Department of Biodiversity, Conservation and Attractions
GOVERNMENT OF WESTERN AUSTRALIA

Nomination *(to be completed by nominator)*

Current conservation status	
Name of ecological community:	Perth to Gingin Ironstone Association
Other names:	Gingin Ironstone, northern ironstone
Description:	The community occurs on ironstone soils in the Perth area and is characterised by massed everlastings. Many of the plant species present are specifically adapted to shallow seasonal inundation, specifically the rich herb layer present in late winter and early spring which is a major distinguishing characteristic of the community. The daisies *Rhodanthe manglesii*, *Rhodanthe spicata* and *Myriocephalus helichrysoides* dominate. Other common herbs include *Tribonanthes variabilis* (southern tiurndin), *Stylidium longitubum* (jumping jacks) (priority 4) and *Isotropis cuneifolia* subsp. *glabra* (priority 3). A very open shrub layer is typical with common shrubs *Melaleuca viminea* (mohan), *Banksia sessilis* (parrot bush), *Acacia saligna* (orange wattle), *Jacksonia furcellata* (grey stinkwood), *Grevillea curviloba* (endangered) and *Kunzea recurva*.
Nomination for:	Listing ☒ Change of status ☐ Delisting ☐

1. *Is the ecological community currently on any conservation list, either in a State or Territory, Australia or Internationally?* 2. *Is it present in an Australian jurisdiction, but not listed?*	*Provide details of the occurrence and listing status for each jurisdiction in the following table*

Jurisdiction	**List or Act name**	**Date listed or assessed (or N/A)**	**Listing category eg. critically endangered (or none)**	**Listing criteria eg. B1ab(iii)+2ab(iii) (or none)**
National	EPBC Act	16/07/2000	Endangered	
Western Australia	Current ranking under WA Minister ESA list in policy	6/11/2001	Critically Endangered	A) ii B) ii
	Priority list		1 ☐ 2 ☐	3 ☐ 4 ☐
Other State/Territory				

Nominated conservation status: category and criteria (include recommended status for deleted ecological communities)

Critically endangered (CR) ☒ Endangered (EN) ☐ Vulnerable (VU) ☐ Collapsed (CO) ☐

Priority 1 ☐ Priority 2 ☐ Priority 3 ☐ Priority 4 ☐ None ☐

What criteria support the conservation status category for listing as a threatened ecological community or collapsed ecological community? *Refer to Section 32 of the Biodiversity Act 2016 for definition of 'Collapsed', and Appendix 3 table 'IUCN Red List Criteria for ecosystems version 2.2'.*		CR B1a(iii),b,c; B2a(iii),b,c
Eligibility against the criteria		
*Provide justification for the nominated conservation status; is the ecological community eligible or ineligible for listing against the five criteria. For **delisting**, provide details for why the ecological community no longer meets the requirements of the current conservation status.*		
A.	Reduction in geographic distribution *(evidence of decline)*	☐ **A1** ☐ **A2a** ☐ **A2b** ☐ **A3**
	Justification of assessment under Criterion A.	For criteria A and B, the ecosystem was assumed to collapse when the mapped distribution declines to zero. • Ironstone soils near Perth are highly restricted in distribution. Gibson *et al.* (1994) state "*An undescribed northern ironstone community is known to occur on private land in the Gingin area. Roadside occurrences of this community type were so badly disturbed as to preclude sampling…The community is totally unreserved, apparently very restricted and would be classed as critically threatened. The private land on which the community occurs is grazed. Some of the occurrences have been converted to improved pastures*." • The original distribution of the community is unknown, but there is insufficient evidence to indicate the community has declined by more than ≥30% over any 50 year period or ≥50% since 1750 to meet VU. • **Insufficient evidence to indicate the community meets criterion A.**
B.	Restricted geographic distribution *(EOO and AOO, number of locations and evidence of decline)*	☒ **B1** (specify at least one of the following): ☐ **a)(i)** ☐ **a)(ii)** ☒ **a)(iii)** ☒ **b)** ☐ **c);** ☒ **B2** (specify at least one of the following): ☐ **a)(i)** ☐ **a)(ii)** ☒ **a)(iii)** ☒ **b)** ☐ **c);** ☐ **B3 (only for Vulnerable Listing)**
	Justification of assessment under Criterion B.	• B1: EOO is 1.7km^2 (<2,000km^2). The community's EEO is less that the 2,000km2 threshold for rank CR. Community meets threshold for rank CR under criterion part B1. • B1a(iii); B2a(iii): weed data indicate a continuing decline of native taxa in relation to weed taxa in the community, representing a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem (see Criterion D and Appendix 1). • B1b, B2b): Continuing decline observed or inferred from the impacts of weed invasion, grazing, intense or too frequent fire, hydrological change, and drying climate (see Appendix 1 for details of threats). • B1 c) Community is considered to occur at 1 threat defined location, based on the identification of 1 cluster (0.6 – 1.8km between occurrences) of occurrences of the community that is likely to be subject to similar threats affecting a particular aquifer, or

		bushland location (such as fire). The community meets CR under B1c) as the threshold for CR for threat defined locations is 1. • B2: AOO- the community covers 1 grid cell – less than the 2 grid cell threshold for CR. The community meets CR under criterion part B2 (subcriteria b, and c are the same as for B2). • B3: community is considered to consist of 1 threat defined location, based on the identification of 1 single cluster of occurrences that may be subject to similar threats such as those that affect a particular aquifer, or bushland location (such as fire). • Meets VU under criterion B3, as community occurs at less than 5 threat defined locations and is prone to effects of stochastic events within a very short time period such as hydrological change, and intense or too frequent fire, and thus capable of collapse or becoming CR within a short time period. • **Meets criteria for Critically Endangered B1a(iii),b,c and B2a(iii),b,c. Meets VU under B3.**
C.	Environmental degradation of abiotic variable *(Evidence of decline over 50-year period)*	☐ **C1** ☐ **C2** ☐ **C3**
	Justification of assessment under Criterion C.	• Hydrological change from a drying climate in the form of rainfall and groundwater decline is an abiotic variable that is a significant threat to the community. • For criterion C, the assessment of decline in abiotic processes focussed on a drying climate using data on the depth of seasonal inundation of the community. Drying climate will reduce the depth and period of inundation that support the key taxa (herb layer). Collapse in this context is defined as decline in surface water levels or periodicity to support the herbaceous layer, resulting in loss of 90% of the native herbs. Due to a lack of data linking surface water levels and flora composition, the collapse threshold has not been determined. • Drying climate (as mentioned in further detail below), is likely to result in increasingly shorter periods of seasonal inundation periods which in turn will result in a change in the composition and structure of this community. • Currently, there are inadequate systematic collected quantitative data linking the floristic composition of the community in relation to depth and length of inundation to support assessment of the community against criterion C. • **Insufficient evidence to indicate the community meets criterion C.**
D.	Disruption of biotic processes or interactions *(Evidence of decline over 50-year period)*	☒ **D1** ☐ **D2** ☐ **D3**
	Justification of assessment under Criterion D.	• Weed invasion is considered to a significant biotic threat to the community. The severity of weed invasion associated with collapse is uncertain, but it is assumed conservatively that the community reaches a collapsed state when only 10% (plausible range 0–20%) of the vegetation cover is native plant species.

		• In 2004, 4.7ha of the largest occurrence had weed cover above 75% (Ecoscape Pty Ltd 2004). Considered across the full extent of the community, this indicates that 13% of the full extent of the community was subject to a severity ≥75% weed cover. Assuming that no weeds occurred prior to 1750 and that all weed invasion occurred since then, the threshold to meet CR is that ≥90% of the extent of the community is subject to ≥90% severity of weed invasion. Community therefore does not meet CR. • Ecoscape Py Ltd (2004) data indicates that 14% of the overall extent of the community was subject to ≥50% weed cover. This does not meet the thresholds of ≥50% of the extent of the community subject to ≥50% severity of weed invasion to meet VU. • **Does not meet criterion D**
E.	Quantitative analysis *(statistical probability of ecosystem collapse)*	• No quantitative estimates of the risk of ecosystem collapse have been completed • **Does not meet criterion**

Reasons for change of status

Genuine change ☐ New knowledge ☐ Previous mistake ☐ Review/Other ☐

Provide details: The community was initially ranked as CR using ranking criteria developed in WA that do not match those in the IUCN Red List Criteria for Ecosystems (version 2.2).

Summary of assessment information *(provide detailed information in the relevant sections of the nomination form)*

EOO	1.7km^2	AOO	1 grid cell (10x10km grid).
No. occurrences	3	Severely fragmented (justification below)	Yes ☒ No ☐ Unknown ☐
Justification of whether fragmented	Geological maps indicate that the substrate that supports the community was historically restricted in extent. Land clearing has increased the isolation and fragmentation of this naturally restricted and fragmented community.		
Current known area			37.4 ha
Pre-industrialisation extent or its former known extent (if known)			Unknown
Estimated percentage decline			97% of all vegetation on the eastern side of the Swan Coastal Plain cleared historically (Keighery and Trudgen 1992; CALM 1990).

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	-	• Available data are inadequate to indicate if community meets criterion
A2a	-	• Available data are inadequate to indicate if community meets criterion
A2b	-	• Available data are inadequate to indicate if community meets criterion
A3	-	• Available data are inadequate to indicate if community meets criterion
B1a	CR	• EOO is <2,000km^2 • Continuing decline of native taxa relative to weed taxa in the community, representing a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem • Meets criterion B1aiii
B1b	CR	• EOO is <2,000km^2 • Observed and inferred continuing decline from weed invasion, grazing, intense or too frequent fire, hydrological change, and drying climate • Meets criterion for CR
B1c	CR	• EOO is <2,000km^2 • Ecosystem exists at 1 threat defined location • Meets criterion for CR
B2a	CR	• AOO is 1 grid cell • Continuing decline of native taxa relative to weed taxa in the community, representing a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem • Meets criterion for CR B2aiii
B2b	CR	• AOO is 1 grid cell • Observed and inferred continuing decline from weed invasion, grazing, intense or too frequent fire, grazing, hydrological change, and drying climate • Meets criterion for CR
B2c	CR	• AOO is 1 grid cell • Ecosystem exists at 1 threat defined location • Meets criterion for CR
B3	VU	• Known from 1 threat-defined location • Prone to the effects of weed invasion, grazing, intense or too frequent fire, and inferred changes to hydrologic regime • Meets criterion for VU
C1	-	• Inadequate evidence to indicate if the community meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over the past 50 years to meet VU.
C2	-	• Inadequate evidence to indicate if the community meets the minimum thresholds for proportion of the extent (30%) or proportional severity of degradation (≥30%) over any 50-year period to meet VU.
C3	-	• Inadequate evidence to indicate if the community meets thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since 1750 to meet VU.
D1	VU	• Does not meet threshold for extent (≥30%) and severity (≥30%) of weed invasion over the past 50 years to meet VU. • Does not meet
D2	-	• Does not meet threshold for extent (≥30%) and severity (≥30%) of weed invasion over any 50 year period to meet VU.
D3	-	• Does not meet threshold for extent (≥50%) and severity (≥50%) of weed invasion since 1750 to meet VU.
E	NA	• No quantitative estimates of the risk of ecosystem collapse.

		Meets CR under B1a(iiii),b, c; B2a(iii),b,c. Meets VU under B3. *The highest risk category obtained by any of the assessed criteria will be the overall risk status of the ecosystem'* (IUCN RLE Guidelines V1.1 page 42). **Meets CR under B1a(iii),b,c; B2a(iii),b,c.**

Summary of location (occurrence) information *(provide detailed information in the relevant sections of the nomination form)*						
Occurrence	Land tenure	Survey information: date of survey	Condition	Area of occurrence (ha)	Threats *(note if past, present or future)*	Specific management actions
NIRONNW (1)	DBCA (Reserve 46373)	1995, 2003, 2010, 2012, 2016 and 2018	50% Good and 50% Very good	33.7	Weed invasion, too frequent fire (past, present, future), hydrological change and drying climate (present, future)	Develop fire management strategy, implement weed control, monitor water levels and quality and link to monitoring of floristic composition
NIRON2 (2)	Private	1997	100% Very good	1.6	Clearing (past), weed invasion, too frequent fire, (past, present, future), hydrological change (present, future), and grazing by native or introduced species (past, present, future)	Seek to exclude stock from occurrence, liaise with property owners, develop fire management strategy, ensure hygiene conditions, implement weed control, monitor water levels and quality and link to monitoring of floristic composition
NIRON3 (3)	Private	1997	100% Very good	2.1	Clearing (past), weed invasion, too frequent fire (past, present, future), hydrological change (present, future) and grazing by native or introduced species (past, present, future)	Seek to exclude stock from occurrence, develop fire management strategy, implement weed control, monitor water levels and quality and link to monitoring of floristic composition

*For the purposes of relating condition to IUCN Criteria, condition categories from (Keighery (1994) Vegetation Condition Scale (Government of WA 2000)) are defined below:

Good ('Pristine', 'Excellent', 'Very Good' using Bush Forever (2000) scale): This includes vegetation ranging from 'Pristine' - with no obvious signs of disturbance, to 'Excellent' - Vegetation structure intact, with disturbance only affecting individual species, weeds are non-aggressive species and 'Very Good' - Vegetation structure altered, obvious signs of disturbance eg: from repeated fires, dieback, logging, grazing.

Medium ('Good' using Bush Forever (2000) scale): This includes vegetation categorised as 'Good' - Vegetation structure altered but retains basic vegetation structure or ability to regenerate it, obvious signs of disturbance are present, from activities including partial clearing, dieback and grazing.

Poor ('Degraded' using Bush Forever (2000) scale): Basic vegetation structure severely impacted by disturbance such as partial clearing, dieback, logging and grazing. Scope for regeneration but not to a state approaching good condition without intensive management.

Beyond recovery ('Completely degraded' using Bush Forever (2000) scale): Vegetation structure is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native shrubs and trees.

Table 1. Known vegetation condition occurrences that have been surveyed of '*Perth to Gingin Ironstone Association'*

Condition Ranking (Keighery 1994) from Government of Western Australia 2000)	**Hectares**	**IUCN Criteria condition ranking**	**Hectares**
Pristine	0		
Excellent	0		
Very Good	20.55		
Good	16.85	**Good**	20.55
Degraded	0	**Medium**	16.85
Completely degraded	0	**Poor**	0
Total	37.4	**Total**	37.4

APPENDIX 1 THREATS

Clearing

Clearing for agriculture has been extensive on the heavy soils on the eastern side of the Swan Coastal Plain, with some 97% of all vegetation in the area cleared historically (Keighery and Trudgen 1992; CALM 1990). The vegetation on the ironstone soils near Perth occur on this portion of the plain and has suffered almost total destruction.

The largest remnant of the community (Occurrence 1), adjacent to Airfield Road, was apparently rolled and fertilised in 1969. However, the attempt to convert the area to more useable pasture was not successful as the soils were too shallow (former landowner, personal communication).

Hydrological change

Local hydrogeology is likely to be important in maintaining the shrublands and woodlands of the Perth to Gingin Ironstone community. The hydrology of the occurrences is most likely to be influenced by the interactions of regional and local groundwater flows, and surface flows. There is little information available about these hydrological interactions, however, some information can be gleaned from data held in the literature, and from direct observations.

The ironstone soils near Gingin are seasonally inundated (surface water in wetter months). Many of the plant species present are specifically adapted to this shallow seasonal inundation, eg., *Kunzea* aff. *recurva* (swamp kunzea) and the herb layer that appears in late winter and early spring. This herb layer is a major distinguishing characteristic of this community.

Long term observations ([redacted]; landholder, personal communication) indicate that seasonal inundation is limited to very shallow surface water during the winter months. Inundation usually persists for a period of around three months, with the soils drying out at the surface in summer. The surface waters may be linked to the water table as the groundwater is close to the surface in September - October (Davidson 1995). Surface water would also originate from rainfall runoff in the wetter months of the year and be retained by the impervious substrata of heavy soils and rock. If there are connections between the surface and groundwater through the ironstone, then both these sources would affect the quantity and quality of water on the surface of the site. A recent site visit to occurrence NIRONNW (1) in Timaru Nature Reserve on the 20th of September 2019, exhibited no shallow surface water in the community. The northern portion of this occurrence was relatively dry with minimal abundance of the indicator herb species, however, the central and southern portion was increasingly damp with a higher abundance of typical herb species. As mentioned in further detail below, due to an overall trend of drying climate, this community will likely experience shorter periods of seasonal inundation that will result in changes to the composition and structure.

Occurrences of the community are all located on the north Gnangara Mound, an unconfined groundwater aquifer. The height of the groundwater table is 60-70m above sea level (m AHD) where the community occurs. Occurrences are also located in a low point adjacent to a peak in the water mound (a 'col') and adjacent to a flow channel in the groundwater mound (Davidson 1995).

A trend of falling water tables in the general area is evident since around 1976 (Greay 1993). Altered surface flow and/or alteration of the height of the local water table may change the length of the period or the depth of ponding and may impact the timing of growth of herbs in the understorey and in turn affect the species composition of the community by favouring different plant species.

Bore data for 45m northwest of occurrence NIRONNW (1) (site ref: 61610953), indicate water levels are slowly declining, with a relatively stable period between 1977 and 2000, followed by a steeper decline from 2000 to the present (figure 1) (DoW 2019). Between 1977 and 2000 water levels declined approximately 0.5m, and between 2000 and 2019, by approximately 1m. Groundwater decline at this occurrence is likely to mainly be linked to reduced rainfall. Licences to abstract from both the superficial Swan and Leederville aquifers do exist close to the occurrences of the community and the sudden decline from 2000 may indicate water abstraction and/or altered drainage.

Figure 2 shows the predicted groundwater decline for the bore at occurrence NIRONNW (1) over the next 50 years, using the trendline calculated for the 2000-2019 period (y=-0054x + 65.95). As this bore is located just on the border of occurrence NIRONNW (1), Timaru Nature Reserve, the declining water table probably relates to the lack of surface water in the community as observed during a recent site visit (23/09/2019). The northern portion of the occurrence was relatively dry, with low numbers of the characteristic herbs. The central and southern portion was increasingly damp with higher abundance of the characteristic herbs.

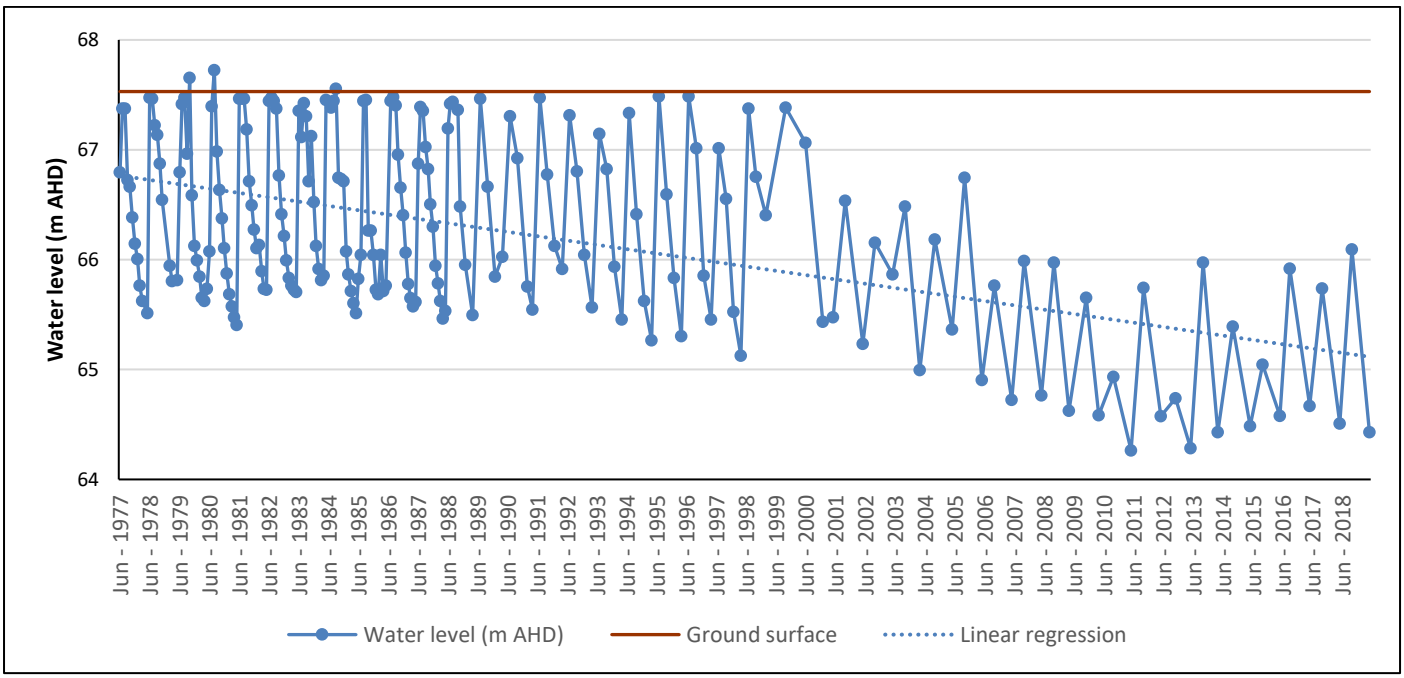

Figure 1. Hydrograph of monitoring bore located 45m northwest of occurrence NIRONNW (1) (site ref: 61610953) in DBCA reserve 46373, sampling the superficial Swan aquifer.

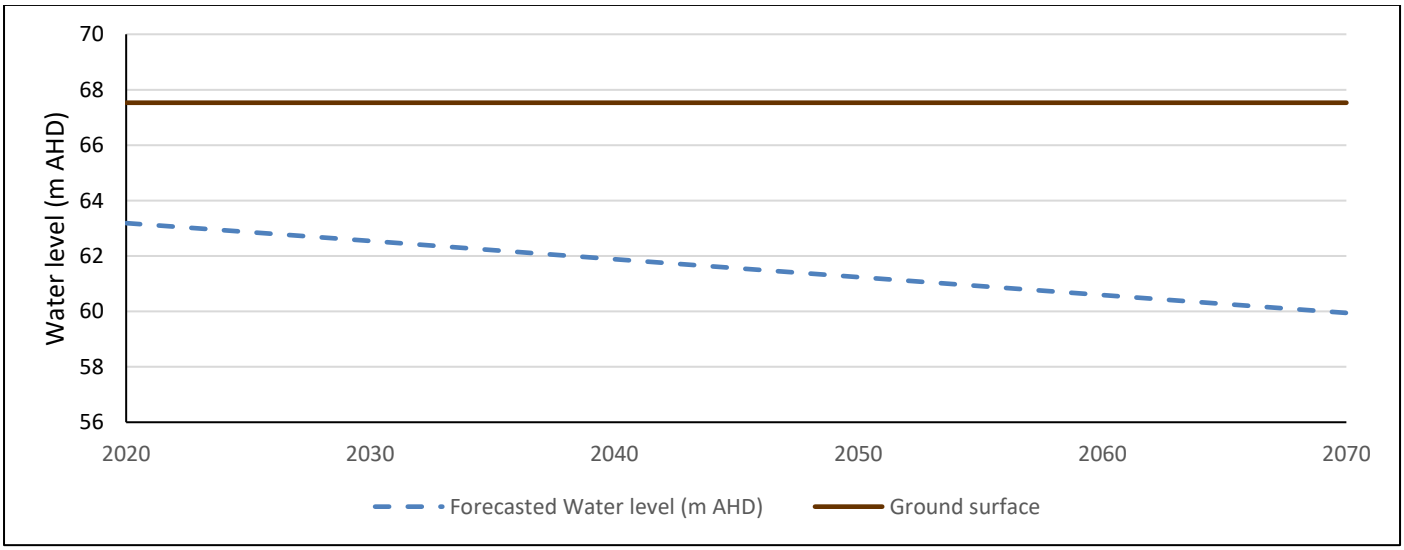

Figure 2. A 50-year forecast of groundwater level decline at occurrence NIRONNW (1) (site ref: 61610953) as calculated using the trendline (y=-0054x + 65.95) between 2000 and 2019.

Grazing by introduced herbivores

Grazing of the community is likely to have caused alterations to the species composition, by the selective grazing of edible species, the introduction of weeds and nutrients, trampling, and general disturbance.

Occurrence 1 was grazed by livestock for many years prior to the land becoming a conservation reserve. The shallow soils are not very productive and the area was historically only lightly grazed as a consequence. Grazing was reduced

when the area became a nature reserve and ceased with the erection of the subsequent permanent fencing in 2004. Kangaroos and rabbits still graze the reserve, and this may affect regeneration.

The most northerly remnant (Occurrence 2) was permanently fenced from stock by DBCA in 2004. Fencing was very difficult in the ironstone soils. Occurrence 3 is basically fenced within a larger area that is used as pasture and in 1997 was lightly grazed as a bull-paddock.

Weed invasion

Weed invasion is increased by grazing, increased nutrient levels and other disturbances such as fire. The pollution of the surface waters with droppings from stock is likely to increase nutrient levels and, hence to favour weed species that are generally adapted to higher levels of nutrients than local species.

In 2003, DBCA commissioned Ecoscape Pty Ltd (2004) to conduct a survey of weeds within the largest occurrence, at Timaru Nature Reserve (Occurrence 1-NIRONNW). Post-fire monitoring transects established by DBCA District staff in occurrence 1 complemented this work. As a result of survey a comprehensive list of weeds species, cover values and their distribution within the reserve was obtained. The significant weeds identified in occurrence 1 include *Romulea rosea, Sparaxis bulbifera, Lupinus cosentinii* and *Zantedeschia aethiopic*a. Weed control has been undertaken in the heavily infested parts of the reserve.

Too frequent fire

Mediterranean ecosystems are usually fire responsive and indeed may require a particular fire regime to assist regeneration (Abbot and Burrows 2003). If an appropriate fire frequency is exceeded, however, species that are obligate seeders may not have sufficient time to flower and produce seed. If the time between fires is too long, obligate seeders may senesce and be unable to regenerate. Therefore, bushfires or prescribed burns must occur at appropriate intervals, and possibly at the appropriate season and intensity, to sustain the integrity of plant communities.

Too frequent fire can increase the risk of invasive weeds establishing within small bushland remnants such as this community (Abbot and Burrows 2003). Following the hot wildfire in January 2003, there was an observable increase in grass and pasture weeds ([redacted][1], personal communication).

As this community is not well studied, little is known of its requirements in terms of fire regime to maintain species composition. In 2003, an intense bush fire occurred in Timaru Native reserve, with some sections of the reserve burnt and others unburnt. Monitoring transects were established to assess the impact of the fire on this community. Surveys after the 2003 fire indicated that weed invasion increased post fire, and that some of the dominant daisies in the community had largely been replaced by others. As at 2019 the dominant daisies were again becoming evident ([redacted] personal observations).

Drying climate

The ironstone soils near Gingin are seasonally inundated (surface water in wetter months). Many of the flora present are specifically adapted to this shallow seasonal inundation, eg., *Kunzea* aff. *recurva* (swamp kunzea) and the herb layer that appears in late winter and early spring. This herb layer is a major distinguishing characteristic of this community.

Trends of rainfall decline may affect various components of the community, as it is reliant on rainfall and local hydrology. Reduced rainfall is likely to have a detrimental effect on the herbaceous assemblage in particular. Altered periods or depths of ponding will impact the timing of growth of herbs in the understorey and may also affect the species composition by favouring different flora taxa.

[1] [redacted], DBCA Swan Coastal District

Climate models indicate decreases in winter spring and annual rainfall with high confidence. There is strong model agreement and good understanding of the contributing underlying physical mechanisms driving this change (southward shift of winter and spring storm systems).

According to CSIRO data, early in the century (2030) and under all emission scenarios, winter rainfall is projected to decrease by up to 15 per cent. Late in the century, intermediate emissions (RCP4.5) lead to a projected decrease in winter rainfall of up to around 30%, and under high emissions (RCP8.5) winter rainfall decline is projected to decrease by up to 45%. Changes in autumn and summer are less clear, although downscaling results suggest a continuation of the observed autumn declines. (https://www.climatechangeinaustralia.gov.au/en/climate-projections/future-climate/regional-climate-change-explorer/sub-clusters/?current=SSWSW&tooltip=true&popup=true) (accessed November 2019).

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APPENDIX 2: Distribution of the Perth to Gingin Ironstone Association (orange)

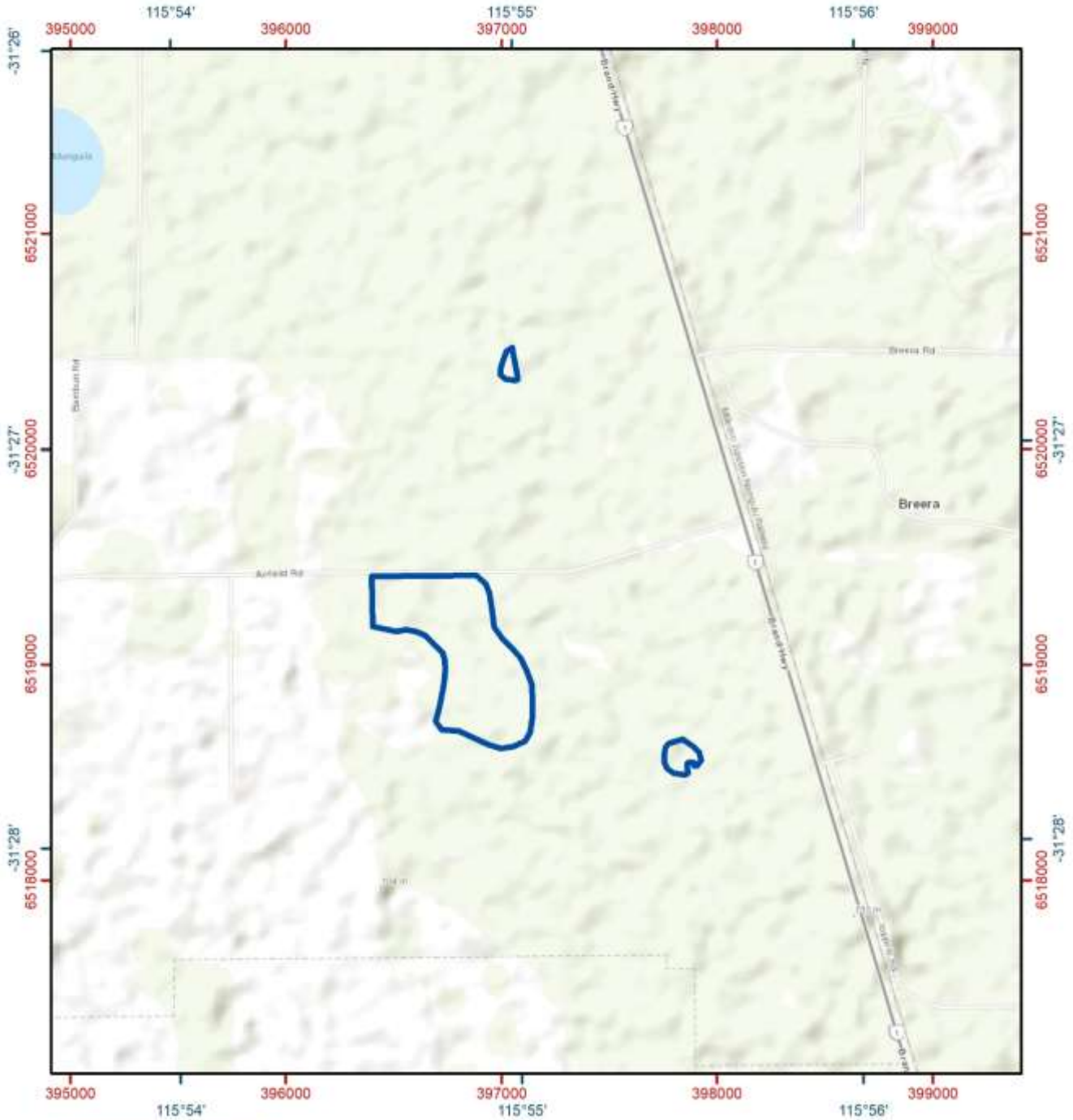

Figure 3. Distribution of the Perth to Gingin Ironstone Association.

The community occurs on characteristic heavy ironstone derived soils over range of 1.8km in Bambun. Occurrences were likely to have been naturally highly fragmented due to ironstone soils being extremely restricted in distribution. The heavy soils in this area are around 97% cleared.

The map was created from mapped occurrences of the community contained in the Western Australian Threatened Ecological Community database (TECDB), as administered by the Department of Biodiversity and Conservation (DBCA).

APPENDIX 3 IUCN Red List Criteria for ecosystems (version 2.2) (IUCN 2017)

A. Reduction in geographic distribution over ANY of the following time periods:

		CR	EN	VU
A1	Present (over the past 50 years).	≥ 80%	≥ 50%	≥ 30%
A2a	Future (over the next 50 years).	≥ 80%	≥ 50%	≥ 30%
A2b	Future (over any 50 year period including the present and future).	≥ 80%	≥ 50%	≥ 30%
A3	Historic (since 1750).	≥ 90%	≥ 70%	≥ 50%

B. Restricted geographic distribution indicated by EITHER B1, B2 or B3:

		CR	EN	VU
B1	Extent of a minimum convex polygon enclosing all occurrences (Extent of Occurrence)	≤ 2,000 km^2	≤ 20,000 km^2	≤ 50,000 km^2
	AND at least one of the following (a-c):			
	(a) An observed or inferred continuing decline in **EITHER**:			
	i. a measure of spatial extent appropriate to the ecosystem; **OR**			
	ii. a measure of environmental quality appropriate to characteristic biota of the ecosystem; **OR**			
	iii. a measure of disruption to biotic interactions appropriate to the characteristic biota of the ecosystem.			
	(b) Observed or inferred threatening processes that are likely to cause continuing declines in geographic distribution, environmental quality or biotic interactions within the next 20 years.			
	(c) Ecosystem exists at …	1 location	≤ 5 locations	≤ 10 locations
B2	The number of 10 × 10 km grid cells occupied (Area of Occupancy)	≤ 2	≤ 20	≤ 50
	AND at least one of a-c above (same sub-criteria as for B1).			
B3	A very small number of locations (generally fewer than 5) **AND** prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and thus capable of collapse or becoming Critically Endangered within a very short time period (B3 can only lead to a listing as VU).			VU

C. Environmental degradation over ANY of the following time periods:

			Relative severity (%)		
		Extent (%)	≥ 80	≥ 50	≥ 30
C1	The past 50 years based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 80	≥ 50	≥ 30
C2	The next 50 years, or any 50-year period including the present and future, based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 90	≥ 70	≥ 50
C3		≥ 90	CR	EN	VU

	Since 1750 based on change in an abiotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 70	EN	VU	
		≥ 50	VU		
D. Disruption of biotic processes or interactions over ANY of the following time periods:					
			Relative severity (%)		
		Extent (%)	≥ 80	≥ 50	≥ 30
D1	The past 50 years based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 80	≥ 50	≥ 30
D2	(D2a) The next 50 years, or (D2b) any 50-year period including the present and future, based on change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table: OR	≥ 80	CR	EN	VU
		≥ 50	EN	VU	
		≥ 30	VU		
			≥ 90	≥ 70	≥ 50
D3	Since 1750, based on a change in a biotic variable affecting a fraction of the extent of the ecosystem and with relative severity, as indicated by the following table:	≥ 90	CR	EN	VU
		≥ 70	EN	VU	
		≥ 50	VU		
E. Quantitative analysis					
			CR	EN	VU
	… that estimates the probability of ecosystem collapse to be:		≥ 50% within 50 years	≥ 20% within 50 years	≥ 10% within 100 years