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Section 1 – Eligibility for Listing		
1. Name of the ecological community		
Monsoon (vine) thickets on the coastal sand dunes of Dampier Peninsula		
2. Listing Category for which the ecological community is nominated		
	State categories	EPBC Act (wholly or as a component)
Current ranking under WA Minister ESA list in policy	☐ Critically endangered ☐ Endangered ☒ Vulnerable ☐ Priority 1-4 ☐ Data Deficient ☐ None – not listed	Name: Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula ☐ Critically endangered ☒ Endangered ☐ Vulnerable ☐ None – not listed
Proposed listing category (Please check box)	WA Biodiversity Conservation Act ☐ Collapsed ☐ CR: Critically endangered ☒ EN: Endangered ☐ VU: Vulnerable ☐ Priority 1-4	
Select one or more of the following criteria under which the community is to be nominated for BC Act listing. (Please check box). For further details on these criteria please refer to the Attachment to this form. The information you provide in Section 3 should support the criteria you select here.	☐ Criterion A – Reduction in geographic distribution ☒ Criterion B – Restricted geographic distribution ☐ Criterion C – Environmental degradation based on change in an abiotic variable ☐ Criterion D – Disruption of biotic processes or interactions based on change in a biotic variable ☐ Criterion E – Quantitative analysis that estimates the probability of ecosystem collapse	

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Section 2 – Description, Condition, Threats & Recovery

Please answer all the questions, providing references where applicable. If no or insufficient information exists to answer a question, you must indicate this instead of leaving the question blank. The answers may be provided within this form or as attachments, ensuring that responses clearly indicate which question number they refer to.

Classification

3. 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?

Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula (commonly referred to as the monsoon vine thickets, or vine thickets).

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

The community was originally identified by McKenzie *et al*. (1991) in the Kimberley Rainforests Australia survey. The community type was recognised following the publication of that report and was endorsed as vulnerable (under criteria VU C) by the WA Minister for Environment in 2001. It was ranked using criteria developed in WA, that do not match those used in the International Union for Conservation of Nature's Red List of Ecosystems criteria (IUCN RLE) RLE, that is now the internationally recognised standard. The community was then listed as EN under the name 'Monsoon vine thickets on the coastal sand dunes of the Dampier Peninsula' under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2013. The criteria used under that Act also differ from the ranking criteria used for the IUCN RLE.

5. 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?
Describe how you might distinguish the ecological community in areas where there is overlap (also see Description section below).

The vine thickets of the Dampier Peninsula are a very distinctive type of rainforest in the Kimberley region. The Kimberley Rainforests Australia survey (McKenzie *et al*. 1991) determined assemblages in the region through statistical analysis of plant species composition. The vine thickets assemblage differs from other rainforest floristic groups in the absence of many of the tree and large shrub species that characterised other rainforest groups in other parts of the Kimberley (Kenneally *et al*. 1991). The differences between the species composition of the rainforest groups could be related to responses to environmental factors, such as rainfall and substrate. Rainforest only occurs in the drier areas in fire refugia with favourable hydrological conditions, and none are recorded in areas where rainfall was less than 580mm (McKenzie *et al*. 1991).

Three Priority ecological communities (PECs) adjoin or occur nearby the monsoon vine thickets community, as follows:

1. Kimberly vegetation association 37, Priority 3
   Description: Shrublands; teatree thicket. Originally described in vegetation mapping for the Kimberley by Beard (1979).
2. Kimberley vegetation association 73, Priority 3
   Description: Grasslands, short bunch grass savanna, grass; salt water grassland (*Sporobolus virginicus*). Originally described in vegetation mapping for the Kimberley by Beard (1979).
3. *Corymbia paractia* dominated community on dunes, Priority 1
   Description: *Corymbia paractia* dominated dunes behind the transitional zone where coastal dunes with vine thickets merge with Pindan vegetation.

Description

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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.

This vine thicket community is a type of rainforest ecosystem that occurs in discrete patches along the Dampier Peninsula, from Broome to Derby in the south-western portion of the Kimberley region. Vine thickets occur as discrete areas of dense vegetation and can occur as a stand of a few trees or as larger patches. The vine thickets assemblage differs from other rainforest floristic groups through the absence of many of the tree and large shrub species that characterised other rainforest groups in other parts of the Kimberley, such as *Vitex acuminata*, *Ganophyllum falcatum*, *Albizia lebbeck*, *Elaeodendron melanocarpum*, *Adansonia gregorii*, *Glycosmis* sp., *Strychnos lucida* and *Micromelum minutum*; as well as low number of annuals (Kenneally *et al*. 1991).

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).

The Kimberley Rainforests Australia survey (McKenzie *et al*. 1991) determined floristic assemblages in the region through statistical analysis of plant species composition from four rainforest sites on the Dampier Peninsula. These four sites were distinguished as a separate floristic group on the basis of similarities of the perennial plant species. The rainforest sites as a group were generally low in annuals compared to increased numbers of annuals found in rainforest patches with open canopies or with large glades. McKenzie *et al*. (1991) noted the following characteristics at four patches:

- Average canopy height of 8.2m.
- Average perennial plant species richness of 30.7 species.
- Average bird species richness of 12.75 species per patch, with a total of 24 species recorded in the four patches surveyed.
- Average total species richness (birds, snails and plants) of 48.5 species.
- Six species of land snail recorded.

About 25% of the plant species recorded in the vine thickets were mostly or completely confined to the community (Black *et al*. 2010). Common tree and tall shrub species included Marool or blackberry tree (*Terminalia petiolaris*), currant or coffee fruit (*Grewia breviflora*), Goonj (*Celtis strychnoides*), ebony wood (*Diospyros humilis*), mangarr (*Sersalisia sericea*), broad-leaved cherry (*Exocarpos latifolius*), walara (*Mimusops elengi*), bauhinia or jigal tree (*Bauhinia cunninghamii*) and helicopter tree (*Gyrocarpus americanus* subsp. *pachyphyllus*). Common tall shrubs included dogwood (*Flueggea virosa* subsp. *melanthesoides*), Croton habrophyllus and broad-winged hop bush (*Dodonaea platyptera*). The most common climbers were crabs eyes (*Abrus precatorius*), bush caper (*Capparis lasiantha*), snake vine (*Tinospora smilacina*), *Jasminum didymum*, *Caesalpinia major*, and oyster-catcher bill (*Vincetoxicum cinerascens*). While most patches were dominated by a mix of several different tree species that varied in height, a few patches were dominated by a single tree species at a uniform height and had little to no understorey of shrubs. Any ground layer was sparse in healthy patches. Twenty three percent of the native perennial plant species present comprise generally inconspicuous vine species (Black *et al*. 2010).

The vine thickets support high species richness, and this provides important habitat and food for fauna. Birds believed to utilise the vine thickets include rose crowned fruit-dove (*Ptilinopus regina*), and the great bower bird (*Ptilonorhynchus nuchalis*), broad-billed flycatcher, red-crowned pigeon and mangrove golden whistler (Kenneally *et al*. 1996; Johnston and Burbidge 1991; Biota Environmental Services 2009b). Dollar birds (an insectivore), honeyeaters, and channel billed cuckoos (frugivore) reportedly feed on the spatially variable and seasonally complementary fruit, nectar and habitat resources in the stands of vine thickets (Environs Kimberley 2009). A

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breeding group of Gouldian finches (*Erythrura gouldiae*) was also recorded in the vine thickets (Department of Water and Environmental Regulation (DWER 2017).

From Northern Territory studies (Bach and Price 1999) bats also seasonally rely upon vine thicket and adjacent or neighbouring complementary habitats for year-round survival. The protection of alternative roosting sites and the succession of seasonal feeding sites for these frugivores is critical for maintenance of the vine thicket ecological processes, species diversity and survival of the ecosystem functionality.

There are few records of mammalian fauna in the vine thickets, however, the black flying fox (*Pteropus alecto*) has an important role as both a pollinator and seed disperser for species such as *Syzygium* spp. (Palmer *et al*. 2000). McKenzie *et al*. (1991) recorded agile wallaby (*Macropus agilis*) as utilising vine thicket areas and species such as northern brush-tailed possum (*Trichosurus arnhemensis*) and water rat (*Hydromys chrysogaster*) are highly likely to utilise vine thickets for habitat and available fruit and flowers.

8. Give a description of the associated non-biological landscape characteristics or components of the ecological community.

For instance, what is the typical landscape 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, latitudes or geographic coordinates

The vine thickets community occurs as semi-deciduous vine thicket on leeward slopes of coastal sand dunes on the Dampier Peninsula. Many occurrences include scattered discrete vine thicket patches located in swales throughout the dune system and are likely to be indicators of the movement of the dune system over time. The community generally occurs on deep dune sands with a dark superficial grey organic layer, with a surface layer of moist leaf litter, but it can occur on other substrates due to other influences.

The vine thicket community is dependent on specific rainfall, hydrology and high humidity levels. Rainfall in the northern end of the Peninsula is between about 700 to 750mm per year, and in the southern end of the range of the community it is about 600m. Many occurrences are known to occur adjacent to or on groundwater springs or shallow aquifers, described as permanent soakage by Kenneally *et al*. (1991), and so some level of dependence on groundwater can be assumed. A concentration of water flow into the shallow recharge zones at the base of the dune systems is believed to support the community (DBCA 2018).

The vine thickets mainly occur on Quaternary sands, which are dark grey, dark greyish brown, or reddish brown in colour (McKenzie *et al*. 1991). They occur on leeward slopes and swales and occasionally exposed dune crests. Many occurrences extend into the red pindan soils on the inland portions of the dunes. Landforms occupied by the vine thickets include beach fronts, sand-spit headlands, low cliffs above mangrove lined creeks, storm ridges within intertidal flats, and red soil gullies inland of coastal cliffs (Black *et al*. 2010). The soils in the Holocene dunes where the community occurs are deep coastal dunes, generally white but can be pink, with a thin humus layer.

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

The habitats of the vine thickets possess little surface drainage, are dominated by sheet runoff, and are generally a very simple environment of gently sloping surfaces, often internally draining. In the southern portion of the Dampier Peninsula, site drainage is from east to west; in the northern portion groundwater flow is generally from south to north; and the eastern portion it is from west to east. There are no permanent rivers or creeks in the habitat of the vine thickets. Minor drainage lines flow after rain, where water accumulates behind the first sand dune system at the coast (Environs Kimberley 2010).

A micro-climate is created behind the dune systems, where the cooler air is thought to become trapped, interacting with the warm moist coastal breeze resulting in a higher level of precipitation from fog and dew concentrated along the coastal strips. It is believed that the high humidity and heavy fogs along the coast, and the wet season rains, also help the community to survive the long dry periods. The moisture and humidity are

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accentuated by the dense and protective shady canopy and support the ecosystems' role as a biological refuge. The humidity is also thought to assist in protecting the community from fires.

It is likely that the community is groundwater dependent. Groundwater appears to be 2 to 4m below ground level. These water levels indicate that trees species will be accessing shallow groundwater from the regional aquifer. All occurrences in the study were found to be accessing older water from the Broome Sandstone aquifer that was forced up over the near-coastal saltwater interface, and not water derived from recent rainfall (Department of Water and Environmental Regulation (DWER) 2017). Many vine thicket occurrences are also situated adjacent to, or on ground water springs or shallow aquifers described as permanent soakage by Kenneally *et al*. (1991) in which case they will be highly or entirely groundwater dependant.

10. Does the ecological community show any consistent regional or other variation across its extent, such as characteristic differences in species composition or structure?

If so, please describe these.

The units recorded by McKenzie *et al*. (1991) were grouped by similarities of perennial plant species. McKenzie *et al*. (1991) surmised that differences between species composition could be related to responses to environmental factors, such as rainfall and substrate. They noted that species richness correlated with rainfall and higher levels of soil phosphorus, but that richness declined with increased annual temperature range.

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 and/or national lists and the nature of their dependence on the ecological community.

The Threatened flora taxon *Seringia exastia* occurs near a small vine thicket occurrence near the Broome Port. This species is listed as critically endangered in WA and under the EPBC Act. Three priority flora *Gomphrena pusilla* (Priority 2), *Polymeria distigma* (Priority 3) and *Pittosporum moluccanum* (Priority 4) occur in the vine thickets or allied assemblages (Biota Environmental Services 2009a). *Pittosporum moluccanum* is only known in WA from four occurrences of the vine thickets on the Dampier Peninsula and the Maret and Berthier Islands.

The greater bilby (Schedule 1), Peregrine falcon (Schedule 4), Dampierland burrowing snake (Priority 2), bush stone curlew (Priority 4), *Leristra separandra* (Priority 4), rainbow bee-eater (*Merops ornatu*; Commonwealth migratory species), white-bellied sea eagle (Commonwealth migratory species) occur in the vine thicket occurrences or similar assemblages at James Price Point (Biota Environmental Services 2009b). Dampierland limbless slider is endemic to the Dampier Peninsula and is recorded as inhabiting sand dune transition zones (Wilson and Swan 2003), and within the vine thickets. A breeding group of Gouldian finches (*Erythrura gouldiae;* Priority 4 in WA and endangered under EPBC Act) was recorded in a vine thicket (DWER 2017).

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

Bach, C. and Price O. (1999) Fruit resources, frugivore movements and landscape scale conservation in monsoon rainforests of northern Australia, In: Gorman, J., Pethram and Vigilante, T. 12th Annual conference of the Australasian Wildlife Management Society, Darwin, 1-3 Dec 1999.

Bach, C. and Price, O. (2005) Fruit resources and landscape scale conservation in monsoon rainforests of Northern Australia. *Wildlife Research* 33(6) Pg.521–528.

Black, S.J., Willing, T. and Dureau, D.M. (2010) A comprehensive survey of the flora, extent and condition of vine thickets on coastal sand dunes of Dampier Peninsula, West Kimberley 2000-2002. Final report September 2010. Broome Botanical Society (Inc.). Broome, Western Australia.

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Department of Water and Environmental Regulation (2017) Groundwater-dependent ecosystems of the Dampier Peninsula. Royalties for Regions groundwater investigation. Environmental water report series Report no. 29. August 2017.

Fensham R.J. and Butler D.W. (2004) The spatial pattern of dry rainforest colonising unburnt Eucalyptus savanna. *Austral Ecology* 29, 121-128.

Fisher, J. and Beames, L. and Rangers, B. and Rangers, N. and Majer, J. and Heterick, B. (2014) Using ants to monitor changes within and surrounding the endangered Monsoon Vine Thickets of the tropical Dampier Peninsula, north Western Australia. *Forest Ecology and Management*. 318: pp. 78-90.

Fisher, J., Beames, L., van Dongen, R., Delaney, J., Bardi Jawi Rangers, Nyul Rangers (2013) Fire history and vegetation change in threatened Monsoon Vine Thickets of northern Western Australia: applying culturally informed science. Draft manuscript. University of Western Australia, Nedlands.

Harding, C. (2009) Monitoring of the extent of Dampier Peninsula Vine Thickets Threatened Ecological Community. Version 1.0 (June 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project.

Harding, C., McGilvray, A., and Beames, L. (2009) Monitoring the Effectiveness of Weed Control in Dampier Peninsula Vine Thickets Threatened Ecological Community. Version 1.0 (October 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project.

Kenneally, K.F., Keighery, G.J. and Hyland, B.P.M (1991) Floristics and phytogeography of Kimberley rainforests, Western Australia. Chapter 6 in *Kimberley Rainforests Australia*, edited by McKenzie, N.L., Johnston, R.B., and Kendrick, P.G. Surrey Beatty & Sons in Association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW.

McKenzie (1991) An ecological survey of tropical rainforests in Western Australia: background and methods. Chapter 1 in: McKenzie, N.L., Johnston, R.B., and Kendrick, P.G (eds) (1991) *Kimberley Rainforests Australia*. Surrey Beatty & Sons in Association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW.

McKenzie, N.L., Johnston, R.B., and Kendrick, P.G (eds) (1991) *Kimberley Rainforests Australia*. Surrey Beatty & Sons in Association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW.

Vogwill, R.I.J, (2003) Hydrogeology and Aspects of the Environmental Geology of the Broome Area Western Australia, PhD Thesis, Curtin University, Western Australia.

Distribution

13. Describe the distribution across WA and nationally.

State the appropriate bioregions where the ecological community occurs. Attach or provide any maps showing its distribution with details of the source of the maps, or explain how they were created and the datasets used.

The vine thicket community is confined to the Peninsula between Broome and Derby, along with the coastal dune formations on which it occurs. There are 90 known occurrences which vary in size from about 0.3 ha up to 507 ha, with a mean size of about 33 ha. They can occur as clumps or narrow linear stands (Black *et al*. 2010).

14. What is the area of distribution of 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 Attachment); 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 known area (in ha)? 2,863ha

14 b. What is the pre-industrialisation extent or its former known extent (in ha)? An ecological community is considered to be naturally restricted if it has a pre-industrialisation area of occupancy that is less than 10 000 ha or a pre-industrialisation extent of occurrence that is less than 100 000 ha (refer to the Attachment A)

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The extent of the vine thickets community is estimated to have declined by <40% occurring since ~1750. Black *et al.* (2010) estimated that approximately 5% of the vine thickets had been cleared in the previous 20 years (DBCA 2018).

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

See above.

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

Remote sensing data from 1991 to 2012 indicates 20% of the extent of the vine thickets has experienced declining cover as a result of fire (Fisher *et al.* 2013; DBCA 2018). This decline is likely to be ongoing under current fire regimes.

Patch size

15. 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 could be presented as the range of patch sizes that comprise 90% of the occurrences.

The vine thickets community was mapped using ArcGIS© and a range of data sources including quadrat and survey data, on ground survey, aerial photography, and topographic maps. Minimum patch size is 0.3ha and maximum patch size is 507ha. The mean patch size of those occurrences that have been mapped is 32.5ha (see table below for patch size proportions).

Table 1. Proportion of occurrences with a certain patch size.

Patch size (hectares)	Number of occurrences
0-1	6 (7%)
1-10	26 (29%)
10-100	51 (57%)
>100	5 (5%)
Not mapped	2

16. Quantify, if possible, 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.

All areas of the vine thickets community that are in good condition have been mapped. The community has a mosaic distribution, and there is no minimum area specified for a patch that could remain viable without active management as most occurrences are surrounded by and linked to other intact vegetation.

Functionality

17. 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 vine thickets community is naturally fragmented occurring on leeward slopes of coastal sand dunes on the Dampier Peninsula. Many occurrences occur as scattered discrete vine thicket patches located in swales throughout the dune systems.

18. Has there been a loss or decline of functionally important species?

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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 viability of the community.

The flora species within the community are a major part of characterising and differentiating the community. Changes to the floristic composition are likely to occur through the introduction of weeds, change in fire regimes and changes to water quality and quantity.

18 a. If yes, which species are affected?

All native flora species are affected by competition with weed taxa. Fire will particularly affect species that are fire-sensitive.

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

Vine thickets are floristically diverse and provide a good food source for many fauna during the dry season, and the vegetation, with its dense canopy and large fruiting trees provides a particular refuge, habitat and nesting sites for many birds and reptiles. They also provide a food source for fauna such as flying foxes and rose-crowned fruit-doves which then transfer pollen and distribute seeds ensuring the pockets of vine thickets are maintained. Clearing, frequent fire, weed invasion and hydrological changes may impact on the thickets resulting in a reduction in vegetation condition and causing occurrences to decline in size through edges retreating over time.

Remote sensing data shows a trend of vegetation decline associated with fire, with 20% of the area of the vine thickets experiencing declining cover between 1991 and 2012 (Fisher *et al.* 2013). This has implications for the future ecological function of the vine thickets as the vegetation will retreat rapidly as a consequence of hot fires.

Reduction in community integrity

19. 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 recognises 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.

The structure of the vine thickets is generally a dense tree canopy, providing a generally damp and shady habitat. When in good condition the community generally lacks grass cover and can include a thick layer of leaf litter and a sparse layer of medium sized fruiting shrubs. Buffel grass and other grassy weeds are penetrating the vine thickets along tracks and access points and have been spread by feral cattle, donkeys, pigs, and human access tracks.

The occurrence that is closest to the benchmark state is occurrence 90 which was recorded as pristine when last surveyed. Other occurrences recorded as in excellent condition include 6-10, 12, 15, 16, 19-22, 24-29, 32, 33, 35-39, 45-47, 49-51, 55, 57, 59, 60, 62, 63, 66-70, 72, 76, 80, 81, 85-88. They are characterised by the following:

- Few weed taxa and low weed cover
- All previously recorded natural strata of the vegetation present
- Connectivity with other intact vegetation and other occurrences of the community
- Diverse flora including numerous perennial plant species (McKenzie *et al*. (1991) recorded average perennial plant species richness of 30.7 species)
- Intact populations present in patches where rare and priority flora were historically recorded.

Survey and Monitoring

20. Has the ecological community been reasonably well surveyed?

Provide an overview of surveys to date, including coverage of different land tenure, and the likelihood of the ecological community's current known distribution and/or patch size being a true reflection of its actual distribution (consider area of occupancy and area of extent, including any data on number and size of patches).

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Kimberley Rainforests Australia surveyed and analysed data from 95 rainforest sites across the Kimberley, including assessments of four vine thicket sites on the Dampier Peninsula (McKenzie *et al*. 1991).

Broome Botanical Society and staff from the then Department of Conservation and Land Management undertook a three-year survey of the vine thickets in likely habitat on the Dampier Peninsula from 2000 to 2002.

DBCA staff and volunteers from Broome Botanical Society worked with Aboriginal Ranger groups and Environs Kimberley in February 2010, and September 2015 to survey a selection of the vine thickets to collect updated information about boundaries, composition, threats, and current on-ground management by Traditional Owners. Environs Kimberley works with Yawuru Country Managers and Nyul Nyul rangers to collect additional survey and mapping data for previously unrecorded vine thicket occurrences.

21. 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.

Include commentary on issues to do with accessing different land tenures within the area of distribution, including private property, and the likelihood that these areas may include occurrences.

Potential locations identified by Broome Botanical Society in 2001 and 2002 (Black *et al*. 2010) should be investigated with more up to date mapping software and subsequent ground truthing. Botanical and condition survey should be completed for occurrences that remain un-surveyed. This includes occurrences in the town of One Arm Point, Tooey Creek, Weedong, Christmas Island, Broome Airport, and at Hidden Valley.

Patches of rainforest have also been recorded at Cape Villaret about 45km south west of Broome, at Sunday Island on the far north-east Dampier Peninsula, and on Coronation Island; however, it is not known if the assemblages are similar to those in the vine thickets on the remainder of Dampier Peninsula (DBCA 2018).

A number of boundaries of occurrences of the vine thickets may require checking or redefining based on recent remote sensing analysis of areas currently mapped (van Dongen and Huntley 2017).

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

As part of the Commonwealth-funded Resource Condition Monitoring Project from 2008 to 2009, two monitoring protocols were developed for the vine thicket community. These provide information and procedures for monitoring the effectiveness of weed control work in occurrences of the vine thickets (Harding *et al*. 2009), and for monitoring the extent of occurrences of the vine thickets (Harding 2009). Monitoring of the community is on an opportunistic basis.

Condition Classes and Thresholds

23. Do you think condition classes/thresholds apply to this ecological community? If not, give reasons.

The community occurs in different condition classes based on levels of clearing and vegetation disturbance, weed invasion, fire impacts and hydrological change. The minimum viable condition for this community to be considered viable is Good Condition. This refers to a patch in which "Vegetation structure altered but retains basic vegetation structure or ability to regenerate it. Obvious signs of disturbance, e.g. from partial clearing, grazing, hydrological changes. Presence of very aggressive weeds" (Keighery (1994) Vegetation Condition Scale (Government of WA 2000)). No minimum patch size is specified, as future viability will depend on management. Very small areas are known to be able to maintain their condition if they are subject to very minimal disturbance.

24. 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?

Condition categories 'Very Good to Pristine' as below (see ^ below in Table 2) are considered to be in good condition, so therefore 2,447ha or 85% of known occurrences are considered to be in good condition. They contain high diversity of native plant species, maintain integrity of vegetation structure, and have minimal weed/introduced species cover.

Table 2: Vegetation condition of mapped occurrences of monsoon vine thickets

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Occurrence number (portion of occurrence estimated as percentage in brackets)	**Total area (ha)***	**Condition when last surveyed**
1, 13 (85%), 14 (**50%**), 17 (10%), 43 (20%), 65 (10%), 71 (**33%**), 79 (35%)	±162.6967	^^^Poor ('degraded', 'completely degraded' using Bush Forever (2000) scale)
2, 4, 14 (**50%**), 28 (5%), 31 (5%), 71 (**33%**), 74, 75, 77, 78 (65%), 79 (30%), 80 (5%), 81 (20%), 82 (**50%**)	±86.74015	^^Medium ('good' using Bush Forever (2000) scale)
3, 6-10, 12, 13 (15%), 15, 16, 17 (90%), 19-27, 28 (95%), 29, 30, 31 (95%), 32, 33, 35-39, 43 (80%), 44-64, 65 (90%), 66-70, 71 (**33%**), 72, 73, 76, 78 (35%), 79 (35%), 80 (95%), 81 (80%), 82 (**50%**), 84-89	±2,446.856	^Good ('pristine', 'excellent', 'very good' using Bush Forever (2000) scale)
5, 11, 18, 34, 40, 41, 42	±166.5	Condition unknown

*where two or more condition classes were recorded but no percentage given (those in **bold**), the percentage for each class was divided evenly between the classes.

25. 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.

See Section 24 above.

^This includes vegetation ranging from 'Pristine' - with no obvious signs of disturbance and native plant species diversity fully retained or almost so, zero or almost so weed cover/abundance, to 'Excellent' - Vegetation structure intact, with disturbance only affecting individual species, weeds are non-aggressive species, and the area contains high native plant species diversity, with less than 10% weed cover, and 'Very Good' - Vegetation structure altered, obvious signs of disturbance eg: from repeated fires, dieback, logging, grazing, aggressive weeds are present, with moderate native plant species diversity, and typical weed cover is less than 20% (5 – 20%).

26. 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?

Medium condition aligns with WA condition categories 'Very Good to Good' as below (see ^^below and Table 2 above), so therefore 88ha or 3% of known occurrences are considered to be in medium condition, and contain medium plant species diversity, reduced of vegetation structure, and a medium level of weed/introduced species cover.

^^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, logging, grazing, and very aggressive weeds are present, with low native plant diversity (5 – 50%).

27. 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.

See section 26 above.

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

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Poor condition relates to WA condition categories 'Degraded' and 'Completely Degraded', (see ^^^below and Table 2 above), so 163ha or 6% of known occurrences are considered to be in poor condition, with vegetation containing minimal native flora, presence of aggressive weeds, and evidence of much disturbance.

^^^This includes vegetation ranging from 'Degraded' Basic vegetation structure severely impacted by disturbance, the vegetation requires intensive management, and disturbance such as partial clearing, dieback, logging and grazing are present, very aggressive weeds are present at high density, and very low native plant species diversity is observed (20 – 70%) to 'Completely Degraded' where vegetation structure is no longer intact and the area is completely or almost completely without native flora, referred to also as 'Parkland Cleared', with very low to no native species diversity (weed species greater than 70%).

29. Please describe how you would identify areas in poor condition using one or a combination of indicators such as species diversity, structure, remnant size, cover of weeds or other invasive species, etc.

See section 28 above.

Threats

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

30. Identify PAST threats to the ecological community indicating whether they are *actual* or *potential*.

Past threats include clearing, disturbance through intense or frequent fire, weed invasion, hydrological change, recreational activities, and grazing and trampling by introduced herbivores, all of which are actual threats.

31. Identify CURRENT threats to the ecological community indicating whether they are *actual* or *potential*.

Current threats include vegetation clearing, disturbance through frequent fire, spread of introduced flora, hydrological change and recreational activities, all of which are currently actual threats.

32. Identify FUTURE threats to the ecological community indicating whether they are *actual* or *potential*.

Future threats include clearing (fragmentation) and dune movement, disturbance through too intense or frequent fire, weed invasion, hydrological change, damage to vegetation through recreational activities and feral animals, all of which are actual threats.

For each threat describe:

32 a. How the threat has impacted on this ecological community in the past.

Clearing and development (fragmentation)

Most of the vine thicket occurrences are small or very narrow and linear and have high edge to area ratios, making them particularly susceptible to clearing and fragmentation (Black *et al*. 2010). Clearing is a relatively new and escalating threat with an estimated 5% of the vine thickets community cleared from developments within the Broome area in the early 2000s (Black *et al.* 2010). Environmental approvals were provided in 2015 for a Liquified Natural Gas (LNG) precinct at James Price Point (Occurrence 62).

Altered fire regimes

All occurrences are under threat from intense or too frequent fire. Remote sensing data correlated with on ground measurements indicated that about 70% of the total area of the vine thickets burnt between 2000 to 2010 (Fisher *et al.* 2013). A median of 4.5 fires occurred per 'patch', and inter-fire intervals consisted of one to three years in 71.4% of patches from 1989 to 2010. Sixty eight percent of all fires were found to have occurred during the late dry season. Remote sensing data between 1991 to 2012 indicates that 20% of the area of the vine thickets has experienced declining cover as a result of fire (Fisher *et al.* 2013; DBCA 2018).

Weed invasion

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Many of the major weed species that are invading the vine thickets were historically pastoral or horticultural species that are now spreading into native bushland. Weeds have been recorded in just under 60% of vine thicket occurrences. *Passiflora foetida* var. *hispida* (passion vine) and *Cenchrus* spp. (including *Cenchrus ciliaris* - buffel grass, *C. setiger* and *C. biflorus*) are the most common weeds, with passion vine occurring in about 40% of occurrences and *Cenchrus* spp. in about 30% of occurrences. Grassy weeds such as buffel grass dry out in the late dry season and greatly increase flammability of the vine thickets. The species regenerate rapidly, and greatly increase both the fire risk and intensity of fire, thereby increasing weed invasion. *Macroptilium atropurpureum* (siratro) is another significant and increasing weed in the vine thickets, and also contributes to the fuel load where it occurs in the community. Tree weeds, including neem trees (*Azadirachta indica*) and coffee bush *(Leucaena leucocephala),* spread from old settlements and can displace native trees and form impenetrable thickets. The occurrence closest to Broome (occurrence 1) has suffered major infestations of vine species that can smother tree canopies, including siratro and *Merremia aegyptia* (hairy morning glory).

Hydrological changes

Road construction and residential developments have impacted on the hydrology of occurrences 1, 62 and 63 through an influx of sediment, nutrients, weed infestations, and an increase in flooding. Increasing flooding can result in changes to species composition, such as loss of helicopter trees, *Gyrocarpus americanus* (Black *et al*. 2010). More recent subdivisions have more water sensitive urban design that is intended to reduce excess nutrients and other possible pollutants in stormwater entering surrounding bushland and waterways. They still result in a substantial amount of run-off, soil erosion and weed spread observed from the drainage system however (DBCA 2018).

Introduced herbivores and feral animals

Populations of un-managed cattle, donkeys, pigs and possibly horses damage canopy-forming plants, open the canopy and result in erosion and weed invasion that can subsequently result in more damaging fires. 'Widespread and severe' cattle damage was noted in several occurrences by McKenzie *et al.* (1991). Impacts of unmanaged cattle were also recorded in 24 (39%) of the 62 occurrences surveyed in the early 2000s (Black *et al*. 2010). Plant species that are grazed by these animals are less likely to continue to propagate successfully. Pastoral activity has declined on the peninsula and much of the land has been destocked. Black rats have also previously been noted in vine thickets (McKenzie 1991) and have the potential to compete with native species for fruit and habitat resources.

Recreational activities

Vine thicket occurrences 63 and 75 appear to be very popular shady areas for camping, placing them under intense pressure from tourists and associated vehicle impacts, weed invasion, rubbish dumping, clearing for camping and increased fires (Environs Kimberley 2009).

Dune movement

The vine thickets can be covered by natural movement of coastal dunes through natural coastal processes. Although a 'natural threat' this can be exacerbated through destabilisation of dunes by removal or damage to vegetation. Black *et al*. (2010) recorded patch 28 (Occurrence 65) as an example of significant dune movement and noted that some trees were buried up to the middle of their trunk in pink sand. Shifting sand dunes are also covering some areas of vine thickets near Hunter Creek (Occurrence 32) and possibly a site south west of Swan Point, Karrakatta Bay (Occurrence 38) (Harding *et al.* 2009).

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

- 63 occurrences are potentially threatened from clearing and fragmentation associated with ongoing development in Broome, such as establishment of Aboriginal outstations and ecotourism ventures, clearing for building and track construction, and recent proposals for industrial development on the coast of the peninsula. Residential areas and Aboriginal settlements in Broome and the Aboriginal settlements of Beagle Bay, Lombadina-Djarindjin and One Arm Point are expanding and vine thicket patches in their

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vicinity may be potentially affected by infrastructure expansion. The upgrading of the Broome to Cape Leveque Road and ancillary roads will increase vehicle traffic, economic development and tourism pressures on the Dampier Peninsula, potentially increasing impacts to the vine thickets associated with increased runoff, erosion and visitor pressure.

- Visitation and impacts associated with recreation use of vine thickets for camping and four wheel driving such as soil compaction, fire wood collection, increased fire frequency, rubbish dumping and increased weed spread have the potential to increase, particularly with the upgrade and realignment of the road from Broome to Cape Leveque.
- It is likely that frequent intense fires will continue to threaten the integrity of the vine thickets through impacting on species diversity, encouraging weed invasion and encroachment of Pindan vegetation. Those occurrences afforded some protection from rocky outcrops, steep sided gullies, or the ocean are likely to be burnt less frequently (McKenzie *et al*. 1991).
- Weed invasion will continue to threaten the vine thickets and is exacerbated by disturbances such as fires and grazing which in turn, can predispose areas to further weed invasion. As visitation increases on the Peninsula, the threat posed by weed invasion is likely to increase.
- Increasing future abstraction of groundwater for domestic and industrial use has the potential to impact the community due to drawdown. Some developments proposed for the Peninsula involve groundwater abstraction, and have potential for saltwater intrusion, interface up-coning and subsequent impacts to groundwater dependent ecosystems. Groundwater contamination due to pollution events or runoff from industrial, agricultural or residential areas can also create impacts to vine thickets as a result of unacceptable water quality. There is restricted opportunity for water abstraction in areas where the vine thicket community occurs (DWER 2017). Specific management considerations will be required where abstraction proposals do occur within these areas.
- The impact from feral animals is likely to continue with increasing population and visitation.

32 c. Identify whether the threat only affects certain portions or occurrences. Give Details.

The threats associated with direct human impacts as listed above are more likely to impact on those occurrences that are close to developed/populated areas.

33. Identify any natural catastrophic event/s

Explain its likely impact and indicate the likelihood of it occurring (e.g. a drought/fire in the area every 100 years). Catastrophic events are those with a low predictability that are likely to severely affect the ecological community.

The incidence of more frequent and intense fires is likely. Major fires can occur any time and have potential for major impacts to the structure of the community, increasing weed invasion.

34. Additional biological characteristics

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.

34 a. How does it respond to disturbance?

The frequent intense fires threaten the integrity of the vine thickets through impacting on species diversity, encouraging weed invasion and encroachment of Pindan vegetation. Recovery of the vine thicket assemblages following fire is likely to be slow as many species are fire-sensitive and much of the soil seedbank is likely to be destroyed by fire (Environs Kimberley 2010). Re-emergence of vine thicket vegetation into the surrounding woodlands only occurring where areas have been subject to much less frequent fire.

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

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Research in the Northern Territory indicates that monsoon vine thicket species re-colonize areas that remain unburnt for long periods. The reinvasion process in vine thickets is generally concentrated around existing savannah trees due to the deposition of seeds by roosting bats and birds (Fensham and Butler 2004).

Threat Abatement and Recovery

35. Identify key management documentation available for the ecological community, e.g. recovery plans, biodiversity management programmes, or site specific management plans (e.g. for a reserve).

Department of Biodiversity, Conservation and Attractions (2018). Interim Recovery Plan 2018-2023 for the Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula. Interim Recovery Plan No. 383. DBCA, Perth.

Department of the Environment, Water, Heritage and the Arts ((DEWHA) 2013). Approved Conservation Advice for the Monsoon vine thickets on the coastal dunes of the Dampier Peninsula. URL: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/105-conservation-advice.pdf accessed December 2019.

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

Regulations that control land clearing under the WA *Environmental Protection Act 1986* and the *Environment Protection and Biodiversity Conservation Act 1999* have reduced land clearing.

Key measures required to mitigate risks to the ecological community include:

- Through the WEED Project (Weed Education Eradication Delivery), coordinated by Environs Kimberley working in partnership with DBCA, on-ground actions were undertaken by Aboriginal Ranger Groups, including Bardi Jawi Rangers, the Society for Kimberley Indigenous Plants and Animals (SKIPA) and Environs Kimberley staff, and facilitated by the Kimberley Land Council. Weeds were surveyed in 11 occurrences and follow up weed control activities undertaken at 7 occurrences. The project resulted in community-driven momentum for the protection and management of vine thickets and weed management, awareness raising, production of community information materials and propagation of native plants for restoration (Environs Kimberley 2009).
- As part of the Commonwealth-funded Resource Condition Monitoring Project in 2008-2009, two monitoring protocols were developed which provide information and procedures for monitoring the effectiveness of weed control and information and procedures for monitoring the extent of occurrences of the vine thickets (Harding 2009).
- Rubibi Aboriginal Land, Heritage and Development Council commissioned a comprehensive survey and report on the environmental weeds of Minyirr Coastal Park (Black *et al*. 2010). Activities included weed removal.
- SKIPA, DBCA and Yawuru rangers have an ongoing program of revegetation and rehabilitation works in Minyirr Park, including weed control, upgrading walk trails and fire planning.
- Survey was undertaken by DBCA staff, volunteers from Broome Botanical Society, Aboriginal Ranger groups and Environs Kimberley in 2010 and 2015 to collect updated information about boundaries, composition, threats, and current on-ground management by Traditional Owners. Data collected has been added to DBCA community database.
- Environs Kimberley undertook a major vine thicket conservation project from 2009 to 2013. The WKNP, funded through Caring for our Country via Rangelands NRM WA, supported the Bardi Jawi and Nyul Nyul Rangers undertook weed control, fire management and protection and access management in the habitat of the vine thickets. Some traditional knowledge was recorded and developed into management signs and materials and a community publication 'Plant Stories' was produced.
- Fisher Research consultancy undertook research to identify biological indicators and design monitoring protocols to assess vine thicket health, including research into the impacts of fire, fire history and vegetation cover change within the vine thicket community (Beames 2013).

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- Kimberley Nature Project (KNP) involves continuing to work with ranger groups to manage weeds, fire, feral fauna and rare fauna, in addition to managing and further documenting the vine thickets. The project brings together traditional ecological knowledge, scientific monitoring, and management of natural and cultural areas.
- Environs Kimberley and Biodiversity, Conservation and Attractions Yaruwu rangers surveyed and mapped a series of new occurrences of vine thickets in 2013. The project included prioritising management works and coordinating fee-for-service burning and weeding work with other planned activities.
- Environs Kimberley and Bardi Jawi Oorany rangers undertake seed collection and propagation activities.
- A vine thicket plant identification resource that can be adapted for different language groups and regions is currently being developed by Environs Kimberley, SKIPA and ranger groups.
- Eleven Green Army projects partnered with Aboriginal groups, were funded in 2015 to improve the management and protection of vine thickets.
- A West Kimberley Threatened Flora and Ecological Communities Recovery Team was established in February 2016 and coordinates recovery activities for the vine thickets.
- There is substantial ongoing project work on managing the community by Environs Kimberley and Traditional Owners.

37. What portion of the current extent of the ecological community is protected in a reserve set aside for conservation purposes, and what proportions are private land, or other tenure? Give details including the name of the reserves, and the extent the ecological community is protected within these reserves.

Of the area of the community mapped on the community database (note that some tenure categories overlap) (from DBCA 2018):

About 1,147ha (~40%) occurs on Indigenous managed lands

About 159ha (~5%) occurs on pastoral stations (note: some pastoral stations are also managed by Indigenous groups)

About 1,028ha (~36%) occurs on Unallocated Crown Lands (UCL) – unspecified land managers/usage.

About 264 ha (~9%) occurs on land vested with the Shire of Broome

About 302ha (~11%) occurs on private freehold land

About 0.8ha (~0.03%) occurs on road reserves.

About 6% of the total area occurs in a reserve managed for conservation in Minyirr Coastal Park in the town of Broome.

37 a. Which of the reserves are actively managed?
Note which, if any, reserves have management plans and if they are being implemented.

- Through the WEED Project (Weed Education Eradication Delivery), coordinated by Environs Kimberley working in partnership with DBCA, on-ground actions were undertaken by Aboriginal Ranger Groups, including Bardi Jawi Rangers, the Society for Kimberley Indigenous Plants and Animals (SKIPA) and Environs Kimberley staff, and facilitated by the Kimberley Land Council. Weeds were surveyed in 11 occurrences and follow up weed control activities undertaken at 7 occurrences. The project resulted in community-driven momentum for the protection and management of vine thickets and weed management, awareness raising, production of community information materials and propagation of native plants for restoration (Environs Kimberley 2009).
- Rubibi Aboriginal Land, Heritage and Development Council commissioned a comprehensive survey and report on the environmental weeds and weed removal (Black *et al*. 2010).
- SKIPA, DBCA and Yawuru rangers have an ongoing program of revegetation and rehabilitation works in Minyirr Coastal Park, including weed control, upgrading walk trails and fire planning.

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- Environs Kimberley undertook a major vine thicket conservation project from 2009 to 2013. The WKNP, funded through Caring for our Country via Rangelands NRM WA, supported the Bardi Jawi and Nyul Nyul Rangers undertook weed control, fire management and protection and access management in the habitat of the vine thickets. Some traditional knowledge was recorded and developed into management signs and materials and a community publication 'Plant Stories' was produced.
- Kimberley Nature Project (KNP) involves continuing to work with ranger groups to manage weeds, fire, feral fauna and rare fauna, in addition to managing and further documenting the vine thickets. The project brings together traditional ecological knowledge, scientific monitoring, and management of natural and cultural areas.
- Environs Kimberley and Biodiversity, Conservation and Attractions Yaruwu rangers surveyed and mapped a series of new occurrences of vine thickets in 2013. The project included prioritising management works and coordinating fee-for-service burning and weeding work with other planned activities.
- Environs Kimberley and Bardi Jawi Oorany rangers undertake seed collection and propagation activities.
- A vine thicket plant identification resource that can be adapted for different language groups and regions is currently being developed by Environs Kimberley, SKIPA and ranger groups.
- Eleven Green Army projects partnered with Aboriginal groups, were funded in 2015 to improve the management and protection of vine thickets.
- There is ongoing project work on managing the community by DBCA and Traditional Owners in Minyirr Park

37 b. Give details of any other forms of protection, such as conservation covenants, and whether the protection mechanisms are permanent.

37. Indigenous interests
Is the nominated ecological community or parts thereof known to occur on any culturally significant sites? If so comment on any issues with respect to aboriginal interests, in particular with regard to management of the ecological community.

Many vine thicket occurrences contain sites that are of Aboriginal significance and many are also managed by Indigenous people. The vine thicket community provides seasonal fruits, yams, carving timber and other valuable resources for Aboriginal people on the Dampier Peninsula. For example, *Gyrocarpus americanus* can be used to make shields and *Cassytha* species were used for fishing nets and shoes.

There are a number of Aboriginal small business operations that include harvesting of some bush fruits and medicines for use in saleable products, for example Gubinge, a species often occurring on the edge of vine thickets is harvested by a number of Aboriginal owned and operated businesses for sale in the food, nutritional and cosmetic industries. It is important that any commercial harvesting strikes a balance with allowing emerging sustainable economies to be further developed while also ensuring the ecosystem is not compromised by unsustainable levels of harvest (DBCA 2018).

An Aboriginal Sites Register, kept by the Department of Planning, Lands and Heritage (DPLH), lists 53 sites of Aboriginal significance occurring within or adjacent occurrences of the monsoon vine thickets community (DBCA 2018).

37 a. Native Title
Do Native Title or Indigenous Protected Areas apply to any parts of the community? If so comment on any issues with respect to exclusive possession and rights to plants and animals, in particular with regard to management of the ecological community.

Many occurrences of vine thickets are on land subject to native title and managed by Aboriginal groups, and the involvement of Aboriginal people in the planning and management for the vine thickets is crucial. Many of the vine thicket areas are also located in significant law grounds.

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An IPA has been established with Bardi Jawi Traditional Owners on the northern Dampier Peninsula.

39. 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).

DBCA (2018) lists the following major actions:

- Complete on ground surveys of occurrences
- Identify and implement appropriate fire regime
- Monitor and control weeds
- Report and control high threat weeds
- Investigate hydrological processes
- Protect critical habitats and species
- Monitor and manage feral and exotic animals

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

Management of the monsoon vine thickets community is coordinated through Environs Kimberley, DBCA and the West Kimberley Recovery Team.

41. Describe methods for identifying the ecological community including when to conduct surveys.

For example, 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.

Surveys for the monsoon vine thickets should be conducted in both the wet and dry seasons to determine the full suite of native species present. The following should be recorded to identify the community:

- Landform, rock type, soil type and colour, drainage
- Vegetation classification, flora species (as compared to McKenzie *et al*. 1991)
- Condition including vegetation structure in relation to tree size, number of large mature trees especially fruit bearing trees, canopy cover and health and the depth of leaf litter. Condition classes will also need to incorporate the fire history and the abundance of major weed species.

A flora species list should be compared against that provided in The Kimberley Rainforests Australia survey (McKenzie *et al*. 1991).

Data collected should include that outlined on a Report Form located on the web (refer https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/forms/TEC_Occurrence_Report_Form_v6_July2013.pdf).

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

No

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Section 3 - Justification for this nomination

In order for the nomination to be considered further, one or preferably more of the following criteria need 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'. The type of data available will determine which criteria will be used to justify the application of a listing category.
At least one criterion must trigger the thresholds of a listing category as indicated in the Attachment. Criteria may be of different levels of listing category e.g. Criterion 1 = CR and Criterion 3 = VU.

43. Provide data that demonstrates why the ecological community meets at least one of the following criteria for the nominated listing category.

Please use data provided in previous sections to demonstrate how it specifically meets at least one of the following criteria. Advice on how to interpret the listing criteria is in Attachment A. Provide a response for every sub-criterion.

Criterion A: Reduction in geographic distribution.

Criterion A	
☐ CR ☐ EN ☐ VU ☒ not eligible	☐ **A1** ☐ **A2a** ☐ **A2b** ☐ **A3**

Justification for assessment under Criterion A:

For criteria A, the ecosystem was assumed to collapse when the mapped distribution declines to zero.

The extent of the vine thickets community is estimated to have declined by of <40% occurring since ~1750. Black *et al.* (2010) estimated that approximately 5% of the vine thickets had been cleared in the previous 20 years (DBCA 2018). This level of decline does not meet the minimum ≥30% decline threshold in geographic distribution over any 50-year time period or ≥50% decline since 1750 to meet vulnerable under Criterion A.

Does not meet Criterion A.

Criterion B: Restricted geographic distribution.

Criterion B	
☐ CR ☒ EN ☐ VU ☐ not eligible	☒ **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)

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Justification for assessment under Criterion B:

For criteria B, the ecosystem was assumed to collapse when the mapped distribution declines to zero.

B1: The extent of a minimum convex polygon enclosing the monsoon vine thickets community is 8,381km^2 (≤20,000km^2, which is less than the threshold for EN). There is also evidence of continuing decline in the community from increased intensity and frequency of fire, weed invasion, and inferred from future changes to the hydrological regime. The status under criterion B1 is Endangered.
B2: The monsoon vine thickets community is estimated to occupy 25 10 × 10km square grid cells (threshold for VU is ≤50 grid squares, for EN is ≤20 and for CR is ≤2 grid cells). As for criterion B1, there is continuing decline in the community from increased fire and weeds, and inferred from changes to the hydrological regime. The status under criterion B2 is Vulnerable.

a): Remote sensing data from 1991 to 2012 indicates 20% of the area of the vine thickets has experienced declining cover as a result of fire (Fisher *et al.* 2013; DBCA 2018). These data provide an appropriate measure of disruption to abiotic interactions. Meets EN B1aii.

b): Decline observed from continuing decline in the community from increased fire intensity and frequency and weed invasion; and inferred from future changes to the hydrological regime within the next 20 years. Meets criteria for Endangered B1b.
c) Ecosystem exists at approximately 25 threat-defined locations based on the distance between the groups of occurrences and presence of intact vegetation between them (threshold for CR is one, for EN is five, and for VU is 10 threat-defined locations). Does not meet B1c or B2c.

B3: The monsoon vine thickets community is dependent on certain biotic and abiotic conditions. Therefore, the effects of human activities or stochastic events may cause the ecosystem to collapse within a very short period of time, given its highly restricted distribution, and ongoing threats from fire, weed invasion and hydrological changes. The ecosystem is known from 25 locations however, and therefore does not meet vulnerable status under criterion B3.

Meets criteria EN B1a(ii),b; VU B2a,b

Criterion C: Environmental degradation based on change in an abiotic variable.

Criterion C	
☐ CR ☐ EN ☐ VU ☒ not eligible	☐ **C1** ☐ **C2** ☐ **C3**

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Justification for assessment under Criterion C:

C1,2: Intense or too frequent fire is a significant abiotic variable affecting the community. For criterion C, collapse of the community is defined as too frequent or intense fires regimes. Collapse in this context is fire regimes that cause total loss of cover of fire sensitive species.

Remote sensing data from 1991 to 2012 indicates 20% of the area of the vine thickets experienced declining vegetation cover as a result of fire (Fisher *et al.* 2013; DBCA 2018). There are no appropriate data to link this decline in cover to species composition to determine the loss of fire sensitive taxa. Regardless of this, the measured level of decline and extent of environmental degradation does not meet the minimum thresholds for proportion of the extent (≥30%) or proportional severity (≥30%) over any 50-year period, to meet VU under this criterion.

C3: With evidence that indicates 20% of the area of the community experiencing declining cover as a result of fire in a 21 year period, the community does not meet the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since 1750, to meet VU under this criterion. As for C1,C2, there are no available data to link this decline to species composition to determine the loss of fire sensitive taxa.

Inadequate data to indicate if community meets criterion C

Criterion D: Disruption of biotic processes or interactions based on change in a biotic variable.

Criterion D	
☐ CR ☐ EN ☐ VU ☒ not eligible	☐ **D1** ☐ **D2** ☐ **D3**

Justification for assessment under Criterion D:

D1, D2, D3:

Weed invasion is a significant biotic variable affecting 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.

There are inadequate systematic monitoring data to indicate if the community meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of weed invasion (≥30%) over any 50-year period, or proportion of the extent (≥50%) or proportional severity of weed invasion (≥50%) since 1750 to meet VU under criterion D.

Inadequate data to determine if the community meets criterion D

Criterion E: Quantitative analysis that estimates the probability of ecosystem collapse.

Criterion E	
☐ CR ☐ EN ☐ VU ☒ not eligible	

Justification for assessment under Criterion E:

The ecosystem could not be assessed under Criterion E as there were no quantitative estimates of the risk of ecosystem collapse.

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Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	-	• Does not meet criterion
A2a	-	• Does not meet criterion
A2b	-	• Does not meet criterion
A3	-	• Does not meet criterion
B1a	EN	• EOO is ≤20,000km^2 • (ii) declining vegetation cover as a consequence of inappropriate fire regimes is a measure of disruption to abiotic interactions • Meets EN
B1b	EN	• EOO is ≤20,000km^2 • Continuing declines within the next 20 years likely from observed increased fire intensity and frequency, and weed invasion, and inferred from future changes to the hydrologic regime • Meets EN
B1c	-	• EOO is ≤20,000km^2 • Ecosystem exists at 25 threat-defined locations • Does not meet criterion
B2a	VU	• AOO is 25 grid cells • Declining vegetation cover as a consequence of fire is an observed measure of disruption to abiotic interactions • Meets VU
B2b	VU	• AOO is 25 grid cells • Observed continuing decline likely within the next 20 years from increased fire intensity or frequency, and weed invasion; and inferred from future changes to the hydrological regime • Meets VU
B2c	-	• AOO is 25 grid cells • Ecosystem exists at 25 threat-defined locations • Does not meet criterion
B3	-	• Known from 25 threat-defined locations • Does not meet criterion for VU
C1	-	• Inadequate data to indicate if community meets criterion
C2	-	• Inadequate data to indicate if community meets criterion
C3	-	• Inadequate data to indicate if community meets criterion
D1	-	• Inadequate data to determine if the community meets the minimum thresholds for proportion of the extent (≥30%) and proportional severity of disruption of biotic processes (≥30%) over past 50 years to meet VU.
D2	-	• Inadequate data to determine if the community meets the minimum thresholds for proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) over any 50-year period to meet VU.
D3	-	• Inadequate data to determine if the community meets the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of biotic processes (≥50%) since 1750 to meet VU.
E	NA	• No quantitative estimates of the risk of ecosystem collapse.

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		Meets EN under B1a(ii),b; VU under B2a,b *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 EN B1a(ii),b**

Section 4 – References/Standard of Scientific Evidence/Critical habitat

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.

Bach, C. and Price O. (1999) Fruit resources, frugivore movements and landscape scale conservation in monsoon rainforests of northern Australia, In: Gorman, J., Pethram and Vigilante, T. 12th Annual conference of the Australasian Wildlife Management Society, Darwin, 1-3 Dec 1999.

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Beames, L. (2013) Valuable & Endangered. Working Together to Understand and Manage Threats to Monsoon Vine Thickets of the Dampier Peninsula. A Summary of Key Findings. Environs Kimberley, West Kimberley Nature Project 2011-2013.

Black, S.J., Willing, T. and Dureau, D.M. (2010) A comprehensive survey of the flora, extent and condition of vine thickets on coastal sand dunes of Dampier Peninsula, West Kimberley 2000-2002. Final report September 2010. Broome Botanical Society (Inc.). Broome, Western Australia.

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Department of Water and Environmental Regulation (2017) Groundwater-dependent ecosystems of the Dampier Peninsula. Royalties for Regions groundwater investigation. Environmental water report series Report no. 29. August 2017.

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Government of Western Australia (2000) Bush Forever. Department of Environmental Protection, Perth.

Harding, C. (2009) Monitoring of the extent of Dampier Peninsula Vine Thickets Threatened Ecological Community. Version 1.0 (June 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project.

Harding, C., McGilvray, A., and Beames, L. (2009) Monitoring the Effectiveness of Weed Control in Dampier Peninsula Vine Thickets Threatened Ecological Community. Version 1.0 (October 2009). Prepared for Significant Native Species and Ecological Communities – Resource Condition Monitoring Project.

Keighery, B.J. (1994) Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of Western Australia (Inc.), Nedlands, Western Australia.

Kenneally, K. F., Choules Edinger, D., Willing, T. (1996) *Broome and Beyond. Plants and People of the Dampier Peninsula, Kimberley, Western Australia.* Department of Conservation and Land Management.

Kenneally, K.F., Keighery, G.J. and Hyland, B.P.M (1991) Floristics and phytogeography of Kimberley rainforests, Western Australia. Chapter 6 in *Kimberley Rainforests Australia*, edited by McKenzie, N.L., Johnston, R.B., and Kendrick, P.G. Surrey Beatty & Sons in Association with the Department of Conservation and Land Management and Department of Arts, Heritage and Environment. Chipping Norton, NSW.

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Palmer, C., Price, O., and Bach, C. (2000) Foraging ecology of the black flying fox (*Pteropus alecto*) in the seasonal tropics of the Northern Territory, Australia, *Wildlife Research* Vol 27. Pg 169-178.

Van Dongen, R. and Huntley, B. (2017) Monsoon Vine Thicket – remote sensing analysis. Department of Biodiversity, Conservation and Attractions.

Vogwill, R.I.J, (2003) Hydrogeology and Aspects of the Environmental Geology of the Broome Area Western Australia, PhD Thesis, Curtin University, Western Australia.

Wilson, S. and Swan, G. (2008) *A Complete Guide to Reptiles of Australia*. Second Edition. New Holland Publishers (Australia) Pty Ltd. Sydney, Australia.

45. Statement on the Standard of Scientific Evidence

Published data on the monsoon vine thickets community was sufficient to apply the Red List of Ecosystem criteria, although there are likely to be inaccuracies in various aspects of the assessment. However, the outcomes of the assessment are robust.

46. Has this document been reviewed and/or have relevant experts been consulted?
If so, indicate by whom and provide their contact details.

Val English, Principal Ecologist, DBCA Species and Communities Program, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983; p: (08) 9219 9154; Email: val.english@dbca.wa.gov.au.

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Nicole Godfrey, Operations Officer, DBCA West Kimberley District; Parks and Wildlife Service; 111 Herbert St, (PO Box 65), Broome WA 6725; P: (08) 9195 5535; email: nicole.godfrey@dbca.wa.gov.au Bruce Greatwich, Acting Nature Conservation Coordinator, DBCA West Kimberley District; Parks and Wildlife Service; 111 Herbert St, (PO Box 65), Broome WA 6725; P: (08) 9195 5548; email: bruce.greatwich@dbca.wa.gov.au
47. Do you wish to propose any areas of habitat for consideration as Critical Habitat for the nominated community? If so, refer to Ministerial Guideline No 5 and attached a separate nomination proposal addressing the matters required under that guideline. Indicate location/s including a map, and attached shapefiles.
No

Section 5 - Nominator Details & Declaration

48. Contact Details

Note: Nominator details are subject to the provision of the *Privacy Act 1988*

Title/Full Name	[redacted]
Organisation or Company name	Department of Biodiversity, Conservation and Attractions
Postal address	17 Dick Perry Avenue, Kensington Post: Locked Bag 104, Bentley Delivery Centre, WA 6983.
Email	[redacted]dbca.wa.gov.au
Phone	9219[redacted]
Fax	

49. Declaration

Signature (Or insert electronic signature)	***I declare that the information in this nomination form and any attachments is true and correct to the best of my knowledge.***
Date signed	

Section 6 – Completed nomination form checklist

Please check all items on this list have been completed or are included with your nomination.

- ☐ I have read and applied the further information and guidelines for completing this nomination form in Attachment A
- ☐ 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:

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- ☐ 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

How to lodge your nomination

Completed nominations may be lodged either:

1. by email to: **communities.data@dbca.wa.gov.au**

If submitting by email, please also mail hard copies of attachments that cannot be emailed.

OR

2. by mail to: Species and Communities Branch
Department of Biodiversity, Conservation and Attractions, WA Government
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

If submitting by mail, please include an electronic copy on memory stick or CD.

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Appendix 1. Monsoon vine thickets community (red)