

Abridged Threatened Species Nomination Form

For nominations/assessments under the Common Assessment Method (CAM) where supporting information is available, but not in a format suitable for demonstrating compliance with the CAM, and assessment against the IUCN Red List threat status.

Cover Page *(Office use only for Assessment)*

Species name (scientific and common name):	<i>Leucopogon</i> sp. Flynn (F. Hort, J. Hort & A. Lowrie)
Nomination for (addition, deletion, change):	Addition
Nominated conservation category and criteria:	CR: B1ab(iii,v)+B2ab(iii,v)

Scientific committee assessment of eligibility against the criteria:		
This assessment is consistent with the standards set out in Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding.		Yes <input type="checkbox"/> No <input type="checkbox"/>
A.	Population size reduction	•
B.	Geographic range	•
C.	Small population size and decline	•
D.	Very small or restricted population	•
E.	Quantitative analysis	•

Outcome:			
Scientific committee Meeting date:			
Scientific committee comments:			
Recommendation:			
Ministerial approval:		Date of Gazettal/ Legislative effect:	

Nomination/Proposal summary *(to be completed by nominator)*

Current conservation status				
Scientific name:	Leucopogon sp. Flynn (F. Hort, J. Hort & A. Lowrie)			
Common name:	None			
Family name:	Ericaceae	Fauna <input type="checkbox"/>	Flora <input checked="" type="checkbox"/>	
Nomination for:	Listing <input checked="" type="checkbox"/>	Change of status/criteria <input type="checkbox"/>	Delisting <input type="checkbox"/>	
1. Is the species currently on any conservation list, either in a State or Territory, Australia or Internationally? 2. Is it present in an Australian jurisdiction, but not listed?		Provide details of the occurrence and listing status for each jurisdiction in the following table		
Jurisdiction	State / Territory in which the species occurs	Date listed or assessed (or N/A)	Listing category i.e. critically endangered or 'none'	Listing criteria i.e. B1ab(iii)+2ab(iii)
International (IUCN Red List)				
National (EPBC Act)				
State / Territory	1. WA	2012	Critically Endangered	B1ab(iii,v)+B2ab(iii,v)
	2.			
	3.			
Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:				
<ul style="list-style-type: none"> this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria; 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:				
<ul style="list-style-type: none"> surveys of the species were adequate to inform the assessment; 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:	A further partial survey was undertaken in 2016 but was not able to evaluate population size compared to 2011.			
<ul style="list-style-type: none"> the conclusion of the assessment remains current and that any further information that may have become available since the assessment was completed supports or is consistent with the conclusion of the assessment. 			Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Comments:	Assessment is consistent and criteria remains current.			
Nominated national conservation status: category and criteria				
Presumed extinct (EX) <input type="checkbox"/>	Critically endangered (CR) <input checked="" type="checkbox"/>	Endangered (EN) <input type="checkbox"/>	Vulnerable (VU) <input type="checkbox"/>	
None (least concern) <input type="checkbox"/>	Data Deficient <input type="checkbox"/>	Conservation Dependent <input type="checkbox"/>		

What are the IUCN Red List criteria that support the recommended conservation status category?		B1ab(iii,v)+B2ab(iii,v)
Eligibility against the IUCN Red List criteria (A, B, C, D and E)		
Provide justification for the nominated conservation status; is the species eligible or ineligible for listing against the five criteria. For delisting , provide details for why the species no longer meets the requirements of the current conservation status.		
A.	Population size reduction (evidence of decline)	<ul style="list-style-type: none">• Variability has been observed in monitored plant numbers with an overall trend not being able to be quantified. Therefore it is not possible to calculate a value for percentage population reduction.• Unable to assess
B.	Geographic range (EOO and AOO, number of locations and evidence of decline)	<ul style="list-style-type: none">• (B1) Using Minimum Convex Polygon (MCP) the EOO is 0.296 km² which was calculated by drawing a minimum convex polygon around the plants.• (B2) Area of Occupancy is <10 km² based on actual area occupied of 0.0481 km² or estimated 4km² using the 2km x 2km grid method.• (a) The species is only known from one location.• (b) Continuing decline observed and projected:• (iii) Ongoing threats to habitat condition and extent from fire, road maintenance, grazing, poor recruitment, pigs, <i>Phytophthora cinnamomi</i> and a drying climate.• (v) Monitored plant numbers have shown significant variability at the population with a potential overall reduction from 3,000 in 2001 to between 1870 (38%) in 2011 or potentially 621 (80% reduction, but only partial; survey) in 2016.• Meets criteria for Critically Endangered B1ab(iii,v)+B2ab(iii,v)
C.	Small population size and decline (population size, distribution and evidence of decline)	<ul style="list-style-type: none">• Known from between 621 and 1870 mature individuals in total.• Monitored plant numbers show significant variability, with an apparent decline overall from 3,000 individuals in 2001 to potentially 621 individuals in 2016. However an increase was also observed in 2011 to 1,870 individuals. The cause of these variations in plant counts is not known, and may be partially due to survey variability, and hence it is not possible to calculate a value for percentage population reduction.• Unknown if number of mature individuals in all subpopulations less than 1000.• Insufficient data to assess
D.	Very small or restricted population (population size)	<ul style="list-style-type: none">• (D) There are estimated to be between 621 and 1870 mature individuals in total.• May meet Vulnerable D1, but requires complete population count.
E.	Quantitative analysis (statistical probability of extinction)	<ul style="list-style-type: none">• No information to assess.

Summary of assessment information					
EOO	0.296 km ² (MCP)	AOO	4 km ² (2 km x 2 km grid). Mapped area of occupied habitat 0.0481 km ² .	Generation length	-
No. locations	1	Severely fragmented	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>		
No. subpopulations	2	No. mature individuals	621 to 1870		
Percentage global population within Australia			100		
Percentage population decline over 10 years or 3 generations			Unknown		
Threats (detail how the species is being impacted)					
Threat <i>(describe the threat and how it impacts on the species. Specify if the threat is past, current or potential)</i>		Extent <i>(give details of impact on whole species or specific subpopulations)</i>		Impact <i>(what is the level of threat to the conservation of the species)</i>	
Altered fire regimes <ul style="list-style-type: none"> The species is a re-seeder that is killed by fire, with 80% of mature plants dying following a prescribed burn in June 2006. It is not known how long it takes the species to reach maturity and there may not be enough time for the species to set seed and recover if the interval between fires is too short. Past, current and future		Whole population		Severe	
Grazing (kangaroos) <ul style="list-style-type: none"> A number of plants severely grazed to less than 3cm tall, preventing flowering and fruiting and thereby limiting natural recruitment. Past, current and future		Whole population		Severe	
Road maintenance <ul style="list-style-type: none"> Grading, chemical spraying, construction of drainage channels and the mowing of vegetation. Past and present		Whole population		Severe	
Recreational activities <ul style="list-style-type: none"> Trail bike riders and 4WD users are a threat to the population. The area where the population is located is next to an existing track and is low lying and easy to access, making it attractive to off-road vehicles. Current, future		Whole population		Severe	
Phytophthora dieback <ul style="list-style-type: none"> <i>Phytophthora cinnamomi</i> may kill plants or degrade associated habitat. It is not known if 		Whole population		Severe	

<p><i>Leucopogon</i> sp. Flynn (F.Hort, J.Hort & A.Lowrie 859) is susceptible to dieback, however, other members of the genus are known to be highly susceptible.</p> <p>Potential</p>		
<p>Poor recruitment</p> <ul style="list-style-type: none"> The species is likely to require a disturbance to recruit, but if disturbance is too frequent or is followed by a drought, the population may be impacted. <p>Current, future</p>	Whole population	High
<p>Feral pigs</p> <ul style="list-style-type: none"> These are a potential threat to the population as they may dig up plants when looking for food. Currently they are not prevalent in the area due to ongoing control. <p>Future</p>	Whole population	Moderate
<p>Drought</p> <ul style="list-style-type: none"> This is a threat to the species if it occurs over a number of years. Plants grow in a drainage area and would be susceptible to changes in surface water flow and decreases in groundwater levels. <p>Future</p>	Whole population	Severe
Management and Recovery		
Is there a Recovery Plan (RP) or Conservation Management Plan operational for the species?		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<p>List all relevant recovery or management plans (including draft, in-preparation, out-of-date, national and State/Territory recovery plans, recovery plans for other species or ecological communities, or other management plans that may benefit or be relevant to the nominated species).</p> <ul style="list-style-type: none"> Department of Parks and Wildlife (2016 DRAFT) <i>Leucopogon</i> sp. Flynn (F. Hort, J. Hort & A. Lowrie) Interim Recovery Plan 2016–2021. Interim Recovery Plan No. #. Department of Parks and Wildlife, Western Australia. 		
<p>List current management or research actions, if any, that are being undertaken that benefit the conservation of the species.</p> <ul style="list-style-type: none"> Monitoring and surveys have been carried out to determine plant numbers and impact of threats. Threatened flora markers have been installed at the subpopulation of <i>Leucopogon</i> sp. Flynn (F.Hort, J.Hort & A.Lowrie 859). 		
<p>List further recommended management or research actions, if any, that would benefit the conservation of the species. Please ensure that this section addresses all identified threats.</p> <p>Management</p> <ul style="list-style-type: none"> Ongoing monitoring and observations of subpopulation and threats. Develop and implement a fire management strategy, including associated weed control measures and the need for, and method of, the construction and maintenance of firebreak. Install fencing at the subpopulation to reduce grazing and trampling by kangaroos and pigs and allow recruitment within a larger area of habitat. Collect and store seeds to guard against the extinction of natural populations. Collections should aim to 		

sample and preserve the maximum range of genetic diversity possible.

- Undertake surveys in areas of potentially suitable habitat between December and February.
- Restrict access (in particular 4WD's) to the subpopulation through installation of barriers such as bollards. Install signs indicating the significance of the area.
- Follow dieback hygiene measures.
- Develop a translocation proposal and select a disease free translocation site.
- Map habitat critical to the survival of the species to facilitate its protection and appropriate management.
- Promote awareness of the species with general public.

Research

- As habitat disturbance (physical or fire) is thought to promote germination of soil stored seed, it is recommended that germination trials be undertaken.
- Research biology and ecology of the species, with a focus on pollination effectiveness, seed viability, conditions required for natural germination, response to threats and disturbances and reproductive biology.

Nomination prepared by:	
Contact details:	
Date submitted:	6/9/2016
<i>If the nomination has been refereed or reviewed by experts, please provide their names and contact details:</i>	

Summary of subpopulation information <i>(detailed information to be provided in the relevant sections of the form)</i>						
Location <i>(include coordinates)</i>	Land tenure	Survey information: Date of survey and No. mature individuals	AOO	Site / habitat Condition	Threats <i>(note if past, present or future)</i>	Specific management actions
Crown Reserve 47883 (Wandoo National Park), Crawler Road	National Park	2001: 3,000 2007: 600 2011: 1,870 2016: 621+ (only 4 out of 5 plots were counted so likely to be more plants)	4.81 ha (using 2011 figure as not recorded in 2016)	Healthy, habitat excellent.	Fire (past, present, future) Grazing (kangaroos) (past, present, future) Road maintenance (past, present) Damage by off-road vehicles (present, future) Lack of recruitment (present, future) Disease (future) Feral pigs (future) Climate change (future)	Develop a fire management plan Install fencing Install markers Restrict access where possible Collect seed and test viability, conduct regeneration trials Undertake dieback mapping Baiting/trapping program to be completed



Department of
Environment and Conservation

Our environment, our future



Form to nominate a Western Australian species for listing as threatened, change of category or delisting 2012 (Updated 2016).

NOTICE: Incomplete forms may result in delays in assessment, or rejection of the nomination. To fill out this form you must refer to the Guidelines and contact the relevant Officer in the DEC Species and Communities Branch. DEC staff can advise you on how to fill out the form and may be able to supply additional, unpublished information.

Answer all relevant sections, filling in the white boxes and indicating when there is no information available. **Note**, this application form applies to both flora and fauna species, and hence some questions or options may not be applicable to the nominated species – for these questions, type “N/A”.

To mark boxes with a **cross**, double click the box and select not checked or checked.

SECTION 1. NOMINATION

1.1. Nomination for:

Flora ☒ Fauna ☐ Threatened / DRF ☒ Change of category ☐ Delisting ☐

1.2. Scientific Name

This name will be used to identify the species on all official documentation. Use the approved name used by the Western Australian Museum or Herbarium, if possible.

Leucopogon sp Flynn

1.3. Common Name

If the species has a generally accepted common name, please show it here.

N/A

1.4. Current Conservation Status. If none, type 'None'.

	IUCN Red List Category e.g. Vulnerable	IUCN Red List Criteria e.g. B1ab(iv);D(1)
International IUCN Red List	None	None
National EPBC Act 1999	None	None
State of Western Australia	Critically Endangered	B1ab(iii,v)+B2ab(iii,v)
State of WA Priority	1 <input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	

1.5. Nominated Conservation Status.

	IUCN Red List Category	IUCN Red List Criteria
State of Western Australia	Critically Endangered	B1ab(iii,v)+B2ab(iii,v)
State of WA Priority	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/>	

Is the species listed as 'Threatened' in any other Australian State or Territory? If Yes, list these States and/or Territories and the status for each.

No ☒ Yes ☐

1.6. Reasons for the Nomination.

Briefly summarise the reasons for the nomination in dot points. Please include details relevant to the IUCN Categories and Criteria where appropriate.

Leucopogon sp. Flynn has a low actual area of occupancy, 0.0481 km² or 4.81 hectares, and is only known from one population (2 sub populations). However, these sub populations are located very close together and have never been monitored separately. The extent of occurrence is 0.296 km².

The number of mature individuals found in this population has fluctuated significantly since the species was first surveyed in 2001. In 2001, 3,000 mature individuals were located, 600 in 2007, 1,870 in 2011 and 621+ in 2016 (incomplete survey). Some of the individuals located in 2011 were a result of further survey and can not be considered a true increase in the size of the original population.

The small number of sub-populations and area of occupancy and extent of occurrence enable this plant to meet the IUCN categories Critically Endangered: B1ab(iii,v)+B2ab(iii,v).

History

Population numbers have varied significantly since it was discovered in 1999 as a result inappropriate fire and grazing pressures.

In 2001, over 3,000 plants were recorded. A control burn was completed across the area in June 2006. The area was surveyed again in January and November 2007, where it was observed that only 600 plants remained. It is presumed that approximately 2,400 plants were taken in the burn. At the time of the survey, no new germinants were recorded.

In May 2011, the population was resurveyed. 1,030 mature individuals were located, however many of the plants were severely grazed. This suggests that approximately 430 plants had germinated following the 2006 burn. This is less than 16% of the plants that were originally taken in the burn.

Further survey completed a few weeks later located an additional 840 mature individuals in an area where *Leucopogon* sp. Flynn had not previously been recorded. This increased the area of occupancy by 0.160 km² and the number of mature individuals to 1,870.

In 2016, approximately 621 mature individuals were counted from both subpopulations. However only 4 out of 5 plots were surveyed and it is likely this figure is an underestimate.

These fluctuations in numbers show that this plant is very susceptible to changing environmental conditions and threatening processes such as inappropriate fire regimes.

SECTION 2. SPECIES

2.1. Taxonomy.

Describe the taxonomic history, using references, and describe the key distinguishing features that can be used to separate this taxon from closely related taxa. Include details of the type specimen, changes in taxonomy, scientific names and common names used for the species.

Leucopogon sp. Flynn (F. Hort, J. Hort & A. Lowrie 859) was discovered by Parks and Wildlife volunteers Fred & Jean Hort in December 1999. This phrase-name was subsequently added to the Western Australian Plant Census in June 2000. In this sense although undescribed, it is conventionally accepted. The species belongs to a small group of *Leucopogon* sens. lat. which can be most obviously characterized by the presence of flattened leaf-like fruit. There are two described species in this group (*L. flavescens* and *L. blepharolepis*) as well as a couple of other phrase-named taxa, *L. sp.* Lake Magenta and *L. sp.* Moore River. The group can be conveniently referred to as the *L. flavescens* group. Within the group *L. sp.* Flynn is well-differentiated morphologically from the others. The only other group-member that occurs anywhere near Perth is *L. sp.* Moore River which grows on the coastal plain mostly to the north of Perth but with an outlier near Mandurah. *L. sp.* Flynn is easily distinguished from *sp.* Moore River by its shorter leaves and filiform sepals which are as long as, or longer than, the corolla tube (shorter than in *sp.* Moore River). No hybrids involving *L. sp.* Flynn are known, and are considered very unlikely to occur.

Several recent cladistic studies into relationships within Ericaceae tribe *Styphelieae*, based on morphological data (Powell *et al.* 1997), DNA sequence data (Quinn *et al.* 2003) or a combination of both (Taaffe *et al.* 2001), have provided strong evidence that the genus is polyphyletic. The same studies have also given strong support for the monophyly of a group of species which includes the type of the genus, *L. lanceolatus*. The latter can therefore be regarded as representing *Leucopogon s. str.* Results obtained by Quinn *et al.* (2003) placed most of the remaining species in a large, morphologically diverse grouping which they refer to as the *Styphelia* clade. Members of the *L. flavescens* group are among the almost fifty percent of Western Australian species that belong to this clade and which will therefore need to be transferred to other genera in due course. Within the *Styphelia* clade, Quinn *et al.* found support for various potential generic grouping was mixed but that *L. blepharolepis* 'occupies an isolated position terminating an early-diverging lineage'. This strongly implies that the *L. flavescens* group is monophyletic and on the basis of the fruiting synapomorphy a new genus is likely to be described soon. It is further anticipated that the undescribed species from this group, including *L. sp.* Flynn, will be described at the same time as the new genus.

Is this species conventionally accepted? If no, explain why. For example, is there any controversy about the taxonomy? For undescribed species, detail the location of voucher specimens (these should be numbered and held in a recognised institution and be available for reference purposes).

No ☐ Yes ☒

Describe any known hybridisation with other species in the wild, indicating where this occurs and how frequently.

N/A

2.2. Description

Describe the physical appearance, habit, behaviour/dispersion and life history. Include anatomy or habit (e.g. size and/or weight, sex and age variation, social structure) and dispersion (e.g. solitary, clumped or flocks etc), and life history (eg short lived, long lived, geophytic, etc).

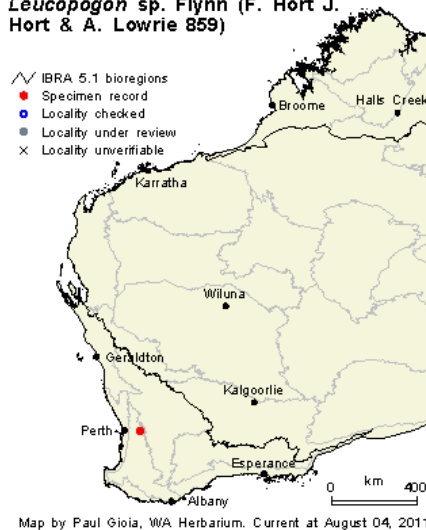
L. sp. Flynn is a rather low, compact shrub to c. 70 cm high and 120 cm wide, but usually smaller. Its life expectancy is not known, however some of the plants present when the population was discovered in 1999 are still present.

2.3. Distribution

Describe the distribution of the species in Australia and, if possible, provide a map.

The distribution of this species is highly restricted as it is only known from one population (2 sub populations) in the Perth Hills. Its area of occurrence is 0.296 km². The nearest townsite to the population is York (26 km away).

Leucopogon sp. Flynn (F. Hort J. Hort & A. Lowrie 859)



(taken from Florabase <http://florabase.dec.wa.gov.au/browse/profile/19424>)

2.4. Habitat

Describe the non-biological habitat (e.g. aspect, topography, substrate, climate) and biological habitat (e.g. forest type, associated species, sympatric species). If the species occurs in various habitats (e.g. for different activities such as breeding, feeding, roosting, dispersing, basking etc) then describe each habitat.

Non-biological habitat

Climate

The closest weather station to the population is located in Bickley. The mean annual maximum temperature for Bickley is 22.5 and mean minimum is 11.1. The temperature ranges from 41.1 to 1 degrees Celsius. (Bureau of Meteorology 2012). The population lies between the 600 and 700mm rainfall isohyets.

Soil

The observed soil type is white sand.

According to the "Atlas of Australian Soils Western Australia," (CSIRO 1967), the soil type of the area has been mapped as Soil Type JZ2.

This is defined as a "dissected plateau having a gentle to moderately undulating relief, and with broad swampy drainage-ways and basins. It is characterized by lateritic gravels and block laterite: the chief soils are ironstone gravels with sandy and earthy matrices. They overlie duricrusts of recemented ironstone gravels and/or vesicular laterite, and/or mottled-zone and/or pallid-zone material. These soils cover ridges and slopes where some soils containing ironstone gravels also occur. Leached sands are a feature of the drainage-ways and basins.

Biological habitat

Please see attachment 1 for details.

Does the (fauna) species use refuge habitat e.g. in times of fire, drought or flood? Describe this habitat.

N/A

Is the species part of, or does it rely on, a listed threatened ecological community? Is it associated with any other listed threatened species?

Population 5 of *Banksia aurantia*, currently listed as Threatened, Vulnerable (D2), occurs within the known population of *Leucopogon* sp. Flynn. There were 444 individuals of *Banksia aurantia* recorded at Population 5 when last monitored in 2009.

2.5. Reproduction

Provide an overview of the breeding system.

For fauna: Provide an overview of the breeding system and breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?

For flora: When does the species flower and set fruit? Is the seed produced viable? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, ground disturbance) in order to reproduce?

Leucopogon sp. Flynn has a lengthy flowering period beginning in mid to late spring and continuing through the summer months and possibly beyond. Because of this, flower buds, flowers and fruits are often to be found together on the same plants. Flowers of *L. sp. Flynn* are smaller than average but do not otherwise differ from the typical configuration for the genus. Because of the unspecialized nature of the flower structure it is probable that many small insects can effect pollination. Fred and Jean Hort have recorded native bees, wasps and Mydid flies (*Miltinus minutus*) tending to the flowers. (See attached images, images 1-3)

The species is known to be a re-seeder. Following the prescribed burn in 2006, observations suggest that the number of new plants recruited (as judged 5 years after the event) was significantly less than the number killed. It is not known whether this circumstance was related to low seed viability, high mortality of seedlings in the hotter and drier than average years that followed the burn or to other factors. It seems unlikely that the occurrence of fire is an absolute requirement for recruitment in *L. sp. Flynn*. Across the Western Australian members of the tribe *Styphelieae*, species generally recruit well after fire, although young plants which have apparently germinated between fire events are also frequently in evidence. In common with all other Western Australian members of the family, no vegetative reproduction occurs in this species.

2.6. Population dynamics

Provide details on ages of sexual maturity, extent of breeding success, life expectancy and natural mortality. Describe population structure (presence of juveniles/seedlings, mature and senescing individuals).

It is assumed that all plants are adults, but this can not be confirmed as some plants were too grazed to determine sexual maturity.

600 adult plants were not burnt in the 2006 burn. Therefore these plants must be older than 5 years.

The 430 plants that germinated following the 2006 burn would be between 1 and 5 years old. The age of the 840 plants found in the population extension is unknown, however based on the size of the plants they are also likely to be between 1 and 5 years old.

There has been some mortality due to drought. The death of approximately 30 plants, possibly more, was observed in 2011 following the drought in 2010. Plants that were alive when visited in January were dead when visited again in May. No other mortality has been observed.

The breeding success and life expectancy is unknown.

Questions 2.7 and 2.8 apply to fauna nominations only

2.7. Feeding

Summarise food items or sources and timing/availability.

N/A

Briefly describe feeding behaviours, including those that may make the species vulnerable to threatening processes.

N/A

2.8. Movements

Describe any relevant daily or seasonal pattern of movement for the species, including relevant arrival/departure dates if migratory. Provide details of home range/territories.

N/A

SECTION 3. INTERNATIONAL CONTEXT

For species that are distributed both in Australia and in other countries.

3.1. Distribution

Describe the global distribution.

Restricted to Western Australia, see question 2.3 for its distribution.

Provide an overview of the global population size, trends, threats and security of the species outside of Australia.

N/A

Explain the relationship between the Australian population and the global population. What percentage of the global population occurs in Australia? Is the Australian population distinct, geographically separate or does part, or all, of the population move in/out of Australia's jurisdiction? Do global threats affect the Australian population?

N/A

SECTION 4. CONSERVATION STATUS AND MANAGEMENT

4.1. Population

What is the total population size in terms of number of mature individuals? Has there been any known reduction in the size of the population, or is this likely in the future? – provide details. Are there other useful measures of population size and what are they? Or if these are unavailable, provide an estimate of abundance (e.g. scarce, locally abundant etc).

In 2011, the total population size consisted of 1,870 mature individuals which comprised of 1,720 adults and 100 unknown (plants too severely grazed to determine if they are adults as they have no flowers or seeds). In 2016, the total population size is 621+ mature individuals. However only 4 out of 5 plots were counted and it is likely this figure is an underestimate.

If this area is burnt again or if the grazing pressures increase, it is likely that the population numbers will decrease significantly.

Provide locations of: captive/propagated occurrences or *ex situ* collections; recent re-introductions to the wild; and sites for proposed re-introductions. Have these sites been identified in recovery plans?

Currently there are no seed/ex situ collections.

For flora, and where applicable, for fauna, detail the location, land tenure, estimated number of individuals, area of occupancy, and condition of site for each known date, location or occurrence.

Location Description: Wandoo National Park off Crawler Road, Talbot Brook, Shire of York. Plants grow among the heath south of the road and west of the drainage line, to the corner of the pine plot – Flynn n Plot 3. (approximately 400m gap between plants in the drainage line and plants near the pine plot)

Date of survey	Location	Land status	Number of individuals at location	Area of occupancy at location	Condition of site
2001	Wandoo National Park, Crawler Rd, Population 1a and 1b	National Park	3,000	0.0321km ²	Condition of habitat: Unknown Plants recorded as being in generally good condition though some appeared stressed due to prolonged drought.
2007	Wandoo National Park, Population 1a and 1b Crawler Rd,	National Park	600	0.0321km ²	Condition of habitat: Very Good Over 2400 plants taken in the control burn in June 2006
2011	Wandoo National Park, Crawler Rd, Population 1a and 1b	National Park	1,870	0.0481km ²	Condition of Habitat : Excellent Many species, including <i>L. sp. Flynn</i> , exhibited signs of stress as a result of the 2010 drought. Young <i>L. sp Flynn</i> plants had been severely grazed by Kangaroos

2016	Wandoo National Park, Crawler Rd, Population 1a and 1b	National Park	621+	Not estimated	Plants healthy, habitat excellent. Young plants grazed by kangaroos
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Has the number of individuals been counted, or is this an estimate? Provide details of the method of determining the number of individuals.

The number of mature individuals in 2016 (621+) for the species was determined by installing five plots and tagging each plant. However only four out of five plots were counted and therefore the count was not complete.

The number of the plants located in the 2011 survey was an actual count. This was completed by marking individuals with paper to prevent counting them twice. The area of the population and surrounding area was walked in transects (strip lining).

The number of individuals recorded for the 2001 and 2007 survey was an estimate. Approximately half the population was traversed and any plants identified were marked. This was then extrapolated.

Has there been any known reduction in the number of locations, or is this likely in the future? – provide details.

There has not been a reduction in the number of locations. But as it is only known from 1 location If there was a reduction in the number of locations the plant would become extinct.

What is the extent of occurrence (in km²) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable, provide a range of values or a minimum or maximum area estimate. Include estimates of past, current and possible future extent of occurrence.

0.296km² based on minimum convex polygon around the 2 known sub populations. See map 3

If available, include data that indicates the percentage decline over 10 years or 3 generations (whichever is longer) that has occurred or is predicted to occur.

Using the 2011 population count as the 2016 count was incomplete, the percentage decline since the population was discovered is approximately 38%.

Is the distribution of the species severely fragmented? Why?

No, as there is only one known location.

Identify important occurrences necessary for the long-term survival and recovery of the species? This may include: key breeding populations, those near the edge of the range of the species or those needed to maintain genetic diversity.

As there is only one known population, all populations would be considered to be important.

4.2. Survey effort

Describe the methods to conduct surveys. For example, (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort (including where species not encountered); any limitations and expert requirements.

Surveys for additional populations of this species were completed over 11 years by Fred and Jean Hort who are very familiar with this plant and the flora of the Perth Hills. In total, Fred and Jean Hort have spent over 281 hours surveying for this species.

Surveys were conducted in daylight hours, predominantly during the plants main flowering period from December – May, however a few plants flower year round. As it has a distinctive fruit and leaf form, it is possible to survey for this plant throughout the year.

Areas of potential suitable habitat, namely sandy heath and banksia shrubland, were identified and traversed in strip lines a few metres apart. Areas of suitable habitat with a similar species composition close to the existing population were targeted as a priority.

Most of the areas that were surveyed had a similar species composition to the known population, however as the plant is only known from one location, sites that generally fitted *Leucopogon* sp. Flynn's habitat requirements (ie heath over white sand but with a different species composition) were also surveyed.

Limitations - Because the flowers of *L. sp. Flynn* are quite small, it is not easy to detect unless the surveyor is close to the plant. This makes survey work time consuming.

Expert Requirements- Expert Requirements- Surveyors needed to be familiar with the *L. sp. Flynn* as it may be confused with other *Leucopogon* that occur in the area, including *Leucopogon conostephioides* and *L. gracillimus*.

Provide details on the distinctiveness and detectability of the species, or the distinctiveness of its habitat, that would assist survey success.

Leucopogon sp. Flynn has very small inconspicuous white tube flowers around 3mm in length. The fruit is shaped like an enlarged leaf growing from the leaf axles. This makes it difficult to detect unless the surveyor is close to the plant. Upon close inspection, it is quite distinctive but the surveyor does have to be familiar with the species.

Its habitat, white sandy flats and gullies with heath, is quite distinctive and easily recognised.

Has the species been reasonably well surveyed? Provide an overview of surveys to date (include surveys of known occurrences and surveys for additional occurrences) and the likelihood of its current known distribution and/or population size being its actual distribution and/or population size. Include comments on potential habitat and surveys that were conducted, but where the species was not present/found.

This species has been extensively surveyed for by Fred and Jean Hort since its initial discovery in 1999.

The only known population of this species has been officially monitored 3 times, but has been visited on numerous occasions by the Horts.

Year of survey	Population number	Number of plants	Area of occupancy
2001	1a and 1b	3,000	0.0321km ²
2007	1a and 1b Crawler Rd	600	0.0321km ²
2011	Population 1a and 1b	1,871	0.0481km ²
2016	Population 1a and 1b	621+	Not estimated

It is likely that its current population size is its actual population size as the population and the surrounding area was surveyed thoroughly in 2011 by Parks and Wildlife volunteers Fred and Jean Hort, and Michael Pasotti and Catherine Page from Parks and Wildlife Perth Hills District. The result of this extensive survey was a minor increase (0.160km²) in the known extent of the population.

The surveys completed primarily targeted white sandy flats and drainage lines, with low heath, merging with *Banksia attenuata* and *Eucalyptus marginata* open woodland. Populations of *Banksia aurantia* (Vulnerable D2) were also targeted for survey as this occurs within the known population of *Leucopogon* sp. Flynn.

The attached spreadsheet is a list of the areas surveyed, the time spent surveying in hours, the observed vegetation type, the mapped vegetation type (for surveys completed in 2010/2011) and a potential habitat rating, based upon the species composition and soil type.

No additional populations have been found as a result of these surveys.

4.3. Threats

Identify past, current and future threats indicating whether they are actual or potential. (see table)

For each threat describe:

- a). how and where they impact this species**
- b). what the effect of the threat(s) has been so far (indicate whether it is known or suspected**
- c). present supporting information/research**
- d). does it only affect certain populations?**
- e). what is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?).**

1) Inappropriate Fire

A) How and where they impact this species

Leucopogon sp. Flynn is a re-seeder and fire often kills adult plants. It is not known how long it takes *L.* sp. Flynn to reach maturity, but if fires are too frequent, post-fire germinants may not be able to mature and replenish the seed bank before the next fire, leading to population decline. There is also some evidence to suggest that for some *Leucopogon* species, germinants have higher mortality and slower growth following a winter fire than after a summer fire (Ooi 2010). Fire may also interact with other threats (eg grazing). Grazing was not recorded as a threat at this population until after the 2006 fire.

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected)

Following the prescribed burn in 2006, the number of new plants recruited 5 years was significantly less than the number killed. It is not known if this is as a result of low seed viability, high mortality of seedlings in the hotter and drier than average years that followed the burn or to other factors.

C) Present supporting information/research

See previous survey results

D) Does it only affect certain populations? It affects all populations

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). It is expected that inappropriate fire will result in a decline in numbers.

2) Grazing

A) How and where they impact this species. A number of plants had been severely grazed (to less than 3cm tall). As a result of grazing, plants are unable to flower or reproduce

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected.

There has been a decrease in the number of plants. It is suspected that this has occurred as result of excessive grazing combined with inappropriate fire

C) Present supporting information/research See previous survey results

D) Does it only affect certain populations? It affects all populations

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). It is expected that young plants will continue to be grazed excessively unless kangaroo numbers are controlled or access to the plants is prevented

3) Road Maintenance

A) How and where they impact this species

Plants may be taken in the process of road maintenance activities

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected

Approximately 3 plants were taken a few years ago during road maintenance works.

C) Present supporting information/research N/A

D) Does it only affect certain populations. Affects all populations

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). It is expected that plants will not be taken in future as rare flora markers have been installed

4) Off Road Vehicles

A) How and where they impact this species. Wandoo National Park is a popular area for trail bike and 4WD users. Park rangers have had issues in the past with off-road vehicles creating their own tracks and causing damage (Douglas Giles, *DPaW National Park Ranger*, Personal Communication, June 2011). As the area where the population occurs is next to an existing track and is low lying and easy to access, it may be attractive to off-road vehicles. If an off-road vehicle enters the area of the population, a number of plants could be killed.

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected If an off-road vehicle drives through the population, it is likely that a number of plants may be killed.

C) Present supporting information/research N/A

D) Does it only affect certain populations? It affects all populations.

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). Uncertain what will occur in the future. If access to the area is restricted, the threat may be reduced.

5) Altered Hydrology

A) How and where they impact this species. As the plants are growing in a drainage area they would be prone to changes in hydrology, such as changes in surface water flow and long-term decreases in groundwater levels from water a drying climate.

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected. No known threat so far.

C) Present supporting information/research None at present.

D) Does it only affect certain populations. It affects all populations.

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). Uncertain what will happen in the future. Further research required to determine this.

6) Dieback (*Phytophthora cinnamomi*)

A) How and where they impact this species. Other *Leucopogon* species are known to be highly susceptible to this disease. The susceptibility of *L. sp. Flynn* has not been tested but it is expected that it would also be highly susceptible. The introduction of dieback into the area is likely to result in the death of a large proportion of the population.

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected Dieback is not known to be present in this area.

C) Present supporting information/research. Papers relating to the susceptibility of various species to dieback can be provided if required.

D) Does it only affect certain populations? It affects all populations.

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). If the appropriate hygiene measures are not practiced, dieback is likely to be introduced, which may result in a high number of plant deaths.

7) Lack of Recruitment

A) How and where they impact this species N/A

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected). The recruitment of plants has been poor which has resulted in a reduction in numbers. Unsure as to the cause of this poor recruitment.

C) Present supporting information/research Monitoring/Survey Results

Ooi *et al.* (2010) states that "Germination of seeds of species within the family Epacridaceae (now Ericaceae) is very difficult according to horticultural studies and laboratory trials, particularly within the tribe *Styphelleae*."

D) Does it only affect certain populations? It affects all populations

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). It is not clear what will occur in the future as the reason for the poor recruitment is not known.

8) Pigs

A) How and where they impact this species. Pigs disturb the ground when looking for food/water, and may dig up plants.

B) What the effect of the threat(s) has been so far (indicate whether it is known or suspected) No known threat to date.

C) Present supporting information/research) N/A

D) Does it only affect certain populations? It affects all populations.

E) What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?). Pigs are not currently prevalent in the area, but if pig control programs do not continue in the surrounding areas their numbers may increase.

If possible, provide information threats for each current occurrence/location:

Location	Past threats	Current threats	Potential threats	Management requirements (see section 4.4)
Wandoo National Park (population 1a and 1b)	Fire	Fire		Requires a fire management plan.
	Grazing (Kangaroos)	Grazing (Kangaroos)		Fences to be installed to minimise grazing. Kangaroo control could also be considered if required
	Road Maintenance	Road Maintenance Damage by off-road vehicles (illegal access)	<i>Phytophthora cinnamomi</i>	Rare flora markers in place. Restrict access to area where possible Dieback mapping and management plan to be completed

	Altered Hydrology	Complete a surface water management plan for the area
Lack of recruitment		Collect seed and test its viability. Consider fencing an area and see if grazing is significantly impacting recruitment
	Disturbance by Pigs	Pig baiting/trapping program to be completed

Identify and explain why additional biological characteristics particular to the species are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing the survival of the species?

No data available

4.4. Management

Identify key management documentation for the species e.g. recovery plans, conservation plans, threat abatement plans etc.

None

Does this species benefit from the management of another species or community? Explain.

Yes, *Banksia aurantia* (Vulnerable D2) occurs within the area of occupancy. Any management actions completed for this species may also benefit *Leucopogon* sp. Flynn.

How well is the species represented in conservation reserves or covenanted land? Which of these are actively managed for this species? Provide details.

This species is located within Wandoo National Park. The park is not actively managed for this species.

Are there any management or research recommendations that will assist in the conservation of the species? Provide details.

There is not a current management plan for this park. If a management plan is written, it may contain recommendations that could assist in the management of this species.

Management requirements to include:

- Monitor the population for evidence of grazing, or changes in plant or site health;
- Protect the sites from fire unless required for ecological reasons, and implement early intervention in any wildfires which may threaten the site;
- Install fencing at the subpopulation to reduce grazing and trampling by kangaroos and pigs and allow recruitment within a larger area of habitat;
- Collect and store seed;
- Survey any newly identified areas of suitable habitat;
- Erect barriers if access issues continue to threaten the population;
- Practice appropriate hygiene measures to protect susceptible habitat from disease introduction;
- Establish new populations in more secure locations, if a suitable location can be found;
- Determine fire response;
- Assess susceptibility to *Phytohthora cinnamomi*.

4.5. Other

Is there any additional information that is relevant to consideration of the conservation status of this species?

SECTION 5. NOMINATOR

Nominator(s) name(s)

Organisation(s)

Address(s)

Telephone number(s)

Email(s)

Date

23/1/12

If the nomination has been refereed or reviewed by experts, provide their names and contact details.

Nomination completed with the assistance of

Mike Hislop, Botanist, Western Australia Herbarium

SECTION 6. REFERENCES

What references or sources did you use to prepare your nomination? Include written material, electronic sources and verbal information. Include full references, address of web pages and the names and contact details of authorities with whom you had verbal communications.

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Douglas Giles, DEC National Park Ranger, Personal Communication, June 2011.

Attachment 1- Biological Habitat

Heddl Vegetation Complex's

The area occupied by *Leucopogon* sp Flynn has been mapped as 2 different vegetation complexes by Heddl, the Goonaping Complex and the Pindalup- Yarrigal Complex

The descriptions provided below of these complexes have been taken from "Mapping the Vegetation for the Perth Region," by E.M. Heddl, 1979. Please note that the species names listed may no longer be current.

Goonaping Complex- An open forest of *Eucalyptus marginata* and a low open woodland of *Banksia attenuata*/*Banksia menziesii* on dry sites and a low open forest of *Melaleuca preissiana* on moist sites. The dominant vegetation within this complex is type F and J and less consistently type A and B. The species that should and may be present in these vegetation types are listed below

Type F

- Should be present- *Eucalyptus marginata*, *Hakea ruscifolia*, *Stirlingia latifolia*
- May be present- *Caustis dioica*, *Hibbertia polystachya*, *Leptocarpus scariosus*, *Mesomelaena tetragona*, *Nuytsia floribunda*, *Patersonia occidentalis*

Type J

- Should be present- *Conospermum stoechadis*, *Daviesia pectinata*, *Eucalyptus marginata*, *Grevillea wilsonii*, *Hibbertia polystachya*, *Lyginia tenax*, *Mesomelaena tetragona*,
- May be present – *Adenanthos barbigerus*, *Baeckea camphorosmae*, *Banksia attenuata*, *Corymbia calophylla*, *Hakea cyclocarpa*, *Hakea ruscifolia*, *Hypocalymma angustifolium*, *Leptospermum angustatum*, *Leptocarpus scariosus*, *Nuytsia floribunda*, *Patersonia rudis*

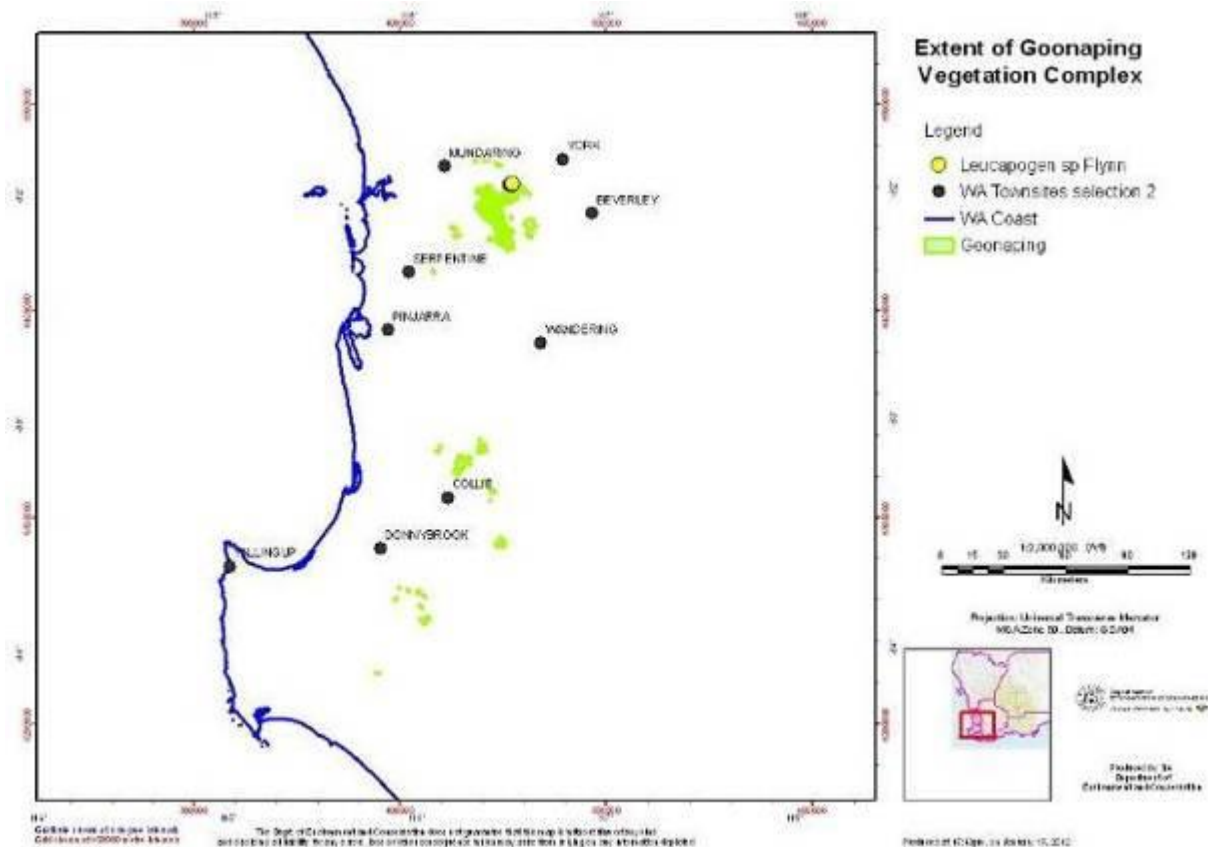
Type A

- Should be associated- *Astartia fascicularis*, *Banksia littoralis*, *Eucalyptus patens*, *Hakea ceratophylla*, *Hakea varia*, *Hypocalymma angustifolium*, *Leptocarpus scariosus*, *Leptospermum ellipticum*, *Melaleuca preissiana*, *Mesomelaena tetragona*

Type B

- Should be present -*Conospermum stoechadis*, *Dasypogon brumalis*, *Eucalyptus marginata*, *Corymbia calophylla*, *Hibbertia polystachya*, *Leptospermum angustatum*, *Leptocarpus scariosus*, *Leucopogon cordatus*, *Lyginia tenax*, *Mesomelaena tetragona*, *Patersonia occidentalis*

There are 31,142.85ha of this vegetation type remaining, which is 94% of its pre European extent (Department of Environment, n.d). See the map below for the approximate current extent of this vegetation type



Map 1

Pindalup and Yarragil Complex - An open forest of jarrah-marri on slopes with an open woodland of wandoo with some yarri in the lower gullies. The dominant vegetation types are types H,M and Y and less consistently types A, L, Z and E. The species that should and may be present in these vegetation types are listed below

Type H

Should be associated- *Daviesia pectinata*, *Eucalyptus marginata* *Leptospermum angustatum* *Mesomelaena tetragona*, *Patersonia rudis*

May be associated- *Acacia browniana*, *Baeckea camphorosmae*, *Hakea cyclocarpa*, *Hakea ruscifolia*, *Hypocalymma angustifolium*, *Isopogon dubius*, *Lasiopetalum floribundum*, *Sphaerolobium medium*, *Stirlingia latifolia*, *Synaphea petiolaris*, *Trymalium ledifolium*.

Type Y

Should be associated- *Eucalyptus wandoo*, *Hakea lissocarpa*, *Hypocalymma angustifolium*, *Macrozamia riedlei*,

May be associated- *Baeckea camphorosmae*, *Dampiera alata*, *Dillwynia cinerascens*, *Eucalyptus marginata*, *Corymbia calophylla*, *Eucalyptus patens*, *Gastrolobium calycinum*, *Leptomeria cunninghamii*, *Patersonia occidentalis*, *Phyllanthus calycinus*

Type A

Should be associated - *Astartia fascicularis*, *Banksia littoralis*, *Eucalyptus patens*, *Hakea ceratophylla*, *Hakea varia*, *Hypocalymma angustifolium*, *Leptocarpus scariosus*, *Leptospermum ellipticum*, *Melaleuca preissiana*, *Mesomelaena tetragona*

Type L

Should be associated *Diplolaena drummondii*, *E wandoo*, *Hakea lissocarpa*, *Hibbertia lineata*, *Hypocalymma angustifolium*

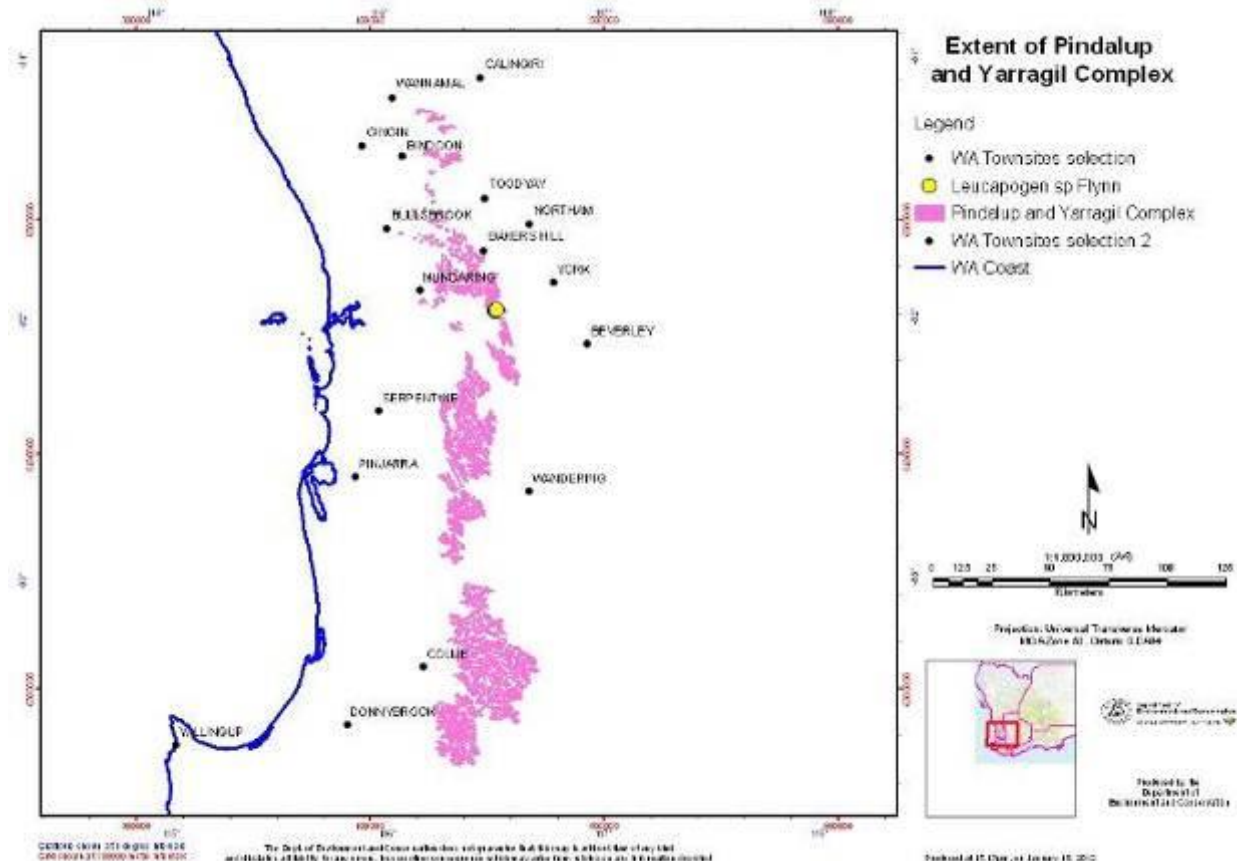
Type Z

Should be associated - *Eucalyptus marginata*, *Hakea lissocarpa*, *Leucopogon capitellatus*, *Leucopogon propinquus*, *Macrozamia riedlii*, *Patersonia rudis*, *Styphelia tenuifolia*

Type E

Should be associated *Baekea camphorosmae*, *Dampiera alata*, *Eucalyptus marginata*, *Hypocalymma angustifolium*, *Kingia australis*, *Leptocarpus scariosus*, *Leptospermum angustatum*, *Mesomelaena tetragona*

140,532.47 ha remaining of this vegetation which is 77% of its pre-European extent. (Department of Environment, n.d) See the map below for the approximate current extent of this vegetation type.



Map 2

Observed vegetation type:

Both sub-populations were found on white sands

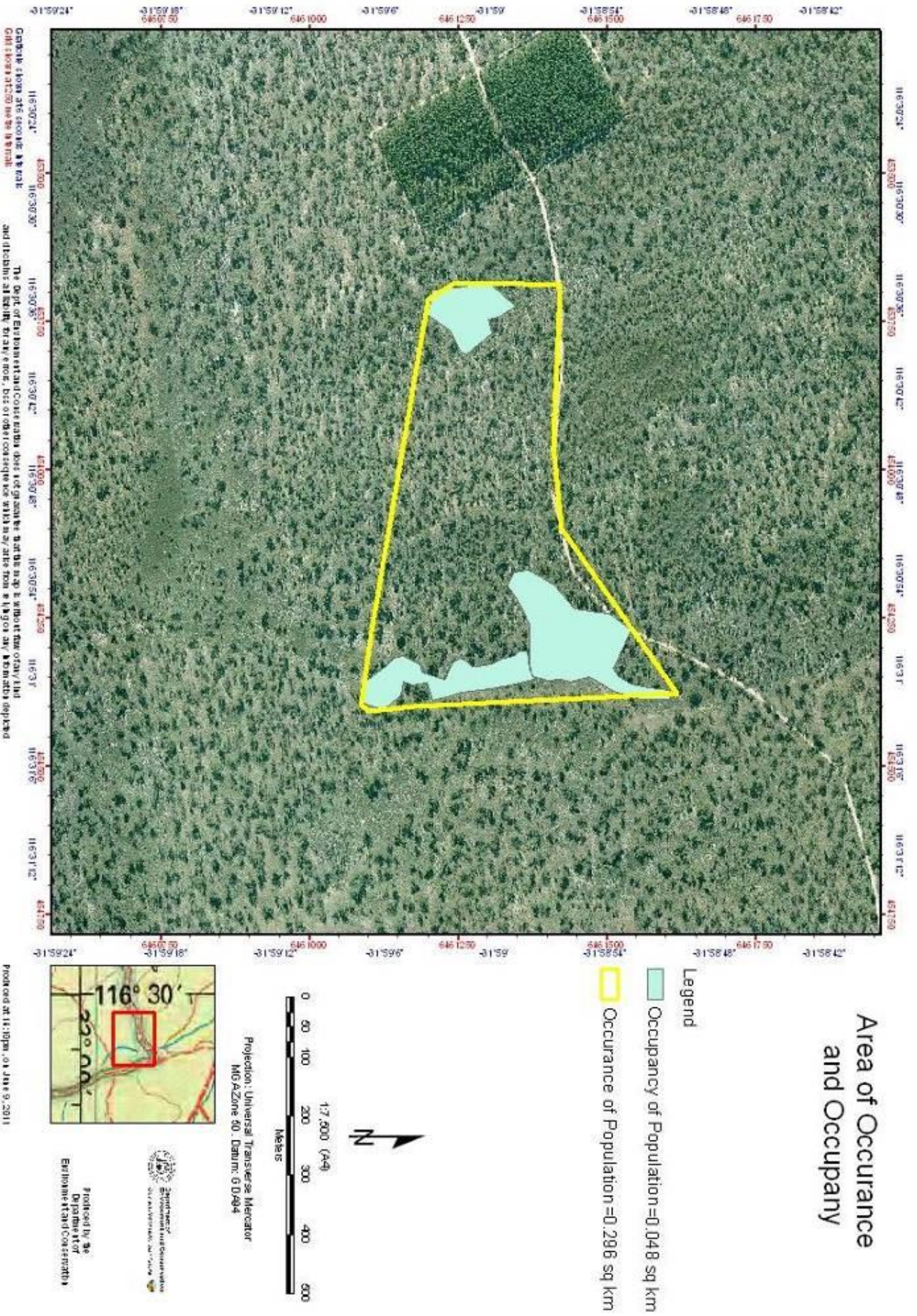
Population 1a -Open Heathland dominated by *Phyllota gracilis*, *Leucopogon* sp Flynn, *Petrophile serruriae* and *Eremea* sp along the drainage line with open woodland of *Banksia attenuata* and *Eucalyptus marginata* on the upper slopes.

Population 1b- Open Woodland of *Banksia menziesii* and *Eucalyptus marginata*.

Other species associated with the populations include *Allocasuarina humilis*, *Stirlingia latifolia*, *Kunzea ericifolia*, *Conospermum stoechadis*, *Stirlingia latifolia*, *Lomandra hermaphrodita*, , *Daviesia physodes*, *Patersonia occidentalis*, *Adenanthos cygnorum*, *Stylidium preissii*, *Scholtzia involucrata*, *Conostephium pendulum*, *Lepidosperma* sp, *Verticordia densiflora*, *Jacksonia furcellata*, *Hibbertia huegelii*, *Calytrix flavescens*, *Phlebocarya* sp, *Drosera parvula* and *Banksia aurantia*

Based on the list of species that should be associated with the Heddle vegetation complex, there does not appear to be a strong correlation between the mapped communities and the observed community. This may be because of the scale at which the mapping was completed as both communities occur over quite a large area. Therefore, all surveys completed for additional populations were based on the observed community rather than the mapped communities.

Area of Occurance and Occupancy



Map 3



Original Extent and New Extent

New extent Surveyed by Fred and Jean Hort, June 2011

Legend

Occupancy of Population

<all other values>

ID

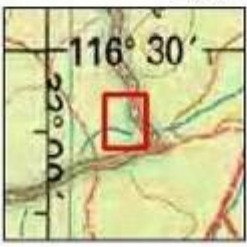
New Extent

Original Extent

Original Extent



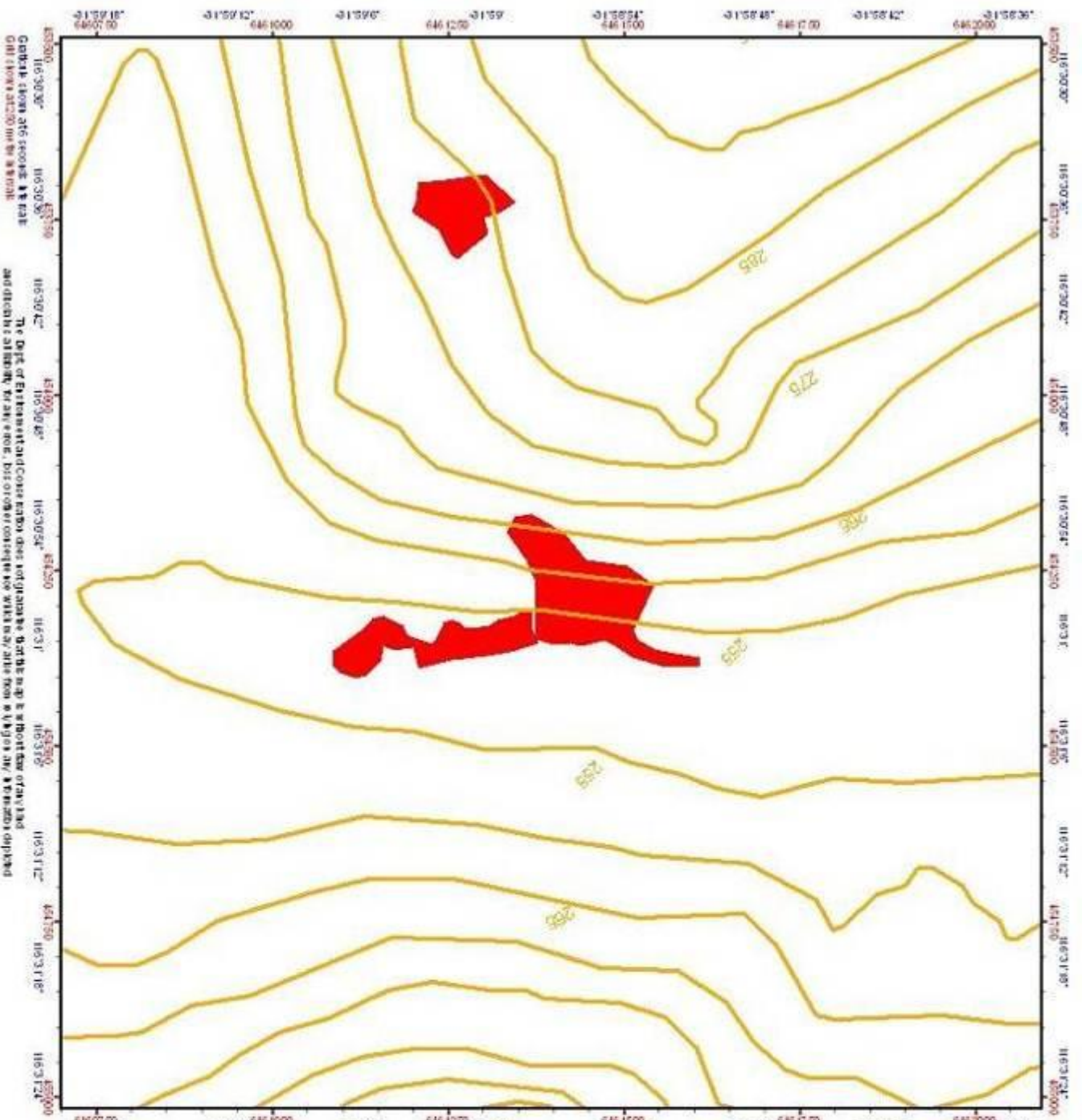
Projection: Universal Transverse Mercator
MGS Zone 50, Datum: G D 84



Printed at 11:00pm on June 9, 2011



Produced by the
Department of
Environment and
Conservation



Contours

Legend

- Occupancy of Population
- Contours (5m)



Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94



Produced by the
Department of
Environment and Heritage

Printed at 11:10am, on 28th 9, 2011

Map 5

1163012 1163014 1163016 1163018 1163020 1163022 1163024

646000 646010 646020

L. campopogon sp. (Lynch, Hon. J. Hart & A. Loyale 659)

Banksia aurea

[illegible]



Image 1 - Mydid fly (*Miltinus minutus*) feeding upon *Leucopogon* sp. Flynn
photo: J Hort



Image 2 - Mydid fly (*Miltinus minutus*) feeding upon *Leucopogon* sp. Flynn
photo: J Hort



Image 3 - Native Bee on *Leucopogon* sp. Flynn
photo: J Hort



Image 4, *L. sp. Flynn*
scans: F Hort



Image 5, Large adult plant population 1a
photo: C.Page



L. sp. Flynn population, site 1a
photo :J Hort



L. sp. Flynn population site 1b
photo: F Hort