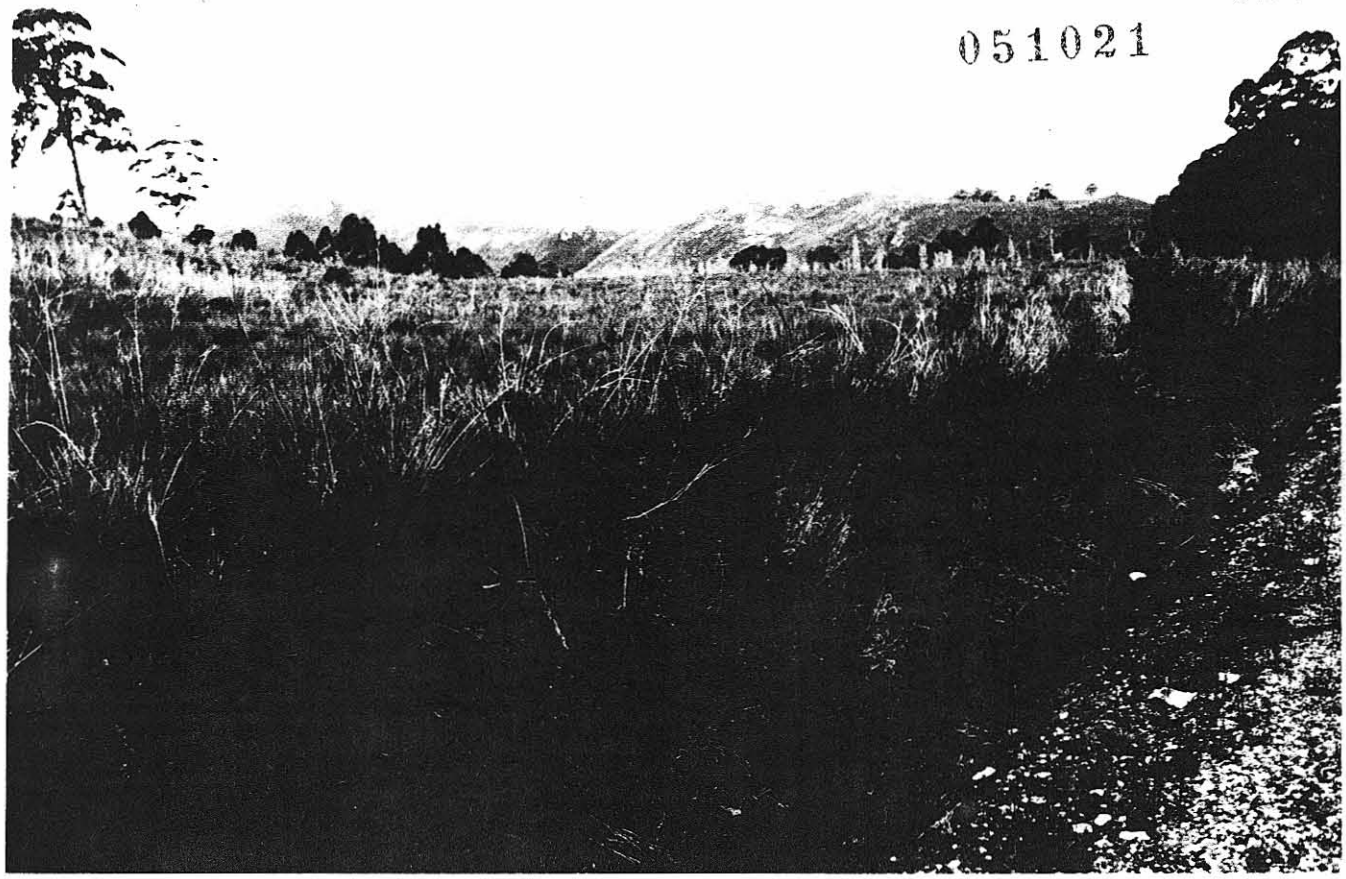

PLATE 5 Deaths among seedling regeneration of rainforest species on a road batter near Mt. McCutcheon, south west Tasmania.

PLATE 6 Close-up of Plate 5 showing deaths of seedling *Richea pandanifolia*, *Gaultheria hispida*, etc.

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