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Consultants Report on

# PHYTOPHTHORA CINNAMOMI IN THE AMOCO AREA OF INTEREST - CAPE SORELL PENINSULA SOUTH-WEST TASMANIA



by

Dr. F.D. Podger B.Sc.(For.) Dip.(For.) M.Sc.(For.) Ph.D.

October 1984

AMG REFERENCE POINTS ADDED

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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.

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, the main area of current activity by Amoco, can be considered to be now virtually unprotectable and sensibly requiring no restrictions upon movement of men or materials. The second zone is an area to the 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.

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. The environmentally responsible practice of washing down machinery before its entry is known not to be contributing significantly to the control of P. cinnamomi in the licence areas. 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 responsible officers of Amoco 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 Amoco:

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 Amoco.

5. That Amoco 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) sedgeland 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 1-4 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 3-4).

METHOD OF SURVEY

Dr. Podger and Mr. Peter Brown an officer of N.P.W.S. accompanied Mr. Phil Jones of Amoco on a reconnaissance by helicopter on 9th March, 1984. The flight path is shown on the attached photocopies of portions of the Cape Sorell, Olga and Spero sheets (Figs. 2a-c). The reconnaissance was directed principally to low elevation, low speed, overflights of sedgeland heaths since recognition of infection is easiest in these communities. The helicopter was landed for collection of soil samples at 10 points also shown on the attached sheets.

At each sampling point a composite of five subsamples of soil was collected from around the base of native plants which exhibited symptoms typical of Phytophthora infection or, in the case of healthy areas, from the bases of plants known to be susceptible to the fungus.

The soil samples were baited with newly germinated radicals of New Zealand Blue lupin and the fungus isolated from these after plating on a selective agar medium (VP agar).

At each of the 10 sampling sites a list of plant species was compiled and those exhibiting symptoms of infection by P. cinnamomi noted.

RESULTS

The plant species list and those species which exhibited symptoms of infection are indicated in table 1. The results are consistent with previous experience in sedgelands elsewhere in the southwest.

Of the 10 sites sampled 6 exhibited symptoms of the fungus and samples from all these yielded P cinnamomi. Five of these were in sedgeland-heath (sites 5-9) and one in regeneration of rainforest species along a road verge (site 10). The fungus was not recovered from any of the three sites in sedgeland-heath which exhibited no symptoms (sites 1 and 4) nor at the Amoco base camp (site 3).

DISCUSSION

The results of this reconnaissance survey should be considered with those of earlier surveys undertaken for the Hydro-Electric Commission and for Geopeko which may be summarised in figure 1.

On the evidence available the region defined by Cape Sorell, Elliott Bay and the Lower Gordon-Olga Catchment can be divided into two areas. The first is the basin of the lower Gordon which may be considered to be apparently free of infection. The second is all the area to the west of and including the D'Aguilar Range and southward to Elliott Bay. Throughout this area there is clear evidence of a scattered mosaic of Phytophthora infestation, concentrated along lines of vehicular access formed during earlier mineral exploration by B.H.P. and Geopeko. Much if not all of this infestation appears to be exotic and of relatively recent origin (perhaps little more than the past two decades). Rates of natural expansion appear to be very rapid especially downhill.

Because of

(i) the possibility of spread by vectors other than heavy machinery e.g. bushwalkers, trail bike riders, helicopters and native fauna

and

(ii) difficulty in locating practicable hygiene control points, there does not appear to exist a sensible basis for attempts at control of further spread of infection at least on a widespread scale.

Despite this there might be merit in considering what measures could be taken to protect certain small areas which, by virtue of their location, topography and freedom from infection, may be less difficult to protect. Among these are, in order of significance:

(i) The heaths of Point Hibbs

(ii) The heaths of an extensive plateau south of the Wanderer River (site 4)

(iii) The small coastal heaths at sites 1 and 2.

If these areas are outside the present areas of interest for Amoco then it may be sufficient to proscribe these areas from recreational access.Should there be a need to operate in their vicinity more detailed assessment of the local distribution of P. cinnamomi would be needed, and a well defined and practicable plan of hygiene developed, if indeed this is practicable.

As a general policy it would be desirable for all parties interested in the area to restrict movement as far as possible, particularly recreational use of trail bikes.

RECOMMENDATIONS

1. A more detailed survey of the distribution of P. cinnamomi around Point Hibbs (and possibly sites 1, 2 and 4 of this survey) should be conducted with a view to develop a plan for its protection from infection. This presumably would be a matter for parties with an interest in the specific locality notably N.P.W.S.

2. Amoco should undertake to

   (i) restrict as far as practicable the movement of vehicles and machinery

   (ii) require that its employees do not make recreational use of the four areas defined here as apparently Phytophthora free and generally minimise trail bike usage.

3. There seems to be little purpose in cleaning of machinery between movements within the generally infected zone.

4. It would be environmentally responsible to clean down machinery both before entry to the area (as a precaution against the introduction of other yet unspecified pathogens) and at the time of removal (as a contribution to the protection of other Phytophthora free areas outside the Southwest). Strahan would be a suitable location for such control.

ACKNOWLEDGEMENTS

I am grateful to officers of Amoco, particularly Phil Jones for friendly hospitality and for the professional manner in which they have discharged the obligations undertaken by Amoco.

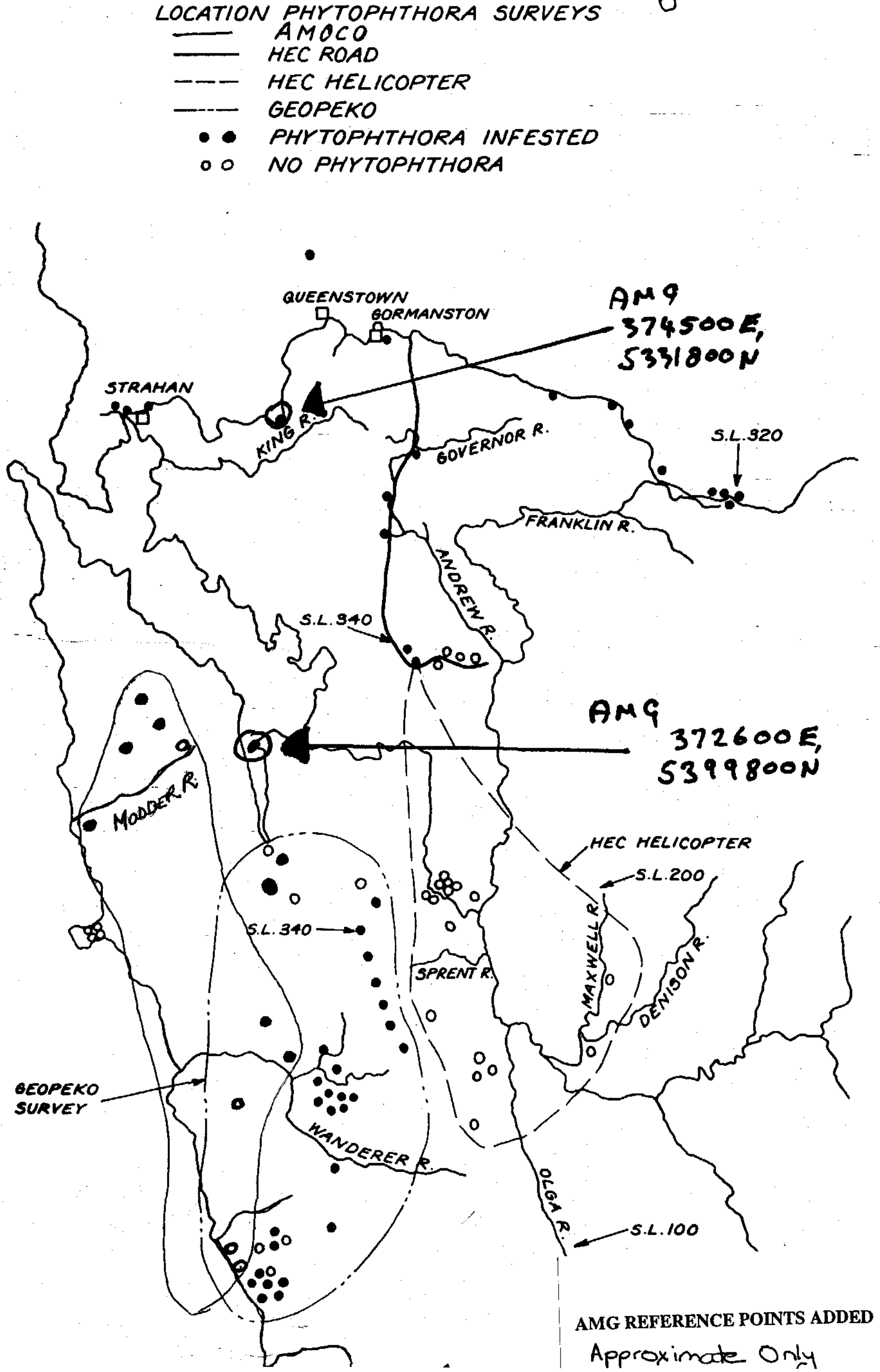
Peter Brown of N.P.W.S. for his assistance.

Geoff Tyson, N.P.W.S. 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 Amoco geologists with whom I have dealt in this survey.

FIGURE 1 Location of the Amoco and earlier Geopeko and HEC 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.

Fig 1.


LOCATION PHYTOPHTHORA SURVEYS
AMOCO
HEC ROAD
HEC HELICOPTER
GEOPEKO
PHYTOPHTHORA INFESTED
NO PHYTOPHTHORA
QUEENSTOWN
GORMANSTON
STRAHAN
KING R.
GOVERNOR R.
S.L. 320
FRANKLIN R.
ANDREW R.
S.L. 340
AMG
374500 E,
5331800 N
AMG
372600 E,
5399800 N
MODDER R.
S.L. 340
HEC HELICOPTER
S.L. 200
MAXWELL R.
DENISON R.
SPRENT R.
GEOPEKO SURVEY
WANDERER R.
OLGA R.
S.L. 100
AMG REFERENCE POINTS ADDED
Approximate Only

Plates 1-4 were taken from 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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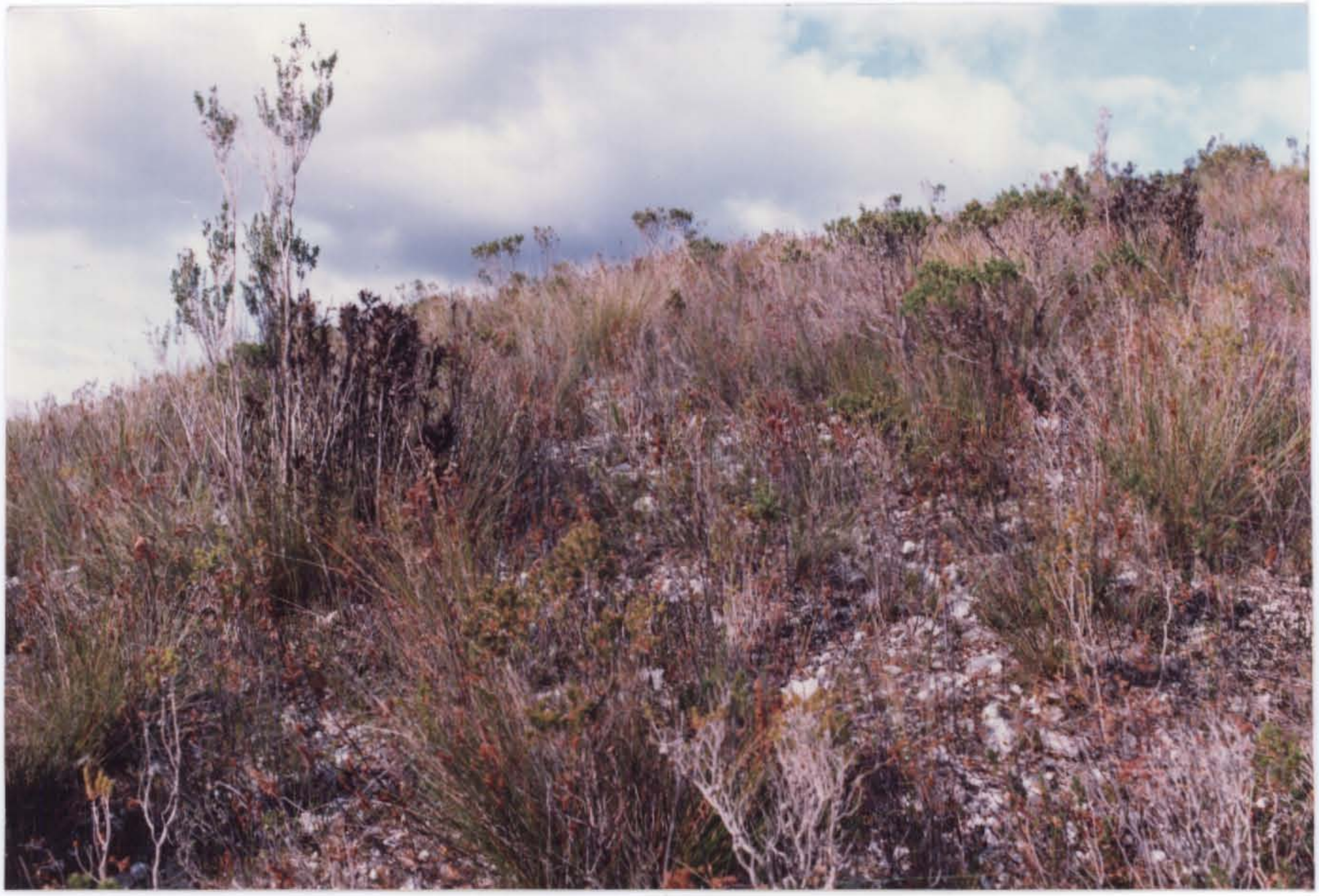

PLATE 3 Deaths among seedling regeneration of rainforest species on a road batter near Mt. McCutcheon, south west Tasmania.

PLATE 4 Close-up of Plate 3 showing deaths of seedling *Richea pandanifolia*, *Gaultheria hispida*, etc.

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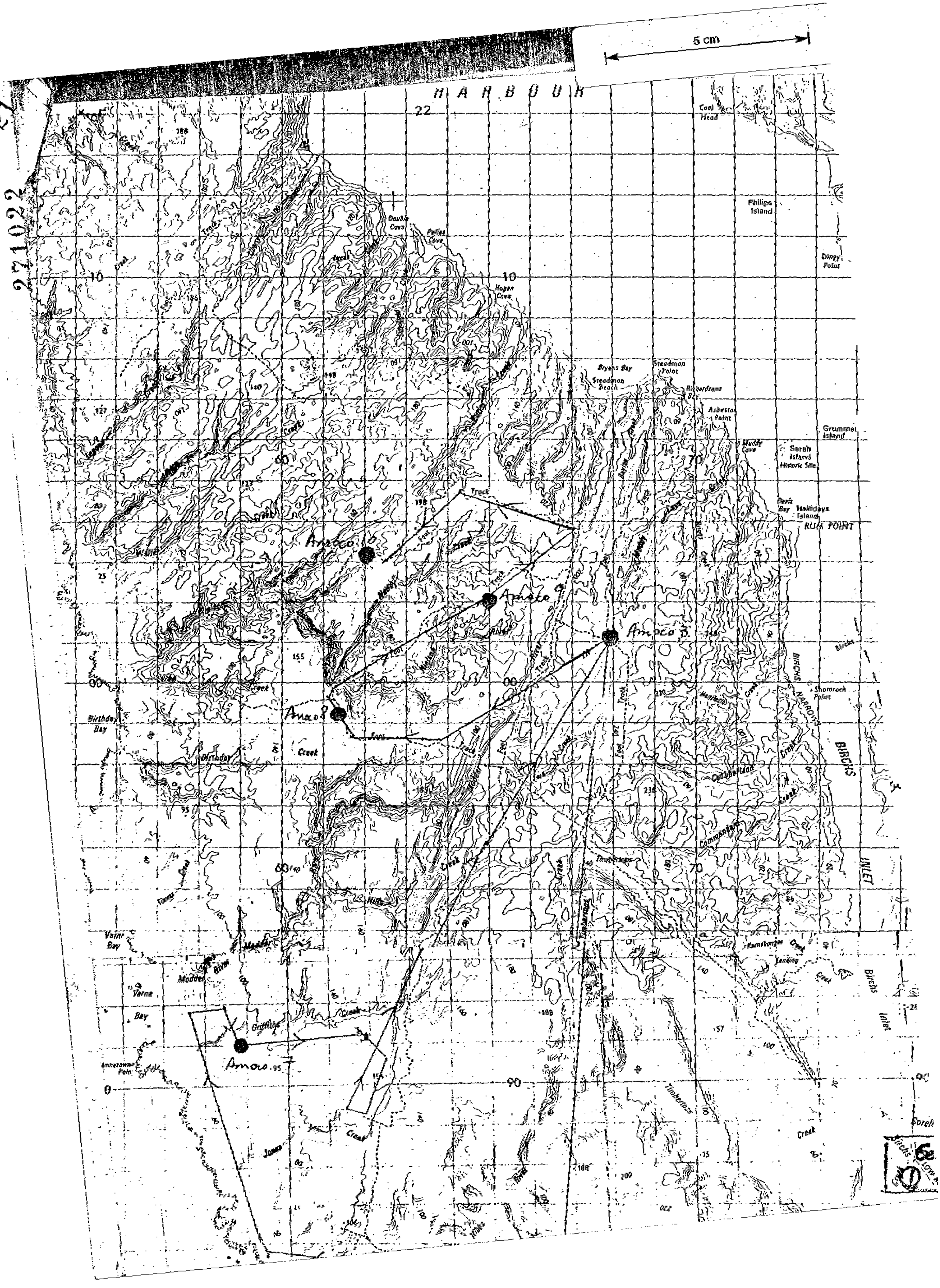
FIGURE 2a-c Location of sample sites in Amoco survey. Localities underlined in red indicate presence of P. cinnamomi. Other localities proved both sympton free and negative for P. cinnamomi.



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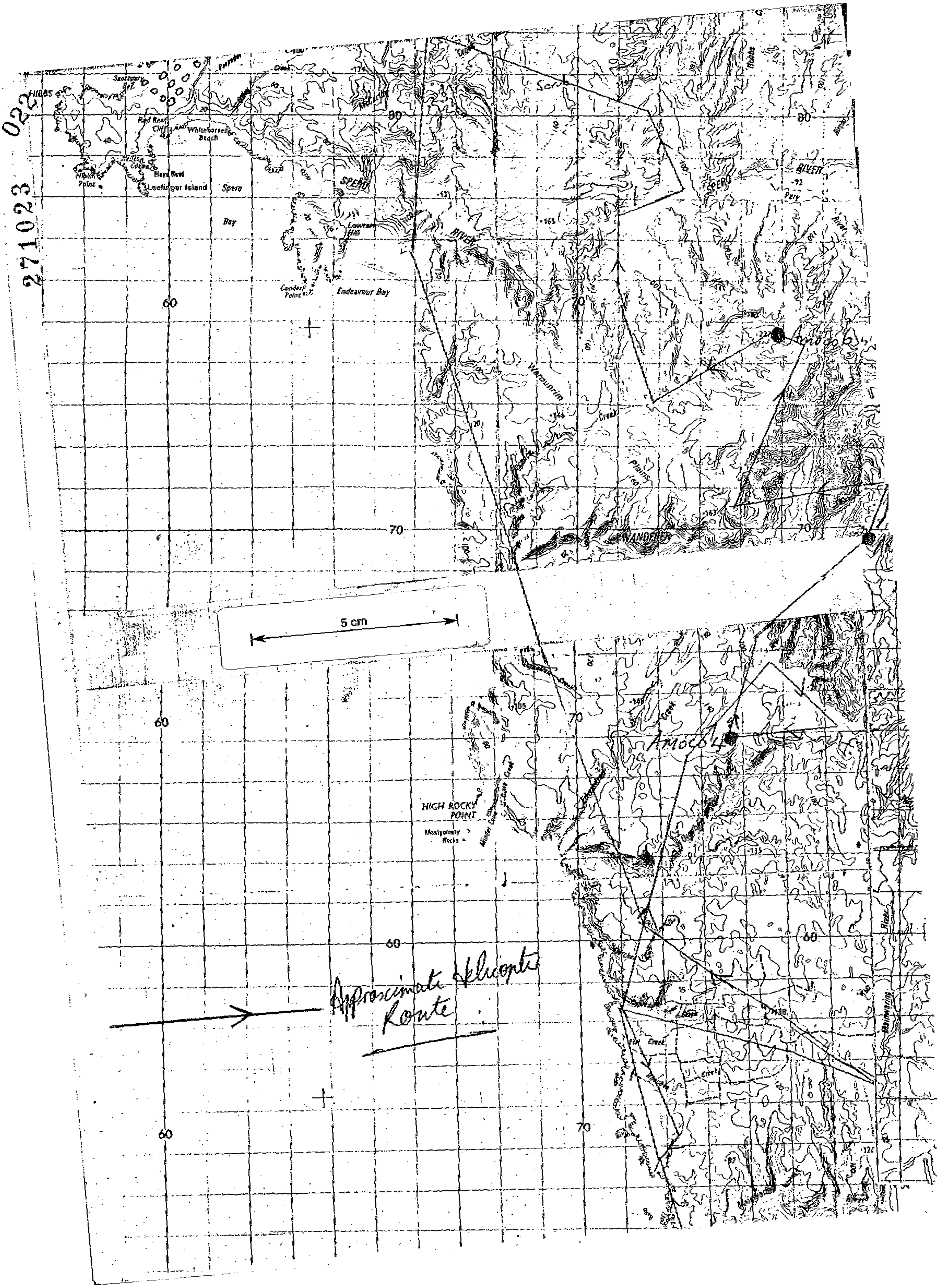
5 cm
H A R B O U R
22
Philips Island
10
Bryans Bay
Steadman Point
Steadman Beach
Asbestos Point
Grummet Island
Sarah Island Historic Site
Hallidays Island
RUM POINT
Amoco 10
Amoco 9
Amoco
Amoco 8
Amoco 7
Birthday Bay
Creek
Track
00
70
60
90
BIRCHS
INLET
Birchs Inlet


022
271023
HIBBS
Red Reef
Hays Reef
Spero
Bay
Endeavour Bay
SPERO
RIVER
Creek
Plains
WANDERER
5 cm
HIGH ROCKY
POINT
Amoco 4
Approximate Helicopter
Route

023

271024

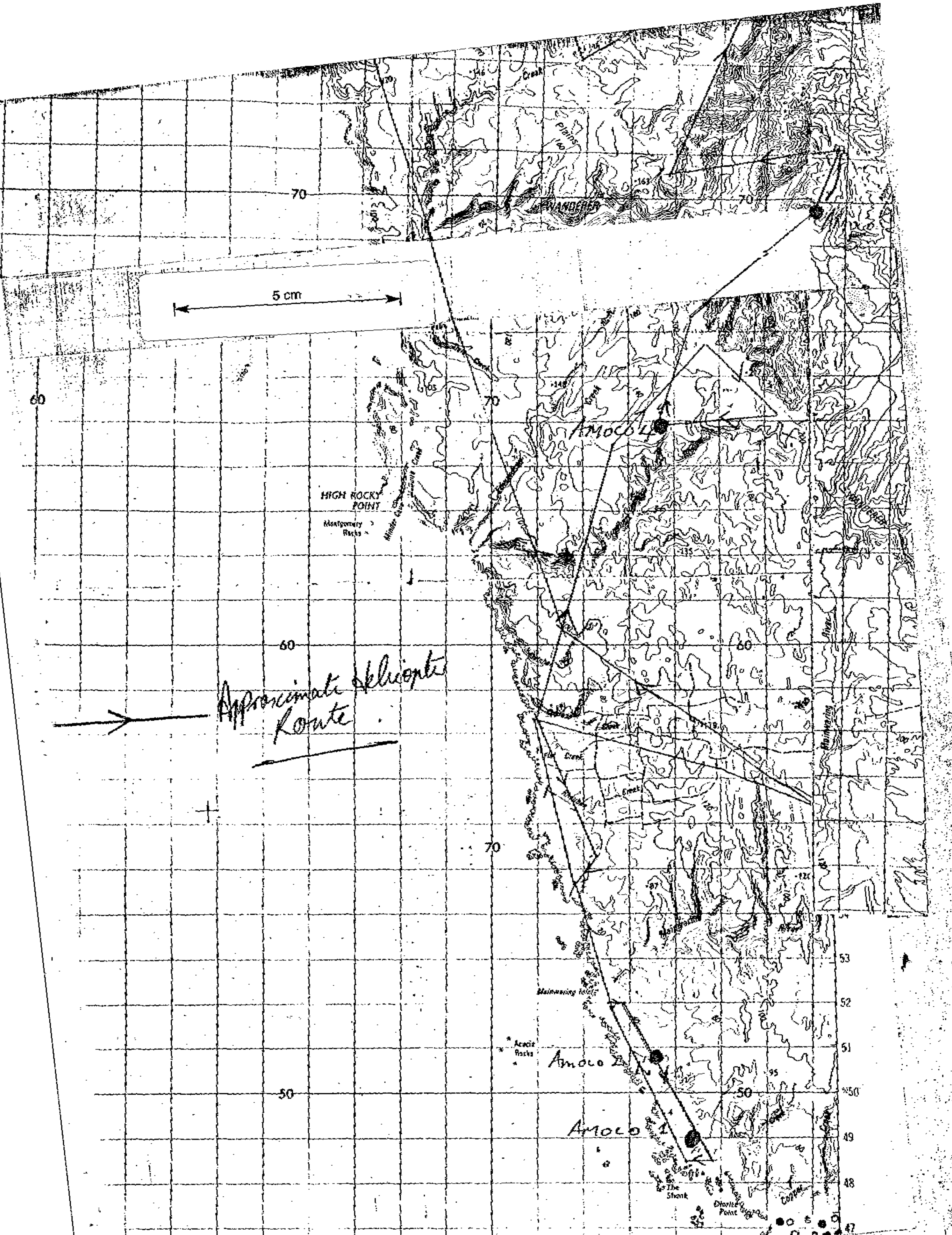

5 cm
70
60
Plains
Creek
WANDERER
HIGH ROCKY POINT
Montgomery Rocks
Amoco 4
Approximate Helicopter Route
Mainwaring Islets
Acacia Rocks
Amoco 2
Amoco 1
50
The Shank
Diorite Point
53
52
51
50
49
48
47

TABLE 1 - LISTS OF PLANT SPECIES PRESENT X AND AFFECTED X BY PHYTOPHTHORA CINNAMOMI

| Grid Ref. | 742490 | 736508 | 678011 | 735648 | 772699 | 748748 | 588910 | 613992 | 650020 | 620032 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Species** / Amoco Plot No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Boronia citriodora | X | | | X | | | | | | |
| Boronia pilosa | | | | (X) | (X) | (X) | (X) | (X) | | (X) |
| Boronia parviflora | | | | X | (X) | (X) | | | | (X) |
| Melaleuca squarrosa | X | X | | X | | | X | X | | X |
| Melaleuca squamea | X | | | | (X) | (X) | (X) | | | (X) |
| Leptospermum scoparium | X | X | | X | | | X | | | |
| Leptospermum nitidum | | X | X | X | | X | X | X | X | X |
| Leptocarpus tenax | X | | X | X | X | | X | X | X | |
| Xyris marginata | X | | | | X | X | X | X | X | |
| Xyris muelleri | | | X | X | X | | | | | |
| Sprengelia incarnata | X | X | | X | (X) | (X) | (X) | (X) | (X) | (X) |
| Gymnoschoenus | X | X | | X | X | X | X | X | X | X |
| Schoenus tenuissimus | X | X | | X | X | X | | X | | |
| Empodisma minus | X | X | X | X | X | X | X | X | X | X |
| Banksia marginata | X | X | | | (X) | (X) | (X) | (X) | | (X) |
| Epacris obtusifolia | | X | | X | | | | | | |
| Epacris corymbiflora | X | | | X | | | (X) | | | (X) |
| Bauera rubioides | X | | | X | (X) | (X) | (X) | (X) | (X) | (X) |
| Patersonia longiflora | X | X | | X | X | | | | | X |
| Cenarrhenes nitida | X | X | | | | | | | | |
| Microlaena tasmanica | X | X | | | | | | | | |
| Tetraria capillaris | X | | X | | | | | | X | |
| Actinotus bellidioides | X | | | X | X | X | | X | | |
| Restio monocephalus | X | | | X | X | X | X | X | | X |
| Restio complanatus | | | | | X | X | | | | |
| Casytha glabella | X | | | | X | | X | | | |
| Utricularia | | | X | | X | X | | | | X |
| Drossera binata | | | X | | | | | X | X | X |
| Drossera pygmaea | | | | | X | | | | | |
| Lepidosperma filiforme | X | | | X | X | X | | X | | |
| Salignella uliginosa | X | X | | X | X | X | | X | | |
| Lycopodium laterale | | | | X | X | | | | | |
| Pteridium esculentum | | X | | | | | | | | |
| Gleichenia dicarpa | | X | X | X | X | | | | X | X |
| Baeckia leptocaulis | | X | | X | (X) | (X) | (X) | (X) | (X) | (X) |
| Eucalyptus nitida | | X | | | X | | | | | |

| Species | Amoco Plot No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acacia verticillata | | | X | | | | | | | | |
| Hakea epiglottis | | | | X | | (X) | (X) | | | | |
| Restio tetraphyllus | | | | X | | | | | | | |
| Telopia truncata | | | | X | | | | | | | |
| Stylidium graminfolium | | | | | X | X | | | X | | |
| Agastachys odorata | | | | | X | (X) | (X) | | | (X) | (X) |
| Lepyrodia tasmanica | | | | | X | | X | X | X | | X |
| Helichrysum pumilum | | | | | | X | X | | X | | |
| Eriostemon virgatus | | | | | | X | | | | | |
| Isophysis tasmanica | | | | | | X | | | | | |
| Mitrasacme montana | | | | | | | X | | X | | |

X Plant species present

(X) Affected by <u>Phytophthora cinnamomi</u>

Plot samples app. 10 $m^2$