INTERIM RECOVERY PLAN NO. 52

Montane Heath and Thicket of the South West Botanical Province, above approximately 900 m above sea level
(Eastern Stirling Range Montane Heath and Thicket Community)

INTERIM RECOVERY PLAN
1999-2002

by
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Natural Heritage Trust
Helping Communities Helping Australia

Department of Conservation and Land Management

Department of Conservation and Land Management
Western Australian Threatened Species and Communities Unit
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos 44 and 50

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

CALM is committed to ensuring that Critically Endangered ecological communities are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by CALM's Director of Nature Conservation.

This Interim Recovery Plan will operate from 13 February 2000 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked Critically Endangered after three years, this IRP will be replaced by a full Recovery Plan.

The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at February 2000.

SUMMARY

Name: Montane Heath and Thicket of the South West Botanical Province, above approximately 900 m above sea level, hereafter called the Eastern Stirling Range Montane Heath and Thicket Community

CALM Region: South Coast

CALM District: Albany

Shire (s): Gnowangerup, Plantagenet

Current Status: Assessed April 1996 as Critically Endangered.

Recovery aim: To maintain the overall health of selected remnants of the Eastern Stirling Range Montane Heath and Thicket Community and reduce the level of threat to these representative areas, so that the community can be transferred from Critically Endangered to Endangered.

Criteria for success: Maintenance of the diversity and composition of native species in those areas of the community that are relatively intact in terms of species diversity and composition.

Reduction in the impact of *Phytophthora cinnamomi* on the community as measured by improved survival of *Phytophthora cinnamomi* susceptible taxa in infected areas.

Criteria for failure: A sustained or increased level of modification of occurrences of the community as measured by declining survival of *Phytophthora cinnamomi* susceptible taxa in infected areas.

Significant impact of *Phytophthora cinnamomi* in areas that are relatively intact in terms of species composition

Summary of Recovery Actions

Establish a Recovery Team.
Map dieback free areas and areas where the community persists relatively intact following ground based survey
Evaluate threats for areas currently dieback-free or relatively intact
Rank areas of community for urgency for recovery action, identify key actions
Manage threatening processes for the identified priority areas
Develop and implement fire management strategy
Provide information to Eastern Peaks Route users on values and hygiene practices. Review ‘Code of Conduct for backcountry use in the Stirling Range National Park’ with regard to dieback hygiene
Undertake a Phosphite spraying program in priority areas
Institute flora monitoring to evaluate effectiveness of Phosphite
Investigate alignment, condition and use of Eastern Peaks Route and risks posed to priority areas of the community
If appropriate, redesign/realign and mark Eastern Peaks Route to avoid priority areas of the community
Reconstruct Bluff Knoll track to manage risk of *Phytophthora* spread
Research fire ecology
Research dieback-fire interactions
Implement flora monitoring to evaluate impact of rabbits and changes in soil fertility
Implement rabbit control strategy
Continue to monitor visitor use of Eastern Peaks Route and its impact on the community. Consider a system to regulate visitor numbers
Incorporate strategies required to protect the community into the Park Management Plan when it is reviewed

1. BACKGROUND

1.1 Defining characteristics of the ecological community, its distribution, conservation significance, and status

In the eastern Stirling Range a montane community distinct from that occurring in the central and western Stirling Range is found at high altitudes (approximately 750 m above sea level (a.s.l) to 1080 m a.s.l. A key species indicative of its distribution is *Andersonia axilliflora*, which is or was an abundant and dominant member of the community. Using *A. axilliflora* as an indicator, the community extends from the eastern limit of the Stirling Range, Ellen Peak, more or less continuously at these altitudes to Coyanarup Peak, with a separate occurrence on the summit area of Mt Success (Barrett 1996).

Other species that characterise the community include *Kunzea montana, Beaufortia anisandra, Sphenotoma* sp. Stirling Range, *Andersonia echinocephala* and *Darwinia* spp. A range of proteaceous species were or are structurally significant and include *Banksia oreophila, Banksia solandri, Banksia brownii* and *Dryandra concinna*. *Eucalyptus* species are notable for their absence from the community but occur at immediately lower altitudes.

Species endemic to the community are: *Andersonia axilliflora, Dryandra montana, Persoonia micranthera, Darwinia collina, Xyris exilis, Darwinia squarrosa, Nemcia* sp. Ellen Peak, *Hypocalymma myrtifolium, Darwinia* sp. Stirling Range, and *Stylidium keigheryi.*

Eleven threatened (Declared Rare) species occur in the community - *Darwinia collina, Darwinia squarrosa, Dryandra montana, Banksia brownii, Andersonia axilliflora, Sphenotoma drummondii, Darwinia* sp. Stirling Range, *Deyeuxia drummondii*, *Persoonia micranthera*, *Leucopogon gnaphalioides* and *Xyris exilis* (Department. of Conservation and Land Management, 1998). Of these, *D. montana, L. gnaphalioides, P. micranthera, D. drummondii* and *A. axilliflora* have been classified as 'critically endangered' by the WA Threatened Species Scientific Committee (1998) using IUCN (World Conservation Union) criteria.

The distinctiveness of the community is further supported by floristic analysis of a number of mountain sites in the Stirling Range that indicated that those from the Eastern Stirling Range formed a distinct group (Barrett 1996). The community is similar to the *Kunzea montana - Andersonia echinocephala* community identified "as rare and occurring only on exposed slopes and the upper part of higher peaks" by Pignatti *et al.* (1993). The concept of the community is also supported by G. Keighery of the Department of Conservation and Land Management (personal communication[1]) who has completed an extensive flora survey of the Stirling Range National Park (Keighery 1993).

1.2 Extent and location of occurrences

The community extends from Ellen Peak (1 012m) at the eastern limit of its range to Coyanarup Peak (1 045m). The community is largely restricted to the summit areas of this ridge, which includes the following peaks: Pyungoorup (1 060m), the Arrows, Isongerup (994m), Moongoongoonderup (750m) and Bluff Knoll (1 080m). The community covers about 500 ha along this ridge line. There is a separate occurrence on the summit area of Mt Success (750m), and the community covers about 20 ha (M. Grant personal communication[2]) on this peak.

[1] Greg Keighery, Principal Research Scientist, CALMScience Division, Wildlife Research Centre, PO Box 51, Wanneroo, 6065.
[2] Malcolm Grant, CALM South Coast Region, Albany

1.3 Biology and ecology

Key features affecting community composition and structure are aspect/exposure, soil type and depth, temperature, time since fire and the effects of the introduced plant pathogen *Phytophthora cinnamomi*. The latter is discussed in more detail in Section 1.4 under 'threatening processes'.

The community structure is or was typically that of a dense heath or thicket with scrub vegetation on skeletal soils. Taller thicket vegetation is favoured by more sheltered sites on deeper soils. Long unburnt sites are characterised by minimal understorey vegetation. Plant growth after fire is extremely slow in more exposed locations. Factors affecting plant growth include low temperatures and high wind speeds that prevail for much of the year (Barrett 1996). There has been no detailed study of these aspects of the community's ecological needs.

1.4 Historical and current threatening processes

Of the threats to the montane community the most significant is unequivocally plant disease resulting from the introduced pathogen *Phytophthora cinnamomi* (Barrett 1996; Watson 1993; Wills 1993). However, other threatening processes exist (see Table 1), including the impact of frequent fire and disturbance due to recreational activities, both of which impact on disease processes. A less significant threat is grazing by rabbits.

Table 1: Threatening processes and areas of impact

Threatening process	**Areas impacted**
Phytophthora cinnamomi	all
Fire	all
Recreation	Bluff Knoll, Eastern Peaks Route: Ellen Peak to Bluff Knoll
Rabbits	Bluff Knoll, Coyanarup Peak, Ellen Peak

THE IMPACT OF *PHYTOPHTHORA CINNAMOMI*

History of the disease

The Stirling Range has a long history of use and it is difficult to determine when the pathogen may have been introduced. The construction and use of an extensive firebreak system in the 1960s presented an ideal opportunity for the spread of the disease over much of the Park. CSIRO researchers noted that the disease was evident in 1974 (Department of Conservation and Land Management 1997).

It is apparent that the pathogen has been spread to many of the peaks through the transport of infected soil, mainly by foot access. Infections high in the landscape have led to considerable down-slope spread in broad fronts. There also appears to be a correlation between the higher and more significant peaks - notably in the eastern Stirling Range - and the distribution of the fungus (Department of Conservation and Land Management 1997).

Distribution of the disease

The entire extent of the eastern Stirling Range has been infected by *Phytophthora cinnamomi* to some degree, but small remnants of the montane community may be dieback-free due to their location. Approximately 80 ha of the total 500 ha area of the community may be relatively intact in terms of species

composition (M. Grant personal communication).

The impact of *P. cinnamomi* on community floristics and structure

Analysis of floristic survey data shows a significantly lower number of proteaceous and other species that are highly susceptible to the disease in areas long affected by *P. cinnamomi* (Barrett 1996). This impact on community floristics has also been demonstrated for other areas within the Stirling Range (Wills 1993). The implications for ecosystems have been reviewed by Wills and Keighery (1994).

Plant members of the community that are significantly impacted by the disease include the proteaceous species - *Persoonia micranthera, Banksia brownii, B. oreophila, B. solandri, Dryandra montana, D. concinna,* and *Isopogon latifolius; and* the epacridaceous species *Andersonia axilliflora, Leucopogon gnaphalioides, Andersonia echinocephala, Sphenotoma drummondii* and *Sphenotoma* sp. Stirling Range.

The historical contribution of the proteaceous species to floristics and structure of the community is indicated by the burnt 'skeletons' of dominant proteaceous species, and in old photographs of the peaks. These long-lived proteaceous species were major components of the overstorey as can be seen from remains of individuals of *Banksia solandri, Banksia oreophila* and *Dryandra* spp. and *Banksia brownii* still visible on the Bluff Knoll plateau. These species are being replaced largely by sedges (Cyperaceae and Restionaceae) less than one metre in height.

Susceptible epacrid seedlings are still relatively abundant in the community, but survival rates are low.

While highly susceptible species are largely members of the families Proteaceae and Epacridaceae, a range of species in the community from the families Myrtaceae and Papilionaceae have demonstrated low to variable susceptibility to *P. cinnamomi.* Positive recoveries of *P. cinnamomi* were obtained from dead or dying *Darwinia squarrosa* and *Darwinia collina*. There were also positive recoveries from the dominant species *Kunzea montana.* While the latter is still abundant in infected sites, at high inoculum levels individuals may succumb.

THE IMPACT OF FIRE

Fire history

There have been two major fires in the eastern Stirling Range in the last 25 years. These occurred in February 1972 and April 1991. There is also an anecdotal record of a fire in the late 1950s.

Fire distribution

Analysis of aerial photography indicates both of the recent fires had a widespread impact. Some areas of the community were only burnt in 1972, or in 1991, and some areas were burnt in both fires. The fire in 1991 was more extensive than that in 1972. Small remnants of long unburnt (pre-1972) vegetation escaped both fires.

Post-fire regeneration

In comparison to growth rates at lower altitudes or in more sheltered areas, plant growth rates on the exposed summit and plateau areas are extremely slow, particularly for obligate seed regenerating species (Barrett 1996).

Several members of the community have juvenile periods (time to first flowering) of greater than five years, which affects the rate of recovery of seed banks. These include the dominant shrub species *Kunzea montana, Banksia oreophila, Banksia solandri, Banksia brownii, Dryandra concinna, Dryandra montana, Dryandra formosa, Dryandra baxteri, Isopogon latifolius, Adenanthos filifolius, Persoonia micranthera* and

Andersonia axilliflora (Barrett 1996).

The length of time required for many species in the community to reach maturity following fire, combined with deaths of juveniles from dieback, suggests a long fire-free interval (> 25 years) is required for this community (see also Friend & Williams 1993; Main & Gaull 1993).

There has been no detailed study of the fire ecology of the community.

Fire - Plant disease interaction

Observations in the eastern Stirling Range community suggest that fire in this environment, where the disease is already present, may increase site susceptibility to *P. cinnamomi*. Burnt areas where key proteaceous species were present pre-fire (as indicated by burnt 'skeletons') demonstrate widespread seedling deaths due to *P. cinnamomi* post-fire. The under-developed root systems of obligate seeders may increase vulnerability to the disease as may factors that result from fire such as loss of leaf litter, altered soil temperatures and modified drainage characteristics. Altered hydrology post-fire may be the most significant factor in mountain areas where lack of vegetative cover may augment the effects of slope on water movement. In this situation the disease may be spread by water rather than root to root contact.

The apparent visual difference between more frequently burnt and unburnt areas in the eastern Stirling Range thicket community appears to be due to the predominance of an undescribed *Lepidosperma* species in more frequently burnt areas with virtually no occurrence of the species in long unburnt dieback-affected heath and thicket. There has been no comprehensive study of post-fire succession in this community.

There has also been no detailed study of fire-dieback interactions.

RECREATIONAL IMPACTS

History of recreation

The Stirling Range is highly valued by visitors as the most significant mountain range in the southwest of the State and there is a long history of recreational use of the area. In 1913 the Stirling Range National Park was created, and by 1920 the Stirling Range Tourist Association had developed access roads to the area.

The higher peaks of the eastern Stirling Range attract visitors interested in bushwalking, nature observation and rock-climbing.

Distribution of recreational activities

Bluff Knoll is the most popular site visited, being the highest mountain in the southwest. It also provides good rock climbing opportunities. The Ridge Walk from Ellen Peak to Bluff Knoll is a popular walk that is well known by bushwalkers throughout Australia. It takes between two and three days to complete, and preferred camping places are the Arrows and Bakers Knob. The walk is described in bushwalking guides by Morphett (1996) and Rankin (1989).

Mt Success occurs within a proposed Special Conservation Zone for the Stirling Range National Park and a permit is required for access to the area (CALM 1997).

Recreation - plant disease interactions

The major implication of recreational activity for the Eastern Stirling Range Montane Heath and Thicket Community is the potential to spread plant disease. The current distribution of *Phytophthora cinnamomi* in the Stirling Range, and especially the location of apparently recent infections, suggests that humans have continued to disperse the pathogen (Gillen & Watson 1993; Wills 1993). It is apparent that the pathogen has spread to many of the peaks through the transport of infected soil, mostly by foot access, as a result of both recreational and other activities. There appears to be a correlation between the higher, more significant and more readily accessible peaks and the distribution of the pathogen. In some areas at certain times of the year, however, there may also be the potential for spread of the pathogen by movement of wild animals, especially larger species such as the Western Grey kangaroo (*Macropus fuliginosus*).

Path drainage is important in relation to both erosion and the risk of spreading dieback (Watson & Passmore 1993). In wet conditions pooling of water occurs near the summit areas of Bluff Knoll. While confined largely to small sections of the path, these wet areas provide ideal sites for the transfer of *Phytophthora* through soil collected on walking boots (Gillen & Watson 1993). Moist soil conditions prevail for much of the year on the higher peaks, particularly near mountain summits. This is associated with run-off from rock faces, for example on Ellen Peak and the south face of Pyungoorup. The steep climb to the summit of Ellen Peak on muddy loam soils again provides ideal conditions for soil and disease transfer.

Other impacts

Other negative impacts that result from recreational activity include side path formation, path erosion, bare-ground occurrences, camp-fire remains, litter and nutrient enrichment of soils. These impacts tend to be concentrated towards the summit areas of the peaks.

Side paths have formed on the summit of Bluff Knoll where people have explored or accessed viewing points. The paths in the montane community are particularly at risk of track erosion where they run across the contour lines, due to moderately to highly erodible soils and steep inclines. Although the Bluff Knoll track has been realigned, a combination of heavy use and increased water run-off associated with decreased vegetation cover after fires has resulted in significant track erosion.

Litter levels generally correlate with the level of visitor use, although none of the peaks in the community have a serious litter problem despite relatively low levels of litter collection.

Although biodegradable, toilet paper on the mountains, and particularly on Bluff Knoll, has a significant visual impact.

A more significant impact on this plant community with increasing visitor numbers may be increases in soil fertility associated with accumulation of human excreta on the peaks. Specht (1963) demonstrated significant detrimental effects of increases in phosphate and nitrogen levels in heath communities in South Australia. He noted that herbs (weeds in particular), and sedges were favoured by even minor increases in soil fertility in soils that were originally nutrient poor. The impact of increases in soil fertility on composition of the eastern Stirlings montane heath community should be monitored, and remedial steps such as provision of toilets in high use areas may be necessary in the near future.

The number of bare ground occurrences and fire places are not high. This indicates that the impact of camping is not great at current levels of use but needs to be monitored, particularly in relation to the Eastern Peaks Route, which is gaining in popularity.

The Eastern Peaks Route also has implications for the survival of remaining pockets of vegetation that contain a relatively intact community as it traverses several of these remnants.

GRAZING BY RABBITS

Evidence of rabbits (diggings, scats) is conspicuous on the Bluff Knoll Plateau and to a lesser extent in the Ellen Peak area. The effects of grazing are apparent on a range of species, but these appear to be largely species unaffected by *Phytophthora.*

Anecdotal evidence suggests rabbit numbers have increased since the recent occurrence of major compositional changes in this plant community (G. Keighery personal communication).

There has been no research into the effects of rabbit grazing on the regeneration of burnt vegetation in this community, but very young plants are known to be attractive to rabbits and kangaroos. High numbers of either species are likely to hamper regeneration.

1.5 Conservation Status

The community meets criterion B (ii) as follows, for Critically Endangered (from English and Blyth 1997):

B ii) current distribution is limited and there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

1.6 Strategy for recovery

Two strategies are proposed:

- To identify and influence the management of those areas of the community that are currently dieback-free and/or those areas that retain a relatively intact plant community in terms of species diversity and composition.

- To conduct research into the ecology of the community to develop further understanding of the management actions required to maintain the condition of the community.

2. RECOVERY AIM AND CRITERIA

2.1 Aim

To maintain the health and condition of selected remnants of the Eastern Stirling Range Montane Heath and Thicket Community and reduce the level of threat to these priority areas, with the aim of downgrading it from Critically Endangered to Endangered.

2.2 Criteria for success

Maintenance of the diversity and composition of native species in those identified areas of the community that are currently dieback-free or relatively intact in terms of species composition. This will be measured by comparison of species composition in dieback free and infected areas.

Reduction of threatening processes as described above.

2.3 Criteria for failure

Significant loss of area or major modification of occurrences of the community, in those remnants that are currently dieback-free or relatively intact in terms of species composition.

3. RECOVERY ACTIONS

3.1 Establish a Recovery Team

The Albany District Threatened Flora Recovery Team will be the Recovery Team for the community.

Responsibility: Albany District, Western Australian Threatened Species and Communities Unit (WATSCU)
Cost: Nil
Completion date: Completed

3.2 Identify

a) all the remaining dieback-free occurrences of the community; and
b) all the remaining areas where the community persists relatively intact in terms of species composition.

Responsibility: Refer to specific actions as listed below (3.2.1-3.2.3)
Cost: Refer to specific actions as listed below
Completion date: Completed December 1997

3.2.1 Map areas as defined in 3.2 following ground-based survey

Responsibility: CALM (Albany District)
Cost: $1000
Completion date: Year 2

3.2.2 Evaluate the threats to the community, in particular the risk of infection for those areas that are relatively intact in terms of species composition

Other threats that should be evaluated include the possible impact of too frequent fire, increased soil fertility in commonly used portions of walk trails and rabbit infestation.

Responsibility: CALM (Albany District)
Cost: $500
Completion date: Year 2

3.3 Rank all areas of the community as to the urgency for recovery action, in terms of their conservation value, the degree of threat posed, and the likelihood of success of management actions. Identify key actions

Responsibility: CALM (Albany District)
Cost: $500
Completion date: Year 2

3.4 Manage threatening processes for the identified priority areas

Responsibility: Refer to specific actions as listed below (3.4.1-3.4.11)
Cost: Refer to specific actions as listed below
Completion date: Ongoing

3.4.1 Develop and implement a fire management strategy for the community

There is a need for research into recovery of the community from fire, and to determine the implications of findings for management. This would also include developing a fire history map of the occurrences. As evidence indicates the community does not recover well from fire in dieback-infected areas, fire should be excluded from the community for the life of this IRP, effective immediately. This will be achieved by indicating the community as requiring exclusion of fire in the prescription for the relevant fire management unit defined in the Park Management Plan

Responsibility: CALM (Albany District)
Cost: $250
Completion date: Year 1

3.4.2 Provide information to Eastern Peaks Route users regarding the values of the community and necessary hygiene practices. Review the 'Code of Conduct for backcountry use in the Stirling Range National Park' with particular reference to dieback hygiene

Responsibility: CALM (Albany District)
Cost: $5,000
Completion date: Year 2

3.4.3 Undertake a Phosphite spraying program to protect and enhance the values of priority areas in the community. Undertake plant tissue analysis to monitor *in planta* phosphite concentrations

Responsibility: CALM (Albany District) / Dieback Coordinator/ CALMScience Division
Cost: $20,000 p/a
Completion date: Ongoing

3.4.4 Institute a flora monitoring program to evaluate the effectiveness of the Phosphite application

Flora monitoring should include controls in both treated and untreated areas of infected sites where feasible.

Responsibility: CALM (Albany District) / Dieback Co-ordinator/ CALMScience Division
Cost: $28,000 p/a initially, $20,000 p/a subsequent years
Completion date: Ongoing

3.4.5 Undertake appropriate research into the fire ecology of the community, in particular juvenile periods and recovery of seed banks of key species and community growth rates

Responsibility: CALM (Albany District; CALMScience Division)
Cost: $28,000 p/a initially, $20,000 p/a subsequent years
Completion date: Ongoing

3.4.6 Undertake appropriate research into dieback-fire interactions in the community, in particular, the effect of the disease on recovery from fire

Responsibility: CALM (Albany District and CALMScience Division**)**
Cost: $28,000 p/a initially, $20,000 p/a subsequent years
Completion date: Ongoing

3.4.7 Investigate the alignment, condition and level of use of the Eastern Peaks Route and evaluate the risks posed to priority areas of the community

Responsibility: CALM (Albany District)
Cost: $12,000
Completion date: Year 2

3.4.8 If appropriate, redesign, realign and mark the current Eastern Peaks Route in accordance with the Park Management Plan to avoid priority areas of the community

Responsibility: CALM (Albany District)
Cost: Dependent upon outcome of 3.4.7
Completion date: Year 3

3.4.9 Undertake reconstruction of the Bluff Knoll track from the Coyanarup Saddle to the summit to ensure a suitable surface and good drainage to manage the risk of *Phytophthora* being spread from the path

Responsibility: CALM (Albany District)
Cost: $20,000
Completion date: Year 2

3.4.10 Develop and implement a flora monitoring program to evaluate the impact of increased soil fertility in high use areas of walking trails and rabbits

Responsibility: CALM (Albany District)
Cost: $20,000 p/a initial year, $14,500 p/a subsequent years
Completion date: Ongoing

3.4.11 Implement a rabbit control strategy

A rabbit control program should be designed and implemented in the community, focusing on areas where the vegetation is most impacted by rabbit warrens and grazing. Care should be taken not to impact local fauna. The use of myxomatosis, calicivirus, and 1080 baiting are options for use in this Park where macropods that are vulnerable to pindone are present.

Responsibility: CALM (Albany District)
Cost: Dependent upon strategy used
Completion date: Ongoing

3.4.12 Continue to monitor the level of visitor use and its impact on the community, in particular the intensity of use of the Eastern Peaks Route. Consider introducing a system to regulate visitor numbers in accordance with the Park Management Plan

Responsibility: CALM (Albany District)
Cost: $5,000 p/a initial year, 2,500 p/a ongoing
Completion date: Ongoing

3.4.13 Incorporate strategies required to protect the community into the Park Management Plan when it is reviewed

Ensure protection of the community in the implementation of strategies in the Park Management Plan and incorporate any new strategies required to protect the community into the Park Management Plan when it is reviewed.

Responsibility: CALM (Albany District; South Coast Region)
Cost: nil
Completion date: Completed

3.14 Report on success of management strategies for the community

Reporting will be part of annual reports prepared by Recovery Teams for CALM's Corporate Executive. The final report will be presented as part of or complementary to the full recovery plan for the community if a full recovery plan is necessary.

Responsibility: CALM (Perth District; WATSCU)
Cost: Nil
Completion date: End of Year 3.

Table 2: Summary of recovery actions

Recovery Action	Occurrences	Responsibility	Completion date
Establish a Recovery Team.	All	CALM (Albany District), WATSCU	Completed
Map dieback free areas and areas where the community persists relatively intact following ground based survey	All	CALM (Albany District)	Year 2
Evaluate threats for areas currently dieback-free	All	CALM (Albany District)	Year 2
Rank areas of community for urgency for recovery action, Identify key actions.	All	CALM (Albany District)	Year 2
Manage threatening processes for the identified priority areas	All	Refer specific actions as listed below	Refer specific actions as listed below
Develop and implement fire management strategy for community	All	CALM (Albany District)	Year 1
Provide information to Eastern Peaks Route users on values and hygiene practices. Review 'Code of Conduct for backcountry use in the Stirling Range National Park' with regard dieback hygiene	Bluff Knoll to Ellen Peak	CALM (Albany District)	Year 2
Undertake a Phosphite spraying program in priority areas	Areas to be determined	CALM (Albany District)	Ongoing
Institute flora monitoring to evaluate effectiveness of Phosphite	Areas to be determined	CALM (Albany District)	Ongoing
Research fire ecology	All	CALM (Albany District; SID; WATSCU)	Ongoing

Research dieback-fire interactions	All	CALM (Albany District SID)	Ongoing
Investigate alignment, condition and use of Eastern Peaks Route and risks posed to priority areas of community	Bluff Knoll to Ellen Peak	CALM (Albany District)	Year 2
If appropriate, redesign, realign and mark current Eastern Peaks Route to avoid priority areas of the community	Bluff Knoll to Ellen Peak	CALM (Albany District)	Dependent upon evaluation
Reconstruct Bluff Knoll track to manage risk of *Phytophthora* spread	Coyanarup Saddle to the summit	CALM (Albany District)	Year 2
Implement flora monitoring to evaluate impact of soil fertility and rabbits	Areas to be determined	CALM (Albany District)	Ongoing
Implement rabbit control strategy	Bluff Knoll, Ellen Peak	CALM (Albany District)	Ongoing
Continue to monitor visitor use and impact on the community, Consider introducing a system to regulate visitor numbers	Ellen Peak to Bluff Knoll	(Albany District)	Ongoing
Incorporate strategies required to protect the community in the Park Management Plan when it is reviewed.	All	CALM (Albany District; South Coast Region)	Completed

Table 3: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3
Establish a Recovery Team	nil	nil	nil
Map where the community persists dieback-free or relatively intact following ground based survey	$1,000	nil	nil
			nil
Evaluate threats for areas currently dieback-free or relatively intact	$500	nil	nil
Rank areas of community for urgency for recovery action, Identify key actions.	$500	nil	nil
Manage threatening processes for the identified priority areas	Refer specific actions as listed below		
Develop and implement fire management strategy	$250	nil	nil
Provide information to users of the Eastern Peaks Route on values and hygiene practices. Review 'Code of Conduct for backcountry use in the Stirling Range National Park' with regard dieback hygiene	$5,000	$1,000	$1,000
Undertake a Phosphite spraying program in priority areas	$20,000	$20,000	$20,000
Institute flora monitoring to evaluate effectiveness of Phosphite	$28,000	$20,000	$20,000
Research fire ecology	$28,000	$20,000	$20,000
Research dieback-fire interactions	$28,000	$20,000	$20,000
Evaluate alignment, condition and use of Ridge Walk and risks to priority areas	$12,000	nil	nil
If appropriate redesign/realign current route around priority areas and mark suitably	Dependent upon evaluation		
Reconstruct Bluff Knoll track to manage risk of *Phytophthora* spread	$20,000	nil	nil
Implement flora monitoring to evaluate impact of soil fertility and rabbits	$20,000	$14,500	$14,500
Implement rabbit control strategy	Dependent upon strategy used		
Continue to monitor visitor use and impact on the community, Consider booking system if necessary	$5,000	$2,500	$2,500
Include recovery actions in the Management Plan for Stirling Range National Park	nil	nil	nil
Total	$168,250	$98,000	$98,000

Summary of costs over three years

Total $364,250

ACKNOWLEDGMENTS

The National Reserve System Program of Environment Australia funded the project entitled 'Identifying and conserving threatened ecological communities in the south west botanical province' (English and Blyth 1997). The project confirmed the threatened status of this plant community.

The following people have provided valuable assistance and advice in the preparation of this Interim Recovery Plan:

John Blyth	Principal Ecologist, CALM Woodvale
Luke Coney	Ranger-in-Charge, Stirling Range National Park
Val English	Ecologist, CALM Woodvale
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Ellen Hickman	Flora Officer, CALM Albany
Greg Keighery	Senior Research Scientist, CALM Woodvale
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Ian Herford	Planning Officer, CALM Albany
John Watson	Regional Manager, CALM, South Coast Region

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Appendix 1
Typical and common native species regularly associated with the Eastern Stirling Range Montane Heath and Thicket (adapted from Barrett, 1996)

Typical species ***** indicates species endemic to the community		
Shrubs		**Herbs / Sedges**
Sphenotoma drummondii	*Andersonia axilliflora**	*Stylidium keigheryi*
Leucopogon gnaphalioides	*Dryandra montana**	*Xyris exilis*
Andersonia echinocephala	*Persoonia micranthera**	*Drosera huegelii* dwarf form
Banksia brownii	*Darwinia collina**	
Nemcia sp. *Ellen Peak**	*Darwinia squarrosa**	
Hypocalymma myrtifolium	*Darwinia* sp.Stirling Range	
Common species		
Shrubs		**Herbs / sedges**
Calothamnus crassus	*Kunzea montana*	*Leidosperma* sp. *Stirling Range*
Lysinema fimbriatum	*Beaufortia anisandra*	*Tetraria capillaris*
Aotus genistoides	*Sphenotoma* sp. *Stirling Range*	*Schoenus efoliatus*
Monotoca oligarrhenoides	*Actinotus rhomboideus*	*Desmoclados flexuosa*
Agonis parviceps x linearifolia (SB 326)	*Xanthosia rotundifolia var rotundifolia*	
Boronia spathulata	*Veillea foliosa*	
Acacia drummondii	*Banksia oreophila*	
Agonis floribunda		

Appendix 2
Physical and structural characteristics of sites and dieback susceptibility

Geology:	**Structural units:**	**Impact of *Phytophthora cinnamomi*:**
quartzite	heath	high
	dense thicket	
Soil:	dwarf scrub	
sandy clay loam	dense sedge	