Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Section 1 – Eligibility for Listing		
1. Name of the ecological community		
Assemblages of Theda Soak rainforest swamp		
2. Listing Category for which the ecological community is nominated		
	Current ranking under WA Minister ESA list in policy	EPBC Act (wholly or as a component)
Current listing category (Please check box)	☐ Critically endangered ☐ Endangered ☒ Vulnerable ☐ Priority 1-4 ☐ Data Deficient ☐ None – not listed	Name: ☐ Critically endangered ☐ Endangered ☐ Vulnerable ☒ None – not listed
	Recommended ranking under BC Act IUCN assessment	
Proposed listing category (Please check box)	☐ 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	

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?

Assemblages of Theda Soak rainforest swamp (also known as Theda soak)

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

The community was originally described in McKenzie *et al*. (1991) in the Kimberley Rainforest Survey.

The community was recognised and endorsed as a vulnerable TEC by the WA Minister for Environment in 2001 but was ranked as VU using ranking criteria developed in WA, that differ from those 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 occurrence of the Theda Soak rainforest swamp community occurs 20km southeast of an occurrence of Kimberley Vegetation Association 807 ecological community, listed as priority 3 in WA:

The description of that community is 'grasslands, tall bunch grass savanna sparse low tree; acacia over grass on black soil'.

Description

6. List the main features that distinguish this ecological community from all other ecological communities.

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

The Theda Soak rainforest swamp community can be distinguished from other rainforest assemblages through its species composition including perennial plants, birds and land snails; and physical attributes such as climate, lithology, geomorphic setting, soil and geographic location. The assemblage grouping is described by McKenzie *et al*. (1991) as a small patch of rainforest around a spring-fed soak on a floodplain, 0.5km from a tributary of the Morgan River. The camaenid land snail assemblages in rainforest communities of the Kimberley Region can be used to distinguish this patch from similar rainforest communities elsewhere in northern Australia (Solem 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 Theda Soak rainforest swamp community comprises a patch of rainforest around a spring-fed soak (Theda Soak) on a floodplain in the east Kimberley. Trees grow to 20 m high and include *Albizia lebbeck* (lebbek tree), *Antidesma ghaesembilla* (yangu), *Bombax ceiba* (kapok-tree), *Garuga floribunda*, *Glochidion disparipes* (cheese tree), *Ficus aculeata* (sandpaper fig), *Ficus racemosa* var. *racemosa* (cluster fig tree), *Litsea glutinosa*, *Melaleuca leucadendra* (weeping paperbark), *Sesbania formosa* (white dragon tree), *Sterculia quadrifida* (orange-fruited kurrajong), *Syzygium nervosum* (Daly River satinash) and *Terminalia microcarpa* (damson plum). The camaenid land snail assemblage can be used to distinguish this assemblage from similar rainforest assemblages elsewhere in northern Australia.

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 Theda Soak rainforest swamp community is situated in the North Kimberley bioregion on a moderate slope. The lithology of the site is Quaternary alluvium and the subsurface soil is very dark grey sandy loam. Leaf litter depth was recorded as 10cm (McKenzie *et al*. 1991).

The climate for the Kimberley is described as tropical with warm winters and hot, humid summers. In summer (December to February), the average maximum temperature is 34.3°C with an average minimum temperature of 24.6°C. In winter (June to August), the average maximum temperature is 32.5°C with an average minimum temperature of 14.3°C (from 1998 to 2019; data obtained from Bureau of Meteorology website: http://www.bom.gov.au/climate/averages/tables/cw_001019.shtml; [redacted] 001019; 56km to the

southeast). The mean yearly rainfall is 1,282mm (from 1966 to 2018), with the majority occurring during cyclone season from October to April (data obtained from [redacted] 001010, ~8km to the west).

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

The Theda Soak rainforest swamp community contains a discrete patch of rainforest occurring around a spring-fed soak, on a floodplain. The community is likely to be supported by specific hydrological conditions including sustained upwelling of groundwater.

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.

No

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 Sacred Kingfisher (*Todiramphus sanctus*) was recorded by Johnstone and Burbidge (1991) at the Theda Soak rainforest swamp community and is listed as a marine species under s248 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Most of the seven species of camaenid land snails recorded in the Kimberley Rainforest Survey are restricted endemics in the Kimberley. The median linear range for a wet area Kimberley camaenid is 20km, and 82 of the 93 camaenids were only collected in one to five patches (Solem 1991).

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

Johnstone, R.E. and Burbidge, A.H. (1991) The Avifauna of Kimberley rainforests. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

McKenzie, N.L. (1991) An ecological survey of tropical rainforests in Western Australia: background and methods. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

McKenzie, N.L., Belbin, L., Keighery, G.J. and Kenneally, K.F. (1991) Kimberley rainforest communities: Patterns of species composition and Holocene biogeography. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

Solem, A. (1991) Land snails of Kimberley rainforest patches and biogeography of all Kimberley land snails. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

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 known occurrence of the community is ~800m across and is 0.5 km from a tributary of the Morgan River in the east Kimberley. The number of patches and the area occupied by rainforest in the Kimberley Region was estimated by McKenzie *et al*. (1991) using Thematic Mapper data from the Landsat satellite, field evaluation, low-level aerial inspections and aerial photography.

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)? 6ha

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)

The community is considered to occupy its former range as there is no evidence of decline.

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?

Climate change trends from National Climate Change Adaptation Research Facility (NCCARF) website (accessed 2019) are likely to result in changes in the hydrological regime from a decline in rainfall, as well as more extreme fire behaviour, the result of higher temperatures and a greater number of severe fire danger days. Severe fire behaviours can result in weeds invading into the edges of swamps, and drying and loss of wetland adapted flora on the extremities.

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 Theda Soak rainforest swamp community was mapped using ArcGIS© and a range of data sources including quadrat and survey data; on ground survey; aerial photography; and topographic maps. There is only one location of this ecological community, covering 6 hectares.

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.

NA as only one location.

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.

NA

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

This refers to native species that are critically important in the processes that sustain or play a major role in the ecological community and whose removal has the potential to precipitate change in community structure or function sufficient to undermine the overall 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 impacts of cattle, introduction of weeds, severe or too frequent fires, and hydrological changes.

18 a. If yes, which species are affected?

All native flora species are affected by weeds. Fire will affect flora that are fire sensitive. Cattle have trampled mound spring vegetation and introduced nutrients and weed seed.

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

Cattle, weed invasion, too frequent or severe fire, and hydrological change may impact on the soak resulting in changes to species composition and increased drying of the occurrence.

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 community is generally a rainforest on a spring-fed soak on a floodplain. When in good condition the community contains well developed vegetation and relatively rich flora and fauna.

A condition class can be applied to the community as a whole based on:

- Prevalence of weed taxa
- Evidence of cattle and pig damage
- Persistence of previously recorded natural strata of vegetation
- Persistence of previously recorded flora and fauna taxa
- Evidence of hydrological changes.

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).

A broad scale ecological survey was undertaken of the Kimberley rainforests by the department from 1987 to 1989. Information was collected on compositional patterns of biota, disturbance and physical characteristics of the environment. Results provided information on soil and landform, invertebrate fauna, floristics, vegetation structure and spatial distribution of about 1,500 rainforest patches scattered across 170,000km^2 (McKenzie 1991).

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.

The boundary of the occurrence of the community is considered to be adequately defined.

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

The rainforest survey undertaken from 1987 to 1989 by McKenzie *et al*. provided information on condition and threats of the occurrence of the community, established permanent quadrats to record flora and vegetation, an inventory of aquatic invertebrates and water chemistry and soils, and an updated boundary. This information can be used as a baseline for future monitoring and procedures for monitoring. No follow-up monitoring has been completed to date.

Condition Classes and Thresholds

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

The Committee recognises that ecological communities can exist in various condition states. In reaching its decision the Committee uses condition classes and/or thresholds to determine the patches that are included or excluded from the listed ecological community (see the Guidelines for details of the process of determining condition classes). Relevant here is recognition of different states following disturbance and the natural recovery of the occurrence towards a higher condition class.

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. impacts from cattle such as grazing and trampling, partial clearing, 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. This community is known from a

single 6 ha patch and is buffered by the surrounding intact vegetation. 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?

For the purposes of relating condition to IUCN Criteria, good condition related to WA condition categories 'Very Good to Pristine' as below (see ^ below in Table 2) are considered to be in good condition, so therefore 6ha or 100% of the community was considered to be in good condition when last surveyed in 1999, and contains high native flora and fauna species diversity, maintain integrity of vegetation structure, and minimal weed/introduced species cover. The community requires management to protect from pressures such as trampling and grazing by cattle and pigs, spread of introduced species, inappropriate fire regimes, and hydrological changes.

Table 2: Vegetation condition of Theda Soak rainforest swamp community in 1999

Occurrence number (portion of occurrence estimated as percentage in brackets)	**Total area (ha)***	**Condition when last surveyed**
0	0	^^^Poor ('degraded', 'completely degraded' using Bush Forever (2000) scale)
0	0	^^Medium ('good' using Bush Forever (2000) scale)
1 (100%)	±6	^Good ('pristine', 'excellent', 'very good' using Bush Forever (2000) scale)

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 grazing, inappropriate fire regimes, hydrological changes, and 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?

For the purposes of relating condition to IUCN Criteria, medium condition relates to WA condition categories 'Very Good to Good' as below (see ^^below and Table 2 above), so therefore none of the community was considered to be in medium condition when last surveyed in 1999, 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 grazing, trampling, inappropriate fire regimes, partial clearing, hydrological changes are present, 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 poor condition, i.e. unlikely to be recoverable with active management?

For the purposes of relating condition to IUCN Criteria, poor condition in this instance relates to WA condition categories 'Degraded' and 'Completely Degraded', (see ^^^below and Table 2 above), so therefore none of the community was considered to be in poor condition when last surveyed in 1999, 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 grazing, trampling, inappropriate fire regimes, partial clearing, hydrological changes 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*.

A past threat to the community includes grazing and trampling by introduced herbivores which was an actual threat.

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

Current threats include grazing and trampling by introduced herbivores (cattle, pigs - actual), severe or too frequent fire (potential), spread of introduced flora (potential) and hydrological change (potential).

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

Future threats include grazing and trampling by introduced herbivores (actual), increased fire (potential), spread of introduced flora (potential) and hydrological change (potential). A potential future threat to the community is a drying climate.

For each threat describe:

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

Introduced herbivores

The main threats to the community that were reported in the late 1980s were widespread and severe impacts of cattle. The patch has since been fenced to exclude cattle. When the site was revisited in 1999, parts of the fence were damaged, and some impacts of cattle were evident. In 2019, with support from State Natural Resource Management, the Theda pastoral leasee completed a replacement and expansion of the stock exclusion fencing surrounding this site. The protected area was increased in size from approximately 1.5ha to approximately 17ha, taking in a second rainforest patch as well as a much larger buffer area around the two patches.

Feral pigs are present throughout the area and cause physical damage to the vegetation and associated wetland through trampling; as well as grazing the vegetation, altering the species composition by selectively removing edible species, and opening of the vegetation canopy. This can lead to grass and/or weed invasion and increase susceptibility to fire damage. In addition to physical disturbance, faeces of cattle contaminate the soil and water, particularly in open water, causing nutrient enrichment. This may enhance the introduction of weeds as well as elevate nutrient levels in the groundwater.

Weed invasion

Weeds displace native plants and compete with them for light, nutrients and water. Weeds can also prevent recruitment, cause changes to soil nutrients, and affect abundance of native fauna. They can also impact on other conservation values by harbouring pests and diseases and increasing the fire risk. Past disturbance from cattle may have increased the density of weeds in the area.

Hydrological changes

The community is dependent on a constant supply of fresh groundwater (spring-fed soak). However, there is no information available about the aquifer that supports the ecosystem, or about the ecological water requirements. If groundwater abstraction proposals occur in close proximity to Theda Soak, specific management considerations will be required.

Inappropriate fire regimes

In the Kimberley Region and across northern Australia, inappropriate fire regimes pose a significant threat to biodiversity. Fire management regimes have changed since settlement from small scale, patchy burning by Aboriginal people, that resulted in small scale mosaics of burnt and unburnt vegetation. This provided buffers against unplanned bushfires. More recent fire regimes include recurring extensive and intense fire patterns in the mid to late dry season (Carwardine *et al*. 2011; Rangelands NRM 2011).

Rainforests are particularly vulnerable to and degraded by intense fires late in the dry season. An increase in the fire severity and frequency within the community has the potential to alter structure and composition, and increase weed invasion. In the absence of appropriate management, the impacts of fire are likely to increase as the region is predicted to become more fire prone with a warming climate (CSIRO and BOM 2015).

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

- Fence maintenance will be required to limit impacts of cattle and pigs.
- Intense or too frequent fires are likely to will continue to impact on species diversity and encourage weed invasion.
- Fence maintenance will be required to limit potential for pig and cattle damage.
- Increasing future abstraction of groundwater for domestic and industrial use has the potential to impact the community due to groundwater drawdown.
- Higher temperatures are likely to result in increased fire intensity and frequency in the region.
- The tolerance of particular species to changes that may occur in association with changes in rainfall and temperatures is generally unknown. Climate change predictions for northern WA are as follows (from NCCARF website: https://www.nccarf.edu.au/sites/default/files/attached_files_publications/PDF%20Report%20Card%20Low%20Res.pdf); accessed June 2019):
    - Rainfall will reduce slightly in the Kimberley by 2030, compared to 1975-2007 baseline.
    - Changes to vegetation composition may occur due to a change in surface water runoff from a slight decline in rainfall, as well as more extreme fire behaviour, the result of higher temperatures and a greater number of severe fire danger days.

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

The threats listed above are likely to impact on the single known occurrence.

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, with declines in fire intolerant taxa. Fire can also facilitate increased weed invasion if weed propagules are present.

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.

344 a. How does it respond to disturbance?

Intense and too frequent fires have potential for major impacts to the structure of the community. Small scale, patchy burning that results in small scale mosaics of burnt and unburnt vegetation are desirable.

Physical disturbance, such as from grazing and trampling by cattle and pigs, can alter the flora composition of the community by selectively removing edible species, as well as resulting in physical damage.

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

Not known

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).

There is no management documentation available for the community.

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.

- The occurrence of Theda Soak rainforest swamp community was originally fenced by the pastoralist utilising funds provided by DBCA as a part of the Kimberley Science and Conservation Strategy.
- In 2019 a replacement and expansion of the stock exclusion fencing was completed using funding provided through a Natural Resource Management 2018 Community Stewardship Grant. The project resulted in an expansion of the fence from 4.2 ha to 22 ha, the area protected in 2 cattle exclusion fences, and a third rainforest site added to those currently protected. The project engaged the Wungurr Rangers to assist in the work.
- (see figure 1 below).

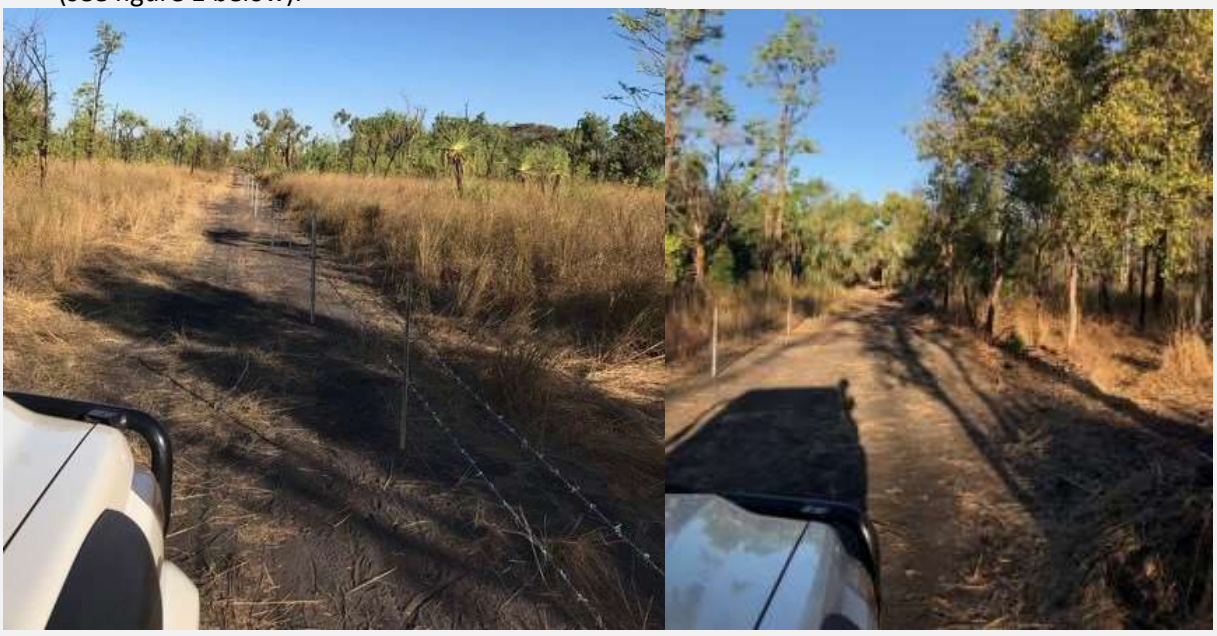

Figure 1. New boundary fence erected in 2019. Photos by [redacted] (pastoralist [redacted]).

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.

All of the community occurs within Theda pastoral lease (LPL N050561). None of the community is reserved for conservation.

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

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

None

378 c. 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.

There are no culturally significant sites that intersect with the community. The Traditional Owners are Wilawila.

378 d. 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.

A Native Title Claim was registered with the Native Title Tribunal in 2004 by [redacted] (refer [redacted]).

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).

- Ongoing inspection and repair of fences to exclude cattle and pigs;
- Monitoring for pig presence and impact with management actions taken if present (eg trapping, shooting);
- Protect from too frequent and intense fires through a prescribed early dry season burning program;
- Map significant weed/s and control/eradicate them;
- Design and implement a project to determine the hydrological drivers of the spring-fed ecosystems. The information should then be employed as a guide to management of abstraction; and
- Design and implement a monitoring program that utilises established quadrats. This should be designed to provide information about the success of land management in the sensitive environment of the mound spring ecosystem.

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

No

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.

The following methods describe surveys of vegetation and molluscs as outlined in McKenzie (1991):

Surveys were undertaken in June and again in late January/early March for a wet season comparison (to include species that only occur during the wet season). Physical and biological data were recorded including a detailed geomorphic appraisal, soil profile description made along topographically representative transects and the selection of typical soil profiles for laboratory analysis; flora (including the establishment and initial sampling of a series of long-term monitoring quadrats along a transect) and fauna.

Difficulties arose due to the remote scattered locations, with the area dominated by rugged sandstone topography, and few tracks that were passable during the wet season. Limitations occurred in sampling

techniques which were aggravated by staff and time limitations, the cost of sampling (use of a helicopter was required) meant that only a few hours could be spent at each location (McKenzie 1991).

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

No

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 and B, the ecosystem is assumed to collapse when the mapped distribution declines to zero.

There is no evidence of decline in the geographic distribution of Theda Soak rainforest swamp community.

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)

Justification for assessment under Criterion B:

B1: The extent of a minimum convex polygon enclosing the Theda Soak rainforest swamp community is 0.06km^2 (≤2,000km^2, which is less than the threshold for CR).
B2: The Theda Soak rainforest swamp community is estimated to occupy one 10 × 10km square grid cell (threshold for EN is 20 and for CR is two grid cells).
a): Inadequate data are available to measure decline in spatial extent, environmental quality or disruption to biotic interactions to support ranking under B1 or B2a.
b): Historically, decline was observed from the impact of cattle. Since the boundary fence was upgraded in 2019, the threat from cattle is minimal. The condition of the community is unknown as access is difficult. Current potential threats are likely damage by feral pigs, late season intense fire, weed invasion and inferred future changes to the hydrological regime associated with groundwater abstraction. The impacts of these threats are thought to currently be 'trivial'.
c): Ecosystem exists at one threat-defined location based on the number of locations and the threat from cattle (threshold for CR is one and for EN is five 'threat-defined locations' ie *a geographically or ecologically distinct area in which a single threatening event can rapidly affect all occurrences of an ecosystem type*).
B3: Known from one threat-defined location and prone to impacts intense and too frequent fires, cattle and pig damage, and potential future changes to hydrology. Community is considered prone to effects of human activities or stochastic events within a very short time period in an uncertain future and thus capable of collapse or becoming CR within a very short time period (meets VU as <5 threat defied locations).

Although plausibly meets criteria for Critically Endangered, recommend rank of Vulnerable B3 due to a likely current relatively trivial level of threat from introduced herbivores and other issues.

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

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

Justification for assessment under Criterion C:

C1, C2: Inappropriate fire regimes are a significant abiotic variable that threatens the community. Collapse in this context is loss of all overstorey components (trees) as a consequence of an inappropriate fire regime (generally, too frequent late season severe fires). 100% of the area of the community was in excellent condition when last surveyed in 1999.

No available data support an inference that 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: Does not meet the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since European settlement (1750) to meet VU.

No available evidence indicates 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: The most significant biotic variable affecting the community is considered to be physical impacts of grazing and trampling by invasive herbivores (pigs and cattle). Collapse under criterion D is defined as a decline in vegetation condition to totally degraded (Bush Forever scales, ie beyond recovery) as a consequence of grazing and trampling by introduced herbivores. It is estimated that 100% of the community however was in excellent condition in 1999.

There is no evidence to indicate the community meets the minimum thresholds for vulnerable rank under criterion D1, D2: ie 30% of the extent of the community affected to at least 30% severity over any 50-year period.

D3: No available evidence indicates the community meets the minimum proportion of the extent (≥50%) or proportional severity of disruption of biotic processes (≥50%) since 1750.

No available evidence indicates 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 community could not be assessed under Criterion E as there were no quantitative estimates of the risk of ecosystem collapse.

Summary assessment against IUCN RLE Criteria

Criterion	Rank indicated	Overall conclusion
A1	-	• Available data do not indicate community meets criterion
A2a	-	• Available data do not indicate community meets criterion
A2b	-	• Available data do not indicate community meets criterion
A3	-	• Available data do not indicate community meets criterion
B1a	-	• EOO is ≤2,000km^2 • NO available data indicate decline in spatial extent, environmental quality or disruption to biotic interactions that would meet minimum thresholds of the criterion (VU) • Does not meet criterion
B1b	-	• EOO is ≤2,000km^2 • Impacts observed from introduced herbivores, weed invasion, late season fire; and inferred future changes to hydrology considered 'trivial' • Does not meet CR B1b, as overall threats are thought to be 'trivial'
B1c	-	• EOO is ≤2,000km^2 • Ecosystem exists at one threat-defined location based on single known occurrence • Does not meet CR B1c, as overall threats are thought to be 'trivial'
B2a	-	• AOO is one grid cell • No data available that indicate decline in spatial extent, environmental quality and disruption to biotic interactions that meets minimum thresholds of the criterion (VU) • Does not meet criterion
B2b	-	• AOO is one grid cell

		• Threat from feral cattle and pigs, weed invasion, late season fire, and inferred future changes to hydrology are considered 'trivial' • AOO indicative of rank CR however does not meet B2b, as overall level of threat is thought to be 'trivial'
B2c	-	• AOO is one grid cell • Ecosystem exists at one threat-defined location based on one known occurrence • Does not meet CR B1b, as overall threats are considered 'trivial'
B3	VU	• Known from one threat-defined location • Prone to the impacts of introduced herbivores, frequent fire and future changes in hydrology, within a short time period in an uncertain future • Meets criterion for VU
C1	-	• Does not meet the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over past 50 years to meet VU
C2	-	• Does not meet the minimum thresholds for proportion of the extent (≥30%) or proportional severity of degradation (≥30%) over any 50-year period to meet VU.
C3	-	• Does not meet the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of abiotic processes (≥50%) since European settlement (1750) to meet VU
D1	-	• Does not meet the minimum thresholds for proportion of the extent (≥30%) or proportional severity of disruption of biotic processes (≥30%) over past 50 years to meet VU
D2	-	• Does not meet 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	-	• Does not meet the minimum thresholds for proportion of the extent (≥50%) or proportional severity of disruption of biotic processes (≥50%) since European settlement (1750) to meet VU
E	NA	• No quantitative estimates of the risk of ecosystem collapse
		Meets VU under B3

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.

Carwardine, J., O'Connor, J.T., Legge, S., Mackey, B., Possingham, H. and Martin, T. (2011). Priority threat management to protect Kimberley wildlife. CSIRO Ecosystem Sciences, Brisbane.

CSIRO and Bureau of Meteorology (2015). Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report, CSIRO and Bureau of Meteorology, Australia.

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

Johnstone, R.E. and Burbidge, A.H. (1991). The Avifauna of Kimberley rainforests. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

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.

McKenzie, N.L. (1991). An ecological survey of tropical rainforests in Western Australia: background and methods. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

McKenzie, N.L., Belbin, L., Keighery, G.J. and Kenneally, K.F. (1991). Kimberley rainforest communities: Patterns of species composition and Holocene biogeography. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

Rangeland NRM Western Australia (2011). The Kimberley Project Group 2009−2011. Caring for Our Country.

Solem, A. (1991). Land snails of Kimberley rainforest patches and biogeography of all Kimberley land snails. In: Kimberley Rainforests of Australia. McKenzie, N.L., Johnston, R.B. and Kendrick, P.G. (eds). Surrey Beatty and Sons, Norton, NSW.

45. Statement on the Standard of Scientific Evidence

There are few current data available about the status of the community to apply ranking criteria due to remoteness and access difficulties. Improved data from more regular monitoring of the assemblage and hydrological status are required to verify status of condition and threats. Ranking should be reviewed when new data become available.

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

The document was reviewed by the following people:

Nature Conservation Coordinator, DBCA East Kimberley District; Parks and Wildlife Service;

Principal Ecologist, DBCA Species and Communities Program

Regional Leader Nature Conservation, DBCA East Kimberley District; Parks and Wildlife Service

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]
Phone	[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:

- ☐ 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.

Appendix 1. Theda Soak rainforest swamp community (red)