SCOPE ITEM 2

A COORDINATED PROGRAM OF PHOSPHONATE APPLICATION FOR THE PROTECTION OF NATIVE PLANT COMMUNITIES IN SOUTH-WEST WESTERN AUSTRALIA

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1 INTRODUCTION

In spring, 1996 and autumn, 1997, two major aerial applications of phosphonate[1] were carried out in the Department of Conservation and Land Management's (CALM) Albany District (Barrett *et al.*, 1997). A total of 285ha of native vegetation were sprayed, including 225ha at Bell Track in the Fitzgerald River National Park and 60ha in the Stirling Range National Park. These operational spray applications were based on the results of three years' research into the use of phosphonate to protect native flora against dieback disease caused by *Phytophthora* in the Albany District (Komorek *et al.*, 1997).

The planning of further strategic applications of phosphonate, to protect endangered flora, commenced in spring of 1997. During field surveys undertaken in summer, 1997/98, Albany District staff identified a number of additional areas in the Stirling Ranges where endangered flora were at risk from *Phytophthora*. Other sites supporting threatened species were identified at Cape Arid (Esperance District) and Busselton (South West Capes District).

The final list of sites to receive aerial application of phosphonate in 1998 was drawn up after consultation with CALM's District staff, Wildlife Branch and Science and Information Division. A list of the sites sprayed in 1998 is provided in Appendix 1 together with the proposed program for 1999. All sprayed areas support one or more species of Declared Rare Flora (DRF). Selection of sites for spraying was based on satisfaction of the major criteria listed below:

- presence of species classified as critically endangered, endangered or vulnerable DRF, or Priority 1 or 2;
- presence of DRF populations recognised as susceptible to direct or indirect effects of *Phytophthora* species; and
- existence of threat to conservation value due to the presence or imminent arrival of dieback disease associated with infection by *Phytophthora*.

[1] The phosphite ion is the active ingredient in phosphonate. When vegetation is sprayed with phosphonate in the field, phosphite is absorbed by the shoots and translocated to the roots.

The work outlined in this report was undertaken to address Scope Item No. 2 for the *Phytophthora* and *Diplodina* Canker project (1997/98) and this constitutes the objective stated below.

2 OBJECTIVE

The major objective of this work was to implement an extended and coordinated program of actions for the use of phosphonate in the protection of native species of critically endangered, endangered or vulnerable DRF, and Priority 1 or 2 species, from the direct or indirect effects of *Phytophthora* spp.

3 METHODS

The Project comprised four main phases:

- field surveys to locate target species;
- marking target sites;
- spraying operations; and
- monitoring.

3.1 FIELD SURVEYS

The locations of target plant species at Cape Arid (Esperance District) and South West Capes were well known, thus further surveying of those areas was not required. However, extensive field surveys were necessary for selection of appropriate sites in the Stirling Ranges. This usually involved lengthy treks (2-3 hours) into the peaks of the ranges before commencing the search for threatened flora. The adopted strategy was to locate patches of uninfected thicket, at least 1ha in area, where one or more target species were present.

3.2 SITE MARKING

To ensure that target areas were readily visible from the air, the corners of each site were marked conspicuously. In the Stirling Ranges, orange or yellow flags (0.2 x 0.6m) on 4m-tall poles were driven into the ground at the corners of each site. Because of damage due to frequent strong winds, flags had to be re-erected prior to each aerial application of phosphonate. Helium-filled balloons were used to mark sites in South West Capes district, but these proved to be less visible from the air and will be replaced by flags in future.

3.3 SPRAYING OPERATIONS

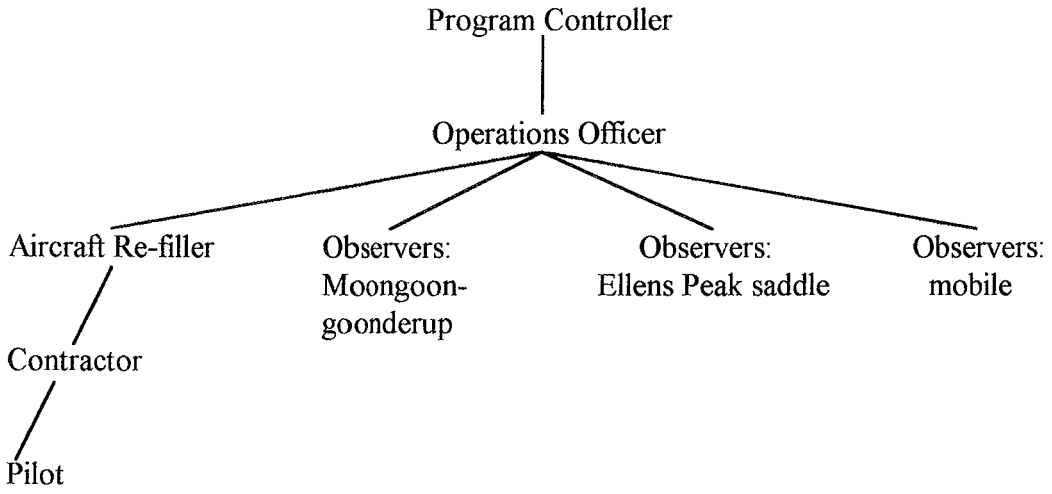
3.3.1 The Stirling Ranges

At Mondurup Peak, a large infection on the northern slope of the mountain was sprayed with phosphonate in an attempt to arrest its spread. Mondurup supports the only montane thicket (= Mixed Stirling Range Thicket; see Anon., 1997) in the Stirling Range that is not infected by *Phytophthora*.

On Moongoongoonderup, Ellens Peak, Pyungoorup and Bakers Knob, small islands of healthy montane thicket were present and spraying was carried out to halt or delay incursions of *Phytophthora* from surrounding areas. Similarly, spraying was conducted at the South Bluff Track where an area of jarrah mallee heath including *Dryandra anotona* (DRF) is surrounded by dieback-infected vegetation.

Experience gained during the 1997 program has indicated, that when aerial spraying is conducted in the Stirling Ranges, it is imperative that the pilot receives up-to-date reports on wind conditions in the mountains prior to departure from the airstrip, and thereafter until delivery of the spray. In the absence of remote weather stations, this requires personnel to be deployed on the peaks with equipment for measuring wind speed and for communication with the pilot.

This year, two observers camped on the Ellen's Peak saddle and two on Moongoongoonderup. They used hand-held anemometers to gauge wind speed and communicated by VHF radio with the aircraft re-filler and operations officer. UHF transmitters were used to communicate directly with the aircraft pilot if wind strength had altered significantly since departure. The personnel and communications structure used for the aerial spraying operation is outlined below.



Overall control and day-to-day management of spraying operations were the responsibilities of the program controller and operations officer, respectively. The controller made strategic decisions in relation to resources allocation. Decisions such as that to carry out spraying at a given location or time were left to the operations officer, and were based on wind conditions reported by observers. At Mondurup, the mobile observer team set up flags and monitored wind conditions .

In the Stirling Ranges, wind conditions at altitudes of 700-1100m were critical for spraying operations. For mountain sites, winds of less than 5km hour $^{-1}$ were ideal. It was important that wind speed remained fairly constant and that unexpected up-drafts on the faces of the peaks did not occur. There was often little or no breeze at the

airstrip near Bluff Knoll when 30-60km hour $^{-1}$ winds were blowing on the peaks. The typical barometric map for optimum spraying conditions comprised a large, high-pressure system anchored in the Great Australian Bight.

3.3.2 South West Capes and Esperance Districts

Three sites were sprayed in the South West Capes District. These all contained both southern ironstone heathland, which is listed as a threatened environmental community by CALM, and the jarrah-marri forest ecotone. At each site, the declared rare species *Dryandra nivea* ssp. *uliginosa, D. squarrosa* ssp. *argillaceae* or *Petrophile latericola* are affected by *Phytophthora* root-rot disease.

At Cape Arid National Park in the Esperance District, a large infection of *Phytophthora cinnamomi* is located in *Banksia speciosa* woodland. At Lucky Bay, a small remnant of shrubland containing *Lambertia echinata* ssp. *echinata* (DRF) is present in a *Phytophthora*-infected, disused gravel pit which is undergoing rehabilitation. Here, the strategy is to prolong the life of remaining adult plants and protect cuttings of this species which are to be translocated in winter.

By comparison with the Stirling Ranges, phosphonate spraying operations were much less complicated in the South West Capes and Esperance Districts. Both areas were basically flat and readily accessible by road. Wind conditions were a less critical factor, and the requirement for dry conditions to prevail for about a day after spraying was generally the only limitation.

3.3.3 Application of Phosphonate

Phosphonate was applied as an emulsion of Foli-R-Fos 400 (40%) supplemented with 2% Synertrol, a surfactant consisting mainly of canola oil. Between 30th March and 3rd April, 1998, the montane community sites in the Stirling Ranges were sprayed with phosphonate at the rate of 15ℓ ha^{-1} to provide delivery of the active ingredient (phosphite) at 6kg ha^{-1}. Lowland sites were sprayed with twice that amount of phosphonate in the same period. Another spray treatment, delivering phosphite at 4kg ha^{-1} or 6kg ha^{-1}, was applied between 4th and 8th May at the South Bluff Track and Mondurup sites. High winds at altitudes above 600m prevented re-spraying of Moongoongoonderur, Pyungoorup, Bakers Knob and the three sites on Ellens Peak. Sites in the South West Capes and Esperance Districts were sprayed with phosphonate (to deliver phosphite at12kg ha^{-1}) on 17th April or 1st May, respectively. Re-spraying of sites in Esperance district is planned for 15th-19th June.

The aircraft were Cessna Agwagons (188B) fitted with Micronair Rotary Atomiser spray systems or CP Nozzles (Esperance). Spray swaths were approximately 15m wide. The planes were generally flown at 5-10m above ground while spraying was carried out. The aircraft was fitted with a GPS navigation system which allowed the pilot to display previously sprayed areas on a screen in the cockpit and to record the position of site corner flags. Lights mounted in front of the pilot indicated the correct flight path and when to activate the spray nozzles.

3.4 MONITORING

Monitoring is to be carried out at most sites to determine the effectiveness of treatments. This is usually accomplished by emplacement and subsequent inspection of infection boundary markers at sites where a clearly defined dieback front is present, and/or by counting individuals of DRF and other susceptible species within quadrats located in sprayed areas. The infection boundary markers consist of steel droppers embedded in the ground at intervals to provide a clear indication of the extent of infection in autumn, 1998. At some sites where *Phytophthora* was widespread, susceptible DRF were tagged and mapped to provide a record of which plants were alive prior to spraying.

4 RESULTS

The monitoring program which commences in December, 1998, will facilitate determination of the effectiveness of applied treatments. So far, some localised leaf burning has been noted at the South Bluff Track and Mondurup sites four weeks after application of the first spray. This was mainly confined to mallee eucalypts. Past experience has shown that the effect is transitory and no long term damage is sustained. In order to prevent recurrence of leaf burning at these sites, application rates for the second treatment was reduced (see Section 3.3.3).

5 OUTCOMES

- Our knowledge on the distribution of rare flora in the Stirling Ranges has increased substantially as a result of the field survey component of this project. It is now apparent that very little of the original montane thicket still remains in the eastern Stirling Ranges. The remnants identified and sprayed during the current work appear to be all that is left of a hitherto widespread community that includes a large proportion of endemic taxa, many of which are classified as endangered.

- It is expected that the program of actions initiated in this project will greatly assist the conservation of native populations of DRF threatened by the presence or impending arrival of dieback disease caused by *Phytophthora*.

6 REFERENCES

Anon. (1996). Stirling Range and Porongurup National Parks Draft Management Plan. Unpublished. Department of Conservation and Land Management; for The National Parks and Nature Conservation Authority, Perth, WA.

Barrett, S., Hickman, E., Gillen, K. & Grant, M. (1997). A report on the aerial application of phosphite to native vegetation in Albany district 1996/97. Unpublished report to Environment Australia.

Komorek, B.M., Shearer, B.L., Blumberg, M., Crane, C., Fairman, R. & Smith, B. (1997). The control of *Phytophthora* in native plant communities: Part A. Application technologies and phosphonate movement in the host. pp. 1-59. In: Control of *Phytophthora* and *Diplodina* canker in Western Australia. Final report to the Threatened Species and Communities Unit, Biodiversity Group, Environment Australia. CALM. Perth, WA.

Appendix 1. Phosphite application targets for autumn 1998

Site Name	District	Area (ha)	Vegetation	Species	Application Method	Date of First Application	Application Rate (a.i.)	Date of Second Application	Application Rate	Comments
Will 01 (Williamson Rd)	S.W. Capes	4.2	Southern ironstone shrubland	*Hakea* aff. *varia* (yellow) *Isopogon scaber* *Petrophile latericola*	Fixed-wing aircraft	17th April 1998	12 kg ha^{-1}	not sprayed		
Smith 01 (Smith Rd, Treeton Block)	S.W. Capes	11.0	Southern ironstone shrubland	*Dryandra nivea ssp. Uliginosa* *D. squarrosa ssp. Argillaceae* *Hakea* aff. *varia* (yellow)	Fixed-wing aircraft	17th April 1998	12 kg ha^{-1}	not sprayed		
Yiron 01 (Gale & Treeton-Jindong Rds)	S.W. Capes	6.4	Southern ironstone shrubland	*Dryandra nivea ssp. Uliginosa* *D. squarrosa ssp. Argillaceae* *Hakea* aff. *varia* (yellow)	Fixed-wing aircraft	17th April 1998	12 kg ha^{-1}	not sprayed		
Quindalup Siding	S.W. Capes	0.01	Marri forest	*Caladenia busselliana*	Backpack mister	14th May 1998	0.04%	not sprayed		
Ellens Peak (Western Saddle) (SRNP)	Albany	1.0	Eastern Stirling Range montane community	*Andersonia axilliflora* *Sphenotoma drummondii*	Fixed-wing aircraft	2nd April 1998	6 kg ha^{-1}	not sprayed		
Ellens Peak (SSE spur) (SRNP)	Albany	7.5	Eastern Stirling Range montane community	*Banksia brownii* *Lambertia fairallii*	Fixed-wing aircraft	2nd April 1998	6 kg ha^{-1}	not sprayed		
Pyungoorup (SRNP)	Albany	3.5	Eastern Stirling Range montane community	*Dryandra montana* *Andersonia axilliflora* *Banksia brownii*	Fixed-wing aircraft	2nd April 1998	6 kg ha^{-1}	not sprayed		
Bakers Knob (SRNP)	Albany	3.0	Eastern Stirling Range montane community	*Darwinia collina* *Sphenotoma drummondii*	Fixed-wing aircraft	30th March 1998	6 kg ha^{-1}	not sprayed		

Appendix 1. (Cont.) Phosphite application targets for autumn 1998

Site Name	District	Area (ha)	Vegetation	Species	Application method	Date of First Application	Application Rate (ai)	Date of Second Application	Application Rate	Comments
Moongoon-goonderup (1) (SRNP)	Albany	4.0	Eastern Stirling Range montane community	*Banksia brownii* *Andersonia axilliflora* *Darwinia squarrosa*	Fixed-wing aircraft	2nd April 1998	6 kg ha^{-1}	not sprayed		
Moongoon-goonderup (2) (SRNP)	Albany	4.0	Eastern Stirling Range montane community	*Banksia brownii*	Fixed-wing aircraft	2nd April 1998	6 kg ha^{-1}	not sprayed		
South Bluff Track (SRNP)	Albany	25.0	Jarrah-*Lambertia erectifolia* shrubland	*Dryandra anotona*	Fixed-wing aircraft	30th March 1998	12 kg ha^{-1}	4th/6th May 1998	4 kg ha^{-1} & 6.4 kg ha^{-1}	Reduced rate for second spraying because of LLB. See map.
Mondurup (SRNP)	Albany	35.0	Western Stirlings mallee		Fixed-wing aircraft	1st April 1998	12 kg ha^{-1}	6th May 1998	4 kg ha^{-1} & 6 kg ha^{-1}	Reduced rate for second application because of LLB; heavier rate on lower slope.
Cape Arid	Esperance	55.0		*Adenanthos ellipticus*	Fixed-wing aircraft	1st May 1998	12 kg ha^{-1}	15th June 1998	12 kg ha^{-1}	
Lucky Bay	Esperance	2	Open heathland with *Eucalyptus doratoxylon*	*Lambertia echinata* ssp. *echinata*	Fixed-wing aircraft	1st May 1998	6 kg ha^{-1}	15th June 1998	6 kg ha^{-1}	Translocation site
Main Roads Dept. Reserve	Perth		*Banksia* woodland	*Caladenia huegeli*	Trunk injection/Back pack mister	24th April 1998				
Valley of the Giants	Walpole	4 trees	Tingle forest	*Eucalytus jacksonii*	Trunk injection	13th May 1998	0.05%			

Appendix 1. (Cont.)

Site Name	District	Area (ha)	Vegetation	Species
Sharpe Block	Walpole			*Astartea* sp. Mt Johnston
Poison Hill	Walpole		Shrubland -outcrop	*Banksia verticillata*
Nicol Road	Walpole	< 1 ha		*Lambertia rariflora* subsp. *lutea*
Valley of the Giants	Walpole		Karri forest	
Twin Swamps NR	Perth		*Banksia* woodland	*Stylidium longitubum*
Ken Hurst Park	Perth		*Banksia* woodland	*Caladenia huegelii*
Main Roads Deptartment Reserve	Perth			*Caladenia huegelii*
Popanyinning	Wheatbelt		*Banksia* woodland	*Banksia cuneata*
Murtin Block	Pemberton	1-2 ha	Jarrah-Marri forest	*Caladenia winfieldii*

Appendix 1. (Cont.)

Proposed 1999 program

Site Name	District	Area (ha)	Vegetation	Species	Comments
Point Anne (junction Perabulup Drive)	Albany	????		*Banksia baxteri*	*P. megasperma* (Trial site?)
Yule Brook/Rixton Reserves	Perth	?????	Herb rich shrublands in claypans	*Calytrix breviseta* ssp. *Breviseta*	CALM/UWA/State Planning Commission - difficult site in suburbs
Bull06 Gt. Northern Hwy., Bullsbrook	Perth	????	Herb rich saline shrublands in claypans		
Boulder Hill	Albany			*Andersonia* sp. Two Peoples Bay	High impact abt 80% dead
Goodga River	Albany			*Andersonia* sp. Two Peoples Bay	High impact abt 80% dead
South Sister NR	Albany		Open mallee shrubland	*Banksia brownii*	High impact, remnant of uninfected remains
Vancouver Peninsula	Albany		Coastal shrubland on granite	*Banksia brownii, Isopogon uncinatus*	Moderate impact – 20% dead
Waychinicup NP	Albany			*Banksia brownii*	High impact – 50% dead
Talyaberlup (SNRP)	Albany		Mallee heathland	*Darwinia wittwerorum*	Moderate impact
Mt. Success(SNRP)	Albany			*Dryandra anatona, Lambertia fairallii*	Moderate impact
Coyanarup (SRNP)	Albany			*Dryandra montana, Sphenotoma drummondii*	?
Kyanorup Eminence	Albany			*Dryandra montana*	?
North Isongerup Peak	Albany		Jarrah-*Banksia* mallee heathland	*Verticordia carinata*	? *P. cinnnamomi* present
Mt. James Track	Albany			*Verticordia carinata*	? *P. cinnnamomi* present

CONTROL OF *PHYTOPHTHORA*

AND *DIPLODINA* CANKER IN

WESTERN AUSTRALIA

FINAL REPORT

TO THE THREATENED SPECIES AND COMMUNITIES UNIT

BIODIVERSITY GROUP

ENVIRONMENT AUSTRALIA

DECEMBER 1998

Department of Conservation and Land Management
Locked Bag 104, Bentley Delivery Centre, WA 6983