

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>Synaphea</i> sp. Serpentine (G.R. Brand 103)
Nomination for (addition, deletion, change):	Addition
Nominated conservation category and criteria:	CR: B1ab(ii,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:	Synaphea sp. Serpentine (G.R. Brand 103)			
Common name:	None			
Family name:	Proteaceae	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	2013	Critically Endangered	B1ab(ii,iii,v)+B2ab(ii,iii,v)
	2. WA	28/9/2016	Critically Endangered	B1ab(ii,iii,v)
	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:	There have been no further surveys of the species since nomination in 2012.			
<ul style="list-style-type: none"> the conclusion of the assessment remains current and 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 with 2013, however, with clarification of interpretation of AOO calculation, criterion B2 no longer meets threshold for CR. Criterion B1 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(ii,iii,v)																	
Eligibility against the IUCN Red List criteria (A, B, C, D and E)																							
<i>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.</i>																							
A.		Population size reduction (evidence of decline)					<ul style="list-style-type: none"> Insufficient information is available to reliably show rate of decline as most populations have only been fully surveyed on one occasion. 																
B.		Geographic range (EOO and AOO, number of locations and evidence of decline)					<ul style="list-style-type: none"> The current extent of occurrence is 60 km². The area of occupancy using the 2x2 km grid system is 28 km². The total mapped area of the subpopulations is 0.03857km². Known from six populations, four locations, occurring in a narrow band from the northernmost point at 4 km west of Byford (38 km SSE of Perth) to 5 km south of Serpentine (54 km SSE of Perth), over a range of 18 km. The locations are severely fragmented and located mostly along road and rail reserves. Continuing decline in the extent of occurrence and area of occupancy due to land clearing. Decline in future population size is likely as surveys in 2010 to 2012 recorded approximately 10% of plants in poor condition. Ongoing decline in condition of habitat due to road and rail maintenance, fire and weeds. Meets CR: B1ab(ii,iii,v) 																
C.		Small population size and decline (population size, distribution and evidence of decline)					<ul style="list-style-type: none"> Known from 1,328 mature individuals at four locations, SSE of Perth over a linear range of 18 km. 1,242 mature individuals (94% of total population) are found in one population. Does not meet criteria but on threshold of meeting EN C2(a)(ii) 																
D.		Very small or restricted population (population size)					<ul style="list-style-type: none"> 1,328 mature individuals. Does not meet criteria 																
E.		Quantitative analysis (statistical probability of extinction)					<ul style="list-style-type: none"> No data 																
Summary of assessment information																							
EOO		60 km ²					AOO		28 km ² using 2km x 2km grid method.					Generation length		-							

			Mapped area of subpopulations = 0.03857 km ² .		
No. locations	4	Severely fragmented	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>		
No. subpopulations	6	No. mature individuals	1,328		
Percentage global population within Australia			100		
Percentage population decline over 10 years or 3 generations			unknown		
Threats <i>(detail how the species is being impacted)</i>					
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>	
Refer to table at end.					
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><i>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).</i></p> <ul style="list-style-type: none"> Department of Parks and Wildlife (in prep) <i>Synaphea</i> sp. Serpentine (G.R. Brand 103) Interim Recovery Plan 2016–2021. Draft Interim Recovery Plan No. #. Department of Parks and Wildlife, Western Australia. 					
<p><i>List current management or research actions, if any, that are being undertaken that benefit the conservation of the species.</i></p> <ul style="list-style-type: none"> Liaise with road, rail and utilities managers to minimise disturbance to remnant vegetation when maintaining roads, railway and powerlines; Liaise with adjacent land managers to ensure herbicides used do not impact on road and rail reserve populations; Install of markers on road, rail reserves, firebreaks and under powerlines to protect habitat when undertaking maintenance; Monitor the populations for evidence of rabbits 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 sites; Implement of hygiene measures to protect susceptible habitat from disease introduction; Survey for additional populations. 					

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.

Management

- If viable, ensure protection from exposure, particularly from herbicide drift, through planting and maintaining adequate vegetation buffers;
- Control infestations of weeds that might impact the species and its habitat;
- Monitor groundwater at sites to identify if management intervention required;
- Erect barriers if recreational activities continue to threaten populations;
- Remove rubbish dumped at sites;
- Control rabbits if evidence of a rabbit population or herbivory noted;
- Identify mealy bug insect infesting plants and determine appropriate control required;
- Collect seed for storage and *ex situ* propagation;
- Establish new populations on secure tenure through implementation of translocations.

Research

- Determine species pollination ecology, seed germination requirements and viability, and longevity;
- Determine disturbance response of the species and attempt to stimulate germination;
- Investigate genetic variation within the species to confirm its taxonomic boundaries;
- Investigate the susceptibility of the species to *Phytophthora cinnamomi*.
- Investigate species and habitat susceptibility to changes in ground water depth.

Nomination prepared by:

Contact details:

Date submitted:

7/7/2016

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

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	Area sub-populations	Site / habitat Condition	Threats <i>(note if past, present or future)</i>	Specific management actions
Serpentine within Lambkin NR; Leslie St, Hardey St, Hall Rd, Rapids Rd, Punrak Rd, Tonkin St, Richardson St; UCL (corner of Tonkin and Richardson Sts)	Road and rail reserves, nature reserve, UCL, freehold land (owned by WAPC)	2010-12: 1,264	36,084 m ²	Excellent (NR, freehold land); degraded along road and rail reserves	<p>Past</p> <ul style="list-style-type: none"> • Weeds • Habitat fragmentation (due to land clearing) • Road, rail construction and maintenance • Changes in hydrology (local changes to drainage systems) <p>Current</p> <ul style="list-style-type: none"> • Weeds • Road, rail, firebreak, fence and utilities maintenance • Fragmented habitat • Herbicide spread • Active recreation • Grazing • Mealy bug infestation <p>Future</p> <ul style="list-style-type: none"> • Weeds • Accidental herbicide spray • Road, rail maintenance and construction • Inappropriate fire regimes • Climate change 	As above

Abernethy Road, Mundijong	Freehold (WAPC)	2012: 2	100 m ²	Degraded	<p>Past</p> <ul style="list-style-type: none"> • Weeds • Grazing • Habitat fragmentation (due to land clearing) • Road, rail construction and maintenance • Changes in hydrology (local changes to drainage systems) <p>Current</p> <ul style="list-style-type: none"> • Weeds • Herbicide spread • Firebreak maintenance • Fragmented habitat • Low plant numbers <p>Future</p> <ul style="list-style-type: none"> • Weeds • Accidental herbicide spray • <i>Phytophthora</i> spp. • Inappropriate fire regimes • Climate change 	As above
Soldiers Rd, Cardup	Rail reserve	2011: 10	140 m ²	Very good	<p>Past</p> <ul style="list-style-type: none"> • Weeds • Habitat fragmentation (due to land clearing) • Road, rail construction and maintenance • Changes in hydrology (local changes to drainage systems) <p>Current</p>	As above

					<ul style="list-style-type: none"> • Weeds • Herbicide spread • Low plant numbers • Fragmented habitat <p>Future</p> <ul style="list-style-type: none"> • Weeds • Accidental herbicide spray • Inappropriate fire regimes • Climate change 	
Mundijong Rd CR23793	Government Requirements reserve	2011: 52	2,247m ²	Very good to disturbed	<p>Past</p> <ul style="list-style-type: none"> • Weeds • Habitat fragmentation (due to land clearing) • Road, rail construction and maintenance • Changes in hydrology (local changes to drainage systems) <p>Current</p> <ul style="list-style-type: none"> • Weeds • Fragmented habitat • Herbicide spread • Low plant numbers <p>Future</p> <ul style="list-style-type: none"> • Planned road construction (Tonkin Hwy extension) • Weeds • Accidental herbicide spray • Inappropriate fire regimes • Climate change 	As above



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.

Synaphea sp. Serpentine (G.R. Brand 103)

1.3. Common Name

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

No common name at present.

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		
National EPBC Act 1999		
State of Western Australia	[CR (2013)]	[B1ab(ii,iii,v)+2ab(ii,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"/>

1.5. Nominated Conservation Status.

	IUCN Red List Category e.g. Vulnerable	IUCN Red List Criteria e.g. B1ab(iv);D(1)
State of Western Australia	Critically Endangered	B1ab(ii,iii,v)+B2ab(ii,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.

1. Reduction in population size (observed, inferred and projected [explanations below]).
 - Observed – dead plants were observed during the 2010-2012 surveys with substantial amounts recorded in a number of populations.
 - Inferred – plant numbers have been reduced where populations have not been re-located and also through substantial past clearing of suitable habitat adjacent to the majority of populations.
 - Projected – plant numbers will almost certainly reduce in the future, when considering the number of recorded dead and stressed plants from recent surveys, and the likelihood of repeated fires that will result in weed invasion at a number of sites.
2. Extent of occurrence <100 km²
3. Area of occupancy <10 km²
4. Continuing decline (observed and projected) in the extent of occurrence; area of occupancy; area, extent & quality of habitat and number of locations or subpopulations.

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.

Synaphea sp. Serpentine was segregated from *S. odocoileops* (Priority One) as a new taxon in 2005. When it was segregated, *S. sp. Serpentine* was given a lower conservation listing (Priority 3) as collections had been made from secure tenure (within Lambkin Nature Reserve, Serpentine) with other localities scattered from Byford to Elgin (NB: This species has not been relocated at many of its originally stated collection locations (i.e. near Byford, near Elgin).

Synaphea odocoileops was described by George in 1995 but, regrettably, the description of this species was based primarily on collections which differ significantly from the type specimen (A.S. George 17072; 'near Elgin railway siding, south of Bunbury, W.A.'). Accordingly, *S. odocoileops* was segregated into *S. odocoileops sens. str.* ('in the strict sense') and *S. sp. Serpentine*, with the majority of specimens being re-determined as *S. sp. Serpentine*. The diagnostic characters of *S. odocoileops* discussed by George (1995) refer mainly to *S. sp. Serpentine*. As such, when George (1995) stated that *S. odocoileops* was distinguishable from *S. stenoloba* (T) by its "less-divided leaves with longer, flatter terminal lobes and a long-pilose petiole, and slightly smaller flowers", this statement actually refers to *S. sp. Serpentine*. Typical plants of *S. odocoileops* are more similar to *S. stenoloba* than has been previously documented, but the two taxa are still distinguishable in the field and from herbarium specimens.

A morphometric analysis of conservation-listed *Synaphea* taxa from the Swan Coastal Plain has shown that *S. sp. Serpentine* can be readily distinguished from all other taxa and confidently recognised as a new species (Butcher & Thiele, in prep.). It is in the process of being formally described (Butcher, in prep.).

Key distinguishing features of *Synaphea* sp. Serpentine (G.R. Brand 103): P3

- Plants clumped, with or without elongate stem internodes.
- Leaves 2–4 x tripartite, terminal lobes linear with acute to acuminate apices, some asymmetry in terminal lobing; lowest lobes often falcate. Mid to dark green.
- Petioles pilose (i.e. with long hairs) at base or along length.
- Spikes long, undulating, axis frequently dark red (or green heavily infused with red).
- Flowers small, openly spaced, +/- horizontal and opening narrowly, glabrous or sparsely pubescent. Tepal apices scarcely reflexed.
- Stigma with erect, narrow, apical lobes.
- Fruit cylindrical to narrowly obovate with a small apical rim, the base of the fruit tapering

into a relatively long (c. 1/3 total fruit length), slender neck. Sparsely hairy to hairless in upper 1/3 of fruit body (Butcher 2010; Butcher, in prep.)

This taxon is based on voucher specimen *G.R. Brand* 103 (PERTH 05251397) but no type specimen has been formally allocated yet, although it is intended to also use this collection as the type (Butcher, in prep.).

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 ☒

Voucher specimens (36) for this species are held in the WA Herbarium (PERTH). As stated above, this species can be readily distinguished from all other taxa. Segregation of this taxon from *S. odocoileops* has clarified its taxonomy boundary and its status as a distinct species is supported by morphometric analysis (Butcher & Thiele, in prep.).

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

Synaphea sp. Serpentine is not known to hybridise with other *Synaphea* taxa despite co-occurring with up to four other species at a location (e.g. *S. sp.* Pinjarra Plain, *S. sp.* Fairbridge Farm, *S. petiolaris* and *S. gracillima* in the rail reserve and adjacent Lambkin Nature Reserve, Serpentine). It must be noted, however, that there exists at Serpentine a very small-flowered entity, known from only three specimens (*R. Butcher* RB 1082, RB 1083; *R. Davis* 6568), that is closely allied to *S. petiolaris* and that has some similarity to *S. gracillima* and *S. sp.* Serpentine. It is not known whether these collections represent a new taxon, variation within *S. petiolaris* or putative hybrids between *S. petiolaris* and *S. gracillima* or *S. sp.* Serpentine. This entity has not been seen at any other site surveyed on the Swan Coastal Plain, including other locations where *S. sp.* Serpentine and *S. petiolaris* co-occur.

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).

Perennial, erect, clumped shrub (sub-shrub), to 0.6 m high x to 0.5 m wide. Flowers are yellow and borne on long spikes, well above the leaves, from late August to November. Reproduces by seed (one seed per fruit).

2.3. Distribution

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

Synaphea sp. Serpentine currently occurs in a narrow band from the northernmost point at 4km west of Byford (38km SSE of Perth) to the southernmost point at 5km south of Serpentine (54km SSE of Perth) (see Map 1 attached). Records of locations outlying the current extent include three that are 65km and 127km south and 24km north-northeast of the main population concentration at Serpentine. These are not included in the current extent of occurrence due to variable factors, detailed below.

PERTH 6407307, (*D. Papenfus* 2016). 65km S of Serpentine (c. 1km NE of Yarloop). This specimen of poor quality was collected and tentatively identified as *Synaphea* sp. Serpentine. Survey of this site (Butcher 2004) did not relocate this species although other Priority (*S. odocoileops*) and Threatened (*S. stenoloba*) species were identified in surrounding small remnants of appropriate vegetation. This site is at the base of the Darling Scarp and has jarrah forest to the east, but suitable habitat on the Pinjarra Plain to the west has mostly been cleared.

PERTH 1706675, (*G.J. Keighery* 6781). 127km SSW of Serpentine. *S. sp.* Serpentine occurs/occurred just N of Elgin, however survey of this area (Butcher 2004) found only farmland at the stated locality rather than 'swampy heath'. No specimens of *S. sp.* Serpentine were located in the Elgin area at that time.

PERTH 1706683, (G.J. Keighery 7047). 24km NNE of Serpentine. The description of this location differed markedly to the coordinates as stated with the voucher collection. The coordinates sited the collection location as occurring west of Byford in an area cleared for housing. The site of the location description was 5km east of Byford on Nettleton Rd. A site visit to this area during the 2011 targeted surveys, could not locate the species within the Jarrah/Marri forest on granite outcropping (not considered to be the habitat preference of <i>Synaphea</i> sp. Serpentine) or on the disturbed road verges on both sides of Nettleton Rd.
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
<i>Synaphea</i> sp. Serpentine occurs predominantly on flat terrain on grey-brown sandy loams to clay in seasonally wet areas. Warm Mediterranean climate.
Biological habitat
1) Heath of <i>Pericalymma ellipticum</i> , <i>Xanthorrhoea preissii</i> , <i>Kunzea micrantha</i> , <i>Adenanthos meisneri</i> . 2) Open Woodland to Very Open Woodland of <i>Corymbia calophylla</i> over Very Open Shrubland of <i>Xanthorrhoea preissii</i> , <i>Kingia australis</i> , <i>Adenanthos meisneri</i> over Very Open Herbland of <i>Tricoryne elatior</i> and Sedgeland of <i>Mesomelaena tetragona</i> , <i>Tetraria octandra</i> .
Does the (fauna) species use refuge habitat e.g. in times of fire, drought or flood? Describe this habitat.
Not applicable.
Is the species part of, or does it rely on, a listed threatened ecological community? Is it associated with any other listed threatened species?
<p><i>Synaphea</i> sp. Serpentine is a part of, but does not rely on, three TECs. 1) SCP3a - <i>Corymbia calophylla</i> – <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain (WA: CR; Cth: EN); 2) SCP20b - <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain (EN) and 3) SCP10a - Shrublands on dry clay flats (EN) that is also listed under the Commonwealth's EPBC Act 1999 as Critically Endangered.</p> <p>It is associated with two Commonwealth listed species of Threatened Flora in three locations: the Critically Endangered <i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696) and the Vulnerable <i>Tetraria australiensis</i>.</p>
2.5. Reproduction Provide an overview of the breeding system. For <u>fauna</u>: 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 <u>flora</u>: 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?
<i>Synaphea</i> sp. Serpentine flowers from late August to November and fruits have been seen in December. Observations show that the seed produced is viable (i.e. seedlings observed at 4 locations) and plants regenerate from rootstock after disturbance. The conditions for seed germination are not known. Pollinator is unknown.

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).
Flowers and fruits have been recorded on small plants. The life expectancy has not been researched; however, mature individuals have been relocated up to 5yrs from previous surveys. Seedlings, juveniles and mature individuals have been recorded for a few populations.
Questions 2.7 and 2.8 apply to <u>fauna</u> nominations only
2.7. Feeding Summarise food items or sources and timing/availability.
Not applicable.
Briefly describe feeding behaviours, including those that may make the species vulnerable to threatening processes.
Not applicable.
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.
Not applicable.
SECTION 3. INTERNATIONAL CONTEXT
For species that are distributed both in <u>Australia</u> and in <u>other countries</u>.
3.1. Distribution Describe the global distribution.
Not applicable.
Provide an overview of the global population size, trends, threats and security of the species outside of Australia.
Not applicable.
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?
Not applicable.
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).
The surveys undertaken from 2010 to 2012 are the first detailed plant counts for this taxon. A total of 1,328 mature individuals were recorded. Of these 125 individuals (9.4%) were recorded as being in 'poor' condition. Therefore, a reduction in population size is most likely in the near future. In addition, a further 397 individuals (29.8% of the total population) were recorded as dead, indicating a significant recent decline (very close (under by 0.2%) to the threshold of IUCN criteria used for the Vulnerable assessment).
Provide locations of: captive/propagated occurrences or <i>ex situ</i> collections; recent re-introductions to the wild; and sites for proposed re-introductions. Have these sites been identified in recovery plans?
Not applicable.

How many locations do you consider the species occurs in and why? Where a species is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

For the currently known locations where plants were recorded, *Synaphea* sp. Serpentine occurs in four locations when considering fire as the most serious plausible threat at one point in time. Although, plants have been observed to regenerate and recruit post-fire for other *Synaphea* spp., this area is data deficient for this species. In addition, negative post-fire effects of habitat modification and weed invasion of aggressive species present at the majority of sites, has been noted as a cause of past decline. A real threat of too-frequent fire is also highly likely along the road and rail reserves.

It is also worth considering the (expected, predicted) decline that is highly likely to occur through the continuing effects of weed invasion within the narrow already disturbed remnants of bushland along the road and rail reserves, where the majority of plants occur. The number of locations in this scenario would be three.

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.

The following locations in the table have been compiled using the method employed for completing Threatened and Priority Report Forms according to the DEC criteria for population separation.

The actual total area of occupancy = 38571m² i.e. 0.038571km² which is calculated by estimating the approximate area within which the plants occur (length x width). Using the 2kmx2km grid method, the AOO is 28 km², however this is an over-estimation for available habitat.

Date of survey	Location	Land status (DEC 2012)	Number of individuals at location	Area of occupancy at location	Condition of site (EPA 2000)
Pop'ns 1a-f i18/10/2010 ii-v18/10/2010 & 28/10/2010 vi28/10/2010	iLambkin NR (CR 32352). iiLeslie St. iiiHardey Rd. ivTonkin St. vRichardson St. viBushland at cnr of Tonkin & Richardson St's. Serpentine.	iCrown Reserve. ii-vRoad reserve. viUCL.	i 90 mature ii-v 205 mature vi 153 mature +71 dead	i2280m ² ii-v2560m ² vi2408m ²	i-iiiVery Good to Excellent.
Pop'ns 2a&b 28/10/2010	iRapids Rd. iiPunrak Rd., Serpentine.	iFreehold (WAPC). iiUCL.	i 4 mature ii 18 mature +2 dead	i46m ² ii4900m ²	iVery Good. iiExcellent.

Pop'n 3a <i>i</i> 16/9/2010 14/12/2011 8/10/2012 29/10/2012 3b <i>ii</i> 14/12/2011 1	<i>i</i> Hardey & Hall Rds., <i>ii</i> Hall Rd., Serpentine	<i>i</i> Rail reserve. <i>ii</i> Road reserve.	<i>i</i> 475 mature (60 poor, 415 healthy) 4 juveniles +231 dead <i>ii</i> 22 mature (15 poor, 7 healthy) + 16 dead	<i>i</i> 16300m ² <i>ii</i> 90m ²	<i>i</i> Degraded to Good. <i>ii</i> Degraded.
Pop'n 4 8/11/2011	Richardson St., Serpentine.	Rail reserve.	297 mature (41 poor, 256 healthy) 23 juveniles +66 dead	7500m ²	Very Good to Degraded.
Pop'n 5 16/12/2011	Mundijong Rd. 1km W of Paterson Rd., Mundijong.	CR 23793 (Gov't req)	48 mature (5 poor, 43 healthy) 53 juveniles +3 dead	2242m ²	Very Good.
Pop'n 6 15/12/2011	Mundijong Rd. 200m E of Kargotich Rd., Mundijong.	CR 23793 (Gov't req)	4 mature (1 poor, 3 healthy) 4 juveniles	5m ²	Disturbed point location within Very Good Habitat.
Pop'n 7 19/12/2011	Soldiers Rd., Cardup.	Rail reserve.	10 mature (2 poor, 8 healthy) + 3 dead	140m ²	Very Good
Pop'n 8 1/12/2012	Abernethy Rd., Mundijong.	Freehold (WAPC).	2 mature + 3 dead	100m ²	Degraded.

The area of occupancy shown in the above table is the area of actual plant occupation often surrounded by degraded or highly modified sites.

Has the number of individuals been counted, or is this an estimate? Provide details of the method of determining the number of individuals.

An accurate count of individuals was made using a differential GPS to record exact locations. For each record, information on the number of plants, life-form, reproduction, condition and any other relevant comments were ascribed on a hand-held PDA. It was relatively clear to determine the habit of the majority of plants for accurate counting. Where clumps were encountered, these were separated by hand to determine whether more than one individual occurred.

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

Yes. There has been a reduction in the number of locations. Seven of the locations recorded on Florabase have either not been relocated or plants were not found.

1. PERTH 4263308. December 1900. 'Cockburn Sound', Serpentine. (The coordinates are very broad and no site description was given).
2. PERTH 1706675. September 1983. 1 km N of Elgin. (Farmland found in 2004).
3. PERTH 6407307. October 2002. 1 km NE of Yarloop. (Not relocated in 2004).
4. PERTH 1706683. August 1984. 5 km E of Byford. Nettleton Rd. (Not relocated in 2011. Unsuitable habitat and disturbed road verge).

5. PERTH 5297184. September 1998. 7.5 km SW of Serpentine. Punrak Rd. (Not relocated in 2011. Disturbed road verge).
6. PERTH 7469098. September 2003. Serpentine townsite. Tractor Museum. (Not relocated in 2011 or 2012). Cleared road verge and disturbed habitat).
7. PERTH 4622316. August 1991. 9.5 km W of Mundijong. Intersection of Duckpond and Mundijong Rds. (Not relocated in 2011 or 2012).

A further decline is also likely at two locations due to extremely low plant numbers (<5), the presence of dead and poor condition individuals and the poor condition of the habitat.

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.

Area of current extent is 60km². This has been calculated using the ESRI ArcMap 9.3.1 measuring tool to create one continuous polygon, with no internal angle greater than 180° (As described in IUCN Red List version 8.0). The dataset used for this calculation was collected with a Differential GPS during 2010/2012 field surveys by DEC Swan Coastal District Conservation Officers.

It is important to note that a large proportion of this area is modified land being used for housing, farming and utilities. When calculating the extent of occurrence, if internal angles greater than 180° were not followed (IUCN 2010 V8.0) the area of extent could easily be reduced to less than 10km².

Area of past extent is 1500km². This area has been calculated as for current extent but the dataset has been expanded to also include all Florabase records (including those where plants were not relocated) [extracted November 2011)]. Where Florabase coordinates do not match their location description the written description was used to reposition the location.

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.

Records of the sites where plants were not relocated show a collection range of 20 years, from 1983 to 2003 (not including the Cockburn Sound site from 1900). The abundance of plants for all of these records was either not mentioned, or recorded as scattered, common, infrequent or occasional. These categories are unable to be used in estimations of decline, but there has clearly been a past reduction in plant numbers. There has also been a large historical decline of 96% in the extent of occurrence from 1,500km² (based on all Florabase records) to 60km² (current location records where plants occur).

To predict the likely decline over the future 10 year period, current plant numbers can be used. Results of the 2010 to 2012 surveys show that 29.8% of mature individuals were dead and a further 9.4% in poor condition. As the majority of sites are within insecure tenure with multiple threatening processes, this calculation is viewed as cautious and a higher percentage future decline is highly likely.

Is the distribution of the species severely fragmented? Why?

Yes. Within the very small current extent of occurrence, the populations are separated in a severely fragmented landscape. Although, 50% of the currently known sites and 95% of the total mature individuals are within the boundary of Serpentine, the majority occur on small remnants separated by roads, rail-lines, maintenance tracks, firebreaks and cleared areas of freehold or sites of utilities infrastructure.

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.

When considering the very small extent of occurrence, area of occupancy, continuing decline and identified multiple threatening processes, all populations are considered important.

Three of the eight populations also have extremely low plant numbers (≤ 10 mature individuals) within restricted areas of occupancy. They are in different locations, and are therefore important for possible genetic diversity.

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.

Populations were surveyed during the appropriate season for flowering and fruiting and transects were walked covering the critical habitat for this taxon. Collections were taken from each population and verified by Ryonen Butcher (Research Scientist, WA Herbarium).

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

The various species of *Synaphea* can be difficult to differentiate without experience and generally require examination with a 10x or 20x hand-lens in the field to identify accurately. However, *S. sp. Serpentine* is readily recognisable by the combination of its highly dissected leaves with long, extremely slender, and usually irregularly-divided, terminal lobes and sparse to dense long hairs on the petioles, and its long inflorescences with small, gently curved and widely spaced flowers, with stigmas that have slender, erect apical lobes. The species habitat preference for seasonally-wet areas among Shrubland and Open Woodland with overlapping dominant species (refer 2.4 Biological Habitat) is of additional benefit to survey success.

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.

Yes. Considering the current geographical range of just over 20km and available habitat that has been largely cleared and is reasonably confined.

History of surveys and collections include:

1900 – collection made by Dr. Diels and Pritzel s.n.

1983, 1984, 1991, 1992 and 1995 – collections made by B.J. Keighery, G.J. Keighery and N. Gibson.

1997 and 1998 Rob Davis (Research Scientist) and Diana Papenfus (Environmental Consultant). Opportunistic collections of *Synaphea sp. Serpentine* made whilst undertaking targeted surveys for the Declared Rare *Synaphea* spp. Surveys concentrated on areas around Pinjarra, Serpentine and Mundijong, and extended southwards along the South West Highway and the rail reserves associated with the South West railway to Elgin (Butcher 2004). Refer to attached map of survey area.

September 1998 – collections made by G.R. Brand in the Serpentine area.

2003 – Ryonen Butcher (Research Scientist). Collected specimens of *Synaphea sp. Serpentine* whilst surveying for the Declared Rare *Synaphea* species. Area surveyed comprised a large proportion of the Pinjarra Plain between Byford and Capel, extending to Yoongarillup in the southwest, as well as inland to the lower slopes of the Darling Scarp. Some of the areas surveyed by R. Davis were resurveyed at this time (Butcher 2004). Refer to attached map of survey area.

2003 – collection made by M. Hislop in Serpentine.

<p>2008 & 2009 collections made by P. Foreman, B. Fellows and J. Waud from Lambkin Reserve, Serpentine.</p> <p>2010, 2011 & 2012 – Swan Coastal District Flora Conservation Officers. Targeted surveys for <i>Synaphea</i> sp. Serpentine were undertaken to obtain detailed information of each known population and critical habitat was searched in between the populations.</p> <p>Areas of potential habitat were searched while undertaking targeted surveys for other conservation listed species within the Swan Coastal District during 2009-2012. Plants were found in additional areas to the locations recorded on Florabase, however these were then encompassed within the known sites as extensions of the population. Also, where coordinates from Florabase records were ambiguous, areas of suitable habitat in the vicinity of the records were searched.</p>				
<p>4.3. Threats Identify past, current and future threats indicating whether they are actual or potential. 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?).</p>				
<p>Past threats identified by Ryonen Butcher during surveys undertaken in 2003 for the Declared Rare <i>Synaphea</i> sp. Pinjarra (<i>R. Davis</i> 6578) [formerly <i>S. trifolina</i> R.Butcher ms] include weed invasion, fragmented habitat due to extensive clearing for agriculture and development, road and rail construction and maintenance and changes in hydrology (e.g. local changes to drainage systems) (Butcher 2004, 2007). Although the threats referred to in the reference are not specific to <i>Synaphea</i> sp. Serpentine, they are inherently the same threats impacting upon the remnants along road and rail-lines, where all but three of the <i>Synaphea</i> sp. Serpentine populations occur.</p>				
<p>If possible, provide information threats for each current occurrence/location:</p>				
Location	Past threats	Current threats	Potential threats	Management requirements (see section 4.4)
ⁱ Lambkin NR (CR 32352). ⁱⁱ Leslie St. ⁱⁱⁱ Hardey Rd. ^{iv} Tonkin St. ^v Richardson St. ^{vi} Bushland at cnr of Tonkin & Richardson St's. Serpentine.	See note above	Weed invasion. Mealy bug infestation. ^{ii-vi} Road\ firebreak maintenance activities. Weed control by land managers. ^{iii-vi} Active recreation.	Weed invasion. Repeated short-interval fires. Drying climate. ^{ii-vi} Weed control by land managers.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
ⁱ Rapids Rd. ⁱⁱ Punrak Rd., Serpentine.	See note above	ⁱ Firebreak maintenance. Grazing. Fence maintenance. ⁱⁱ Road works and grazing	Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.

ⁱ Hardey Rd. ⁱⁱ Hall Rd., Serpentine	See note above	Weed invasion. Weed control by land managers. Rail/road maintenance, Active recreation. Scale/mealy bug infestation. Fragmentation. Underground utilities maintenance.	Weed invasion. Weed control by Land managers. road/rail maintenance and construction. Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
Mundijong Rd. 200m E of Kargotich Rd., Mundijong.	See note above	Weeds invasion. Weed control by land managers. Low plant numbers. Fragmentation.	Weed invasion. Weed control by land managers. Repeated short-interval fires. Impacts to habitat from approved road widening and associated works. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
Mundijong Rd. 1km W of Paterson Rd., Mundijong.	Significant soil disturbance and see note above.	Weed invasion. Weed control by land managers. Fragmentation.	Planned road construction (Tonkin Hwy extension). Weed invasion. Weed control by land managers. Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
Abernethy Rd., Mundijong.	Grazing. Historic clearing and see note above.	Weeds invasion. Weed control by land managers. Firebreak maintenance. Low plant numbers. Fragmentation.	Weed invasion, Weed control by land managers, Phytophthora spp. Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
Soldiers Rd., Cardup.	See note above	Weeds invasion. Weed control by land managers. Low plant numbers. Fragmentation.	Weed invasion. Weed control by land managers. Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.

Richardson St, Serpentine.	See note above	Weeds invasion. Weed control by land managers. Fragmentation, habitat incursion. Road/rail maintenance.	Weed invasion. Weed control by land managers. Repeated short-interval fires. Drying climate.	Prepare a Recovery Plan for this species to address current and potential threats specific to each location.
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.				
Despite producing a large number of flowers per plant, only a small proportion develop into fruit and levels of seed abortion and parasitism, as well as fruit galling, are high. Each fully-formed fruit contains a single seed. Seed-bearing fruit do not disperse a long distance away from the parent plants leading to localised clusters of plants in the environment. While the genetic diversity of this species has not been studied, the natural habitat of this species on the Pinjarra Plain has been extensively cleared and remaining vegetation remnants are small and highly fragmented.				
4.4. Management				
Identify key management documentation for the species e.g. recovery plans, conservation plans, threat abatement plans etc.				
No management documentation for the species has been written.				
Does this species benefit from the management of another species or community? Explain.				
Yes, whilst there is no specific management for <i>Synaphea</i> sp. Serpentine, where it occurs in association with a Threatened species or within a TEC that is actively managed, it does benefit. (see section 2.4 'Habitat').				
How well is the species represented in conservation reserves or covenanted land? Which of these are actively managed for this species? Provide details.				
<i>Synaphea</i> sp. Serpentine is poorly represented in conservation reserves and covenanted land. For the few areas that are managed for conservation, only Lambkin Nature Reserve (CR32352) is actively managed through specific recovery actions for the conservation listed flora occurring within.				
Are there any management or research recommendations that will assist in the conservation of the species? Provide details.				
No conservation-biology studies have been conducted for <i>S. sp. Serpentine</i> and no management documents have been written. Given the similar habitat requirements and overlapping distributions of <i>S. sp. Serpentine</i> and the conservation-listed species <i>S. sp. Pinjarra</i> (T), <i>S. sp. Fairbridge Farm</i> (T), <i>S. stenoloba</i> (T), <i>S. odocoileops</i> (P1) and <i>S. sp. Pinjarra Plain</i> (P1; requires re-evaluation), the majority of the Interim Recovery Plan actions applicable to the first three species would also apply in this instance. Given the small size of the vegetation remnants in which all these species occur a whole-of-habitat management approach seems logical and would maximise conservation returns. Research is required on fire response for use as a recovery tool, but this would need to be carried out in conjunction with a comprehensive weed control program.				
As multiple threatening processes have been identified for <i>S. sp. Serpentine</i> , the preparation of a Recovery Plan is highly recommended.				
Specific management requirements include: <ul style="list-style-type: none"> • Maintain liaison with road, rail and utilities managers to minimise disturbance to remnant vegetation when maintaining roads, railway and powerlines; • Maintain liaison with adjacent land managers to ensure herbicides used do not impact on 				

road and rail reserve populations;

- Monitor the populations for evidence of rabbits 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 sites;
- Practice appropriate hygiene measures to protect susceptible habitat from disease introduction;
- Survey any newly identified areas of suitable habitat;
- Protect sites from exposure by planting and maintaining adequate vegetation buffers;
- Control infestations of weeds that might impact the species and its habitat;
- Manage groundwater at sites through monitoring;
- Erect barriers if recreational activities continue to threaten populations;
- Remove rubbish dumped at sites;
- Control rabbits if evidence of a rabbit population or herbivory noted;
- Identify scale insect infesting plants and determine appropriate control required;
- Collect and store seed;
- Establish new populations on secure tenure through implementation of translocations;
- Determine species pollination ecology, seed germination requirements and viability, and longevity;
- Stimulate germination of species in wild;
- Undertake morphological and genetic studies to confirm the species taxonomic boundaries.

4.5. Other

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

As *Synaphea* sp. Serpentine occupies the same area as the Commonwealth listed species *S. sp. Pinjarra* (CR), *S. sp. Fairbridge Farm* (CR), *S. stenoloba* (CR), the listing of *S. sp. Serpentine* as Threatened is warranted given its highly restricted distribution and that it is endemic to the Pinjarra Plain. Furthermore, all but three populations are restricted to small rail and road reserves which are highly threatened across this region.

SECTION 5. NOMINATOR

Nominator(s) name(s)

Organisation(s)

Address(s)

Telephone number(s)

Email(s)

Date

31st January 2013

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

Ryonen Butcher (Research Scientist, WA 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.

Reports

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Authorities

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