Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Threatened Ecological Community Nomination Form
2012 Assessment Period

Use this form to nominate or change the listed status of an ecological community under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Please read these important notes before completing this form:

- The information set out in this form is required for the nomination of a threatened ecological community (TEC) under Division 7.2 subregulation 7.05 (3) of the *EPBC Regulations 2000*.
- The Regulations are available from: www.environment.gov.au/epbc/about/index.html
- Nominations which do not meet the Regulation requirements are ineligible for consideration and will not be prioritised for assessment.
- The nomination form is separated into seven sections, each comprised of a series of questions.
- Complete the form as far as possible. Please use as much space as is required to fully answer each question. Where insufficient information is available to answer a question please indicate this rather than leaving the answer blank.
- The Threatened Species Scientific Committee (the TSSC) has developed Guidelines to assist nominators in providing the necessary information about a nominated ecological community to enable its assessment. The Guidelines should be read in conjunction with this form.
- The Guidelines include important information to assist in completing particular sections and questions of this form. They include the statutory criteria for the 'critically endangered', 'endangered' and 'vulnerable' categories.
- The Guidelines also include indicative thresholds, which may be used by the TSSC to assess whether an ecological community is eligible for listing against the criteria prescribed by the EPBC Regulations. It should be noted that the TSSC does not adhere strictly to these thresholds, but has regard to them when making judgements about ecological communities on a case-by-case basis. In particular, they may not be applicable to all types of ecological communities.
- The completed nomination form is intended to be read and understood by the TSSC without the need to refer to any external references. Therefore all questions must be answered in writing, with relevant sources quoted directly and full references to source documents, or personal communications with experts, provided in the nomination.
- It is important for the TSSC to have clear and comprehensive information and the best case on which to judge an ecological community's potential eligibility against the EPBC Act criteria for listing. A clear and comprehensive nomination (where data exists) has a greater likelihood of being prioritised for assessment.
- To ensure you have the most up-to-date information, it is recommended that you contact relevant Natural Resource Management authorities in the region(s) where the ecological community occurs. For details see: www.nrm.gov.au.
- Completing this form assists the TSSC to gain an understanding of the ecological community at the national scale. In that sense, it is important that you **consider the full, national extent of an ecological community,** not just its occurrence in specific areas or regions.

Important notes continued

- For all facts and all information presented: identify your references and sources of information. Document the reasons and supportive data. Indicate the quality of facts/information and any uncertainty in the information. For example, was it based on a peer-reviewed research publication or anecdote; or on observed data, an inference/extrapolation from the data, or a reasonable premise not yet supported by hard data?

- Personal communications: the opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and contact details should also be provided at the end of this nomination.

- Confidential material: identify any confidential material and explain the sensitivity.

- Tables: can be included at the end of the form or prepared as separate electronic documents included as appendixes or attachments. Refer to tables in the relevant area of the text.

- Maps: must be supplied and are to be adequately labelled. If maps cannot be supplied electronically, please provide them in hard copy.

- Photographs: are to be adequately labelled and used as supporting material only. The criteria need to be addressed in written form.

- Cross-reference relevant areas of the nomination form where needed (but answer each question thoroughly).

- If the ecological community is considered to be affected by climate change, please refer to Appendix 2 of the Guidelines (**Addressing climate change as an important threat)** prior to completing the nomination form.

  More detailed information on all listing categories for threatened ecological communities can be found in Section 182 of the EPBC Act and the statutory criteria can be found in Division 7.1 of the *EPBC Regulations 2000*. These are available at:
  www.environment.gov.au/epbc/about/index.html

  For questions regarding nominations contact:

  The Director
  Ecological Communities Section
  Department of Sustainability, Environment, Water, Population and Communities
  GPO Box 787
  Canberra ACT 2601
  Telephone (02) 6274 2317

Section 1 - Nominator Details

Note: Nominator details are subject to the provision of the *Privacy Act 1988* and will not be divulged to third parties if advice regarding the nomination is sought from such parties.

Full Name	
Organisation or Company name	1. Urban Bushland Council WA Inc 2. Wildflower Society of Western Australia Inc
Postal address	1. PO Box 326, West Perth WA 6872 2. PO Box 519, Floreat WA 6014
Email	1. ubc@iinet.net.au 2. wildflowers@ozemail.com.au
Phone	1. 08 9420 7207 or 08 9271 5707 2. 08 9383 7979 or 0428 345 231
Fax	1. No fax 2. 08 9383 7979 phone/fax
I declare that the information in this nomination form and any attachments is true and correct to the best of my knowledge.	
Signature (Or insert electronic signature)	
Date signed	21 March 2012

Section 2 – Eligibility for Listing

Name of the ecological community	BANKSIA DOMINATED WOODLANDS OF THE SWAN COASTAL PLAIN IBRA REGION
Listing Category for which the ecological community is nominated under the EPBC Act	
Current listing category (Please check box)	Shown in bold ☐ Critically endangered ☐ Endangered ☐ Vulnerable ☒ **None – not listed**
Proposed listing category (Please check box)	Shown in bold ☐ Critically endangered ☐ Endangered ☒ **Vulnerable**
Select one or more of the following criteria under which the community is nominated for EPBC Act listing. (Please check box).	Selected criteria shown in bold: ☒ **Criterion 1 – Decline in geographic distribution** ☐ Criterion 2 – Small geographic distribution coupled with demonstrable threat

For further details on these criteria please refer to the Guidelines to this form. The information you provide in Section 5 should support the criteria you select here.	☐ Criterion 3 – Loss or decline of functionally important species ☒ **Criterion 4 – Reduction in community integrity** ☒ **Criterion 5 – Rate of continuing detrimental change** ☐ Criterion 6 – Quantitative analysis showing probability of extinction

Section 3 – Description, Condition, Threats & Recovery

Please answer all the questions, providing references where applicable. If no or insufficient information exists to answer a question, in accordance with the *EPBC Regulations 2000*, you must indicate this instead of leaving the question blank.

The answers may be provided within this form, with attachments as required, or in a separate document. If the nomination is provided in a separate document you must provide: all contact details requested in Section 1 including the signed declaration; a completed summary of eligibility (Section 2) and ensure that responses clearly indicate which question number they refer to.

Conservation Theme

1. Does the nomination meet any of the conservation themes selected for this assessment period?

Enter your answer to the question here.

Yes. Ecological linkages.

The area of this nomination includes the Perth Metropolitan Region and the Peel region where most of the population of WA lives. While there are some larger patches of intact Banksia Woodland, there are many smaller intact patches as well as remnants of *Banksia menziesii* and *B attenuata* overstorey scattered across the suburbs of Perth along roadways and through parklands, golf courses, and backyards forming regionally and locally significant ecological linkages. These linkages are described and mapped as Perth's Greenways in Bush Forever p.31 and on p.99 Map 6 Bush Forever Vol 1 (Dec 2000). In addition Map 7 on p.72 Vol 2 of Bush Forever shows "Existing and Potential Bushland/Wetland Linkages in the Perth Metropolitan Region."

These linkages are under increasing threat from urban development, and urban 'infill' due largely to the lack of appreciation and understanding of their ecological significance at the local level and regional levels. This is combined with the lack of formal legally binding recognition that such linkages are valuable ecologically and need to be retained, maintained and enhanced by additional planting, even though such advice exists in the (WA) Environmental Protection Authority's 'Environmental Protection Bulletin No 8' (EPB No 8):

> **'South West Regional Ecological Linkages'**. This was based on the *'South West Ecological Linkages Technical Report'* by WALGA's South West Biodiversity Project and DEC's Swan Bioplan, September 2009. EPB No 8 briefly considers the Swan Coastal Plain:
>
> > ***'However, elsewhere on the Swan Coastal Plain native vegetation is highly fragmented. Therefore the maintenance of conservation reserves and all existing bushland patches, and the strategic restoration of ecological linkage function between them is a priority.'***

The sustainability of the biodiversity of these species-rich Banksia Woodlands is now critically dependent on maintenance of these linkages. They are essential as wildlife corridors for seasonal movement of fauna (eg. small bird species, invertebrates), and to act as refugia and corridors for recolonisation after catastrophic events such as fire, hailstorms in a fragmented landscape. For example there are some 12 species of small birds which move seasonally across the Swan Coastal Plain from east to west and north - south for summer feeding along

coastal heathlands, returning east for winter spring feeding and nesting in Banksia Woodland. Many small bird species need cover of vegetation to safely move across the landscape. Even large birds such as the endangered Carnaby's Cockatoo require corridors of Banksias and Eucalypts for resting and feeding in their longer daily journeys. Invertebrates are also highly dependent on connectivity across the landscape.

The Perth and Peel regions are growing steadily as a result of the mining boom in WA and urban infill is actively promoted by the State Government. This provides a major threat to the unprotected ecological linkages as small patches of Banksia Woodland and individual Banksia trees are cleared, little by little, in a classic death of a thousand cuts. As a result the health and inherent species richness of the Banksia Woodlands is under threat.

Classification

By nominating a broader community, you will enable the Committee to consider the national extent and condition of the community and determine the limits of the listed ecological community.

2. What is the name of the ecological community?

Note any other names that have been used recently, including where different names apply within different jurisdictions. For example, is it known by separate names in different States or regions?

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BANKSIA DOMINATED WOODLANDS OF THE SWAN COASTAL PLAIN IBRA REGION
These woodlands are typified and identified by the presence of *Banksia attenuata* and/or *B. menziesii.*
These particular woodlands do not occur in other States or other IBRA regions.

These woodlands are known generally in Western Australia as the Banksia Woodlands of the Swan Coastal Plain.

3. What authorities/surveys/studies support or use the name?

1. The main description of the Banksia Woodlands of the Swan Coastal Plain is by J.S Beard in the Journal of the Royal Society of Western Australia, **71** (4), 1989, 85–86: '**Definition and location of the Banksia woodlands'.** A copy of this article is attached. This paper was presented at the Banksia Woodlands symposium 1989. Indeed the whole edition of the Journal of the Royal Society **71** (4) was devoted to the proceedings of this symposium.

2. System 6 Study Report to the Environment Protection Authority (report No 8 April 1981 by the Department of Conservation and Environment) titled *'The Darling System Western Australia, Proposals for Parks and Reserves'*, where the same area is described as the southern Swan Coastal Plain. Further to the north of this area, Banksia communities occur, but as shrublands and not as woodlands.

3. Gibson, N., Keighery, B.J., Keighery G.J., Burbidge, A.H. and Lyons, M.N. (1994)

A Floristic Survey of the southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). This report is available from the Department of Environment and Conservation (DEC).

4. *Perth's Bushplan* Government of Western Australia 1998

5. *Bush Forever*, Government of Western Australia December 2000. The data and site descriptions in Bush Forever are the same as those in Perth's Bushplan. When the WA Government adopted the proposed Perth's Bushplan, the name of the policy and the report was changed to 'Bush Forever' and the technical content was not changed.

6. Department of Environment and Conservation (DEC)

7. Department of Planning

4. How does the nominated ecological community relate to other ecological communities that occur nearby or that may be similar to it? Does it intergrade with any other ecological communities and, if so, what are they and how wide are the intergradation zones? Please describe how you might distinguish the ecological community in areas where there is overlap (also see Description section below).

Banksia Woodlands may intergrade with wetland communities and with woodlands dominated by Eucalypts on the Swan Coastal Plain. The latter woodlands usually contain *Banksia menziesii* and/or *Banksia attenuata* as understorey species.

Integration zones are generally narrow and scattered being located on sandy patches or tongues into other soil types. The intergrades are generally mapped as separate communities by Beard.

Legal Status

5. What is its current level of protection under Australian State/Territory Government legislation? Please record whether there is an existing State listing for all or part of the nominated ecological community, its listing category (e.g. critically endangered, vulnerable) and its title. If not listed as threatened, is there any other form of protection under State/Territory legislation?

In WA, there are three threatened ecological communities (TECs), and four Priority ecological communities (PECs) that are Banksia Woodlands on the Swan Coastal Plain that are listed by the WA State Government. One Western Australian TEC is listed under the EPBC Act, but at a different rank, as shown below.

Listed Threatened Ecological Communities in Banksia Woodlands of Swan Coastal Plain IBRA

Identifier	Community name	WA Category	EPBC category
SCP20a	*Banksia attenuata* woodland over species rich dense shrublands	EN	not listed
SCP20b	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain	EN	not listed
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain	CR	EN

EN endangered
CR critically endangered

Priority ecological communities that are Banksia Woodlands of Swan Coastal Plain :

Identifier	Community Name	WA category
SCP22	*Banksia ilicifolia* woodlands, southern Swan Coastal Plain ('community type 22')	P2
SCP23b	Swan Coastal Plain Banksia attenuata - Banksia menziesii woodlands ('community type 23b')	P3
SCP21c	*Low lying Banksia attenuata woodlands or shrublands ('community type 21c')	P3
SCP21b	Southern Banksia attenuata woodlands ('community type 21b')	P3

The Clearing Regulations under the Environmental Protection Act class TECs as 'Environmentally Sensitive Areas' which means that disturbance or clearing requires a permit. However, there is a series of exemptions under the clearing regulations whereby a clearing permit is not required. As a result nearly all clearing and disturbance of Banksia Woodlands in the Perth Metropolitan Region is not assessed and a clearing permit is not required, or if assessed, most clearing permits are granted even though they may be at variance with one or more of the clearing principles defined in the regulations (which state that clearing should not be allowed if one or more of the principles apply).

There is no statutory protection for Banksia Woodlands *per se* under State and Local Government laws in WA. Notably the Western Australian State list of TECs has standing, but does not have any legal identity or protection under the *Wildlife Conservation Act 1950* or the

Conservation and Land Management Act 1984. There is no modern biodiversity conservation legislation in place in WA.

Description

6. List the main features that distinguish this ecological community from all other ecological communities? Characteristic (or diagnostic) features can be biological (e.g. taxa or taxonomic groups of plants and animals characteristic to the community; a type of vegetation or other biotic structure), or associated non-biological landscape characteristics (e.g. soil type or substrate, habitat feature, hydrological feature). Please limit your answer to those features that are specific to the ecological community and **can be used to distinguish it from other ecological communities.**

The main feature of these Banksia Woodlands is the presence of both *Banksia attenuata* and/or *B. menziesii* occurring on deep sands. Both species commonly co-occur and are ancient species. They occur on the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes and rarely on the Pinjarra Plain landforms, all of which comprise the dominant landforms of the Swan Coastal Plain as described by Heddle *et al*., and are used by DEC and DOP and the EPA. Chains of wetlands are features of the zones between each of these (pairs of) landforms.

In contrast, the woodlands of the Darling Scarp and Darling Range are dominated by Eucalypts and *Banksia menziesii* and *B. attenuata* are rare or uncommon (and do not dominate) but can be present in the understorey, although other tree Banksias such as *Banksia grandis* may be present.

7. Give a description of the biological components of the ecological community. For instance, what species of plants and animals commonly occur in the community; what is the typical vegetation structure (if relevant).

Flora

The Banksia Woodlands typically have three layers: (1) the tree canopy of Banksias (in patches or scattered), with scattered Eucalypts and Allocasuarina in some areas, (2) a dense species-rich shrub layer and (3) a diverse ground cover layer including annuals and many geophytes.

There are three outstanding features in the composition of flora in the Banksia Woodlands. Firstly is the exceptionally high number of common or dominant species in the shrub and ground level layers. Beard (1989) lists 340 species as dominants.

Secondly each sub-community has a very large number of species with up to 90 species/100m^2.

Thirdly the composition of the understorey changes markedly over its range and in some places these changes are evident over a short distance (eg 500 m) moving north - south or east - west.

Please refer to the Journal of the Royal Society of Western Australia, **71** (4), 1989, which is a publication of the proceedings of the Banksia Woodland Symposium held in 1989.

Further a plant list is available in Appendix 2, p.163–186 of Gibson *et al*. (July 1994): *A Floristic Survey of the southern Swan Coastal Plain*. This report is available through DEC as a database.

Fauna

Although no vertebrate fauna are unique to Banksia Woodlands (How and Dell 1989), these woodlands support a rich and diverse array of reptile and bird species on the Swan Coastal Plain (How and Dell 2000). Over 70 percent of the native ground mammal fauna known from the Swan Coastal Plain at the time of European settlement has now become extinct (Kitchener *et al*. 1978). There is a marked change in the reptile assemblages across the Swan Coastal Plain that reflect the underlying sandy soil structure of the differing Quindalup, Spearwood and Bassendean landforms and the Banksia Woodlands that dominate them. The study of invertebrates is less complete than vertebrates, but several endemic taxa are known from localised woodlands on the Swan Coastal Plain and there is a clear biogeographic association between some invertebrate groups and landform types that underpin the dominant Banksia Woodlands (Harvey *et al.* 1997). It is also highly probable that there are obligate symbiotic relationships between pollinating insects and plant species characteristic of the Banksia Woodlands which remain to be documented and studied (T. Houston pers. comm.)

Fungi

The area is rich in fungi species. However, there has been no comprehensive survey of fungi in Banksia woodlands although there is survey data for some individual reserves. This data has been collected in the community-based Perth Urban Bushland Fungi (PUBF) project over a period of 8 years. The project was initiated by the Urban Bushland Council in conjunction with the WA Naturalists' Club and the WA Herbarium. The project is not running this year 2012 due to a lack of funding (Roz Hart, President WA Naturalists' Club pers. comm. February 2012). Individual survey reports by PUBF are available from http://www.fungiperth.org.au/Reports-all/Fungi-Surveys.html and from DEC.
Bold Park probably has the most comprehensive data set from surveys conducted over more than 5 years.

8. Give a description of the associated non-biological landscape/seascape characteristics or components of the ecological community. For instance, what is the typical landscape/seascape in which the community occurs? Note if it is associated with a particular soil type or substrate; what major climatic variables drive the distribution of the ecological community (e.g. rainfall). Note particular altitudes or geographic coordinates (e.g. latitudes).

The Swan Coastal Plain is a generally flat landscape, but with very complex stratigraphy: a variety of marine sands and other sediments overlie older landforms in very complex soil and ancient rock structures. As a result the vegetation types and floristic communities form a complex mosaic reflecting this underlying complexity.

Dune formations occur along the coast on the Quindalup landform.

Sandy soils of differing composition are a feature of the Quindalup, Spearwood and Bassendean landforms. These landforms lie in zones roughly parallel to the coast: the Quindalups being coastal, then moving east the Spearwood Dunes, then Bassendean and

lastly on the eastern side of the Swan Coastal Plain adjacent to the Darling Scarp is the very flat Pinjarra Plain. Between each of these major landforms are differing chains of wetlands with their own rich flora.

Plant species richness increases from west to east, with the lowest on the youngest Quindalup Dunes and greatest on the oldest landform - the Pinjarra Plain. Vegetated wetlands are a feature of the Pinjarra Plain.

The Banksia Woodlands are the dominant feature of these depauperate sandy soils, which are known colloquially as 'gutless sands'

9. Provide information on the ecological processes by which the biological and non-biological components interact (where known).

The composition of the vegetation communities of the Banksia Woodlands reflect:

1. The sandy surface soils and their underlying stratigraphy
2. Groundwater levels, groundwater quality, and seasonal fluctuations and flows in groundwater which vary according to the stratigraphy
3. Local climate: where the annual rainfall gradient from west to east across the Swan Coastal Plain is marked.

For example *Banksia ilicifolia* is a feature of wetland margins and transition zones where groundwater is relatively close to the surface. Declining groundwater levels in wetlands are thus a major threat to *B. ilicifolia* (Groom P K, 2011).

10. Does the ecocal community show any consistent regional or other variation across its national extent, such as characteristic differences in species composition or structure? If so, please describe these.

Yes, very much so. This marked variation moving both east - west and north - south across the Swan Coastal Plain is an outstanding and distinguishing feature of these Banksia woodlands.

1. Differences in Structural composition
Dominants
1. The species of Banksia differ as dominants. For example moving from the coast towards the east, *Banksia prionotes* is a dominant on the Spearwood - Karrakatta landform, but not on the Bassendean sands. A similar trend occurs on the Dandaragan Plateau (IBRA Swan1) where *Banksia burdettii* and *B. victoriae* replace *B. prionotes* and *Eucalyptus todtiana* replaces Jarrah as the associated *Eucalyptus* species.

2. Dominants can be eucalypts as described by Beard 1989. For example:
In a southerly direction Banksia woodland is affected by increasing rainfall, heavier soils and more swampy conditions. South of Yanchep, Tuart and Tuart with Jarrah form taller eucalypt woodlands on the coastal limestone, and the Banksias persist as an understorey. On the inland side of the Swan Coastal Plain south of Gingin there are heavier soils under Jarrah-Marri woodland and a swampy belt which has (or used to have before clearing) a mosaic of eucalypt woodland, Banksia woodland, paperbarks and *Allocasuarina obesa*.

Understorey
3. The species composition of the understorey is very variable and this is an outstanding feature of the Banksia woodlands. The major landform units have very different compositions of understorey species.
Consistent regional variation is partly described and analysed. The north section (north of the Moore River) is little analysed. In contrast, south of the Moore River floristic studies demonstrating large numbers of floristic community types (FCT) are detailed in *'A Floristic Survey of the southern Swan Coastal Plain'* (Gibson *et al*. 1994) by the Western Australian Department of Conservation and Land Management and the Western Australian Conservation Council for the Australian Heritage Commission.
This report is available from DEC.

The difference in understorey composition is such that 10 floristic communities have been defined on the bases of differences in the composition of the understorey. These are geographic (north-south) or based on the differing soils of the Coastal Plain (eastern compared to Spearwood dune woodlands). Several of these communities are listed as threatened by the Government of Western Australia.

2. Differences in species composition:

According to Gibson *et al.* (1994), there are ten Floristic Community types that are Banksia woodlands in the southern Swan Coastal Plain, as follows:

Community type 20a	*Banksia attenuata* woodlands over species rich dense shrublands
Community type 20b	Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands
Community type 20c	Eastern shrublands and woodlands
Community type 21a	Central *Banksia attenuata* - *Eucalyptus marginata* woodlands
Community type 21b	Southern *Banksia attenuata* woodlands
Community type 21c	Low lying *Banksia attenuata* woodlands or shrublands
Community type 22	*Banksia ilicifolia* woodlands
Community type 23a	Central *Banksia attenuata* - *B. menziesii* woodlands
Community type 23b	Northern *Banksia attenuata* - *B. menziesii* woodlands
Community type 28	Spearwood *Banksia attenuata* or *Banksia attenuata* - *Eucalyptus* woodlands

The reptile assemblages show a marked and consistent difference from west to east across the Swan Coastal Plain that correlates strongly with the differing soil profiles and content of the three major landforms (How and Dell 2000).

11. Does the ecological community provide habitat for any listed threatened species and/or endemic species? If so, please note the species and whether the species is listed on State/Territory and/or national lists and the nature of its dependence on the ecological community.

Yes.

Endemic species of flora

Nearly all the flora (≈ 80%) of the Banksia woodlands is *regionally* endemic to the south west of WA. However, it is not known what percentage of flora is endemic to the Banksia Woodlands. Some species of orchids are confined to and thus are dependent on the Banksia woodlands for habitat – including the nationally threatened *Drakaea elastica*.

Rare species of flora

The attached list on Excel spreadsheet shows all the records in DEC's Threatened and Priority Flora Database recorded as occurring in the areas mapped as Banksia woodlands. The conservation status is also listed and also attached is a document which gives the definitions of the codes used (T= threatened and the number indicates the Priority category). These species are known to occur within or near to the communities that are nominated.

Some of the well recognised species listed as Rare are:

Caladenia huegelii	Grand Spider Orchid
Drakaea elastica	
Conospermum undulatum	
Macarthuria keigheryi	

Andersonia gracilis

Banksia mimica

Chamelaucium sp. Gingin (NG Marchant 6)

Ptychosema pusillum

All listed as Rare Flora in Western Australia

Endemic and threatened species of fauna

Banksia woodlands provide habitat for three species of endangered black cockatoos, all of which are endemic to the south-west of WA, and all have declined greatly over the past 50 years:

Baudin's Cockatoo	*Calyptorhynchus baudinii*	endangered WA
Carnaby's Cockatoo	*Calyptorhynchus latirostris*	endangered WA
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso*	vulnerable WA

Banksia woodlands of the Swan Coastal Plain provide essential feeding, shelter, roosting and possibly some breeding habitat for Carnaby's and also for Red-tails. Baudin's are currently present south of Mandurah and eat similar species. Seeds and nectar of Banksia flowers and cones are a primary food source. Other food sources are Hakea nuts, Grevilleas, eucalypt seeds.

Several mammal species that are listed as threatened were originally known from the Swan Coastal Plain (Kitchener *et al*. 1978), but are now both locally and regionally extinct.

Graceful Sun Moth endangered WA

Other threatened species may occur and this information is available from DEC

Invertebrates

On the eastern side of the Swan Coastal Plain there is a series of small occurrences of a number of communities of plants in TECs that are rare and are likely to be associated with rare fauna, especially invertebrates. The extent and identity of these is unknown.

12. Identify major studies on the ecological community (authors, dates, name of study and publishing details where relevant).

Beard, J.S. (1979). Vegetation Survey of Western Australia 1:250,000 Series. Vegmap publications. Applecross 1979a Moora & Hill River; 1979b Perth; 1979c Pinjarra;

Beard, J.S. (1989). Definition and location of the Banksia woodlands. J Royal Soc of WA, **71**(4), 85-86.

Beard, J.S. & Sprenger, B.S. (1984). Geographical data from the Vegetation Survey of Western Australia. Veg Surv WA Occ Paper 2. Vegmap Publications Applecross.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. & Lyons, M.N. (1994). A Floristic Survey of the southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc). This report is available from the Department of Environment and Conservation (DEC).

Government of Western Australia (2000). Bush Forever Volume 2: Directory of Bush Forever Sites. Department of Environmental Protection, Perth.

Heddle, E.M. (1979). Mapping the vegetation of the Perth region. In: Western Landscapes (ed J. Gentilli) Univ W Aust Press.

Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Speck, N.H. (1952). Plant ecology of the metropolitan sector of the Swan Coastal Plain. MSc thesis, Univ W Aust.

Priority ecological community list for Western Australia October 2011, accessed March 2012; <http://www.dec.wa.gov.au/content/view/849/2017/

Threatened ecological community list for Western Australia, accessed March 2012 <http://www.dec.wa.gov.au/content/view/852/2010/

Distribution

13. Describe the national distribution in Australia. If possible, include appropriate bioregions (see the Guidelines) where the ecological community occurs. Attach or provide any maps showing its distribution (this is required by the *EPBC Regulations 2000*) with details of the source of the maps, or explain how they were created and the datasets used.

This ecological community occurs only in WA and only in the South West Bioregion of WA. Distribution is essentially in the Swan Coastal Plain IBRA region: Swan 1 and Swan 2 and does not exist elsewhere.

Maps by Beard 1989 are attached. DEC has updated GIS layers for this mapping by Beard.

14. What is the national distribution (in ha) for the ecological community? For answers to parts a, b, c & d: please identify whether any values represent extent of occurrence or area of occupancy (as described in the Guidelines); provide details of the source(s) for the estimates and explain how they were calculated and the datasets used.

14 a. What is the current distribution (in ha)?

In 1989 Beard estimated that 61% of the original extent remained.
Currently it is estimated by DEC (Keighery G.J, pers. comm.) that more than 70% has now gone, leaving less than 30% remaining.

The report "Vegetation Statistics Statewide' can be accessed by people external to DEC via SLIP https://www2.landgate.wa.gov.au/web/guest/downloader

The Department of Agriculture and Food WA (DAFWA) maintains remnant vegetation data from 1989 to the present. This data is progressively updated by their GIS branch using satellite imagery of canopy cover and is available from DAFWA.

14 b. What is the pre-European extent or its former known extent (in ha)?

Area calculations from the Vegetation Survey of WA (Beard & Sprenger 1984) estimate that Banksia low woodland originally covered 6,229 km^2. In addition Banksia woodland with scattered emergent eucalypts is estimated to have covered a further 680km^2. Thus the original extent of Banksia woodlands as defined in this nomination is estimated to be 6,909km^2 which is 690,900 ha.

14 c. What is the estimated percentage decline of the ecological community?

It is estimated by DEC that the total loss of Banksia Woodlands is > 70% (Keighery, G.J. pers. comm. 2012)
However, the extent of loss in a radius of 20 km around central Perth is much greater than 70% and is estimated to be greater than 90% leaving less than 10% remaining. Because of the great variation in understorey species, this level of clearing has resulted in some of the floristic community types being listed as Threatened Ecological Communities.

14 d. What data are there to indicate future changes in distribution may occur?

The Department of Agriculture and Food WA (DAFWA) maintains remnant vegetation data from 1989 to the present. This data is progressively updated by their GIS branch using satellite imagery of canopy cover and is available from DAFWA. The GIS branch of DEC regularly updates the percent reserved of Beards major vegetation types, these two data sets can be used to gain trends.

15. Is the ecological community considered to be naturally rare or restricted, based on its original (e.g. pre-European) distribution? An ecological community is considered to be naturally restricted if it has a pre-European area of occupancy that is less than 10 000 ha or a pre-European extent of occurrence that is less than 100 000 ha (refer to the Guidelines).

The Banksia Woodlands are not considered to be naturally restricted.

Patch size

16. What is the typical size (in ha) for a patch of the ecological community (if known)? Explain how it was calculated and the datasets that are used. Relevant data includes the average patch size, the proportion of patches that are certain sizes, particularly proportions below 10 ha and below 100 ha, but also below 1 ha and above 100 ha (for example).

This information is not known as no information specific to Banksia Woodlands has been located. DAFWA could analyse its database of vegetation extent, but this has not been done for Banksia Woodlands as defined in this nomination.

17. Quantify the smallest percentage or area required for a patch of the ecological community to be considered viable. This refers to the minimum size of a remnant that can remain viable without active management. It may be determined through the requirements for dominant native species, level of species diversity, or the nature of invasive weeds.

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This is not known and to our knowledge has not been studied for Banksia Woodlands on deep sandy soils.

What is observed anecdotally is that even a very small patch of Banksia Woodland (< 1 ha) which is fenced and has not ever been disturbed (especially soil disturbance) may remain viable and in good condition. After soil disturbance or frequent fires, Banksia Woodlands are very vulnerable to grassy weed invasion and edge effects. Grassy weeds are a major threat to the understorey, although undisturbed intact vegetation areas are much less vulnerable than disturbed sites.

There are examples of small patches of Banksia woodland in suburbia which are in much better condition than larger areas such as Kings Park or Wireless Hill reserve. The difference is due to the degree and history of disturbance.

Remnants of a canopy of Banksia trees - where the understorey or ground layer has degraded - still retain very important ecological linkage and habitat functions and have remained viable in Perth suburbia in parks and gardens, along roadsides, through some back yards and around golf courses for example for many years. Banksia trees provide essential food habitat for the endangered Carnaby's Cockatoo as well as many other bird species and invertebrates and reptiles on the Swan Coastal Plain.

Once disturbed and weed invasion has occurred, all Banksia Woodlands whether in large or small patches require active management.

Functionality

18. Is the present distribution of the ecological community severely fragmented? If so, what are likely causes of fragmentation? If fragmentation is a natural or positive characteristic of this ecological community, please explain this and state the reason. Severely fragmented refers to the situation in which increased extinction risk to the ecological community results from most remnants being found in small and relatively isolated patches.

The present distribution of Banksia Woodlands is highly fragmented, but much less so on the northern Swan Coastal Plain (i.e. north of the Moore River). This is north of the boundary of the Perth Metropolitan Region.

The causes of fragmentation are clearing for urban and rural development.

The EPA in Environmental Protection Bulletin No 8 (October 2009) states:

'On the southern Swan Coastal Plain the vegetation of the Quindalup Dunes, and to a lesser extent the Spearwood Dunes, retain some relatively contiguous ecological linkage, particularly through Yalgorup National Park. However, elsewhere on the Swan Coastal Plain

native vegetation is highly fragmented. Therefore the maintenance of conservation reserves and all existing bushland patches, and the strategic restoration of ecological linkage function between them is a priority.

19. Has there been a loss or decline of functionally important species? This refers to native species that are critically important in the processes that sustain or play a major role in the ecological community and whose removal has the potential to precipitate change in community structure or function sufficient to undermine the overall community's viability.

There has been a decline in dominating Banksias. In autumn 2011, (after the record extremely dry year 2010 preceded by a series of years of lower than average rainfall), many individual mature Banksias and eucalypts scattered in intact bushland reserves died suddenly.

The decline in groundwater levels is a major factor causing or associated with this decline. Critically low soil moisture is also a factor.

Loss of mature Banksias and eucalypts is a loss also of feeding and shelter habitat for the resident small birds of the Perth region, as well as the endangered Carnaby's Cockatoo. Loss of insect and bird pollinators is also a significant loss in function.

The extent of loss or decline of understorey species is not known.

The dramatic decline of mammal species across the Swan Coastal Plain, and the continued persistence of the dominant Banksia Woodlands, indicates that the loss of these groups does not impact functionality. However, there is no information on the Woodlands before the demise of the mammal species and the role they may have played in maintaining ecological processes.

19 a. If yes, which species are affected?

Banksia ilicifolia is markedly affected because of its dependence on access to groundwater near wetlands.

Banksia menziesii and *B. attenuata* are affected.

Banksias do not 'die back' and then recover when rain returns as Jarrah may do, rather they die suddenly when over-stressed and do not recover.

Catspaws *Anigozanthos humilis* and many herbaceous species including native daisies (*Rhodanthe citrina*, *Rhodanthe chlorocephala*) are affected by weed invasion, repeated fires as well as nutrient enrichment from stormwater inflows. This has been documented in the isolated Banksia woodlands of Perth's Western Suburbs (Keighery and Keighery in press). Small remnant patches of Banksia Woodland support fewer species of reptile than larger remnants, and the major loss is of snake species – the top predators in the reptile assemblage – thus indicating a change in tropic pattern in isolated Banksia Woodlands.

19 b. How are the species functionally important and to what extent have they declined?

This is not known. The extent of decline is unknown.

Reduction in community integrity

20. Please describe any processes that have resulted in a reduction in integrity and the consequences of these processes, e.g. loss of understorey in a woodland. Include any available information on the rate of these changes.
This recognizes that an ecological community can be threatened with extinction through on-going modifications that do not necessarily lead to total destruction of all elements of the community. Changes in integrity can be measured by comparison with a benchmark state that reflects as closely as possible the natural condition of the community with respect to the composition and arrangement of its abiotic and biotic elements and the processes that sustain them. Please provide a description of the benchmark state where available. For further information please refer to the Guidelines.

This information is not known

Survey and Monitoring

21. Has the ecological community been reasonably well surveyed? Provide an overview of surveys to date and the likelihood of the ecological community's current known distribution and/or patch size being its actual distribution (consider area of occupancy and area of extent, including any data on number and size of patches).

Survey information:
1. Beard 1979, 1989, Beard and Sprenger 1984

2. The area south of the Moore River has been reasonable well surveyed by Gibson *et al*. 1994.

22. Where possible, please indicate areas that haven't been surveyed but may add to the information required in determining the community's overall viability and quality.

The area north of the Moore River is not well known and surveyed.

23. Is there an ongoing monitoring program? If so, please describe the extent and length of the program.

There is no monitoring program that we are aware of.

Condition Classes and Thresholds

24. Do you think condition classes/thresholds apply to this ecological community? If not, give reasons.
The Committee recognises that ecological communities can exist in various condition states. In reaching its decision the Committee uses condition classes and/or thresholds to determine the patches which are included or excluded from the listed ecological community (see the Guidelines for details of the process of determining condition classes).

Yes. The condition scale documented in Keighery 1994 (as below) and used in Bush Forever 2000 is now the accepted standard and is used for all detailed surveys in this area.
Keighery, Bronwen (1994). Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc.). PO Box 519, Floreat WA 6014.

25. If so, how much of the community would you describe as in relatively <u>good condition</u>, i.e. likely to persist into the long-term with minimal management?

This data is not available. It may exist for some individual reserves, but this information is not available to us. Notably Banksia woodland reserves are managed by many different landholders including local governments, DEC, WAPC, Dept of Housing, Landcorp, other State Government agencies and private entities

26. What features or variables do you consider to be most valuable for identifying a patch of the ecological community in relatively <u>good condition</u>? Variables for establishing the highest condition class may include: patch size; connectivity; native plant species composition; diversity and cover (for example in overstorey; mid-shrub and/or understorey layers); recognised faunal values; and cover of weeds or other invasive species.

Features to best describe Banksia woodlands in good condition:

- patch size
- intact woodland structure with overstorey (not necessarily dense) , good cover of shrub layer, and herb layer intact
- soils seed bank still healthy - with for example abundant seeds of *Stipa compressa* which can germinate post-fire and would help prevent the invasion of grassy weeds into bare sand post-fire. (Keighery B.J. 1994)
- connectivity with other bushland patches and ecological linkages to allow recolonisation post destructive events such as fire or hail storms
- provision of habitat for breeding populations of many species of small insectivorous and other larger birds which reside and feed in Banksia woodlands
- little edge effects from disturbance and weed invasion
- absence of highly invasive weeds that can invade intact bushland
- history of infrequent fires no less than 30 year interval, or more
- absence of *Phytophthora* Dieback disease

27. How much of the community would you describe as in relatively <u>medium condition</u>, i.e. likely to persist into the long-term future with management?

This is not known. Mapping of current condition would need to be carried out according to the condition scales as described in Bush Forever - for all patches in the nominated area.

28. Please describe how you would identify areas in <u>medium condition</u> using one or a combination of

indicators such as species diversity, structure, remnant size, cover of weeds or other invasive species, etc.

The same features as in Q.26 apply here. Edge effects and soil disturbance from tracks may be evident in parts of a patch. Grassy weed invasion resulting in loss of some groundcover species thus reducing diversity may be common, but groundcover species still present.

If frequent fires, shrub layer diversity may be reduced in burnt areas. Populations of decomposers, reptiles and invertebrate species require at least 7 years to recover after fire (Bamford pers. comm.)

29. How much of the community would you describe as in relatively <u>poor condition</u>, i.e. unlikely to be recoverable with active management?

This is not known.

30. Please describe how you would identify area in <u>poor condition</u> using one or a combination of indicators such as species diversity, structure, remnant size, cover of weeds or other invasive species, etc.

Structure of vegetation barely intact, ground layer likely to be extensively disturbed with few species remaining and mostly weed covered.

Shrub layer may be reduced to scattered plants of only a few species and with most cover by weeds or bare sand. Dominant tree layer (typically scattered or patches of banksias and some eucalypts) may still be intact.

In some cases Dieback may have spread into the patch and have killed susceptible common species: for example *Banksia*, *Xanthorrhoea*. Fauna habitat would be drastically reduced in this case.

<u>Threats</u>

Note: If you plan to identify <u>climate change</u> as a threat to the ecological community, please refer to <u>Appendix 2</u> of the Guidelines for information on how this should be addressed.

31. Identify <u>PAST</u> threats to the ecological community indicating whether they are *actual* or *potential*. For <u>each</u> threat describe:

Past Threats- all *actual*

1. Clearing for urban and rural development.
2. Groundwater drawdown.
3. Climate change, especially reduced rainfall and more erratic and extreme rainfall events.
4. Frequent fires.
5. Weed invasion.
6. Feral animal invasion by cats, foxes, rabbits, European honey bees, Argentine ants.

7. Dieback disease caused by *Phytophthora cinnamomi.*

31 a. How and where it impacts on this ecological community.

Enter your answer to the question here. Please use as much space as you need to fully answer the question.

Past Threats

1. Clearing for urban and rural development: the Perth Metropolitan Region is located on these Banksia woodlands and it is estimated that less than 30% now remains in the nominated area. Clearing is still occurring on the urban fringe and within established urban areas and is effectively uncontrolled by State Government as most clearing is exempt from the Clearing regulations under the Environmental Protection Act.

2. Groundwater drawdown: the overall effects on Banksia woodlands are not known. However, it is known that when the water table drops below a critical level that there is catastrophic vegetation death. This has occurred in the past at Whiteman Park as a result of excessive drawdown by bores for public drinking water supply.

3. Climate change: The effects of this are not known. However, there were extensive deaths on the Swan Coastal Plain of individual mature Banksias and eucalypts in reserves in autumn 2011 after the record dry year of 2010. Groundwater levels are at their lowest in the autumn before winter rains. Although this was widely observed, we are not aware of any data collected, mapped or made available for the whole Swan Coastal Plain.

4. Frequent fires: there are many fires each summer in vegetation, many or most of which are 'suspicious' – i.e. result of arson or are lit by human error. Lightning strikes resulting in major bushfires are not common on the sandy Swan Coastal Plain.
We are not aware that there is any mapping of the extent of all fires each year. Mapping may be done by some land managers or community Friends groups for their reserves, but this data is not available and there is no standard requirement to map and record such information.

5. Weed invasion: The Banksia Woodlands on sandy soils are described by Prof Stephen Hopper and other experts as the ecosystem most vulnerable to weed invasion. Grassy weeds are widespread and have a major impact. After fires, grassy weeds may quickly invade before native species recover unless there is a healthy seed bank of *Stipa compressa*. However, there is no overall data collected for weed invasion on the woodlands.

Many community Friends groups are actively involved in weed control in their local reserves in conjunction with land managers. Management of weeds to date is a major issue for land managers.

Preventing the spread of highly invasive weeds such as Geraldton Carnation weed *Euphorbia terracina* is a major issue as this weed has severe impacts and invades intact vegetation.

6. Feral animal invasion by cats, foxes, European honey bees, Argentine ants
Populations of small mammals are extinct on most of the Swan Coastal Plain as a probable result of the combined impacts of habitat loss and alteration, predation and competition from introduced species and the response to increase fire frequency. There is an array of

introduced mammalian and avian species that are intense competitors with native taxa and have resulted in significant local and regional extinctions

European honey bees have occupied many tree hollows and thus impacted on the many species of vertebrate that are obligate hollow users in Eucalypt woodlands. Very few Banksia species form hollows for nesting vertebrates.

7. Dieback disease caused by *Phytophthora cinnamomi*
Dieback kills *Banksia*, *Xanthorrhoea* and other key species in Banksia woodlands. The extent of Dieback has not been mapped for this area and this information is unknown.

31 b. What its effects have been so far. Indicate whether they are known or suspected; provide supporting information or research.

This information is not available in any detail. No data is being collected on these impacts. All effects are *actual*.

1. **Clearing**. Suffice to say that less than 10% Banksia woodlands remain in inner suburbia as a result of clearing and development. The bushland is now highly fragmented. This is documented by the EPA in Environmental Protection Bulletin No 8.
2. **Groundwater drawdown** has affected some patches badly, but the extent is not mapped or documented to date.
3. **Climate change:** The effect of reduced rainfall is not known.
4. **Frequent fire** from arson in some areas has reduced vegetation condition but there is no data on this. A detailed study of the impact of an intensive fire in Bold Park in December 2000 has indicated that at least eight years is necessary before the reptile assemblage returns to pre-fire composition (How pers. comm.). Extensive fires in small Banksia Woodland remnants are likely to cause major local extinctions as there is no opportunity for re-colonisation of species through the surrounding urban matrix.
5. **Grassy weed invasion** is common in many large reserves (eg Kings Park, Bold Park) as well as smaller reserves, but there is no overall data collected or available on this. Some land managers have done weed mapping for individual reserves.
6. **Feral animal invasion** has decimated mammal populations and most are now locally extinct eg the Honey Possum *Tarsipes rostrum* which is now only found in the northern extremities of the Banksia woodlands. In inner urban woodland remnants kangaroos and wallabies are no longer present, such as in Kings Park and Bold Park, and the only surviving native mammal species is the commensal Brushtail Possum.
7. **Dieback** effects are catastrophic. Dieback has severely degraded some areas, but this is not documented or mapped for the whole nominated area.

31 c. What its expected effects are in the future. Include or reference supporting research or information.

The effects in the future will be at least the same as above in 31b and are highly likely to become worse for all factors except Dieback. Also the combination of threats is highly likely to have a compound effect which will be catastrophic for vegetation health and survival.

In particular declining groundwater levels due partly to reduced rainfall - but also significantly due to increasing and uncontrolled groundwater abstraction for irrigating horticulture, parks and gardens - will stress vegetation making it more weed prone.

Fire risk will increase with drying and higher temperatures.

Ability of fauna to recolonise will decline as ecological linkages and local patches continue to be cleared or degraded by fire and the consequence will be the increased local extinction of native species (known in the literature as the 'extinction debt' for an isolated area).

In addition to the above factors, the continuing uncontrolled clearing (permitted by the State Government as a result of ineffective legal controls under outdated legislation) of small to large patches as well as ecological linkages is of very major community and expert concern.

It is the combination of these risks that fundamentally threatens the sustainability of Banksia woodlands on the Swan Coastal Plain and is the underlying reason for this nomination.

31 d. Is the threat only suspected? Give Details.

It is impossible to be 100% certain of any future risk, but the threats are highly likely (Keighery, G.J. pers. comm. March 2012). This means that the precautionary principle and the principle of prevention must apply.

31 e. Does the threat only affect certain patches? Give Details.

No, but some areas are affected more than others due to the combination of threats at a site and the varying vulnerability of different plant communities.
For example areas with *Banksia ilicifolia* are more vulnerable to falling groundwater levels (Groom P.K., in Urban Bushland Council 2011)

32. Identify <u>CURRENT</u> threats to the ecological community indicating whether they are *actual* or *potential*. For <u>each</u> threat describe:

The current threats are all the same as the past threats and they are all *actual*:

1. Clearing for urban and rural development.
2. Groundwater drawdown.
3. Climate change, especially reduced rainfall and more erratic and extreme rainfall events.
4. Frequent fires.

5. Weed invasion.
6. Feral animal invasion by cats, foxes, rabbits, European honey bees, Argentine ants.
7. Dieback disease caused by *Phytophthora cinnamomi.*

32 a. How and where it impacts on this ecological community.

How and where all the threats will be expressed is not known, but are likely to be throughout the Banksia woodlands (Keighery G.J. pers. comm. March 2012)

1. Clearing for urban and rural development
Currently threatens large patches on the urban fringe for Perth, Mandurah and Bunbury, and smaller patches and linkages within suburbia. There are **≈ 8,000 ha currently under threat** of clearing for development in the Perth region alone and, that under current clearing regulations, will not be subject to State clearing controls via a permit as they are exempt from requiring a permit. These areas will only be subject to the EPBC Act for listed endangered species such as the Carnaby's Cockatoo and the Graceful Sun Moth.

The total area under threat from clearing is, however, greater than this 8,000 ha but is not known.

2. Groundwater drawdown
This is not known, but current threat is greater than in past due to reduced rainfall and increased and uncontrolled abstraction for irrigation and for potable supply as a result of rapid urban expansion and population growth in Perth, Mandurah and Bunbury and areas in between - all of which are located on the Swan Coastal Plain sands.

Impact on vegetation around and associated with wetlands is marked although there is no overall monitoring and documentation of this. Many of the larger seasonal and permanent wetlands are drying eg Forrestdale Lake, Perry Lakes.

Comments under 31a apply here.

3. Climate change, especially reduced rainfall and more erratic and extreme rainfall events
Comments for no 2 above apply here also as groundwater drawdown is linked with decreased rainfall.

The current impacts are not known.

4. Frequent fires
Comments under 31a apply here.
The current impacts will be where fire has occurred this summer as well as in the past seven (7) summers at least. There is no database that we are aware of showing this information.

5. Weed invasion
Weed invasion is general over the whole Swan Coastal Plain.
- extent and locations not known
- comments as in 31a apply here

6. Feral animal invasion by cats, foxes, rabbits, European honey bees, Argentine ants
- comments as in 31a apply here.

- extent and locations not known

7. Dieback disease caused by *Phytophthora cinnamomi*
Extent of current Dieback on Swan Coastal Plain not known, although some local government authorities have mapped and treat some known Dieback infestations e.g. City of Stirling, City of Melville

32 b. What its effects have been so far. Indicate whether they are known or suspected; provide supporting information or research.

As described in above answers, the details of current effects so far are not known. All effects are actual and are at very least as severe as past effects and generally are now more threatening.

It is notable that the DEC (nor any other State agency) has not and is not addressing or monitoring the overall effects of all the threats and there is no program in place to do so.

Thus there is no 'big picture' of the current health of the Banksia woodlands. This is another compelling reason for this nomination.

32 c. What its expected effects are in the future. Include or reference supporting research or information.

It is impossible to be 100% certain of any future risk, but the threats are highly likely if not almost certain to be ongoing (Keighery, G.J. pers. comm. March 2012). This means that the precautionary principle and the principle of prevention must apply.

Climate change with reduced rainfall, increased local temperatures and more extreme weather events are predicted for the region by CSIRO and are already evident. The Perth region has already had a significant decrease in annual rainfall of at least 20%.

Now that less than 30% generally, and in some parts less than 10% bushland remains, and that considerable clearing is still occurring, fragmentation and a lack of connectivity is a major threat. Lack of refugia and ecological linkages for fauna and pollen to move and recolonise after catastrophic events such as fire are severe threats. This is recognised by the EPA in Environmental Protection Bulletin No 8 but this advice is not being implemented and there are no legal instruments in place to do so. Thus the State Government is not intervening to protect these values and there is no proposal by the current State Government to do so and actively control and manage the major threats.

32 d. Is the threat only suspected? Give Details.

No, the threats are all real.
The threats as in answer 31b all apply here and are highly likely to worsen.

32 e. Does the threat only affect certain patches? Give Details.

The effect of threats varies in different landforms and in different plant communities.

Reduced rainfall is a general threat.

Weed invasion is greatest in disturbed sites along tracks, on edges of bushland, where off-road 4WD use has disturbed sands and knocked down vegetation, after repeated fires, along other incursions such as pipeline and power installations, and where rubbish is dumped.

There is no data collected for the whole area for all threats listed above.

33. Identify FUTURE threats to the ecological community indicating whether they are *actual* or *potential*. For <u>each</u> threat describe:

All threats are *actual*.
All future threats are the same as for past and current threats, but are highly likely to worsen and the details are unknown.

1. Clearing for urban and rural development

There is no indication that the State Government will stop clearing of large patches (at least 8,000 ha) of intact Banksia Woodland and indeed the stated intent to continue urban expansion is strong on the basis of projected population growth and perceived demand from WA's mining boom. Therefore the future threat of clearing must be classed as real and actual. In theory it could be 'potential' but this complete change is unlikely as there would need to be a very significant change in government and community attitudes and culture, and in the lack of awareness of both the outstanding values and loss of Banksia woodlands

2. Groundwater drawdown
3. Climate change, especially reduced rainfall and more erratic and extreme rainfall events
4. Frequent fires
5. Weed invasion
6. Feral animal invasion by cats, foxes, rabbits, European honey bees, Argentine ants
7. Dieback disease caused by *Phytophthora cinnamomi*

33 a. How and where it impacts on this ecological community.

How and where future impacts occur is not known (Keighery G.J. March 2012 pers. comm.). Similar patterns to current impacts are likely but where additional changes are likely to occur is simply not known.
In general wetlands and associated vegetation are likely to suffer most by drying out.

33 b. What its effects have been so far. Indicate whether they are known or suspected; provide supporting information or research.

Details of effects over the whole nominated area are not documented and not mapped and thus are not known (Keighery G.J. March 2012 pers. comm.)

33 c. What its expected effects are in the future. Include or reference supporting research or information.

The threats as in answer 31b all apply here and are highly likely to worsen (Keighery G.J. March 2012 pers. comm.)

33 d. Is the threat only suspected? Give Details.

No, all threats are real (Keighery G.J. March 2012 pers. comm.)

33 e. Does the threat only affect certain patches? Give Details.

The effects may be variable at differing locations but there is no data available on this. In general wetlands are likely to be highly affected as this trend is already evident. (Keighery G.J. March 2012 pers. comm.)

34. Identify any natural catastrophic event/s, explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/cyclone in the area every 100 years). Catastrophic events are those with a low predictability that are likely to severely affect the ecological community.

Extreme weather events e.g. cyclones, increased summer storms, hail storms, flooding, drought are all possible future events. The extent of impacts likely is not known. Vegetation deaths, collapse of wetland ecosystems and loss of fauna populations are likely.

35. Identify and explain any additional biological characteristics particular to the community or species within it that are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing survival or particular features.

The plant species have not evolved to be fragmented in the landscape. Thus they are likely to suffer with no adaptations for being isolated as they normally do not move across the landscape.

A feature of the understorey plants is that seeds are not widely dispersed and tend to germinate close to the parent plants. Plant varieties and species have evolved in local niches without much movement across the landscape over a very long period of time, hence the huge genetic variation in species and varieties within short distances.

This contrasts to grasses which tend to spread long distances as they are wind pollinated.

Therefore, the composition of assemblages of plant communities is very varied across the landscape resulting in high biodiversity per unit area. (Keighery pers. comm. 2011)

Interestingly large birds such as Carnaby's Cockatoo eat and digest Banksia seeds as a major food source. So the eaten seed is not available for germination and does not get spread across the landscape even though Carnaby's fly long distances daily.

35 a. How does it respond to disturbance?

Banksia woodlands are highly sensitive to soil disturbance, especially of the top 20 cm of sandy soil. Just one soil disturbance event can result in permanent or very long term

degradation. Off road 4WD vehicles and tracks are very destructive and weeds tend to invade readily displacing native species.

35 b. How long does it take to regenerate and/or recover?

These plant communities are very complex and very diverse and there is no current evidence of comprehensive recovery after disturbance. It is not known how long communities take to regenerate and recover.

Threat Abatement and Recovery

36. Identify key management documentation available for the ecological community, e.g. recovery plans, conservation plans, threat abatement plans or site specific management plans (e.g. for a reserve).

There are no generic or general recovery plans or threat abatement plans for Banksia Woodlands *per se.*

Some individual reserves have current management plans in place such as Kings Park and Bold Park, while many others have management plans which have not been updated and/or are not properly implemented.

Some threatened flora and fauna species (eg Carnaby's Cockatoo, *Caladenia huegelii*) do have individual recovery plans, but these are not legally binding and many are not fully resourced and implemented or updated as required.

There are no set standards for management plans either generally or for Bush Forever sites and there is no authority such as DEC or the Conservation Commission with formal responsibility for assessing and approving management plans.

The Urban Bushland Council has repeatedly recommended a formal legally binding process for the above to be introduced for all Bush Forever sites as well as for locally significant bushland and ecological linkages on the Swan Coastal Plain.

37. Give an overview of how threats are being abated/could be abated and other recovery actions underway/proposed. Identify who is undertaking these activities and how successful the activities have been to date.

There are plans for some reserves and some species and communities.

Information is available from DEC for recovery and threat abatement plans for individual species. There is no information available on how successful threat abatement activities have been to date.

DEC is working on restoring Banksia woodlands at Gnangara and at Jandakot. Further information about this work is available from DEC.

There is a series of management plans by various land managers such as local government authorities, DEC and BGPA and these are being implemented to varying degrees. Many plans however are out of date and are not being implemented properly if at all.

There are no generic threat abatement plans for widespread threats such as grassy weeds (eg Veld grass), Geraldton Carnation Weed *Euphorbia terracina,* foxes, rabbits or Rainbow Lorikeets - although comprehensive technical information on weeds is available from DEC Swan Region and training and educational workshops are presented for land managers. However, DEC is not adequately resourced to do this work to the extent needed.

How threats could be abated

1. Implementation of a legally binding management obligation for all land holders and land managers of Bush Forever sites. Obligations to include basic preventive management of threats such as fencing, signage, removal of rubbish dumping, immediate control of fresh weed invasions and feral animals and feral bees before widespread establishment.

2. In conjunction with (1), a legally binding management obligation for land managers of locally significant bushland reserves (generally LGAs) and ecological linkages.

3. Co-ordination of management standards by DEC Swan Region, including technical advice and assistance, and allocation of proper new operational funding and staff resources for this process.

4. A greater spirit of co-operation between land managers and local Friends groups and community organisations to work together to raise community awareness and educate local folk (including schools) of the values of local reserves and to foster their involvement in bushcare activities and community respect for Banksia woodlands and their fauna.

38. What portion of the current extent of the ecological community is protected in a reserve set aside for conservation purposes?

This information is available from DEC and DAFWA and includes Bush Forever reserves. All Bush Forever sites are shown on the Metropolitan Region Scheme (MRS) map under the Metropolitan Region Scheme Act (WA).

The report 'Vegetation Statistics Statewide' can be accessed by people external to DEC via SLIP at https://www2.landgate.wa.gov.au/web/guest/downloader

Summary of 2011 Reports are available at DEC via Shane French, Manager, GIS Application Section, GIS Branch:

Maps are available showing lands *reserved* for conservation at DEC_Terrestrial_Lands_by_subIBRA_2011_Rsvd_only.PDF

Maps are available showing lands *reserved and proposed* for conservation at DEC_Terrestrial_Lands_by_subIBRA_2011_Rsvd_Propsd.PDF

The data is limited by the accuracy of mapping by DAFWA.

38 a. Which of these reserves are actively managed?

This information is not collected and is not known. There is no statutory requirement for management of all reserves.

Most reserves and bushland remnants receive insufficient management of threatening processes. Although all reserves should have management plans, many or most do not and there is no audit process in place for assessment of management implementation.

It is not known which of the Bush Forever sites are actively managed although it is known that at least 100 do not have any co-ordinated management as they are still only partly or not yet secured and implemented as conservation areas.

There is no co-ordinated management system in place for Bush Forever areas.

38 b. Give details including the name of the reserves, and the extent the ecological community is protected within these reserves and whether the reserves are permanent.

This data and information is not available for all reserves

The names and extent of bushland for all Bush Forever areas is given in Bush Forever Vol 2 and in Appendices: Site Name Index and also under Site Number Index.

There are multiple land owners, most are government and some are privately owned.

38 c. Note which, if any, reserves have management plans and if they are being implemented.

This information is not available and is not being collected.

A survey of all the different land managers - more than 30 LGAs, DEC, BGPA, Ministry of Housing, Landcorp, Water Corporation etc and private landholders- would be needed. It would be a major task to assess the extent of implementation as there is no audit currently carried out and no past audit available to our knowledge.

39. Give locations of sites for proposed management, preferably that have been identified in recovery plans and key sites considered to demonstrate those remnants of highest quality and/or most under threat.

Recovery actions are proposed by DEC for the Gnangara Pine plantation and for the Jandakot Mound.

TECs have recovery plans and further information for these is available from DEC. from Val English (WATSCU). Val.English@dec.wa.gov.au

Many Bush Forever sites are not yet managed under management plans, No audit is available to our knowledge. All Bush Forever sites are high priority as regionally significant bushland and all are under the general threats as described in Q31.

40. Give details of recovery actions that are or could be carried out at the local and regional level, e.g. develop and implement management plan for the control of specific weed species (regional), undertake weeding of known sites (local).

This information is not available. Major work would be needed by government technical officers (botanists, biologists, zoologists, ecologists) to plan and assess recovery actions.

41. Is there an existing support network for the ecological community that facilitates recovery? e.g. an active Landcare group, Conservation Management Network.

There are various support networks but none is responsible for co-ordinating recovery actions.

- LGAs partially supported by WA Local Government Association's Perth Biodiversity Project, however their role is not primarily to support recovery plans. Contact person is Project Manager Renata Zelinova at WALGA rzelinova@walga.asn.au
- NRM groups: the most active group is SERCUL although their primary role is not facilitating recovery of Banksia woodlands unless they have a specific funded project for particular sites. Contact person is Julie Robert julierobert@sercul.org.au Phone (08) 9458 5664
- Land For Wildlife program at DEC. Supplies information and general management support to private landholders throughout south west WA. No specific co-ordination of recovery plans for Swan Coastal Plain. Contact person Penny Hussey at DEC penny.hussey@dec.wa.gov.au
- The Urban Bushland Council WA Inc. is a community association of Friends groups with over 60 member groups in the area. Many of these groups are very active in on ground bushcare activities in their reserves. There is no co-ordinated program for recovery of Banksia Woodlands.

The UBC did hold a well-attended symposium on Banksia Woodlands in March 2011:

'Perth's Banksia Woodlands: Precious and Under Threat. Proceedings of a symposium on the ecology of these ancient woodlands and their need for protection from neglect and destruction, 25 March 2011.

Proceedings are available at www.bushlandperth.org.au or in hard copy by mail from the Urban Bushland Council. A copy is enclosed with the printed copy of this nomination.

42. Describe methods for identifying the ecological community including when to conduct surveys, e.g. season, time of day, weather conditions; length, intensity and pattern of search effort; and limitations and expert acceptance; recommended methods; survey-effort guide. Include references.

This is very well documented in:

1. Keighery, Bronwen (1994). Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA.
2. Gibson *et al*. 1994: A Floristic Survey of the southern Swan Coastal Plain

43. Are there other any aspects relating to the survival of this ecological community that you would like to address?

It is the astounding lack of public awareness and appreciation of Perth's unique Banksia Woodlands that is a major concern.

The fact that these ancient species rich woodlands - which have always been regarded in the public psyche as common - are now under threat as a result of continuing clearing,

groundwater drawdown, and weed and feral animal invasion - has escaped public notice. This is Perth's natural landscape heritage under threat.

Perth is growing rapidly and the obsessive focus is on mining and money and urban sprawl. Bush Forever after 10 years of implementation is only partially implemented and inadequately resourced by planning and environment agencies. The commitment has dropped and there is a lack of robust public policy and commitment for proper bushland management. The network of Bush Forever sites do not even have signs showing their conservation status.

Section 4 - Indigenous Cultural Significance

44. Is the ecological community, or key species within the ecological community, known to have cultural significance to Indigenous groups within the Australian jurisdiction? If so, to which Indigenous groups? In addition, please provide information on the nature of this significance.

Yes. The Swan Coastal Plain is culturally significant to the Noonygar People.

- Banksia woodlands provided shelter and summer food supplies.

- Plants and grubs provided many food sources- e.g. blood roots.

- *Banksia menziesii* trees are significant. Their wrapped, smouldering cones were used to take fire to the next camping site. The brown furry cover on cones has a fire retardant effect and enables them to smoulder very slowly when wrapped.

- Balga *Xanthorrhoea* provided gum for making glue

Section 5 - Justification for this nomination

In order for the nomination to be considered further, one or more of the following criteria needs to be fulfilled and substantiated. A clear case for why the ecological community is eligible for listing under the criteria is required, including evidence as to how it meets the requirements for listing under a particular listing category, e.g. ' David et al. (1999) finding of 95% decline in geographic distribution suggests it should be listed as critically endangered'.
At least one criterion must trigger the thresholds of a listing category as indicated in the TSSC Guidelines, but the nomination does not need to be eligible for listing under all six criteria. Criteria may be of different levels of listing category e.g. Criterion 1 – critically endangered and Criterion 3 – vulnerable.

45 Provide data that demonstrates why the ecological community meets at least one of the following criteria for the nominated listing category. This data may already have been provided in previous sections. Please refer to the data again and demonstrate how it specifically meets at least one of the following criteria. Advice on how to interpret the listing criteria is provided in the Guidelines.

Criterion 1: Decline in geographic distribution.

This criterion applies. There has been a large decline of > 70% distribution leaving 30% or less. In inner regions around Perth less than 10% remains.

Criterion 2: Small geographic distribution coupled with demonstrable threat.

Enter your answer to the question here. Please use as much space as you need to fully answer the question.

Criterion 3: Loss or decline of functionally important species.

This criterion applies. Considerable loss of fauna for pollination for example has occurred. Small mammals and small bird species have become locally extinct.

Criterion 4: Reduction in community integrity.

This criterion applies. The ongoing reduction in community integrity as a result of frequent fires and loss of mammal and invertebrate species, as well as flora loss and degradation of vegetation condition from weed invasion and Dieback are significant.

Criterion 5: Rate of continuing detrimental change.

This criterion applies. It is the rate of continuing detrimental change observed by community groups as well as experts alike which is very significant and is seen as a very major threat.

Banksia woodlands are the iconic landscape setting for Perth, recognised and documented by George Seddon as Perth's 'sense of place' in the landmark publication *'Sense of Place - A response to an environment, The Swan Coastal Plain, Western Australia* (1972). Indeed this landmark text has been used as basic course material for environmental science students at

universities for many years. However, it is the current state of community and government ignorance of the obviously declining condition of the natural landscape of the Swan Coastal Plain which is cause for concern.

The rate of clearing and fragmentation for urban expansion and disturbance from repeated fires and weed invasion is continuing to threaten many bird species, including listed endangered species. A prime example of great concern is the decline of Carnaby's Cockatoo which is a resident icon of the Swan Coastal Plain. The report of the findings of the great Cocky Count 2011 by Birdlife Australia shows a 37% decrease in counts for 2011 compared with 2010. See the report at http://www.birdlife.org.au/projects/carnabys

Criterion 6: Quantitative analysis showing probability of extinction.

Enter your answer to the question here. Please use as much space as you need to fully answer the question.

Section 6 - References

Note: The opinion of appropriate scientific experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below. Harvard style of referencing is preferred.

44. Please provide copies of key documentation/references used in the nomination.

Beard, J.S. (1979). Vegetation Survey of Western Australia 1:250,000 Series. Vegmap publications. Applecross 1979a Moora & Hill River; 1979b Perth; 1979c Pinjarra;

Beard, J.S. (1989). Definition and location of the Banksia woodlands. J Royal Soc of WA, **71**(4), 85-86.

Beard, J.S. (1990). Plant Life of Western Australia. Kangaroo Press.

Beard, J.S. & Sprenger, B.S. (1984). Geographical data from the Vegetation Survey of Western Australia. Veg Surv WA Occ Paper 2. Vegmap Publications Applecross.

Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H. & Lyons, M.N. (1994). A Floristic Survey of the southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc). This report is available from the Department of Environment and Conservation (DEC).

Groom, P.K. (2011). How do Trees an Shrubs of Perth's Banksia Woodlands survive summer drought? In: Urban Bushland Council (2011) p. 19–26.

Heddle, E.M. (1979). Mapping the vegetation of the Perth region. In: Western Landscapes (ed J. Gentilli) Univ W Aust Press.

Keighery, Bronwen (1994). Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc.) September 1994.

Keighery, Greg (2011). Banksia Woodlands: A Perth Icon. In: Urban Bushland Council 2011 p. 3–9.

Royal Society of Western Australia, **71** (4), (1989). Proceedings of the Banksia Woodland Symposium held in 1989.

Seddon, George (1972) Sense of Place: A response to an environment The Swan Coastal Plain, Western Australia. First published by the University of Western Australia Press in 1972. Facsimile edition published in 2004 by Bloomings Books, Melbourne Australia.

Speck, N.H. (1952). Plant ecology of the metropolitan sector of the Swan Coastal Plain. MSc thesis, Univ W Aust.

Urban Bushland Council (2011). Perth's Banksia Woodlands, Precious and Under Threat. Proceedings of a symposium on the ecology of these ancient woodlands and their need for protection from neglect and destruction, 25 March 2011.

45. Has this document been reviewed and/or have relevant experts been consulted? If so, indicate by

whom and provide their contact details.

Yes. The following experts have been consulted and have reviewed the document:

Mr Greg Keighery: Senior Principal Research Scientist, DEC greg.keighery@dec.wa.gov.au

Ms Val English: Principal Ecologist, Species and Communities Branch DEC val.english@dec.wa.gov.au

Ms Melanie Smith: DEC WATSCU melanie.smith@dec.wa.gov.au

Ms Bronwen Keighery: formerly Scientific Policy Officer DEP bjkeighe@it.net.au

Dr Ric How: Western Australian Museum ric.how@museum.wa.gov.au

Section 7 – Completed nomination form checklist

Please check all items on this list have been completed or are included with your nomination. Non-inclusion of items on this list risks non-compliance with the *EPBC Regulations 2000* which could mean your nomination will not be eligible for consideration.

☒ I have read and applied the "Guidelines for Nominating and Assessing the Eligibility for Listing of Ecological Communities as Threatened according to the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the EPBC Regulations 2000" to this nomination

☒ Nominator details including name, address contact phone number included

☒ Name of the EC

☒ Any other names it is known by

☒ Map included or attached

☒ References cited

☒ If questions are left unanswered, a statement indicating that insufficient information is available

A description of:

☒ Biological components of the ecological community

☒ Non biological components of the ecological community

☒ Key interactions and functional processes

☒ Characters distinguishing it from other ecological communities

☒ Key species (dominant, characteristic or diagnostic, threatened etc)

☒ Known or estimated current extent of the ecological community

☒ Past/current/future threats including actual/potential, how/ where, how being/how could be abated

☒ Which listing category/categories it should be listed under and why

Where did you find out about nominating items?

The Committee would appreciate your feedback regarding how you found out about the nomination process. Your feedback will ensure that future calls for nominations can be advertised as widely as possible

☐ DSEWPAC website ☐ The Australian newspaper ☐ Journal/society/organisation web site or email? If so which one……	☐ Web search ☐ Word of mouth ☐ Other……

How to lodge your nomination

Completed nominations must be lodged by 5pm, on the closing day of the annual call:

1. via email to:	2. via post* to:
epbc.nominations@environment.gov.au	The Director, Ecological Communities Section Department of Sustainability, Environment, Water, Population and Communities GPO Box 787 Canberra ACT 2601

** If submitting by post, please include an electronic copy of the nomination in Word format on memory stick or CD.*