The impact of *Phytophthora megasperma* in Cape Arid National Park - June 1995

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This report documents the findings of a field-trip; 29.5.95-2.6.95, undertaken by the above-mentioned. We gratefully acknowledge the financial support provided by ANCA & SID, CALM.

BACKGROUND

Phytophthora megasperma is impacting upon Proteaceae and Myrtaceae "mixed rock heath" in Cape Arid (CANP) and the Fitzgerald River (FRNP) National Parks: two remote, floristically-rich south-coastal national parks containing a number of geographically restricted plant taxa (i.e. Eyre Phytogeographic Region; Beard 1980).

The history of infection in the FRNP is well documented (CALM 1991). After the reconnaissance work of M. Grant, *P. megasperma* was recovered from two flooded sites in 1989 (Table 1). Roadworks after the floods of 1988-89, necessitated further gravel resources. An examination of a gravel pit near Thomas Fisheries by R. Armstrong, A. Moylett and R. Pemberton (in 1990), also recovered *P. megasperma* (M. Grant, *pers. comm.*).

Table 1 Previous recoveries of *P. megasperma* from two locations in Cape Arid N.P.

Site	Plant species	Reference
Rubbish Tip Road	*Banksia speciosa*	R. Wills
Seal Creek	*Dryandra sessilis*	R. Wills
Seal Creek	*D. blackiana*	R. Wills

AIMS

We revisited sites from which *P. megasperma* had been previously recorded in CANP. Plant specimens displaying disease symptoms were sampled. Additionally, vegetative data were recorded in two diseased and adjacent healthy sites.

METHODS

Sites

Sampling of plants displaying disease symptoms (i.e. necrosis of lower leaves) and the root-containing soil-clod were taken from the following locations;

Ranger's Residence at Thomas River (33°51'16.0"S/123°00'32.0"E), Tagon Bay (32°52'55.8"S/122°59'22.7"E), Tip Access Road (33°49'38"S/122°58'49"E), Thomas Fisheries Gravel Pit (33°56'20.8"S/123°15'11.0"E), Seal Creek (33°55'06'S/123°19'38.3"E), and along the Joyndee Creek Road; i) Mal's Blue Peg, northern side of road, downslope = 33°55'52.7"S/123°17'19"E and ii) 33°55'34.9"S/123°18'19.5"E.

Pathogen retrieval

Plant and soil material were either exposed to plant-tissue baits (Tsao 1983) using Lupin/*Eucalyptus sieberi* cotyledons and/or pieces of diseased root were surface sterilised and directly plated onto selective agar (Mitchell and Kannwischer-Mitchell 1992).

Vegetation

At two sites i.e. Thomas Fisheries Gravel Pit and the Ranger's Residence at Thomas River, species/area data were collected in both diseased and contiguous healthy plots of vegetation. Disease/healthy interfaces were arbitrarily determined based upon assessment of dead remnant vegetation, plants displaying diseased symptoms, and the proportion of bare ground. At the Gravel Pit, paired diseased and healthy plots were established at two sites; 1) adjacent to the exposed pit surface, and 2) on the southern flank of the pit, while at the Ranger's Residence at Thomas River, only one site was established.

New species were recorded in quadrats increasing in area, i.e. 0.25 m^2, 1.0 m^2, 4.0 m^2, 16.0 m^2, and 64 m^2.

RESULTS

Disease expression

As can be seen from Table 2, a number of plant species were sampled which displayed diagnostic disease symptoms, i.e. yellowing/necrosis of lower leaves, and loss of vigour. The majority of the species sampled belonged to the Proteaceae family.

Table 2 Plant species sampled and pathogen retrieval from CANP

Location	Plant species	Pathogen retrieval
Joyndee Creek Road	*Banksia occidentalis*	nil
	B. pulchella	nil
	Isopogon buxifolius	nil
	Petrophile sp.	nil
Mal's Blue Peg, Joyndee Crk. Rd.	*I. buxifolius*	*P. cinnamomi*
Taygon Bay	*B speciosa*	nil
Thomas River	*Callitris drummondii*	nil
	B. speciosa	nil
Tip Access Road	*B. repens*	nil
	I. trilobus	nil

Pathogen retrieval

Of the samples taken, the only recovery of a *Phytophthora* species came from a site previously sampled by Mal Grant (Table 2). Of the nine samples taken, a pathogen was only retrieved from one sample.

Species/area relationships in diseased v. contiguous healthy vegetation

The two sites chosen for our species/area studies supported similar vegetative structure, but the site at the Ranger's Residence was associated with granitic outcroppings, while the Gravel Pit had an abundance of massive laterite (Appendix 1). Another landform feature unifying the sites were the very shallow, skeletal soils overlying an impeding layer (Appendix 1).

In all instances, the cumulative number of species in diseased plots was less than the healthy counterpart (Fig. 1). In other words, with increasing area, the species diversity of diseased plots, is less than the diversity associated with healthy sites on the same soil type.

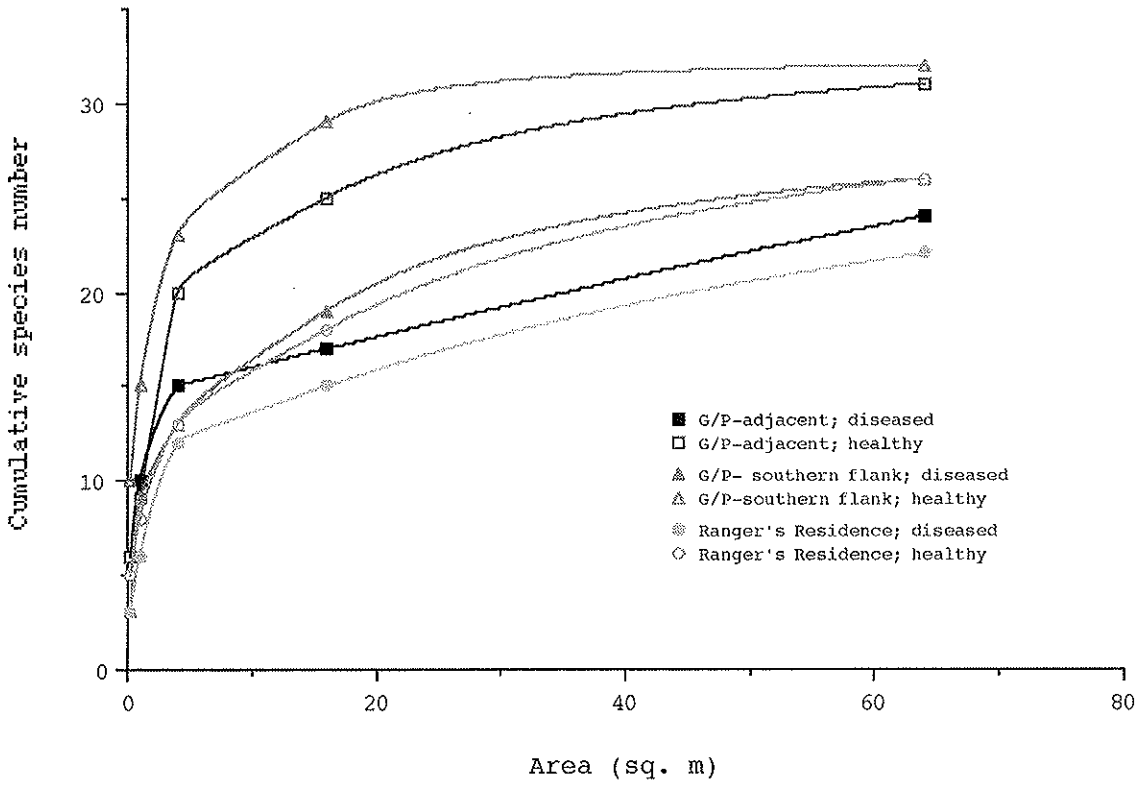

Fig. 1 The cumulative number of species associated with increasing quadrat size in diseased and healthy vegetation at CANP.

Concluding Discussion

Diagnostic of the Eyre Phytogeographic Region, are the tight mosaics of soil/vegetation types resulting from the presence of granitic/quartzitic schists and lateritic outcrops. This mosaic of species-rich heaths and woodlands, generate great habitat diversity. The Proteaceae/Myrtaceae are the two best represented families in these communities. Consequently, removal of plant species contributing to habitat structure, could result in the loss of refugia.

While disease symptoms were observed throughout CANP, retrieval of pathogens was extremely low. Drought-induced, leaf necrosis, may have confounded our on-site diagnoses.

The lower cumulative species numbers associated with sites previously diagnosed as being infested by *Phytophthora*, highlights the pathogen's impact. *P. cinnamomi/megasperma* serve as a selective pressure, effectively eliminating susceptible hosts, and thus reducing the species diversity of the infested community. Conservation of species diversity is a primary function of National Parks. As such, where present, *Phytophthora* species pose a critical management challenge.

Acknowledgments

Mike Paxman for logistical support at CANP and M. Grant (S/C Region) for information on disease history. R. Wills helped identify unknown plant species.

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Appendix 1 Site characteristics of two intensively studied sites in CANP

Site character	Thomas Fisheries Gravel Pit	Ranger's Residence at Thomas River - downslope
Long./Lat.	33°56'20.8"S/123°15'11.0"E	33°51'16.0"S/123°00'32.0"E
Assoc. veg.	Proteaceae-Myrtaceae closed low shrubland	Proteaceae-Myrtaceae mixed rock heath, grading to low open woodland
Topography	mid-slope	mid-lower slope
Underlying rock	laterite	granitic/quartzitic schist
Soil colour	skeletal light-brown	white-grey
Soil type	lateritic sand	sand
Gravel content	> 50%	low
Depth to impeding layer	2-15 cm	0-15 cm
Rock outcrops	yes	yes
Drainage	moderate	moderate
Special features	massive lateritic pisoliths	granite outcrops
Impact	intermediate-high (scattered deaths-most susceptible hosts dead)	intermediate-high (scattered deaths-most susceptible hosts dead)
Age of infection	5 years	5-6 years
Approx. area of infection	3-5 ha.	5-8 ha

Appendix 2 Cape Arid species area curves

1(a). Gravel Pit (adjacent) - diseased

Area (m^2)	Species	Cumulative total
0.25	1. Anarthria prolifera, 2. Mesomelaena stygia, 3. M. tetragona, 4. Melaleuca thyoides, 5. Myrt. 2, 6. A. scabra.	6
1.0	7. Calothamnus gracilis, 8. Dryandra cuneata, 9. Agonis obtusissima, 10. D. aff. nivea.	10
4.0	11. Agonis spathulata, 12. Hakea trifurcata, 13. D. pteridophyta, 14. Caustis diosa, 15. Allocasuarina thuyoides.	15
16.0	16. Melaleuca pentagona, 17. Banksia repens.	17
64.0	18. Acacia aff. drummondii, 19. Xanthorrhoea platyphylla, 20. Eutaxia sp. 1, 21. Petrophile squamata, 22. Stirlingia tenuifolia, 23. Daviesia colletioides, 24. Actinodium sp. 1.	24

1(b). Gravel Pit (adjacent) - healthy

Area (m^2)	Species	Cumulative total
0.25	1. Anarthria prolifera, 2. Agonis obtusissima, 3. Synaphea polymorpha, 4. Xanthorrhoea platyphylla, 5. Dryandra cuneata, 6. Mesomelaena stygia.	6
1.0	7. Daviesia colletioides, 8. Melaleuca thyoides, 9. Caustis diosa.	9
4.0	10. Allocasuarina campestris, 11. M. pentagona, 12. D. aff. nivea, 13. Banksia repens, 14. B. pulchella, 15. D. plumosa, 16. Hakea trifurcata, 17. A. scabra, 18. Isopogon formosus, 19. D. pteridophyta, 20. M. tetragona.	20
16.0	21. I. buxifolius, 22. Adenanthos cuneatus, 23. Eutaxia sp. 1, 24. H. rombifolia, 25. Lomandra sp. 1.	25
64.0	26. Calothamnus gracilis, 27. Actinodium sp. 1, 28. Stirlingia tenuifolia, 29. Conospermum sp. 1, 30. S. polymorpha, 31. Chorizema sp. 1.	31

2(a). Gravel Pit (southern flank) - diseased

Area (m^2)	Species	Running total
0.25	1. Caustis diosa, 2. Beaufortia orbifolia, 3. Stirlingia tenuifolia.	3
1.0	4. Dryandra aff. nivea, 5. D. pteridophyta, 6. Agonis obtusissima, 7. Hibbertia sp. 1, 8. Xanthorrhoea platyphylla, 9. Myrt. 2.	9
4.0	10. Allocasuarina campestris, 11. Eutaxia sp. 1, 12. Actinodium sp. 1, 13. A. thuyoides.	13
16.0	14. B. empetrifolia, 15. Anathria scabra, 16. Mesomelaena stygia, 17. Calothamnus gracilis, 18. Melaleuca pentagona, 19. A. prolifera.	19
64.0	20. Isopogon buxifolius, 21. Banksia repens, 22. Petrophile teretifolia, 23. D. plumosa, 24. H. clavata, 25. D. cuneata, 26. Lomandra sp. 1.	26

2(b). Gravel pit (southern flank) - healthy

Area (m^2)	Species	Running total
0.25	1. Adenanthos cuneatus, 2. Hakea rombifolia, 3. Dryandra cuneata, 4. Chorizema sp. 1, 5. Allocasuarina thuyoides, 6. Melaleuca thyoides, 7. Myrt. 2, 8. Anathria prolifera, 9. Mesomelaena stygia, 10. Acacia aff. drummondii.	10
1.0	11. Hakea trifurcata, 12. Isopogon formosus, 13. Leucopogon pendulus, 14. A. campestris, 15. Agonis obtusissima.	15
4.0	16. D. plumosa, 17. H. prostrata, 18. I. buxifolius, 19. D. aff. nivea, 20. Daviesia colletioides, 21. A. scabra, 22. Beaufortia orbifolia, 23. Conospermum sp. 1.	23
16.0	24. Xanthorrhoea platyphylla, 25. Banksia pulchella, 26. Lysinema ciliatum, 27. Gompholobium sp. 1, 28. Eutaxia sp. 1, 29. M. tetragona.	29
64.0	30. B. repens, 31. Darwinina sp. 1, 32. Lomandra sp. 1.	32

3(a). Thomas River Ranger's Station (eastern flank) - diseased

Area (m^2)	Species	Running total
0.25	1. Leucopogon minutifolius, 2. Melaleuca suberosa, 3. M. scabra	3
1.0	4. Oxylobium sp. 1, 5. Dryandra tenuifolia, 6. Mesomelaena stygia.	6
4.0	7. Hibbertia sp. 2, 8. M. aff. spathulata, 9. Astroloma sp. 1, 10. Pea 2, 11. Lepidosperma sp. 1, 12. Beaufortia orbifolia	12
16.0	13. Grevillea nudiflora, 14. Macrozamia riedlei, 15. Borya nitida.	15
64.0	16. Anarthria scabra, 17. Astroloma sp. 2, 18. Hakea laurina, 19. Eucalyptus dordtoxylon, 20. Lysinema ciliata, 21. Hibbertia hypericoides, 22. Acacia myrtifolia.	22

3(b). Thomas River Ranger's Station (eastern flank) - healthy

Area (m^2)	Species	Running total
0.25	1. Melaleuca suberosa, 2. Beaufortia orbifolia, 3. Leucopogon minutifolius, 4. Melaleuca sp. 2, 5. Isopogon formosus.	5
1.0	6. Dryandra tenuifolia, 7. Restio. sp. 1, 8. Mesomelaena stygia.	8
4.0	9. Acacia myrtifolia, 10. Borya nitida, 11. Hibbertia hypericoides, 12. Eucalyptus dordtoxylon, 13. Lysinema ciliatum.	13
16.0	14. Banksia media, 15. Daviesia colletioides, 16. Anarthria scabra, 17. Hibbertia thymoides 2. 18. Goodeniaceae sp. 1.	18
64.0	19. Pea 2, 20. Grevillea nudiflora, 21. Leucopogon sp. 2, 22. Callitris drummondii, 23. Melaleuca aff. spathulata, 24. Astroloma sp. 1, 25. Astroloma baxteri, 26. Hakea laurina.	26

N.B. Representative preserved plant specimens held by C. Crane (Como/SID), and unknown plant species submitted to R. Cranfield (CALM/Herb.).