Department of Parks and Wildlife

Interim Recovery Plan No. **363**

Synaphea sp. Pinjarra Plain (A.S. George 17182)

Interim Recovery Plan

2016–2021

Department of Parks and Wildlife, Western Australia

July 2016

List of Acronyms

The following acronyms are used in this plan:

AFLP	Amplified fragment length polymorphism
BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CFF	Conservation of Flora and Fauna
CITES	Convention on International Trade in Endangered Species
CPC	Conservation and Parks Commission
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora (also known as Threatened Flora)
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
PTA	Public Transport Authority
SCB	Species and Communities Branch
SRTFCRT	Swan Region Threatened Flora and Communities Recovery Team
SWALSC	South West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*) and Department of Parks and Wildlife Corporate Guideline No. 35 (DPaW 2015*b*). Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened flora, fauna and ecological communities, and begin the recovery process.

Parks and Wildlife is committed to ensuring that threatened flora are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) flora, always within one year of endorsement of that rank by the Minister.

This plan will operate from July 2016 to June 2021 but will remain in force until withdrawn or replaced. It is intended that, if *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is still ranked CR in Western Australia following 5 years of implementation, this plan will be reviewed and the need for further recovery actions assessed.

This plan was given regional approval on 9 May 2016 and was approved by the Director of Science and Conservation on 1 July 2016. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at July 2016.

Plan preparation. This plan was prepared by:

Robyn Luu	Project Officer, Parks and Wildlife Species and Communities Branch.
Ryonen Butcher	Research Scientist, Parks and Wildlife Science and Conservation Division.
Andrew Brown	Threatened Flora Coordinator, Parks and Wildlife Species and Communities Branch.

Acknowledgments. The following people provided assistance and advice in the preparation of this plan:

Andrew Crawford	Principal Technical Officer, Threatened Flora Seed Centre, Parks and Wildlife Science and Conservation Division
Fiona Felton	Nature Conservation Officer, Parks and Wildlife Swan Coastal District
Anne Harris	Flora Conservation Officer, Parks and Wildlife Swan Coastal District
Melissa Okely	Conservation Officer, Parks and Wildlife Swan Coastal District
Amanda Shade	Assistant Curator (Nursery), Botanic Gardens and Parks Authority

Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information, and Parks and Wildlife's Species and Communities Branch staff for assistance.

Cover photograph by Ryonen Butcher.

Citation. This plan should be cited as: Department of Parks and Wildlife (2016) *Synaphea* sp. Pinjarra Plain (A.S. George 17182) Interim Recovery Plan 2016–2021. Interim Recovery Plan No. 363. Department of Parks and Wildlife, Western Australia.

Summary

Scientific name:	*Synaphea* sp. Pinjarra Plain (A.S. George 17182)	**DPaW district:**	Swan Coastal
		Shires:	Serpentine-Jarrahdale, Murray
Family:	Proteaceae	**NRM region:**	South West
Common name:	None	**IBRA region:**	Swan Coastal Plain
Flowering period:	late August–November	**IBRA subregion:**	Perth SWA02
DPaW region:	Swan	**Recovery team:**	SRTFCRT

Distribution and habitat: *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is found in a linear band from just north of Mundijong to West Coolup, growing predominantly in grey-brown sandy loams but also less often in heavier brown clay-sand overlain by laterite pebbles.

Habitat critical to the survival of the species, and important populations: It is considered that all known habitat for wild populations is critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182), and that all wild populations are important populations. Habitat critical to the survival of the species includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Conservation status: *Synaphea* sp. Pinjarra Plain (A.S. George 17182) was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17 September 2013. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criterion B2ab(i,ii,iii,iv,v) due to its area of occupancy being less than 10km^2 and a continuing decline projected in area of occupancy and quality of habitat. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are weeds, road, rail, track and firebreak maintenance, fragmentation of habitat, inappropriate fire regimes, scale insects, dieback disease, insecure land tenure, poor recruitment, limited seed production, recreational activities, infrastructure maintenance and rabbits.

Existing recovery actions: The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. Declared Rare Flora (DRF) markers have been installed at Population 10.
2. The Parks and Wildlife Threatened Flora Seed Centre (TFSC) has seed in storage collected from Subpopulation 7a in December 2008.
3. Surveys have been undertaken for the species.

Plan objective: The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success: The plan will be considered a success if one or more of the following take place over the term of the plan.

- No important populations have been lost and the number of mature plants within those populations has remained within a 10% range or has increased by >10% from 707 to 778 or more or
- New populations have been found, increasing the number of known populations from 12 to 13 or more with no net loss of mature plants or
- The area of occupancy has increased by >15% with no net loss of mature plants.

Criteria for recovery failure: The plan will be considered a failure if one or more of the following take place over the term of the plan.

- Important populations have been lost or
- The number of mature plants has decreased by >10% from 707 to 636 or less or
- The area of occupancy has decreased by >15% with a loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Install DRF markers
4. Conduct morphological and genetic studies
5. Undertake weed control
6. Collect and store seed
7. Implement rabbit control
8. Identify and control scale insects
9. Undertake surveys
10. Limit access to Population 11 and Subpopulation 7b
11. Remove rubbish from Population 11
12. Develop and implement a fire management strategy
13. Undertake regeneration trials
14. Determine susceptibility to *Phytophthora cinnamomi*
15. Maintain disease hygiene
16. Achieve long-term protection of habitat
17. Develop and implement a translocation proposal
18. Liaise with land managers and Aboriginal communities
19. Promote awareness
20. Obtain biological and ecological information
21. Map habitat critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182)
22. Review this plan and assess the need for further recovery actions

1. Background

History

In 2007, *Synaphea* sp. Pinjarra Plain (A.S. George 17182) was placed on the census of Western Australian plants to encompass a recently discovered species from the Mundijong-Pinjarra area. *Synaphea* is currently undergoing further taxonomic review (Butcher in prep.) and other new species from the same geographic area have also been recognised.

Currently, there are 45 confirmed collections of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) held at the Western Australian Herbarium. In addition, there are four other possible collections of the species that require further investigation. One of these is an outlier collected in 1902 from 'Greenmount, Darling Range' east of Perth, some 40km north of the northern most currently known population. This site has not been relocated due to imprecise locality information and the absence of a habitat description.

Synaphea sp. Pinjarra Plain (A.S. George 17182) is known from 12 populations comprising 707 mature plants, the majority of which are found on narrow road and rail reserves threatened by weeds and ongoing maintenance activities. It was listed as threatened flora on 17 September 2013.

Description

Synaphea sp. Pinjarra Plain (A.S. George 17182) is a perennial, erect, clumped shrub to 80cm high with yellow flowers that are held on long spikes well above the leaves. Flowering occurs between late August and November. The shape of the terminal leaf lobes, the length of the flowering spikes and the orientation, pubescence and compression of the flowers, distinguish it from *S.* sp. Fairbridge Farm (D. Papenfus 696) and *S.* sp. Pinjarra (R. Davis 6578) (Butcher 2004).

Key distinguishing features of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) (Butcher in prep.) are:

- Intermediate between *Synaphea petiolaris* and *S. gracillima* in gross morphology i.e. leaves similar to *S. petiolaris* and flowers similar to *S. gracillima*.
- Plants clumped from base.
- Leaves 2–3 x-tripartite; terminal lobes often oblanceolate. Mid to dark green.
- Petioles glabrous, longer than *Synaphea gracillima*.
- Spikes straight or gently undulating.
- Flowers large, dorsiventrally compressed, moderately to openly spaced, oriented +/- horizontally to gently ascending, glabrous.
- Stigma with broad lateral lobes (like a crescent moon).
- Fruit cylindrical to narrowly obovate with a short, thick neck at base and a raised apical 'crown' around the short beak.

Synaphea sp. Pinjarra Plain (A.S. George 17182) is not known to hybridise with other *Synaphea* species despite sometimes co-occurring with *S.* sp. Serpentine, *S.* sp. Fairbridge Farm, *S. petiolaris* and *S. gracillima*.

Illustrations and/or further information

Butcher, R. (2004) A Survey of Gazetted and Proposed Declared Rare species of *Synaphea* (Proteaceae) occurring on the Pinjarra Plain. Unpublished report prepared for the Western Australian Threatened Species and Communities Unit, Department of Conservation and Land Management; George, A.S. (1995) *Synaphea*. *Flora of Australia* 16: 271–316; Western Australian Herbarium (1998–) *FloraBase– the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/.

Distribution and habitat

Synaphea sp. Pinjarra Plain (A.S. George 17182) is found in a linear band from just north of Mundijong (36km south, south-east of Perth) to West Coolup (84km south of Perth). Associated species include *Adenanthos meisneri*, *Corymbia calophylla*, *Hakea varia*, *Kunzea micrantha*, *Mesomelaena tetragona*, *Pericalymma ellipticum*, *Stirlingia latifolia*, *Tetraria octandra* and *Xanthorrhoea preissii*. Plants are predominantly found in grey-brown sandy loams but have also been recorded from heavier brown clay-sand overlain by laterite pebbles. The species is found more often on the boundaries of seasonal wetlands rather than within them.

Table 1. Summary of population land vesting, purpose and manager

Population number & location	DPaW district	Shire	Vesting	Purpose	Manager
1a. North Dandalup	Swan Coastal	Murray	LGA	Road reserve	Shire of Murray
1b. North Dandalup	Swan Coastal	Murray	PTA	Rail reserve	Brookfield Rail
1c. North Dandalup	Swan Coastal	Murray	LGA	Recreation reserve	Shire of Murray
1d. North Dandalup	Swan Coastal	Murray	LGA	Recreation reserve	Shire of Murray
2. SW of North Dandalup	Swan Coastal	Murray	LGA	Road reserve	Shire of Murray
3. NW of Coolup	Swan Coastal	Murray	LGA	Recreation reserve	Shire of Murray
4a. SW of Keysbrook	Swan Coastal	Serpentine-Jarrahdale	LGA	Road reserve	Shire of Serpentine-Jarrahdale
4b. SW of Keysbrook	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
5. SW of Keysbrook	Swan Coastal	Serpentine-Jarrahdale	LGA	Rail reserve	Brookfield Rail
6a. S of Serpentine	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
6b. S of Serpentine	Swan Coastal	Serpentine-Jarrahdale	LGA	Road reserve	Shire of Serpentine-Jarrahdale
7a. Serpentine	Swan Coastal	Serpentine-Jarrahdale	CPC	CFF	Parks and Wildlife
7b. Serpentine	Swan Coastal	Serpentine-Jarrahdale	LGA	Road reserve	Shire of Serpentine-Jarrahdale
7c. Serpentine	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
8a. Serpentine	Swan Coastal	Serpentine-Jarrahdale	LGA	Road reserve	Shire of Serpentine-Jarrahdale
8b. Serpentine	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
9. N of Serpentine	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
10. SW of Mundijong	Swan Coastal	Serpentine-	PTA	Government	Shire of Serpentine-

		Jarrahdale		requirements	Jarrahdale
11. Mundijong	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail
12. Cardup	Swan Coastal	Serpentine-Jarrahdale	PTA	Rail reserve	Brookfield Rail

Biology and ecology

Many *Synaphea* species are morphologically similar to others, are variable in their morphology and occur in sympatry with closely related species making identification difficult. However, a morphometric study of conservation-listed *Synaphea* from the Swan Coastal Plain which included *S.* sp. Pinjarra Plain (A.S. George 17182) showed it can be separated from the related *S. petiolaris* and *S. gracillima* by fruit characters (Butcher and Thiele in prep.). It is also distinguished from *S. gracillima* by its leaf morphology and different shaped flowers (Butcher 2004). Due to the complex relationship between these taxa, leaf material collected from *S.* sp. Pinjarra Plain (A.S. George 17182) and *S. gracillima* was included in an AFLP molecular analysis with results showing that *S.* sp. Pinjarra Plain (A.S. George 17182) is genetically distinct from *S. gracillima* (Butcher *et al.* unpubl. data).

Studies have shown that *Synaphea* sp. Pinjarra Plain (A.S. George 17182) seed is generally viable and plants can also regenerate from rootstock following soil disturbance and fire. Its pollinator is unknown. Despite producing a large number of flowers, only a small proportion of these develop fruit, and levels of seed abortion, parasitism and fruit galling are high. Each fruit contains a single seed. Seed-bearing fruit do not disperse very far from parent plants, leading to localised clusters of plants in the environment. The life expectancy of the species, as has been observed where recent fire has occurred, is thought to span three or more years.

Conservation status

Synaphea sp. Pinjarra Plain (A.S. George 17182) was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17 September 2013. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criterion B2ab(i,ii,iii,iv,v) due to its area of occupancy being less than 10km^2, severe fragmentation of populations and a continuing decline observed in area of occupancy, quality of habitat and number of mature individuals. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Weeds.** Weeds include *Eragrostis curvula* (African Lovegrass) and *Watsonia* spp. Weeds suppress early plant growth by competing for soil moisture, nutrients and light.
- **Road, rail, track and firebreak maintenance.** Threats include grading, chemical spraying, construction and maintenance of drainage channels and mowing roadside vegetation. Adjacent landowners should be informed of the location of populations to prevent accidental damage during fence and firebreak maintenance or other activities.
- **Fragmentation of habitat.** Most populations occur in small, narrow, linear remnants separated by roads, rail-lines, maintenance tracks, firebreaks and cleared areas.

- **Inappropriate fire regimes.** The species is known to regenerate from rootstock following fire. However, negative post-fire effects including habitat modification and weed invasion have been noted as a cause of past decline.
- **Scale insects.** These have been found on plants at Population 11 and Subpopulations 1d, 8a and 8b. The insect requires identification to determine the best treatment method.
- **Dieback disease.** It is not known if *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is killed by dieback (*Phytophthora cinnamomi*) and testing of its susceptibility should be undertaken.
- **Insecure land tenure.** With the exception of one subpopulation that occurs in a conservation reserve, all populations are on land with tenure that is not consistent with conservation.
- **Poor recruitment.** Most populations of the species have poor recruitment.
- **Limited seed production.** The fruits of all *Synaphea* species are single-seeded and high levels of seed abortion and predation have been observed. These factors, in addition to sequential fruit maturation and fruit-fall during its development (non-serotiny), make seed collection for storage and propagation difficult.
- **Recreational activities.** The south-west and north-west corners of the intersection containing Subpopulation 7b are used by pedestrians, horse-riders, motor bike-riders and children building cubby houses. At Population 11 rubbish dumping is common.
- **Infrastructure maintenance.** Powerline maintenance in the area of Subpopulations 6a and 6b is a potential threat to *Synaphea* sp. Pinjarra Plain (A.S. George 17182).
- **Rabbits** (*Oryctolagus cuniculus*). Rabbit grazing and digging has been observed in the area of Population 2.

The intent of this plan is to provide actions that will mitigate immediate threats to *Synaphea* sp. Pinjarra Plain (A.S. George 17182). Although climate change and drought may have a long-term effect on the species, direct actions to prevent their impact are beyond the scope of this plan.

Table 2. Summary of population information and threats

Population no & location	Land status	Year / no. of plants	Current condition		Threats
			Population	Habitat	
1a. North Dandalup	Road reserve	2011 24	Moderate	Good	Fragmentation, weeds, road maintenance, inappropriate fire regimes
1b. North Dandalup	Rail reserve	2011/12 192 (492) [15]	Healthy	Very good	Fragmentation, weeds, rail maintenance (drains), inappropriate fire regimes
1c. North Dandalup	Recreation reserve	2012 10	Healthy	Degraded	Weeds, firebreak maintenance, inappropriate fire regimes
1d. North Dandalup	Recreation reserve	2012 8 (5)	Moderate	Very good	Weeds, inappropriate fire regimes, drain maintenance, scale infestation
2. SW of North Dandalup	Road reserve	2012 2	Healthy	Good	Weeds, grazing, track maintenance, inappropriate fire regimes
3. NW of Coolup	Recreation reserve	2012 4 (16) [1]	Moderate	Very good	Weeds, inappropriate fire regimes
4a. SW of Keysbrook	Road reserve	2012 1	Healthy	Degraded	Weeds, road/track maintenance, inappropriate fire regimes
4b. SW of Keysbrook	Rail reserve	2012 6	Healthy	Degraded	Weeds, rail/track maintenance, inappropriate fire regimes
5. SW of Keysbrook	Rail reserve	2012 30 [1]	Healthy	Good/ Degraded	Weeds, rail maintenance, inappropriate fire regimes
6a. S of Serpentine	Rail reserve	2012 184 (1) [4]	Moderate	Good/ degraded	Weeds, rail and powerline maintenance, inappropriate fire regimes

6b. S of Serpentine	Road reserve	2012	2	Healthy	Good/ degraded	Weeds, road and powerline maintenance, inappropriate fire regimes
7a. Serpentine	Nature reserve	2012	23	Moderate		Weeds
7b. Serpentine	Road reserve	2012	25 [1]	Healthy		Recreational activities, weeds, road maintenance, inappropriate fire regimes
7c. Serpentine	Rail reserve	2011 2012	1 0 (burnt)	Poor	Degraded	Weeds, rail maintenance, inappropriate fire regimes
8a. Serpentine	Road reserve	2011	23 (1)	Poor	Good	Road and rail maintenance, fragmentation, weeds, inappropriate fire regimes, scale infestation
8b. Serpentine	Rail reserve	2011 2012	30 (4) [45] 0 (burnt 2011/12)	Healthy	Good	Road and rail maintenance, fragmentation, weeds, inappropriate fire regimes, scale infestation
9. N of Serpentine	Rail reserve	2012	102 (10) [11]	Moderate	Degraded	Weeds, rail maintenance, inappropriate fire regimes
10. SW of Mundijong	Government requirements	2012	3	Poor	Excellent	Weeds, inappropriate fire regimes
11. Mundijong	Rail reserve	2012	24 (2) [1]	Healthy	Good	Recreational activities, weeds, scale infestation, rail maintenance, fragmentation, inappropriate fire regimes
12. Cardup	Rail reserve	2012	44 (4)	Moderate	Very good	Fragmentation, rail maintenance, weeds, inappropriate fire regimes

Note: Populations in **bold text** are considered to be important populations; ( ) = number of seedlings/juveniles; [ ] = number that are dead.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) may require assessment.

Actions that result in any of the following may potentially significantly impact the species:

- Damage or destruction of occupied or potential habitat.
- Alteration of the local surface hydrology or drainage.
- Reduction in population size.
- Altered fire regimes.

Habitat critical to the survival of the species, and important populations

Synaphea sp. Pinjarra Plain (A.S. George 17182) is ranked as CR in Western Australia and it is considered that all known habitat for wild populations is habitat critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *S.* sp. Pinjarra Plain includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) will also benefit the Threatened and Priority flora listed in the table below:

Table 3. Conservation-listed flora species found in habitat of *Synaphea* sp. Pinjarra Plain (A.S. George 17182)

Species name	Conservation status (WA)	Conservation status (EPBC Act)
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	DRF (CR)	CR
Synaphea sp. Pinjarra (R. Davis 6578)	DRF (CR)	CR
Synaphea sp. Serpentine (G.R. Brand 103)	DRF (CR)	-
Verticordia plumosa var. *ananeotes*	DRF (CR)	EN
Tetraria australiensis	DRF (VU)	VU
Grevillea bipinnatifida subsp. *pagna*	Priority 1	-
Hemigenia rigida	Priority 1	-
Synaphea odocoileops	Priority 1	-
Johnsonia pubescens subsp. *cygnorum*	Priority 2	-
Acacia oncinophylla subsp. *patulifolia*	Priority 3	-
Angianthus drummondii	Priority 3	-
Baeckea sp. Perth Region (R.J. Cranfield 444)	Priority 3	-
Isopogon drummondii	Priority 3	-
Drosera occidentalis subsp. *occidentalis*	Priority 4	-
Parsonsia diaphanophleba	Priority 4	-

For a description of conservation codes for Western Australian flora see http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_ 18092013.pdf

Synaphea sp. Pinjarra Plain (A.S. George 17182) is associated with the three Threatened Ecological Communities (TECs) listed in the table below.

Table 4. Threatened Ecological Communities associated with *Synaphea* sp. Pinjarra Plain (A.S. George 17182)

TEC name	Conservation status (WA)	Conservation status (EPBC Act)
Banksia attenuata and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (type SCP20b)	EN	-
Corymbia calophylla-Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain (type SCP3b)	VU	-
Herb rich shrublands in clay pans (type SCP08)	VU	CR

For a description of TEC categories see Department of Environment and Conservation (2010).

Two Threatened and one Priority fauna species that occur within the range of populations will benefit from management of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and its habitat. These are Baudin's Cockatoo (*Calyptorhynchus baudinii*) (EN), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (EN) and Quenda (*Isoodon obesulus* subsp. *fusciventer*) (P5).

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The species is not listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES), and this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed a site (# 3685, Mills Road) of Aboriginal significance overlapping Population 3 of *Synaphea* sp. Pinjarra Plain (A.S. George 17182). There is also a site (# 3582, Serpentine River) that overlaps Populations 7, 8 and 9. Input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and DAA to determine if there are any issues or interests with respect to management for this species in the vicinity of these sites. Indigenous opportunity for future involvement in the implementation of the plan is included as an action in the plan. Aboriginal involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this species occurs.

Social and economic impacts

The implementation of this plan may result in some social and economic impact for the Shire of Murray (Populations 2 and 3 and Subpopulations 1a, 1c and 1d), the Shire of Serpentine-Jarrahdale (Population 5 and 10 and Subpopulations 4a, 6b, 7b and 8a) and Brookfield Rail (Populations, 9, 11 and 12 and Subpopulations 1b, 4b, 6a, 7c and 8b) through the implementation of recovery actions (controlling weeds and rabbits) and restrictions imposed on the management of the land, including maintenance of road and rail infrastructure.

Affected interests

The implementation of this plan has implications for the Shires of Murray and Serpentine-Jarrahdale and Brookfield Rail.

Evaluation of the plan's performance

Parks and Wildlife, in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT), will evaluate the performance of this plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. Recovery objective and criteria

Plan objective

The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success: The plan will be considered a success if one or more of the following take place over the term of the plan.

- No important populations have been lost and the number of mature plants within those populations has remained within a 10% range or has increased by >10% from 707 to 778 or more or
- New populations have been found, increasing the number of known populations from 12 to 13 or more with no net loss of mature plants or
- The area of occupancy has increased by >15% with no net loss of mature plants.

Criteria for recovery failure: The plan will be considered a failure if one or more of the following take place over the term of the plan.

- Important populations have been lost or
- The number of mature plants has decreased by >10% from 707 to 636 or less or
- The area of occupancy has decreased by >15% with a loss of mature plants.

See table 2 for important populations.

3. Recovery actions

Existing recovery actions

Land owners and managers have been notified of the location and threatened status of *Synaphea* sp. Pinjarra Plain (A.S. George 17182). Notifications detail the current Declared Rare Flora (DRF) status of the species and the associated legal obligations in regards to its protection.

DRF markers have been installed at Population 10 and dashboard stickers and posters describing the significance of these markers have been produced and distributed to Shires and other organisations.

Parks and Wildlife's Threatened Flora Seed Centre (TFSC) has a collection of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) seed made from Subpopulation 7a in December 2008.

In 2003 Rob Davis (Botanist Western Australian Herbarium) made opportunistic collections of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) while undertaking targeted surveys for rare *Synaphea* species. 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.

In 2003 Ryonen Butcher (Research Scientist Western Australian Herbarium) collected specimens of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and noted the locations of new populations. The area surveyed comprised a large proportion of the Pinjarra Plain between Byford and Capel.

In 2008 Dave Kabay (Environmental Consultant) conducted targeted surveys for species of conservation significance along the gas pipeline corridor in the North Dandalup area.

In 2011 and 2012 Parks and Wildlife's Swan Coastal District Flora Conservation Officers undertook surveys and monitoring of *Synaphea* sp. Pinjarra Plain (A.S. George 17182).

Future recovery actions

The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any recovery action if funding is available and other opportunities arise. Where recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

Parks and Wildlife with assistance from the SRTFCRT will oversee the implementation of recovery actions for *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Swan Region), with assistance from the SRTFCRT
Cost:	$8,000 per year

2. Monitor populations

Monitoring of populations and habitat should be undertaken to identify trends or potential management requirements. Population monitoring should record the health and expansion or decline in the population, and other observations such as pollinator activity or seed production. Site monitoring should include observations of grazing, habitat degradation including weed invasion, and hydrological status (inundation and drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) are included in other recovery actions detailed below.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Swan Coastal District), with assistance from the SRTFCRT
Cost:	$10,000 per year

3. Install DRF markers

DRF markers are needed at populations 2, 3, 5, 9, 11 and 12, and subpopulations 1a, 1b, 1c, 1d, 4a, 4b, 6a, 6b, 7b, 7c, 8a and 8b, to reduce the risk of accidental damage during road or rail maintenance activities. DRF markers may also be needed along tracks where infrastructure (powerline) maintenance is undertaken (Subpopulations 6a and 6b).

Action:	Install DRF markers
Responsibility:	Parks and Wildlife (Swan Coastal District)
Cost:	$4,000 in year 1

4. Conduct morphological and genetic studies

While morphometric and AFLP molecular analyses have supported the recognition of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) as a distinct species, the studies did not include slender-leaved forms. A comprehensisve study of the genetic variation within and between populations of this species is required to confirm its taxonomic boundaries.

Action:	Conduct morphological and genetic studies
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)
Cost:	$20,000 in years 1 and 2

5. Undertake weed control

Weeds are a threat to all populations of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and the following actions will be implemented:

1. Determine which weeds are present.
2. Control invasive weeds by hand removal and/or spot spraying as they first emerge.
3. Monitor the the treatment and any observed negative effects on *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and associated native plant species.
4. Report on the method and success of the treatment.
5. Revegetate with site-specific species (in autumn) to suppress weeds.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Swan Coastal District), Shires of Murray and Serpentine-Jarrahdale, Brookfield Rail
Cost:	$10,000 per year, as required

6. Collect and store seed

To guard against extinction of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) if wild populations are lost, additional seed should be collected from the widest range of reproductive plants and stored in the TFSC and at BGPA.

Action:	Collect and store seed
Responsibility:	Parks and Wildlife (Swan Coastal District, TFSC), BGPA
Cost:	$5,000 per year

7. Implement rabbit control

If monitoring ascertains the threat of damage to *Synaphea* sp. Pinjarra Plain (A.S. George 17182) plants and habitat from rabbits is high, control may be required.

Action:	Implement rabbit control
Responsibility:	Parks and Wildlife (Swan Coastal District), relevant land managers
Cost:	$4,000 in years 1, 3 and 5

8. Identify and control scale insects

The scale insect found on *Synaphea* sp. Pinjarra Plain (A.S. George 17182) plants at Population 11 and Subpopulations 1d, 8a and 8b should be identified and appropriate control measures implemented.

Action:	Identify and control scale insects
Responsibility:	Parks and Wildlife (Swan Coastal District)
Cost:	$3,000 per year when required

9. Undertake surveys

Surveys should be undertaken for *Synaphea* sp. Pinjarra Plain (A.S. George 17182) in areas of potentially suitable habitat including, where feasible, volunteers from landcare groups, wildflower societies and naturalist clubs. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and prevent duplication of effort.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Swan Coastal District), with assistance from the SRTFCRT
Cost:	$10,000 per year

10. Limit access to Population 11 and Subpopulation 7b

To limit access to Population 11 and Subpopulation 7b, barriers such as bollards should be erected. Signs indicating the significance of the area may also need to be erected.

Action:	Limit access to Population 11 and Subpopulation 7b
Responsibility:	Parks and Wildlife (Swan Coastal District), Shire of Serpentine-Jarrahdale and Brookfield Rail
Cost:	$10,000 in years 1 and 2

11. Remove rubbish from Population 11

Rubbish dumped at Population 11 should be removed.

Action:	Remove rubbish from Population 11
Responsibility:	Parks and Wildlife (Swan Coastal District), Brookfield Rail
Cost:	$10,000 in year 1

12. Develop and implement a fire management strategy

A fire management strategy which includes recommendations on fire frequency, intensity and seasonality, precautions to prevent bushfire and strategies for reacting to bushfire, and the need, method of construction and maintenance of firebreaks will be developed in consultation with land managers and implemented if necessary. Fire, where possible, will be prevented from occurring in the habitat of populations, except where it is being used experimentally as a recovery tool.

Action:	Develop and implement a fire management strategy
Responsibility:	Parks and Wildlife (Swan Coastal District)
Cost:	$10,000 in years 1 and 2, and $6,000 in years 3–5

13. Undertake regeneration trials

Populations of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) are senescing with little natural recruitment taking place. Soil disturbance or fire may therefore be required to stimulate germination of soil stored seed. This will need to be undertaken in conjunction with weed control.

Action:	Undertake regeneration trials
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)
Cost:	$10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

14. Determine susceptibility to *Phytophthora cinnamomi*

The susceptibility of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) to *Phytophthora cinnamomi* is unknown and needs to be determined.

Action:	Determine susceptibility *Phytophthora cinnamomi*
Responsibility:	Parks and Wildlife (Swan Coastal District, Forest and Ecosystem Management Division)
Cost:	$3,000 in year 1

15. Maintain disease hygiene

To protect populations of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) from disease, dieback hygiene (as outlined in Department of Parks and Wildlife 2014) will be followed during installation and maintenance of firebreaks and when walking into populations in wet soil conditions. Purpose built signs advising of the dieback risk and high conservation values of the sites will be installed if required.

Action:	Maintain disease hygiene
Responsibility:	Parks and Wildlife (Swan Coastal District)
Cost:	$4,000 per year

16. Achieve long-term protection of habitat

Improved security of populations of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) and their associated habitat will be investigated and may include land acquisition for conservation reservation or conservation covenants.

Action:	Achieve long-term protection of habitat
Responsibility:	Parks and Wildlife (Swan Region, SCB Nature Conservation Covenant Program and Land Unit)
Cost:	$4,000 in years 1–3

17. Develop and implement a translocation proposal

Translocations may be required for the long term conservation of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) if natural populations decline.

Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*), Parks and Wildlife Corporate Guideline No. 36 (DPaW 2015*c*) and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al*. 2004). The 2004 guidelines state that a translocation may be needed when a species is represented by few populations and the creation of additional self-sustaining, secure populations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small populations which may be declining in size or subject to high levels of inbreeding, successful population enhancement may increase population stability and hence long-term viability. Translocation is not an alternative to *in situ* conservation and is not a suitable ameliorative, compensatory, or mitigating measure for development and should be considered as a last resort when all other options are deemed inappropriate or have failed (Vallee *et al*. 2004).

Depending on the characteristics of the species, Vallee *et al*. (2004) suggest a minimum viable population size estimated between 50 and 2,500 individuals will be required. Suitable translocation sites may include where the taxon occurs, where it was known to have occurred historically and other areas that have similar habitat (soil, associated vegetation type and structure, aspect etc.), within the known range of the taxon (Vallee *et al*. 2004).

All translocation proposals require endorsement by the Department's Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Develop and implement a translocation proposal
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal District), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in years 3–5 as required

18. Liaise with land managers and Aboriginal communities

Parks and Wildlife will liaise with land managers to ensure that populations of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) are not accidentaly damaged or destroyed, and their habitat is maintained in a suitable condition for the conservation of the species. Consultation with the Aboriginal community will take place to determine if there are any issues or interests in areas that are habitat for the species and opportunities will be provided for Aboriginal people to be involved in implimenting this plan.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	Parks and Wildlife (Swan Coastal District)
Cost:	$4,000 per year

19. Promote awareness

The importance of biodiversity conservation and the protection of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) will be promoted through the print and electronic media and by setting up poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness
Responsibility:	Parks and Wildlife (Swan Region, SCB and Public Information and Corporate Affairs (PICA)), with assistance from the SRTFCRT
Cost:	$7,000 in years 1 and 2; $5,000 in years 3–5

20. Obtain biological and ecological information

Research on the biology and ecology of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) will include:

1. Identification of pollinators and their habitat requirements.
2. Seed viability.
3. Conditions necessary for natural germination.
4. Response to disturbance, competition, drought, inundation and grazing.
5. Longevity of plants, time taken to reach maturity, and minimum viable population size.
6. The impact of dieback and the effectiveness of control techniques.
7. The impact of changes in hydrology.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)
Cost:	$50,000 in years 1–3

21. Map habitat critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182)

Although spatial data relating to habitat critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is alluded to in Section 1, it has not been mapped. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action:	Map habitat critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182)
Responsibility:	Parks and Wildlife (SCB, Swan Region)
Cost:	$6,000 in year 2

22. Review this plan and assess the need for further recovery actions

If *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is still ranked as CR at the end of the five-year term of this plan, the plan will be reviewed and the need for further recovery actions assessed.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Swan Region)
Cost:	$6,000 in year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Swan Region), with assistance from the SRTFCRT	Ongoing
Monitor populations	High	Parks and Wildlife (Swan Coastal District), with assistance from the SRTFCRT	Ongoing
Install DRF markers	High	Parks and Wildlife (Swan Coastal District)	2016
Conduct morphological and genetic studies	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)	2017
Undertake weed control	High	Parks and Wildlife (Swan Coastal District), Shires of Murray and Serpentine-Jarrahdale, Brookfield Rail	Ongoing
Collect and store seed	High	Parks and Wildlife (Swan Coastal District, TFSC), BGPA	Ongoing
Implement rabbit control	High	Parks and Wildlife (Swan Coastal District), relevant land managers	Ongoing
Identify and control scale insects	High	Parks and Wildlife (Swan Coastal District)	Ongoing
Undertake surveys	High	Parks and Wildlife (Swan Coastal District), with assistance from the SRTFCRT	2020
Limit access to Population 11 and Subpopulation 7b	High	Parks and Wildlife (Swan Coastal District), Shire of Serpentine-Jarrahdale and Brookfield Rail	2016
Remove rubbish from Population 11	High	Parks and Wildlife (Swan Coastal District), Brookfield Rail	2016
Develop and implement a fire management strategy	High	Parks and Wildlife (Swan Coastal District)	Developed by 2016 with implementation ongoing
Undertake regeneration trials	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)	2020
Determine susceptibility to *Phytophthora cinnamomi*	High	Parks and Wildlife (Swan Coastal District, Forest and Ecosystem Management Division)	2016
Maintain disease hygiene	High	Parks and Wildlife (Swan Coastal District)	Ongoing
Achieve long-term protection of habitat	High	Parks and Wildlife (Swan Region, SCB Nature Conservation Covenant Program and Land Unit)	Ongoing
Develop and implement a translocation proposal	High	Parks and Wildlife (Science and Conservation Division, Swan Coastal District), BGPA	2020
Liaise with land managers and Aboriginal communities	Medium	Parks and Wildlife (Swan Coastal District)	Ongoing
Promote awareness	Medium	Parks and Wildlife (Swan Region, SCB and PICA), with assistance from the SRTFCRT	Ongoing
Obtain biological and ecological information	Medium	Parks and Wildlife (Science and Conservation Division, Swan Coastal District)	2018
Map habitat critical to the survival of *Synaphea* sp. Pinjarra Plain (A.S. George 17182)	Medium	Parks and Wildlife (SCB, Swan Region)	2017
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Swan Region)	2020

4. Term of plan

This plan will operate from July 2016 to June 2021 but will remain in force until withdrawn or replaced. If *Synaphea* sp. Pinjarra Plain (A.S. George 17182) is still ranked CR after five years, the need for further recovery actions will be assessed and a revised plan prepared if necessary.

5. References

Butcher, R. (2004) A Survey of Gazetted and Proposed Declared Rare species of *Synaphea* (Proteaceae) occurring on the Pinjarra Plain. Unpublished report prepared for the Western Australian Threatened Species and Communities Unit, Department of Conservation and Land Management.

Butcher, R. (in prep.) Four new, conservation-listed species of *Synaphea* (Proteaceae: Conospermineae) from the Swan Coastal Plain of south-west Western Australia. [expected submission to *Nuytsia*]

Butcher, R. and Thiele, K.R. (in prep.) A morphometric study of *Synaphea* (Proteaceae: Conospermineae) species from the Swan Coastal Plain of south-west Western Australia: an investigation of taxon boundaries and intraspecific variation in rare and range-restricted flora. [expected submission to *Australian Systematic Botany*]

Department of Parks and Wildlife (2015*a*) Corporate Policy Statement No. 35 *Conserving Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*b*) Corporate Guideline No. 35 *Listing and Recovery of Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*c*) Corporate Guideline No. 36 *Recovery of Threatened Species through Translocation and Captive Breeding or Propagation*. Perth, Western Australia.

Department of Conservation and Land Management (2003) *Phytophthora cinnamomi* and disease caused by it. Volume 1 – Management Guidelines. Department of Conservation and Land Management, Perth, Western Australia.

Department of Environment and Conservation (2010) *Definitions, categories and criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Western Australia. http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/tecs/tec-definitions-dec2010.pdf

George, A.S. (1995) *Synaphea*. *Flora of Australia* 16, Elaeagnaceae: Proteaceae. 1. CSIRO, East Melbourne. 271–316.

Government of Australia (1999) Environment Protection and Biodiversity Conservation Act.

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. and Rossetto, M. (2004) Guidelines for the Translocation of Threatened Australian Plants. Second Edition. *The Australian Network for Plant Conservation*. Canberra, Australia.

Western Australian Herbarium (1998–) *FloraBase– the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/.

World Conservation Union (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

6. Taxonomic description

Shortened draft taxonomic description of *Synaphea* sp. Pinjarra Plain (A.S. George 17182) from Butcher (in prep.):

Clumped *subshrubs* 0.3−0.8m tall, 0.2–1.5m wide, without elongate stem internodes. *Leaves* 2–3 x tripartite, 57–150mm long, 60–185mm wide, mid- to dark green; terminal lobes linear to oblanceolate with acute to obtuse apices, some asymmetry in terminal lobing. *Petiole* 95–255mm long, glabrous. *Flowering spikes* very long, 1.5–2.5 × longer than leaves, axis straight or gently sinuous, golden green to green and red, appressed pubescent. *Flowers* yellow, *c.* 4.4–6mm long, moderately to openly spaced, held ± horizontally to gently ascending, dorsiventrally compressed, glabrous. *Stigma* transversely oblong to transversely lunate with broad lateral lobes, 0.85–1.3mm long, 1.1–1.85mm wide, including lobes 0.2–0.5mm long. *Fruit* ±cylindrical to narrowly obovate with a thickened dorsal ridge along the lower 3/4 of fruit, tapering obliquely at base into a relatively short, thick neck, the fruit apex with a raised 'crown' around the short beak, 6.5–8.7mm long, 2.5–3.2mm wide, sparsely pubescent in lower 1/2, sub-glabrous above.