Assessing Threatened Species in Queensland

A Practical Manual

Version 2.0

Queensland Government

Prepared by: Queensland Herbarium and Biodiversity Science, Department of Environment and Science

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November 2022

Cover image: Capella potato bush (*Solanum orgadophilum*), a Queensland endemic plant listed as Critically Endangered. Photo credit: Teghan Collingwood.

Contents

List of Figures

List of tables

1 Introduction

1.1 Listing and changing the conservation status of Queensland species

All plant and vertebrate species native to Queensland (excluding most fish which are managed under the Queensland *Fisheries Act 1994*) are protected under the *Nature Conservation Act 1992* (*NC Act*). These taxa are assigned into various wildlife classes depending on their conservation status. Plants and vertebrates (excluding fish) are assigned a status of 'Least Concern', unless they have been assessed as eligible for a different conservation class. A plant under the *NC Act* means any member of the plant or fungus kingdom. Fish and invertebrate taxa are only protected under the *NC Act* if they have been separately listed under a wildlife class. The Department of Environment and Science (the Department) coordinates the process for species to be assessed and listed (or delisted) as under the *NC Act.*

The Species Technical Committee (STC) undertakes the expert assessment of species listing nominations. Any subspecies, variety, race, hybrid, mutation or geographically separate population (hereafter 'species/taxon') can be nominated. Nominations can be prepared and submitted internally by State government scientists, or externally by members of the public. Assessments can also be forwarded by other State/Territory or Federal jurisdictions responsible for listing species that occur in Queensland. The STC make recommendations to the Minister for the Environment and the Great Barrier Reef and Minister for Science and Youth Affairs (the Minister) to list or change the wildlife class of a species. Once this has been approved, the species' updated class is then amended in the *Nature Conservation (Plants) Regulation 2020* or the *Nature Conservation (Animals) Regulation 2020*.

1.2 Common Assessment Method (CAM)

The Queensland Government is working with the Commonwealth and other Australian State and Territory governments to implement the Intergovernmental Memorandum of Understanding – Agreement on a Common Assessment Method (CAM) for listing of threatened species and threatened ecological communities. The CAM assessment process is based on the International Union for the Conservation of Nature (IUCN) Red List categories and criteria. The CAM aims to provide a consistent approach to assessing and listing threatened species across Australian jurisdictions at the national scale, by reducing duplication of effort through the principle of Mutual Recognition and providing a single operational list of threatened taxa for each jurisdiction.

Under CAM, all species nominations made to the STC must comply with the IUCN categories and criteria. In August 2020, the wildlife classes under the *NC Act* were amended to facilitate alignment between with the IUCN categories and criteria so that the CAM could be implemented. Species may now be listed in Queensland as Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC). The CR, EN and VU categories are considered 'threatened'.

The IUCN does not have specific thresholds for NT. Rather, species can be considered NT where they "*do not qualify as threatened now, but may be close to qualifying as threatened, and to taxa that do not currently meet the criteria for a threatened category, but are likely to do so if ongoing conservation actions abate or cease*". In Queensland, the nomination form provides quantitative guidelines for each criterion to assist in delineating between the VU, NT and LC categories.

1.3 Using this manual

This manual is intended to be used alongside the *Nomination to change the conservation status of a species under the Queensland Nature Conservation Act 1992* form. The form is designed for use with taxa endemic to Queensland and is available for download here.

Each section in this manual aligns with those in the nomination form. This should allow assessors to work sequentially through the nomination form, using the manual as a guide for each section.

2 Collate background information

Start the assessment process by collating the relevant background information required to complete the nomination form.

- Assessors should bookmark relevant important links for quick access:
    - GeoCat
    - Queensland Globe
    - Australasian Virtual Herbarium (AVH)
    - WildNet
- Create a folder labelled with the taxon name to save all relevant data and materials. This folder can then be easily shared with experts when reviewing the nomination, or other colleagues who may be assessing similar taxa.
- Download the nomination form and save it into the taxon folder.

2.1 Taxonomic information

- *Check the current name of the taxon.* Taxon names can change with taxonomic revisions and may differ between jurisdictions. Ensure you are using the current name for completing an assessment in Queensland.
- *For listing under the NC Act,* current names are derived from the Census of Queensland Plants (Brown 2021) and any updated names in HERBRECS (DES internal database) for plants, and the names maintained in WildNet for fauna.
- *For CAM-compliant listings*, current names should be obtained from the Australian National Species List (which has multiple indices):
    - For plants, use the Australian Plant Name Index (APNI). The name currently accepted in the Australian Plant Census (APC) will be indicated by a 'red tick' (Figure 1).
    - For animals, use the Australian Faunal Directory (AFD; Figure 2).
- During this step, note any recent synonyms that may be useful to include in the literature review (see Literature Review, pg. 14).
- Where the current name differs between the two abovementioned sources, be sure to explain this in the Taxonomy section of the nomination form (see Taxonomy, pg.15).
- *Identify and save the taxonomic authority reference paper*. This is the paper where the taxon has been described.
- For plants, the reference for this should be listed in your APNI search (Figure 1). Most taxonomic descriptions are published in the Queensland Herbarium's journal – *Austrobaileya,* which is freely available online (see Key Resources, p. 65).
- Where the original taxonomic paper is historic, it may be appropriate to refer to a contemporary description the taxon. For fauna, edited field guides/reference texts such as *Reptiles and Amphibians of Australia* (Cogger 2018) may be suitable. For flora, a contemporary description may be found in the *Flora of Australia.* Note that the botanical/scientific name will retain the authority of the original taxon author.

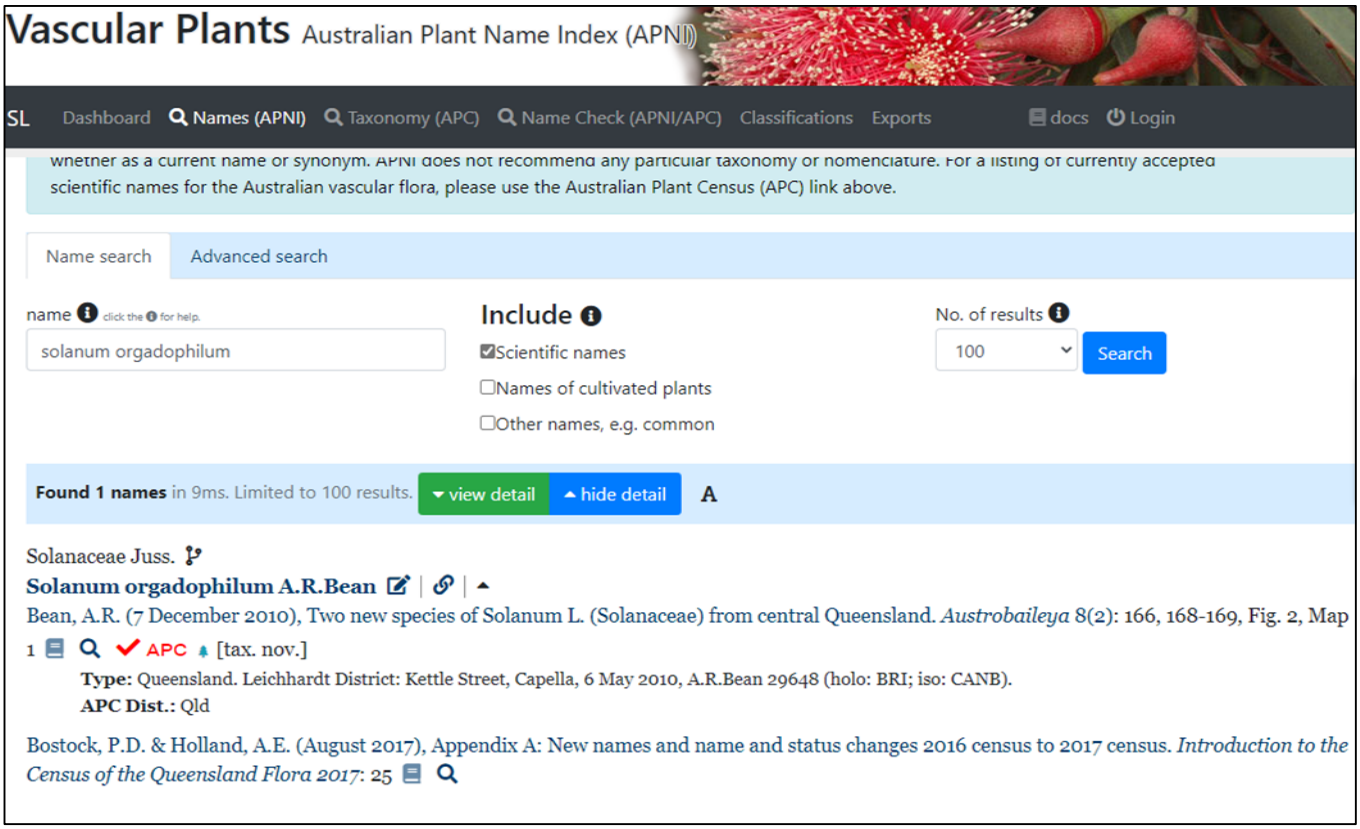

Figure 1. Screenshot of the Australian Plant Name Index, showing a search for *Solanum orgadophilum*. The red text indicates the currently accepted taxonomy.

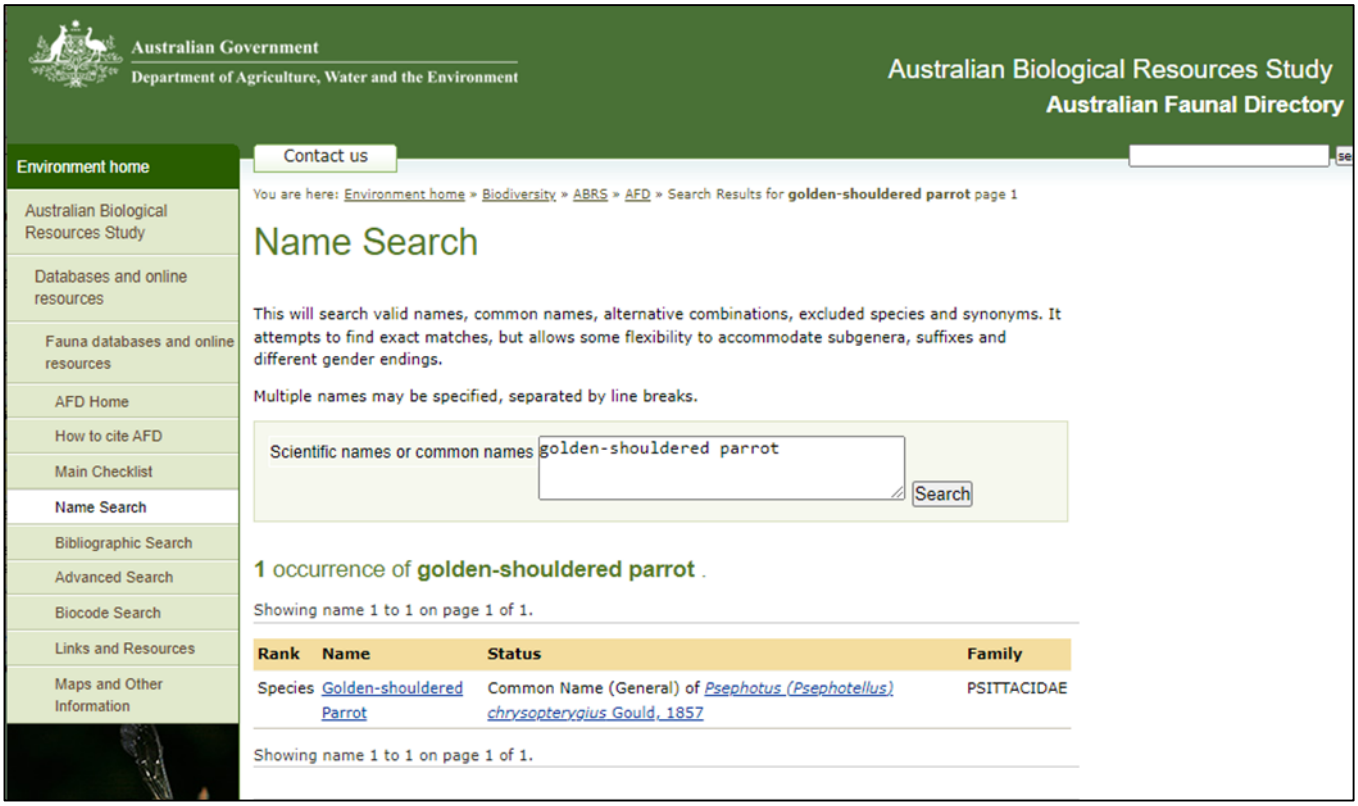

Figure 2. Screenshot of the Australian Faunal Directory, showing currently accepted taxonomy for the Golden-shouldered parrot (*Psephotus chrysopterygius*).

2.2 Distribution information

Information on where a taxon occurs is used to calculate key assessment parameters as part of the nomination. This data can come from a variety of different sources. The most reputable sources are verified or "vouchered" specimen records. Records associated with other surveys may also provide important information, as do personal communications in certain instances.

Note that some taxa have confidential records. If you are preparing a nomination for a taxon that has confidential records, assessors will need to seek guidance from someone with appropriate authority on permission to view/use these. A list of confidential (sensitive) records can be found here.

2.2.1 Flora occurrence records

There are three key sources of flora occurrence records used in Queensland flora nominations. These are the Queensland Herbarium (BRI) records, the Australasian Virtual Herbarium, and the Queensland Biodiversity and Ecology Information System (QBEIS, formerly CORVEG). The following section explains how to access these records.

2.2.1.1 Qld Herbarium (BRI) records

The most reliable source of occurrence records for Queensland endemic flora is the Qld Herbarium BRI records. These records will need to be requested from the herbarium, and in some cases may be confidential. Where possible, assessors should ensure these will have been reviewed and 'cleaned' by an herbarium expert.

2.2.1.2 Australasian Virtual Herbarium

Where access to Qld Herbarium records is not available or you are completing a nomination for a taxon that occurs outside of Queensland, you can retrieve records from AVH. It can also be useful to download these records to supplement the Queensland Herbarium (BRI) records, as in some cases other herbaria will hold collections of Queensland endemic taxa. For example, the Australian Tropical Herbarium (CNS) may hold additional specimen-backed records for taxa endemic to northern Queensland.

To download records from AVH:

- In "simple search" type the taxon name and select "download" (Figure 3).
- Follow the prompts to "login" to the Atlas of Living Australia.
- Select "occurrence records".
- Rename the "File name" with a date and the taxon name (i.e. YYYYMMDD_Genus-species-subspecies)
- Select "Full Darwin Core" for the download format.
- Select .csv as the output file format.
- In Step 2, select conservation management/planning for the industry/application.
- A link to the folder will be provided via email.
- Download the folder, "unzip it" by right clicking it and selecting "extract all". Save the unzipped folder in your taxon folder.

2.2.1.3 Queensland Biodiversity and Ecology Information System (QBEIS)

For some Qld flora, additional records will be available within state site monitoring datasets – QBEIS/CORVEG. As these records are not backed by a specimen (but are field observations) it is particularly important they are spatially reviewed, with any outliers investigated prior to inclusion in a nomination.:

- QBEIS records are available here.
- Add to cart and follow the prompts (Figure 4).
- Alternatively, ask your manager directly to provide this.

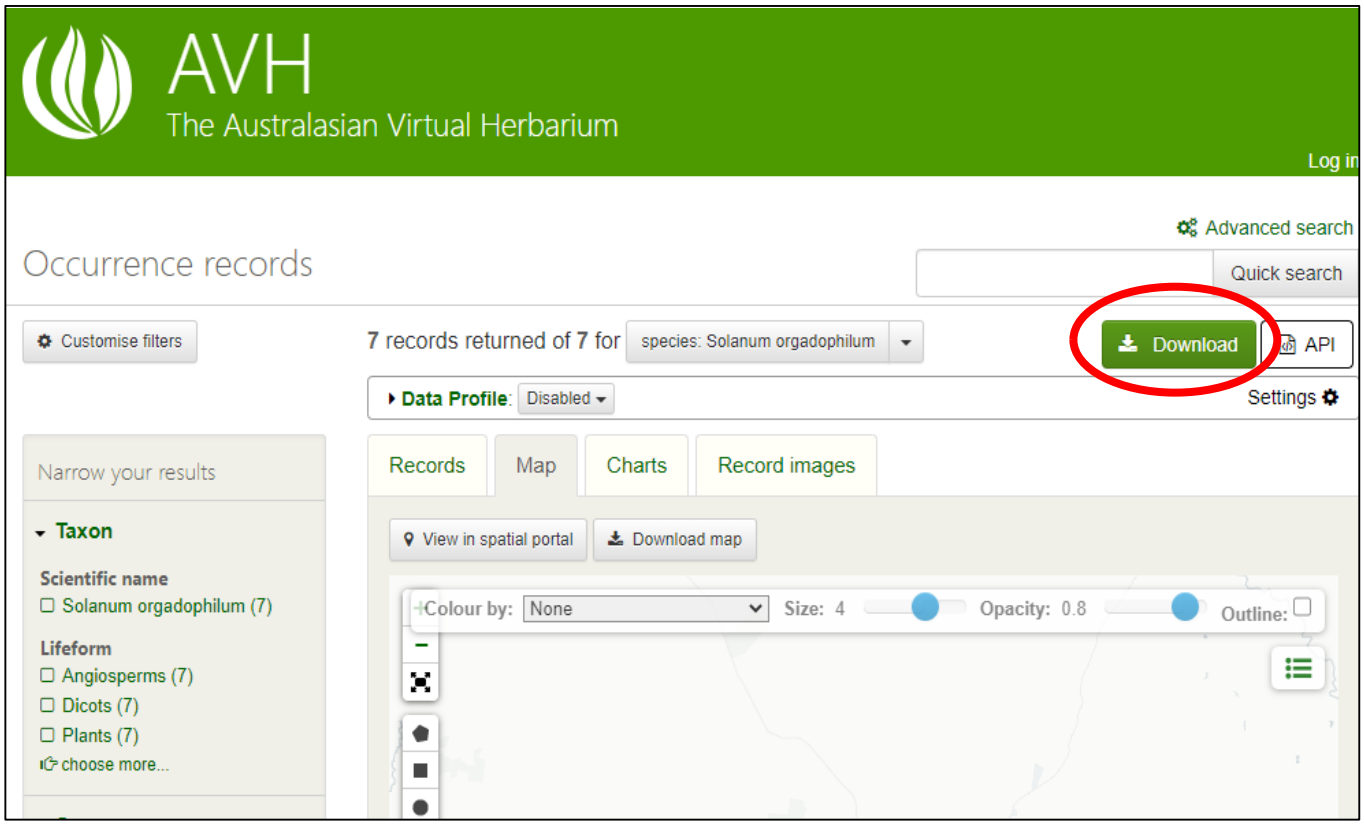

Figure 3. Screenshot of the AVH website interface, showing the 'download' button (red ellipse).

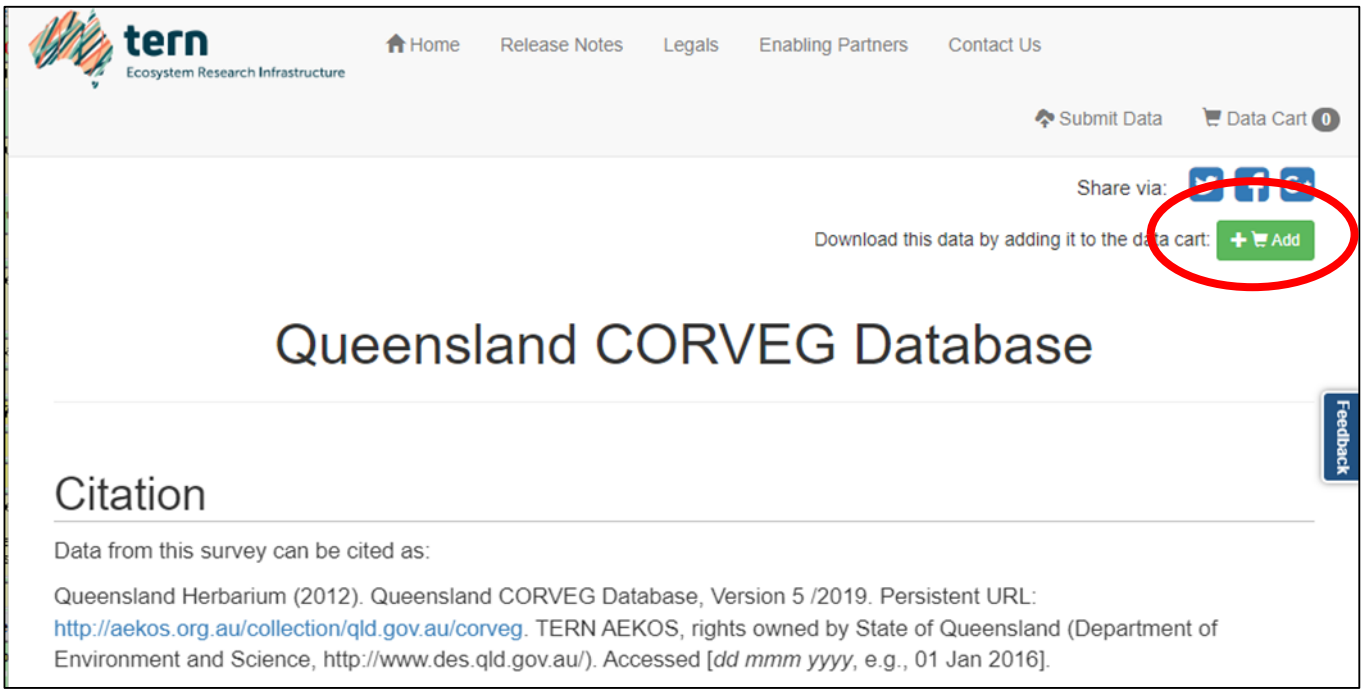

Figure 4. Screenshot of web page to download data from the Queensland CORVEG (now QBEIS) database. Assessors should 'add' the Queensland CORVEG Database to the data cart (red ellipse) and follow the prompts to download.

2.2.2 Fauna occurrence records

2.2.2.1 WildNet records

For taxa endemic to Qld, fauna records should be obtained from the WildNet Database.

- Go to WildNet – Species profile search https://apps.des.qld.gov.au/species-search/
- Enter the taxon name and search, click the species profile from the search results
- Check the taxonomy is correct (that you have the right name) (Figure 5; Figure 6).

Then, download the list of records as a .csv (Figure 5; Figure 6).

2.2.3 Other occurrence record sources

In many cases, it is appropriate to contact experts to obtain additional taxon records. If experts can provide additional records, it is important that assessors review these to check for significant outliers. Inclusion of records that are not specimen-backed should be clearly stated and justified in the distribution section. Inclusion could potentially be justified on the basis of a high-quality photograph of the taxon that clearly shows its distinguishing features.

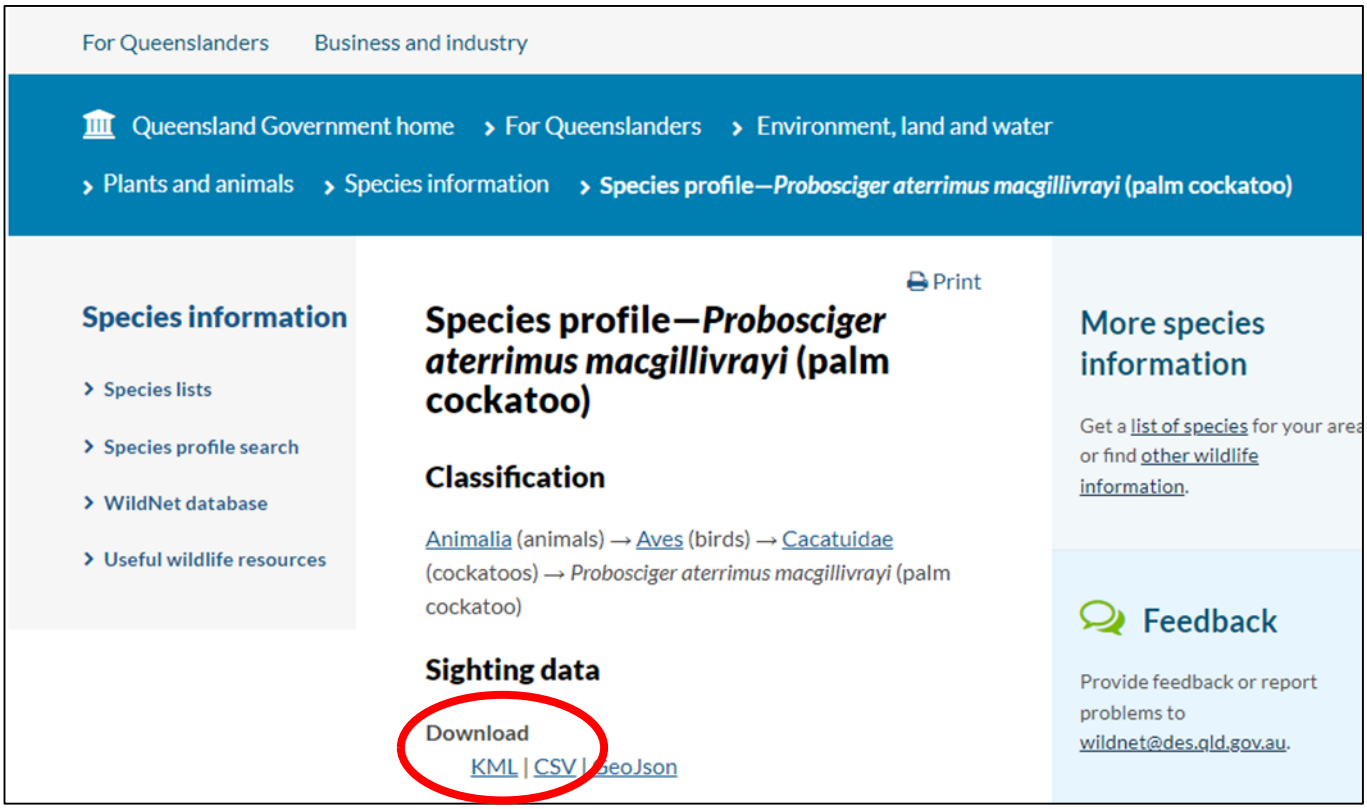

Figure 5. Screenshot of Species profile (WildNet) webpage, showing download button for WildNet records.

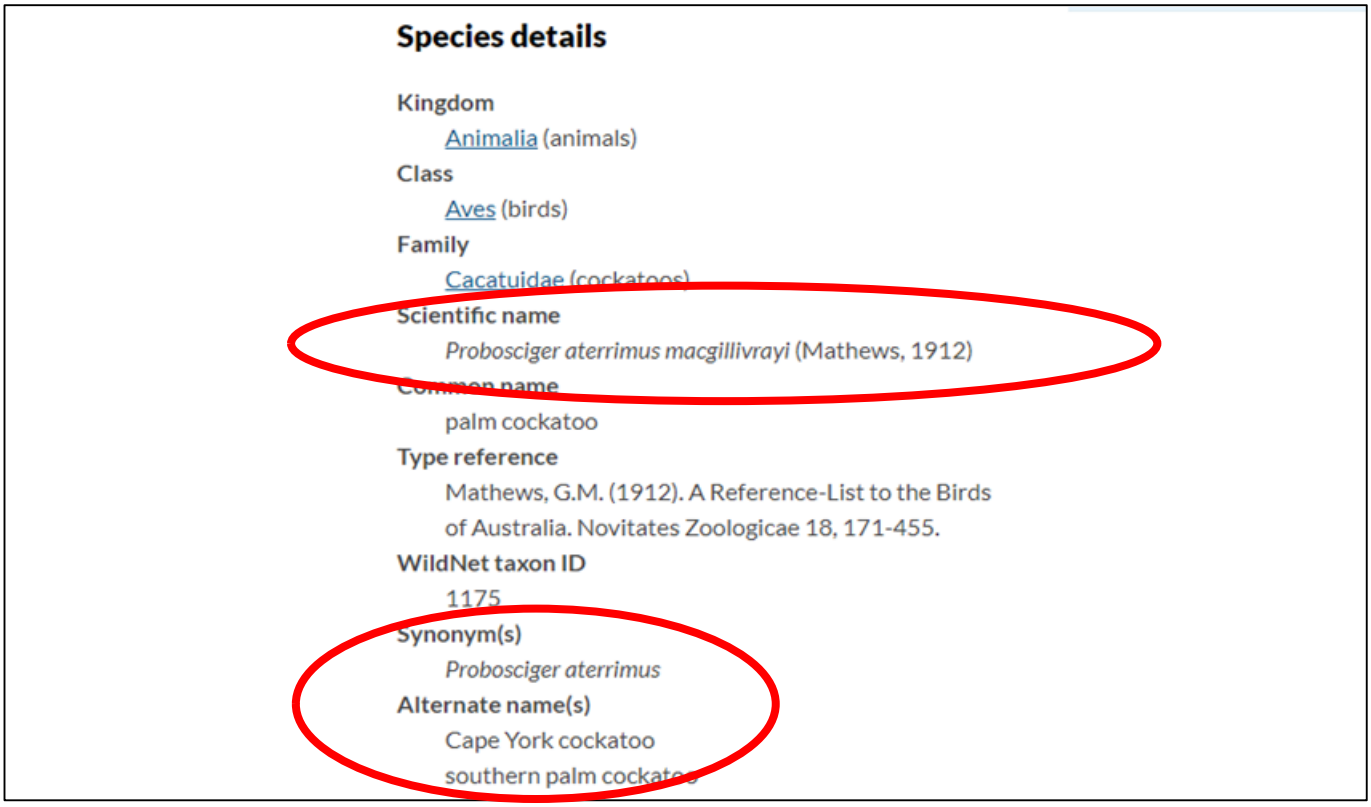

Figure 6. Screenshot of Species profile (WildNet) webpage, showing the accepted Scientific name and author, synonyms and alternate (common) names (red circles) for a fauna species.

2.2.4 Data cleaning

Occurrence data for your taxon will be presented in a spreadsheet format. To ensure this data is fit-for-purpose it will need to be 'cleaned'. Follow these steps to clean your occurrence data:

- Check your spreadsheet(s) refers to the correct taxon
- Delete any unnecessary columns.
- Ensure the columns containing the latitude and longitude in decimal degrees are renamed as "Latitude" and "Longitude" so they can be imported into GeoCat and Queensland Globe.
- For AVH flora records, remove duplicate records by checking the "recordNumber" column for repeated values. Remember to always retain the BRI records.
- Check the precision of the occurrence records (in AVH this will be labelled "coordinateUncertainty"). Generally, any records with precision of >2000 km should be reviewed for accuracy. Any records with poor precision, where the locality description does not match the actual GPS location should either be moved in consultation with the relevant expert. Where records cannot be verified, consider deleting any that have a precision of >10 000 km.
- If you can improve the precision of any records, provide this information to the relevant authority (i.e., your manager, who can ensure the data curator is notified.
- Ensure the final file is saved in a .csv format for use in GeoCat and Qld Globe.

It can be helpful to rearrange your headings as follows:

scientificName	catalogNumber	recordNumber	recordedBy	Date	Latitude	Longitude	elevationMin/Max

→

coordinateUncertaintyInMeters	reproductiveCondition	occurrenceNotes	Habitat	Locality

The column headings will differ depending on the data source. An example of cleaned specimen records is provided in Appendix 1).

2.3 Literature review

Undertake a literature review for the taxon. Save any information you can find on the taxon into the taxon folder. Peer-reviewed publications on the taxon or its genus are especially valuable. If information is scarce, information on related taxa may be particularly relevant. Some sources of literature to consider:

- The original taxon nomination form (if the taxon is currently listed as threatened). You may need to ask your manager to access this for you.
- The taxonomic paper where the taxon was described.
- Peer-reviewed journal articles (Google Scholar or similar) related to the taxonomy, biology and ecology of the taxon or the genus more broadly.
- Textbooks
- Field guides
- Management Plans for conservation areas where the taxon occurs.
- The SPRAT database if the taxon is already listed at the Federal level.
- Grey literature sources from local governments/councils/NRM groups.

Familiarise yourself with the content of the literature you have found. Start to think about how it might relate to each of the nomination form sections.

3 Completing the nomination form

This section explains the level of detail required for each of the nomination form sections. Each heading below corresponds to a section in the nomination form. These are presented sequentially as per the nomination form.

3.1 Details of the nominated species

3.1.1 Scientific name of species

CAM-compliant assessments can include all native organisms within the taxonomic units of species, subspecies and varieties. Populations that have been defined as 'distinct' from the larger population based on geographic distribution, and either genetics, phylogeny, morphology, ecology, physiology, behaviour or ecosystem role may also be assessed under the provisions of the MOU.

The taxonomic authority is The Australian National Species List (auNSL), which includes naming indexes for vascular plants, bryophytes, lichen, fungi and algae. The Australian Faunal Directory (AFD) is also included within auNSL and should be used for all fauna taxa except where the State agrees on an updated taxonomy and nomenclature based on the latest scientific evidence. If the taxon is not conventionally accepted assessors will need to provide either:

- a taxonomic description of the species in a form suitable for publication in conventional scientific literature, OR
- evidence that a scientific institution has a specimen of the taxon, and a written statement signed by a person who is a taxonomist and has relevant expertise (has worked with or is a published author on the group of species nominated) that the taxon is a new entity.

In the designated text box, enter the following information for the taxon:

- Enter the full scientific name followed by the taxon author (Box 1).
- The taxon author can be found in the relevant taxonomic database (see previous step) and in your description paper/book.

Box 1. Example of text format for the Scientific name of species in the nomination form.

Solanum orgadophilum A.R.Bean

3.1.2 Common name

Enter frequently used common names for the taxon (Box 2). Note that the Queensland Herbarium does not capitalise common names, unless they form part of a common noun. For example, "Capella potato bush". Assessors may include any published Indigenous names, if they are from a reputable source, preferably connected to the Traditional Custodians. For example, a bush-tucker book authored by the relevant Traditional Custodians.

Box 2. Example of text format for the Common name in the nomination form.

Capella potato bush

3.1.3 Taxonomy

- Write the Family and Order for animals, and the Family for plants.
- Include the full reference for the taxonomic description for the scientific name of the taxon (Box 3).
- List any synonyms you have identified. These may be in the taxonomic description or in the relevant Australian National Species List index (i.e., APNI or AFI), identified by the label *'syn'.*
- Include details of hybridisation. These may be included in the taxon description, or in other literature. You may need to return to this section after completing the Biology/ecology section, which involves a broader review of literature for the taxon.
- If you have been able to complete the previous steps, then select the "yes" check box for conventionally accepted taxonomy.

Box 3. Example of text format for the Taxonomy section in the nomination form*.

Solanaceae
Bean, AR (2010). Two new species of Solanum L. (Solanaceae) from central Queensland. *Austrobaileya* 8(2), 165-170.

*Excerpt adapted from Collingwood T.D. (2021). Nomination to change the conservation class of *Solanum orgadophilum* under the Queensland Nature Conservation Act 1992. Queensland Department of Environment and Science.

NB: If you notice any contention about the taxon name, or description whilst filling out this section of your form, it may indicate some taxonomic uncertainty. Taxonomy greatly influences the listing outcome for a taxon. Therefore, we will often consider 'dubious' taxa as 'data deficient' because we do not understand whether they are species, or part of a broader, more widespread group of taxa. If you find evidence to suggest the species may not be taxonomically sound, it is important to seek expert guidance to determine whether to progress the species assessment, or whether it should be considered Data Deficient until more appropriate evidence is available. Check in with your manager or relevant expert for support.

3.1.4 Description

Present the description in three paragraphs as set out in the example below (Box 4).

- First, provide a full description, as a direct excerpt from your taxonomic description. Ensure it is in inverted commas, italicised and referenced.
- Then, if available (either in the taxonomic paper or other relevant online/in print field guide), provide a summarised description. This should be a summary of the key descriptive features in layman's terms provided in the taxonomic treatment. *Assessors should not attempt to write this unless they are experienced in taxonomic terms.*
- Finally, clearly state the closely related taxa, and how the taxon being assessed is differentiated from these taxa. This is often stated in the taxonomic description. If it was described some time ago, check for updated information by reviewing descriptions from closely related taxa.

Box 4. Example text for the Description section of the nomination form*. There should be three key paragraphs: the full description, a short description and an overview of distinguishing features.

Full description (as in Bean 2010): "*Erect herbaceous resprouter, 0.2-0.4 m high. Adult branchlets white, grey or brown; prickles 1-5 per decimeter, straight, acicular, 1-3.5 mm long, 5-8 times longer than wide, glabrous or with scattered stellate hairs on lower half; stellate hairs dense or very dense, 0.4-0.7 mm diameter, stalks 0-0.15 mm long; lateral rays 7-8, porrect, central ray 0.3-1.3 times as long as laterals, not gland-tipped; type 2 hairs absent. Adult leaves ovate or broadly ovate, margins entire but often undulate; ...*"

Short description: Erect perennial herb to 40 cm tall that grows from underground rhizomes. Branches are white grey to brown and covered in sparse prickles and stellate hairs (Bean 2010). Leaves are hairy and ovate with entire, often undulating margins 6.5-20 cm long and 3.8-11.7 cm wide, usually with a cordate base (Bean 2010). The inflorescence has 3-6 purple flowers 13-14 mm wide (Bean 2010). Immature fruit have been rarely observed no mature fruit have been seen.

This species belongs to the *S. macoorai* group but is easily distinguished from other species. It is most similar to *S. jucundum*, but differs in plant height, prickle length, leaf shape, corolla indumentum and habitat (Bean 2010).

*Excerpt adapted from Collingwood T.D. (2021). Nomination to change the conservation class of *Solanum orgadophilum* under the Queensland Nature Conservation Act 1992. Queensland Department of Environment and Science.

3.1.5 Distribution

In this section, you will define several important metrics that will be used to assess the taxon against the criteria. You will also start to build a picture of potential threats that may be relevant to the taxon. There are two steps:

- Make a series of maps that display the spatial context of the taxon; and
- Describe and interpret these maps in a succinct series of paragraphs.

Minimum software requirements include an internet browser to access GeoCat (Bachman et al. 2011) and Queensland Globe (see Key resources, pg. 65). GeoCat is used to assess the taxon's distribution and Queensland Globe is used to assess the landscape context of the taxon. Assessors experienced in using GIS packages (i.e.,

QGIS, ArcPro or ArcGIS) can use these in place of Queensland Globe. However, this will require experience in downloading and manipulating spatial layers from Queensland Spatial Catalogue.

3.1.5.1 Estimating the Extent of Occurrence and Area of Occupancy

The Extent of Occurrence (EOO) and Area of Occupancy (AOO) are the primary metrics used to measure the spatial spread of risk to a taxon being assessed. The *Extent of Occurrence* is defined as *"the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected site of present occurrence of a taxon, excluding cases of vagrancy"* (IUCN 2012, pg. 11). This is measured using a minimum convex polygon (IUCN SPC 2022). The *Area of Occupancy* is defined as *"the area within its EOO which is occupied by the taxon, excluding cases of vagrancy".* This is measured using 2 x 2 km grid cells (IUCN SPC 2022). For further explanation of these terms, refer to Criterion B (pg. 52), or the relevant section in the IUCN Guidelines (IUCN SPC 2022).

Follow these steps to estimate the EOO and AOO in GeoCat:

- Save the final 'cleaned' version of occurrence records in .csv format.
- Ensure the decimal latitude and longitude column names are correct so they can be uploaded into GeoCat.
- Select "Start new project" > "Import data" (Figure 7; Figure 8).
- In the bottom right corner, select "Import .CSV" (Figure 9).
- Select your file(s) in your file browser. Select "Import".
- You can repeat this and add in other data sheets.
- Once you have all your data loaded, in the top right corner, select "Enables EOO/AOO" (Figure 9).
- Change your map to *hybrid* to view land use (Figure 10; Figure 9).
- Scale your map to an appropriate size by zooming in and out. Then, drag the occurrence records so they are close to the EOO and AOO calculator (Figure 10). Take a screenshot that includes the map reference information (i.e., scale bar).
- Insert this map into the Distribution section of the nomination form labelled as **Figure 1** (see Box 5).
- If the EOO and AOO are small, investigate whether a grid cell can be moved to reduce the size of the AOO. Make a note if this is relevant for the taxon you are assessing, and ensure you discuss it in your paragraphs.

If the EOO is less than the AOO, the EOO should be changed to make it equal to the AOO to ensure it is consistent with the definition of the AOO as an area within the EOO (IUCN SPC 2022, pg. 50).

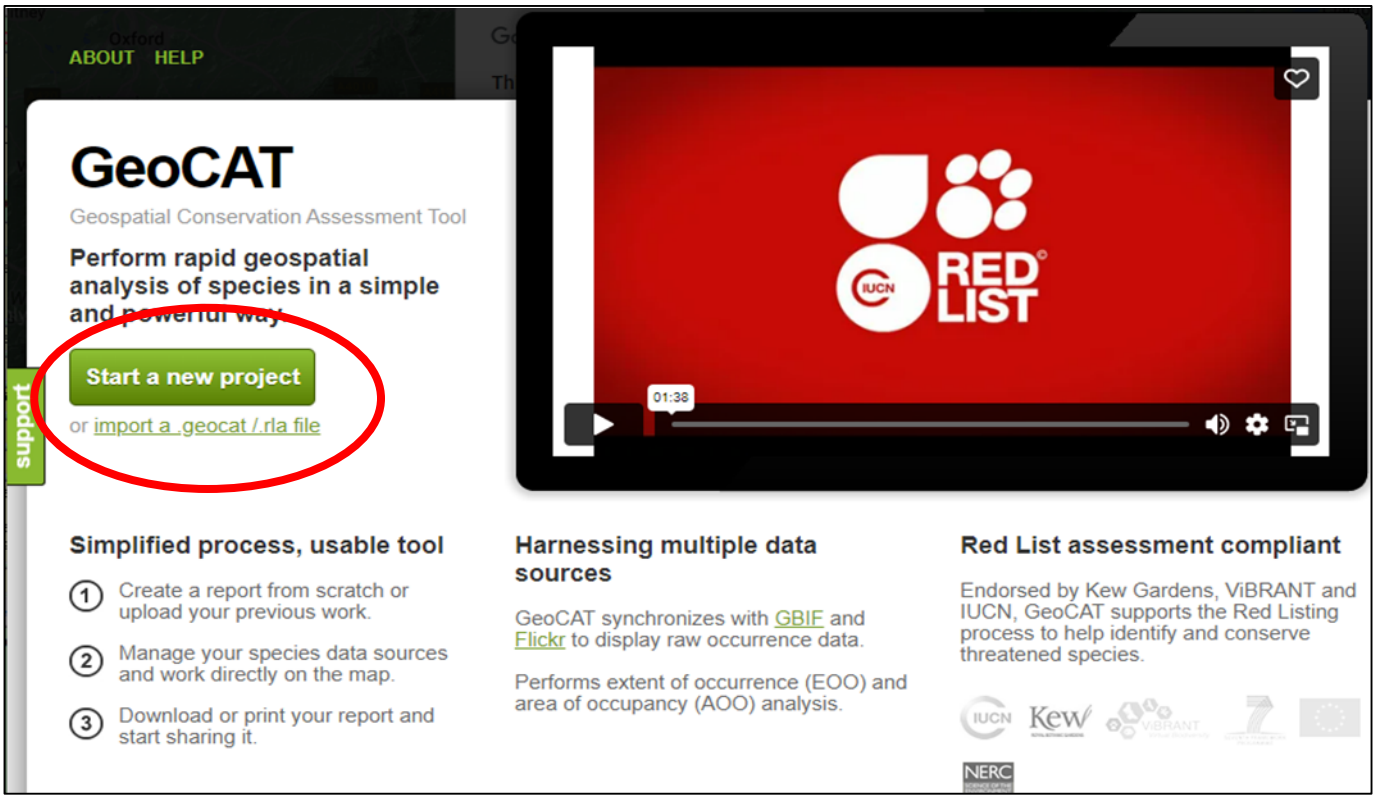

Figure 7. Screenshot of the GeoCat web platform (Bachman et al. 2011). Assessors should 'start a new project' to calculate EOO and AOO (red ellipse).

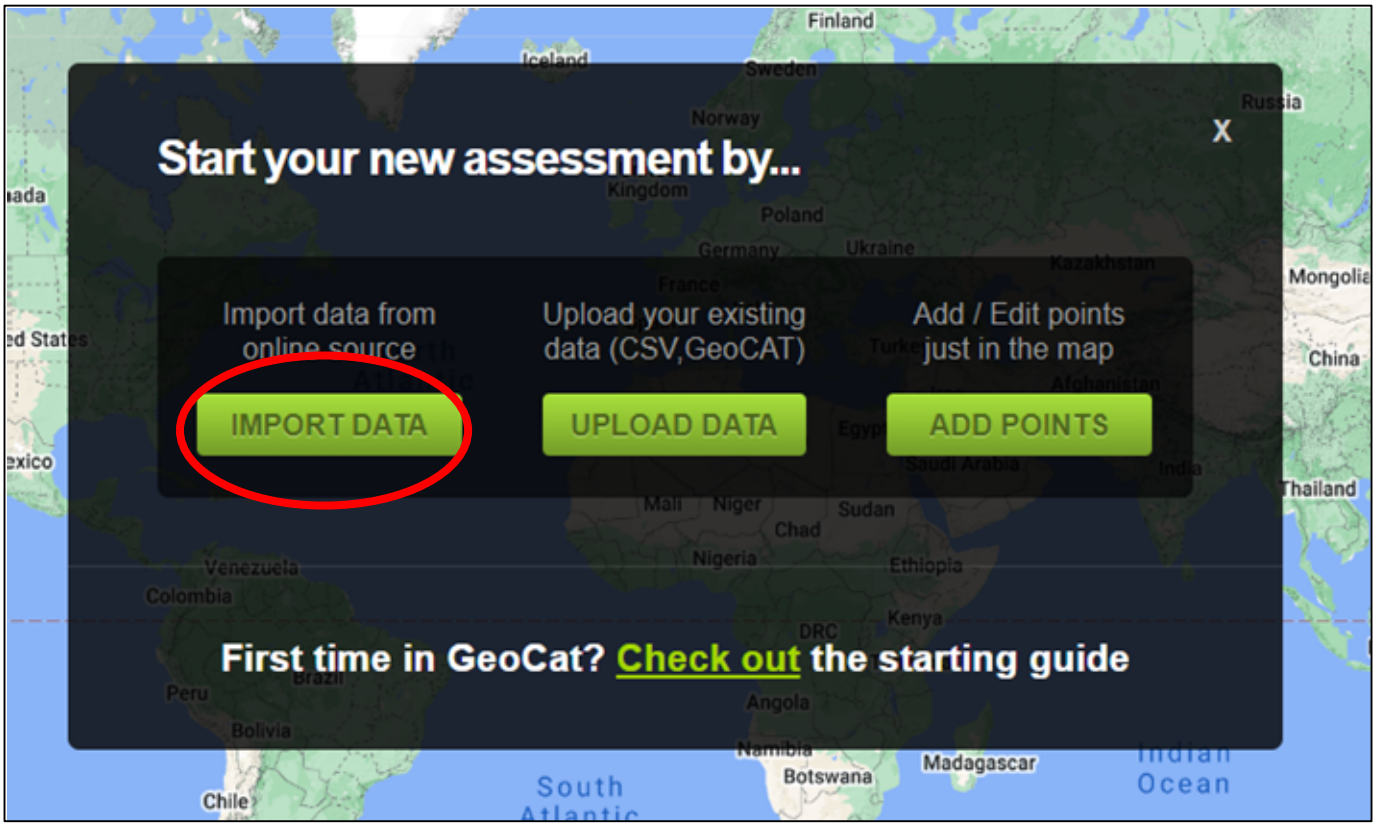

Figure 8. Screenshot of GeoCat web platform (Bachman et al. 2011). Assessors should 'import data' to calculate EOO and AOO (red ellipse).

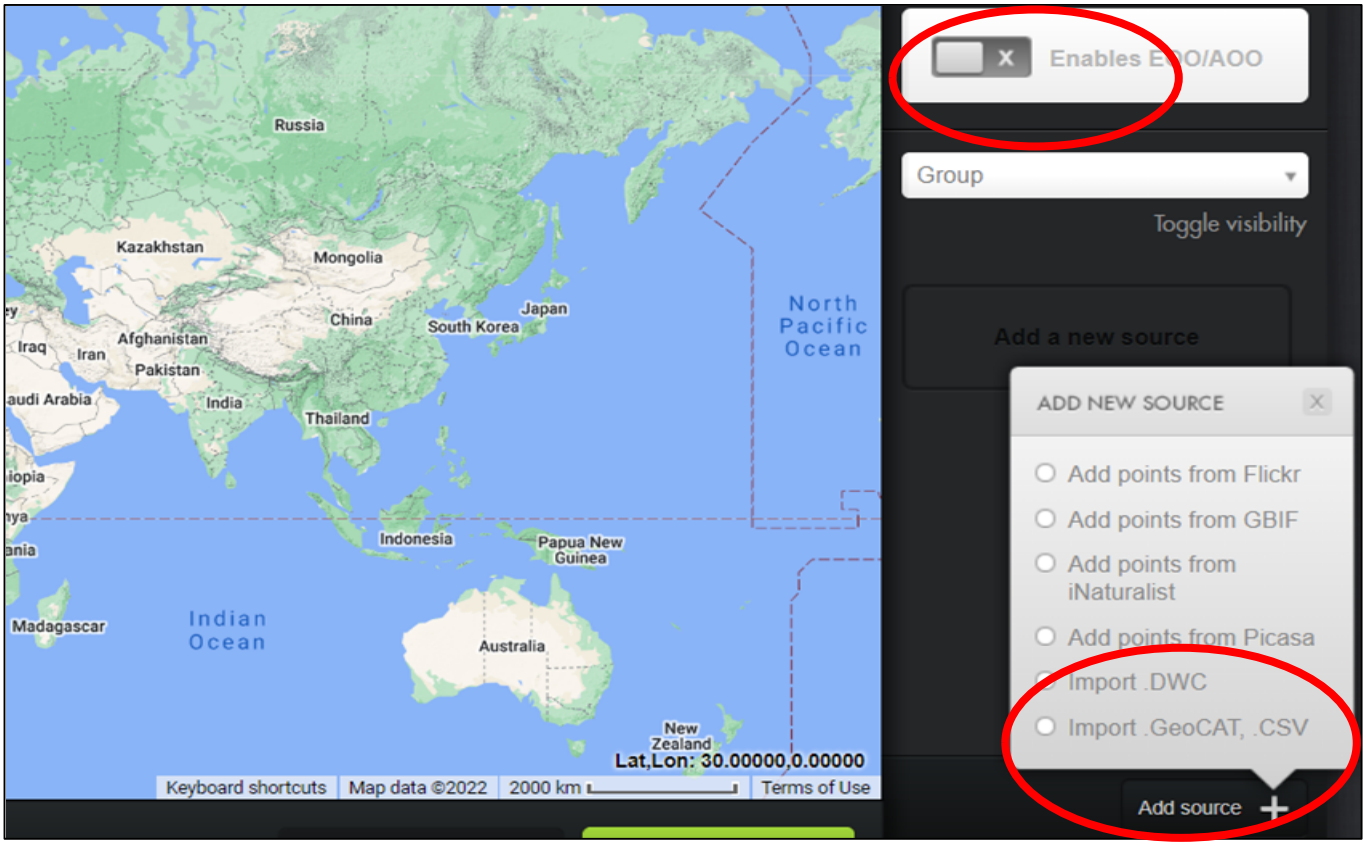

Figure 9. Screenshot of GeoCat showing how to import data (red circle – bottom). Ensure data spreadsheet is in .csv format. EOO and AOO can be calculated automatically by turning the button on (red circle – top).

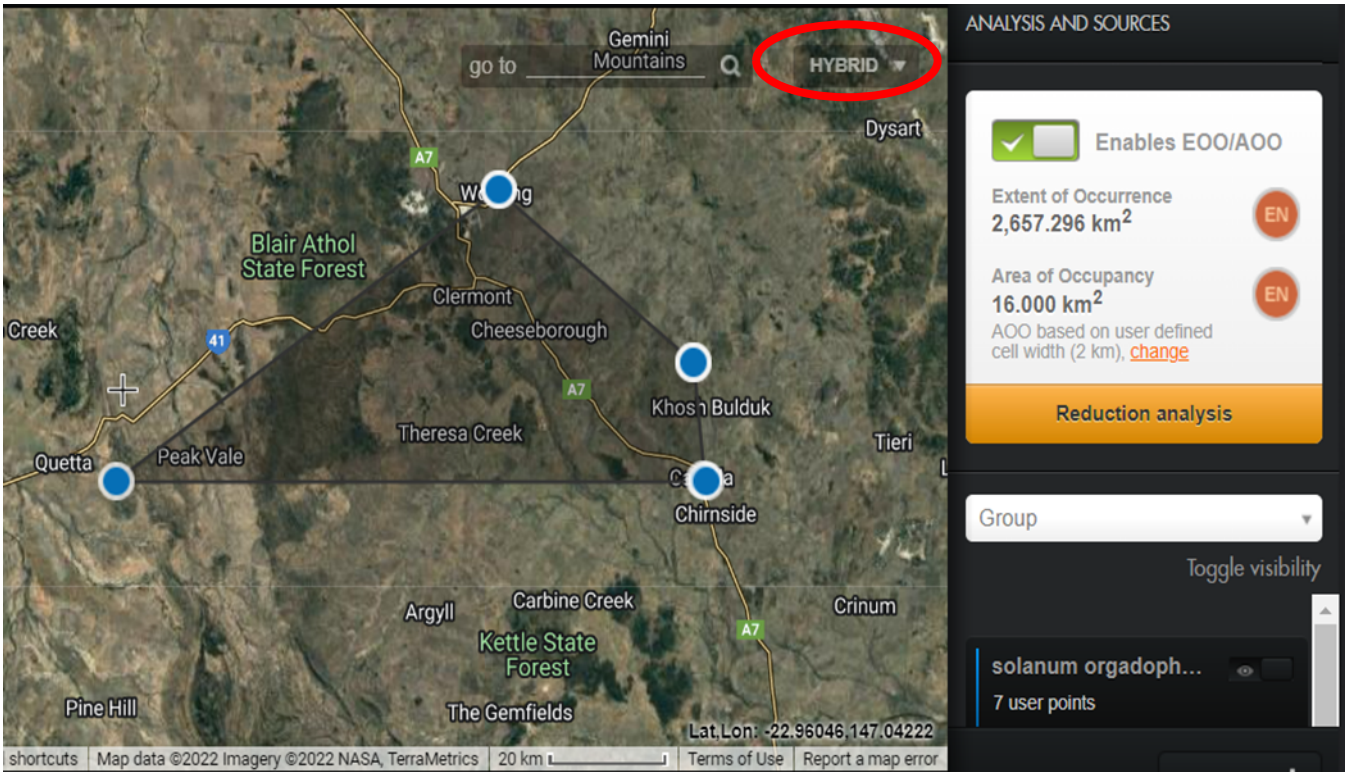

Figure 10. Screenshot of distribution map in GeoCat, with points aligned near the EOO/AOO calculator for transfer into the nomination form. Convert the map to 'hybrid' as shown in the red circle.

3.1.5.2 Reviewing land use and management characteristics

Next, use *Queensland Globe to create relevant maps* that display the geographical context of the taxon.

- Bring in taxon records (LAYERS → ADD MY DATA → EACH ROW AS POINT → IMPORT) (Figure 11).
- Change colour so they are visible – *orange with black outline* is recommended (Figure 12).
- Explore relevant layers that can be used to describe the spatial context of the taxon's distribution.
- LAYERS → ADD LAYERS (Figure 11).
    - Boundaries > Cultural Heritage party boundary
    - Biota > Regional Ecosystem Mapping > Biodiversity Status – pre-clear
    - Biota > Regional Ecosystem Mapping > Biodiversity Status – remnant
    - Economy > Production Permits > select all
    - Environment > Nature Refuge + Parks
    - Planning Cadastre > Land Use
    - Planning Cadastre > Land parcels
- Change the base map as required to enhance the visibility of some layers (e.g., change the base map layer to 'base map grey' or 'base map topographic' to more clearly display mining lease tenure.
- Take screenshots of relevant maps. Before you take a screenshot, reduce the size and shape of your web-browsing window to be similar to the size of the nomination form box. This will ensure the map labels are displayed at a size that can be read.
- Be sure to capture scale bar + legend in screen shot.

Important considerations

- Most of Queensland is covered in exploration permits for resource extraction. It is appropriate to consider 'exploration permits' as a future potential threat, and 'mining leases' as a current/future-actual threat.
- To obtain a description of each of the layers you can search that layer within the Queensland Spatial Catalogue.
- GeoRes Globe can provide a useful alternative to QldGlobe for reviewing mining context.
- If the 'Cultural Heritage Boundary' layer does not provide adequate information to determine the Traditional Owners, please refer to the map provided by the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS).

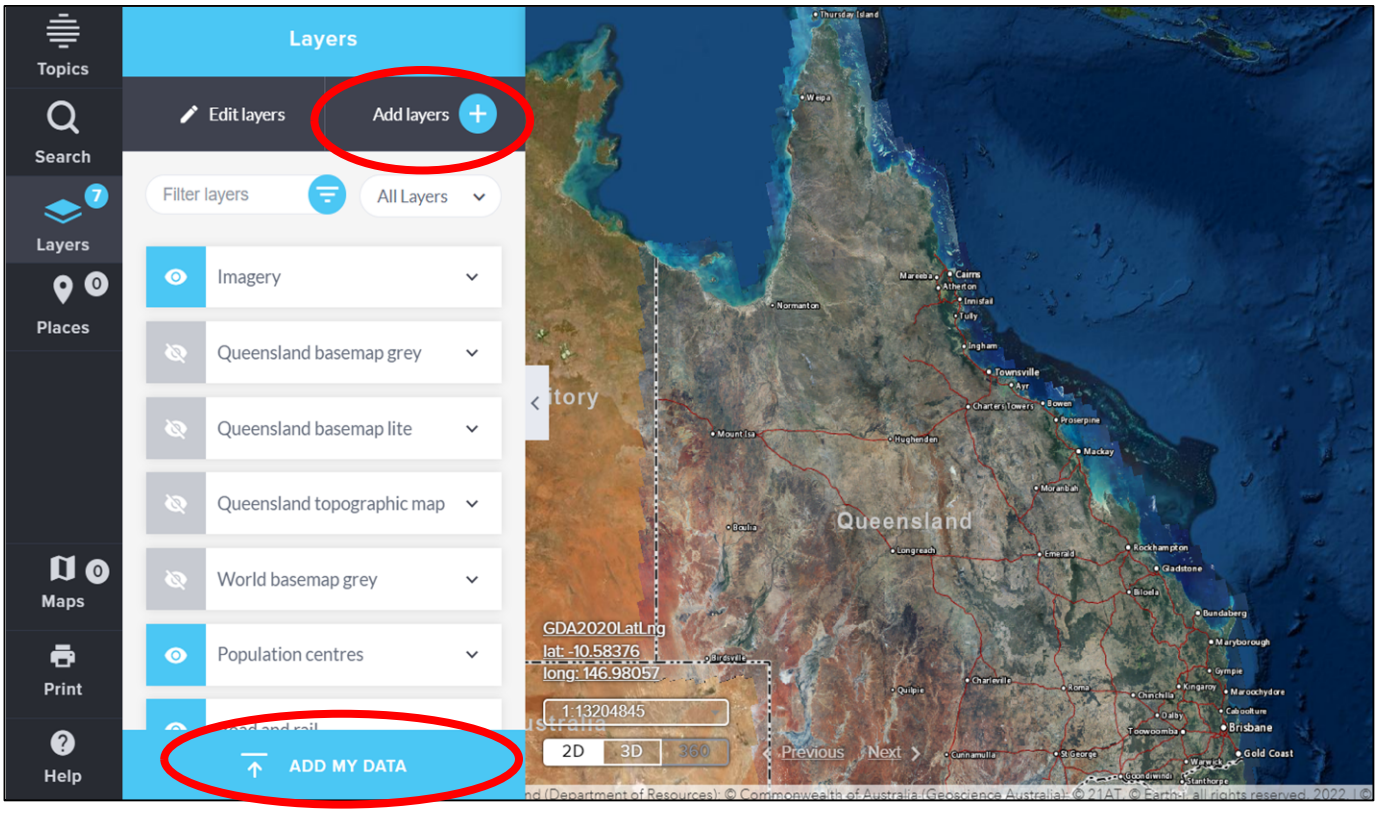

Figure 11. Screenshot demonstrating how to add data and layers in Queensland Globe (red ellipse).

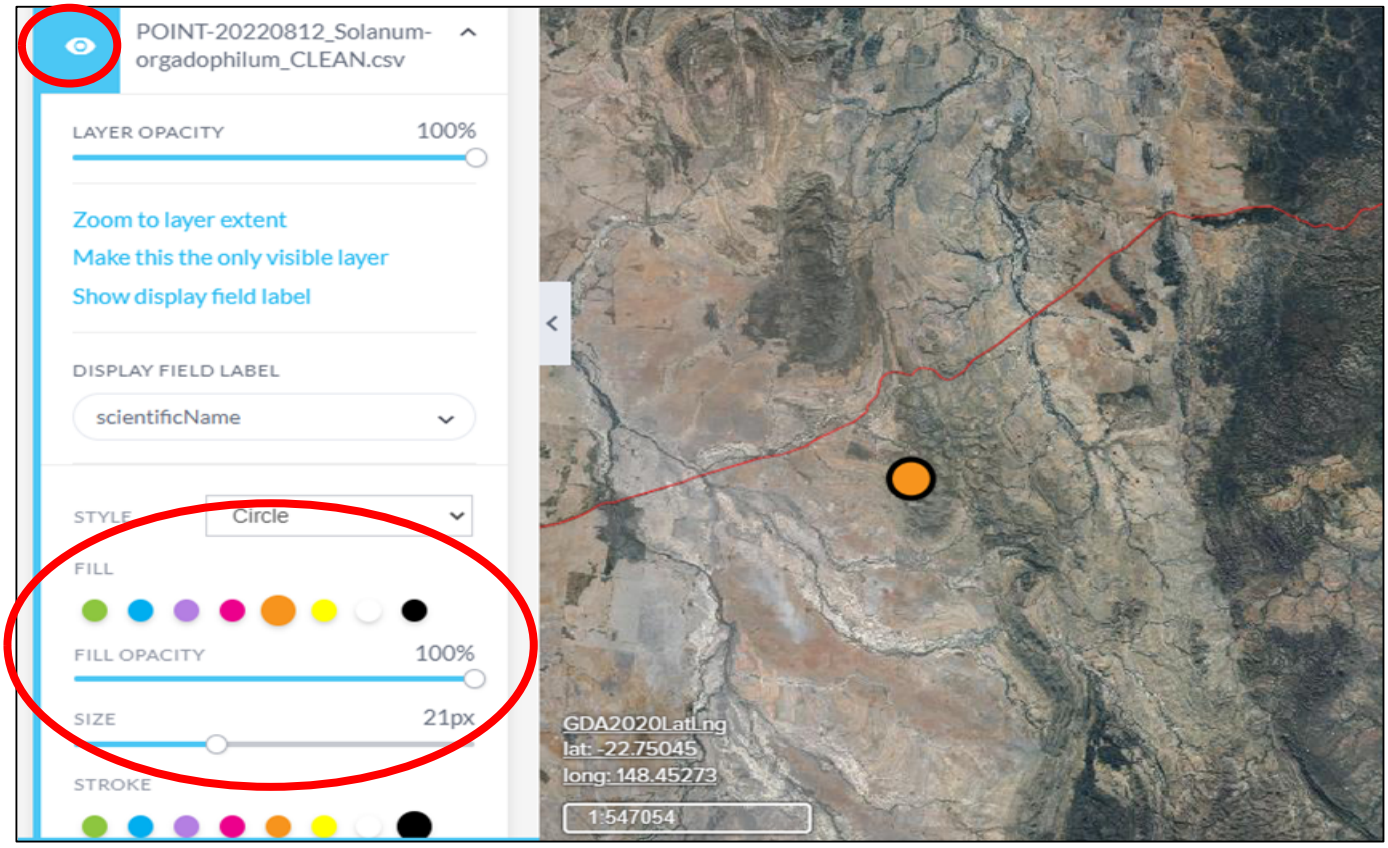

Figure 12. Screenshot demonstrating how to change the colour and size of occurrence records in Queensland Globe (red ellipse).

[SEE EXAMPLE MAPS IN NEXT SECTION]

3.1.5.3 Distribution text

Assessors should then construct a succinct and concise series of paragraphs summarising the abovementioned information. A suggested format is provided below. It is appropriate to model the paragraph text from the example provided (Example of text format and paragraph structure for the Distribution section of the nomination form).

Paragraph 1 – Geographic distribution context

- Describe whether the taxon has a narrow, disjunct, widespread, fragmented range based on a visual assessment of the GeoCat imagery.
- State the general geographic details, including the nearest population centre and the bioregion.
- State the Traditional Custodians of the Country that overlap the distribution of the taxon.
- For fauna, note the taxon's home range and movement patterns, especially if these change seasonally.

Paragraph 2 – EOO and AOO

- State the EOO and AOO, and how this was calculated. Typically, the EOO and AOO are calculated using expert verified records, a minimum convex polygon (EOO) and 2 km grid cell (AOO). Reference the IUCN guidelines (IUCN SPC 2022).
- Be sure to only include 'wild' records in your distribution calculations, i.e., for flora, exclude any cultivated records that are flagged as "C" in the BRI records. Assessors should clearly explain if any records have been excluded and why.

Paragraph 3 – Define subpopulations and population size

- Spatially define the subpopulations, including the number of subpopulations for the purposes of the assessment. Subpopulations are defined as "*geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less)* (IUCN 2012, pg. 10). To define subpopulations, assessors should consider the relative geographic isolation and dispersal capacity of the taxon. For further information on how to define subpopulations see Subpopulations (pg. 58).
- Where there are only a few subpopulations, assessors should attempt to name each one and refer back to these throughout the nomination form. For example, the eastern, western and northern subpopulations.
- Comment on the size of the subpopulations, and the total population size. Population metrics should be discussed in terms of 'number of mature individuals'. If there are not enough data to determine the population size, state this. Consider whether all suitable habitat been searched Make a statement about survey adequacy and confidence regarding the likelihood of finding additional subpopulations/occurrences with further survey in suitable habitat.

Paragraph 4 – Land use and management context

- Describe whether the subpopulations occur on remnant or cleared land.
- Describe the current land tenure (freehold, national park) and land use (grazing, nature conservation) for each subpopulation.

NB. Although it is normal convention to display figures immediately after relevant text, it can be easier to group figures together at the end of the text box. So, the Distribution text box should include paragraphs of text grouped together, followed by a series of maps.

Box 5. Example of text format and paragraph structure for the Distribution section of the nomination form*.

Homoranthus brevistylis is known from a very restricted distribution at Ballamoo Cliffs in the Blackdown Tableland area west of Rockhampton, in the Brigalow Belt North bioregion (Figure 1; Department of Agriculture, Water and the Environment 2019; Queensland Herbarium 2022). The species distribution overlaps with the Country of the Gaangalu Nation People (Figure 2).

The species has an Extent of Occurrence (EOO) and Area of Occupancy (AOO) of 4 km^2, based on expert verified herbarium specimen records, and a minimum convex polygon (EOO) and 2 km grid cell (Figure 1; IUCN 2019; Queensland Herbarium 2022). A collection record from 1988 with a precision of 2000 km has been omitted from these calculations as likely represents a geocoding error (Queensland Herbarium 2022).

The species is considered to occur within a single subpopulation in this assessment, as all collection records have been made at a single site along Ballamoo Cliffs. Within this subpopulation, there are an estimated 50 mature individuals over <1 ha (Copeland et al. 2011). The species may be more widespread that currently documented, given the area where it occurs is poorly botanised away from the track and road network and similar habitat is more widespread in the area (P. Forster, pers.comm. 2019). However, any unreported occurrences are likely to be highly localised, given the species strong preference for a restricted habitat type. *Homoranthus brevistylis* is only known to occur within Blackdown Tableland National Park, which is managed for conservation (Figure 3). It grows amongst vegetation mapped as remnant under the *Vegetation Management Act 1999* (the VMA), in Regional Ecosystems 11.10.5 (Figure 4).

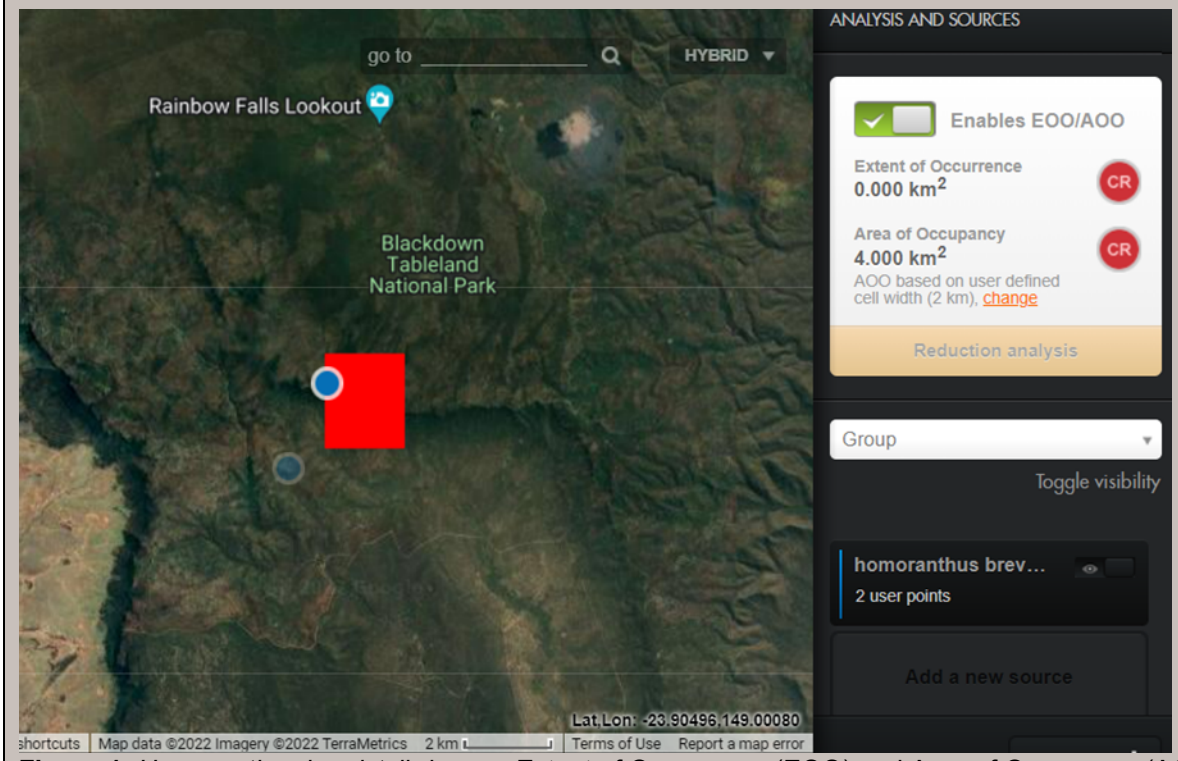

Figure 1. *Homoranthus brevistylis* has an Extent of Occurrence (EOO) and Area of Occupancy (AOO) of 4 km^2, based on expert verified herbarium specimen records, and a minimum convex polygon (EOO) and 2 km grid cell (Figure 1; IUCN 2019; Queensland Herbarium 2022). Map generated on GeoCat (Bachman et al. 2011).

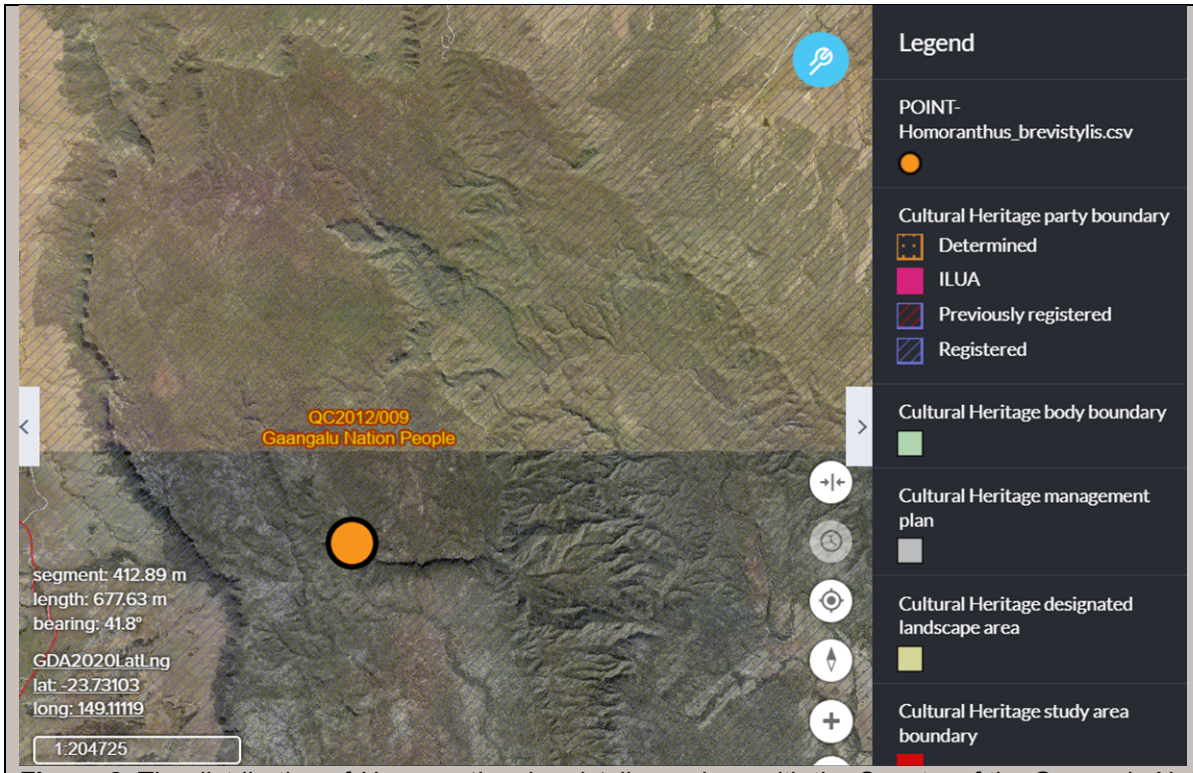

Figure 2. The distribution of *Homoranthus brevistylis* overlaps with the Country of the Gaangalu Nation People. Map generated on Queensland Globe.

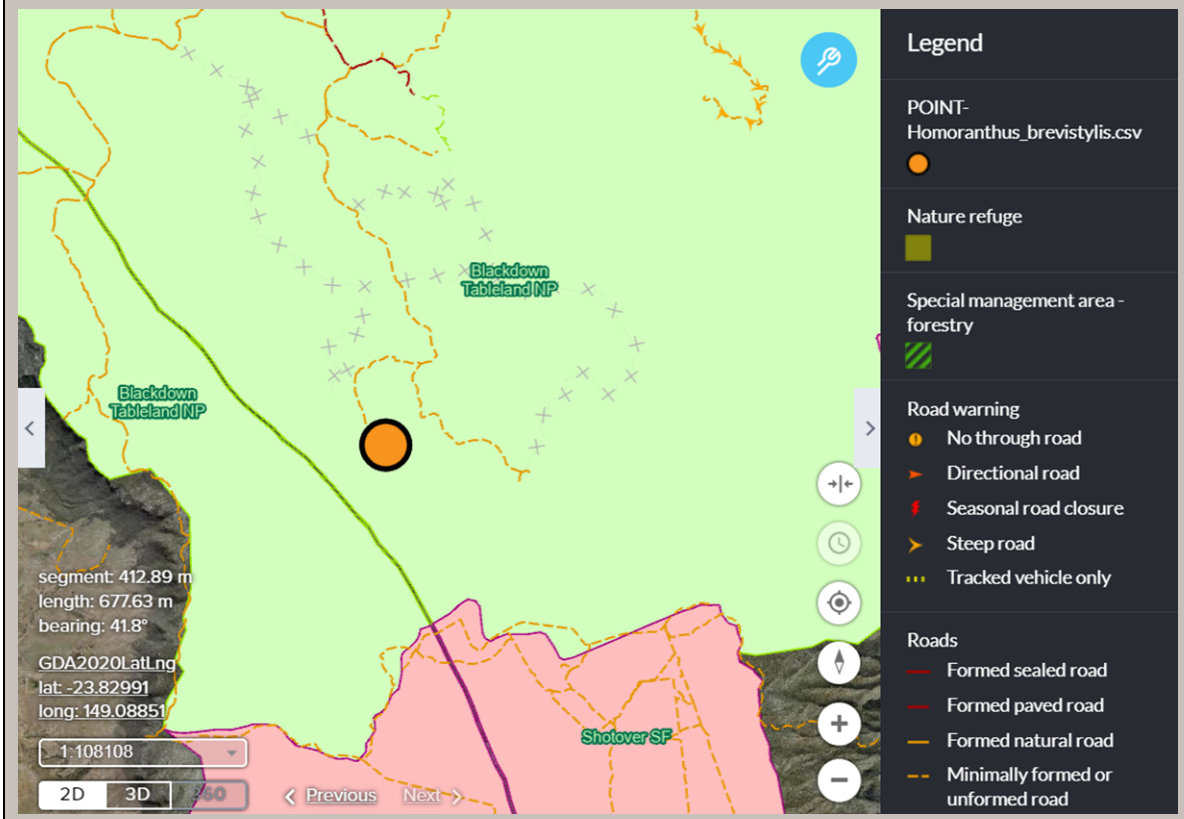

Figure 3. *Homoranthus brevistylis* is only known to occur within Blackdown Tableland National Park, which is managed for conservation. Map generated on Queensland Globe.

[Insert additional maps as required]

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Homoranthus brevistylis* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

3.1.6 Biology and ecology

Assessors should then describe the biology and ecology for the taxon. The IUCN criteria rely on an understanding of how threatening processes interact with a taxon's biology and ecology. Therefore, this section provides important context when applying the criteria in later sections of the nomination form. It is important to review all relevant literature and summarise it in this section. This will greatly assist in making a robust conservation assessment. The nomination form provides good detail about what you should aim to include. While each taxon will be different, responses can be structed following the below format (but reorganise paragraphs in a logical way as necessary) (see Box 6):

Paragraph 1 - Habitat

- Define the key characteristics of the habitat occupied by the taxon. This should include the vegetation type including soil/substrate, vegetation structure, and altitude, aspect, and climate.
- For restricted taxa, habitat information recorded within the specimen collections or taxonomic paper are the authority, rather than regional ecosystem (RE) descriptions. Note that habitat of the taxon does not necessarily equate to the regional ecosystems that intersect the occurrence records. RE mapping can be coarse or comprise multiple ecosystems within a polygon. Therefore, RE mapping information (i.e., what REs the taxon occurs in) should only be stated after a more specific review of habitat requirements (see final dot point for RE information).
- If the taxon occurs in different habitats depending on the subpopulation, assessors should note this by referring to the specimen record information.
- For fauna, explain how habitats are used, for example describe seasonal/breeding changes in habitat, if applicable. Provide detail on refugial habitat (i.e., does the taxon use different habitat in times of fire, drought, or flood)?
- Describe associated taxa. These can be found in the occurrence records or taxonomic description.
- List the Regional Ecosystems (RE) that the taxon's occurrence records are associated with, and reference back to the figure provided in the Distribution section. Provide a brief description of the RE. Details on REs can be found in the Regional Ecosystem Description Database search tool (see Key resources, pg. 65).

Paragraph 2a – Reproduction (flora)

- Does the taxon produce sexually or asexually (vegetatively?) If the taxon reproduces vegetatively, describe when, how and what conditions are needed.
- When does the taxon flower and set fruit? Review the herbarium records and taxonomic description. What conditions are needed for this?
- What is the pollination mechanism for the taxon?
- What are the seed dispersal mechanisms?
- Does the taxon require a disturbance regime (e.g., fire, cleared ground) to reproduce? Given the prevalence of fire in the Australian vegetation, it is almost always relevant to discuss the taxon's susceptibility to fire.

Paragraph 2b – Reproduction (fauna)

- When does the taxon breed?
- What conditions are needed for breeding?
- Are there any breeding behaviours that make it susceptible to threats?
- Are there specific breeding sites, e.g., colonies for seabirds?

Paragraph 3 – Life cycle

- Provide detail on the age at sexual maturity, average life expectancy, natural mortality rates and then use these metrics to calculate generation length.

Generation length is defined as *"the average age of parents of the current cohort (i.e., newborn individuals in the population) [and] reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once"* (IUCN 2022, pg. 29). Where generation length varies under threat, use the more natural pre-disturbance generation length (IUCN 2022). It is often calculated as:

*Age of first reproduction + (0.5 * length of reproductive period)*

Provide full details of the method(s) used to calculate the generation length. For further detail see Generation length (pg. 51).

Paragraph 4 – Feeding and movement (fauna)

- Summarise the feeding behaviours, diet, and the timing/seasonality associated with these. Include any behaviour that may make the taxon vulnerable to a threatening process
- Provide information on daily and seasonal movement patterns.

Some additional tips

- Often, it is not possible to include all this information, because there are few published studies. Ensure you state if this is the case. For example, '*There is no literature available that describes the fire ecology of the species'*.
- If there is no published literature on the taxon, check at the genus level. Often, it is appropriate to comment on the biology and ecology of other, closely related taxa. For example, '*However, other species in the genus are known to re-sprout after fire from a lignotuber'.*
- Review the taxon's occurrence records to get information about habitat types. The habitat type is often listed in the original taxon description, but this can be outdated. Often, new information in available in the taxon's records under the habitat column.
- State the REs in which the taxon occurs (for plants, and animals if restricted to a small number of REs). The utility of Regional Ecosystem mapping as a surrogate for habitat extent may depend on how consistently the taxon of concern is found in the RE.
- You can also use the taxon's occurrence records to check when it flowers and fruits. Relate the date of the record to the reproductive status column.
- For both flora and fauna, try and provide information about dispersal. This will help you define subpopulations and some subcriteria (i.e., severe fragmentation). Return to the Distribution section and check your assessment of subpopulations is consistent with the dispersal/ movement ecology of the taxon.
- For flora, try and investigate the fire response.
- Use this review to think about how the taxon's ecology may make it susceptible to threatening processes.

Box 6. Example text format and paragraph structure for the Biology/ecology section of the nomination form*.

Eucalyptus kabiana occurs on skeletal soils and rock crevices on steep trachyte slopes (QH 2020a). At Mt Beerwah, it occurs with *Corymbia trachyphloia, Calytrix tetragona, Leptospermum* spp.*, Triplarina volcanica, Commersonia fraseri, Hibiscus heterophyllus*, *Allocasuarina filidens, Lomandra confertifolia, Melaleuca groveana* and *Acacia hubbardiana* (QH 2020a). At Mt Coochin, *E. kabiana* grows on a steep slope in montane heath alongside *Corymbia trachyphloia, E. curtisii, Leptospermum luehmannii, L. microcarpum* and *Triplarina volcanica* (QH 2020a). Flowers and fruits have been recorded throughout the year, but flowers mostly occur in spring and fruit in summer (QH 2020a).

Eucalyptus kabiana has a lignotuber and can resprout vegetatively after disturbance such as fire (Nicolle 2008). Because this resprouting capacity is apparently unlimited, eucalypts with lignotubers can be extremely long-lived, i.e., hundreds of years (Nicolle 2008). Generation length for eucalypts has been estimated as 70 years (Fensham et al. 2020) but is probably longer for *E. kabiana* given its resprouting capacity.

Eucalypts generally rely on mobile pollinators (e.g., insects, birds, bats) to mediate and maintain genetic diversity, as seed dispersal is typically passive (Byrne et al. 2008; Booth 2017; Low 2011). As *Eucalyptus* spp. lack dispersal structures on their seeds, seed typically falls <100 m from parent plants, apart from species that occur near watercourses that can further aide seed movement (Booth 2017; Low 2011; Reid and Potts 1998).

Eucalyptus kabiana can reproduce sexually from seed, although data on germination rates is not available (Trueman et al. 2017). Recruitment has not been observed in the wild subpopulations, although this is not unusual for long-lived mallees (Fensham et al. 2020). The species can also be readily propagated from cuttings, which mature to trees 3-5 m in height after six years in ex situ conditions (Trueman et al. 2017). The time to reproductive maturity in situ may be longer due to ecological processes such as competition, nutrient availability and prevailing climatic conditions that affect growth and vigour.

Eucalyptus kabiana is a very long-lived perennial that can survive disturbance such as fire, and therefore extreme fluctuations are not likely (IUCN 2019).

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Eucalyptus kabiana* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

3.2 Threats

3.2.1 Identification of known threats and impact of the threats

Assessors should then describe the threats to the taxon. By this stage, assessors should have a good understanding of the threats relevant to the taxon. Assessors should first review the information they have collated and identify a list of possible threats. Assessors should then contact the appropriate expert for the taxon to refine this list of threats.

3.2.1.1 Review potential threats

Assessors should review possible threats by doing the following:

Check the land use map and remnant regional ecosystem map from the distribution section:

- Does the taxon occur in areas that have been cleared? Review the proportion of relevant Regional Ecosystems that have been cleared by referring to the clearing statistics in the Regional Ecosystem Description Database search tool (see Key resources, pg. 65).
- Does the taxon occur in isolated subpopulations that are surrounded by land use change?
- Does the taxon occur on freehold land near urban areas?

Review the ecology section:

- Is the taxon susceptible to climate change impacts (e.g., is it restricted to refugial habitat)?
- Is the taxon susceptible to decline from fire regimes (i.e., an obligate seeder that now occurs in an area with more frequent fire regimes; or a fauna taxon that relies on long-unburnt habitat)?
- Does the taxon co-occur with any invasive weeds?

- Is the taxon a known dietary component of vertebrate pests? (i.e., in the critical weight range for feral cat/fox predation)?

3.2.1.2 Consult experts to determine threats

After reviewing the possible threats to the taxon, assessors should consult with the relevant expert to refine this list. Relevant experts may include the collectors of the taxon (noted in the occurrence records for the taxon), the curator for the taxon's Family, land managers that work in the region where the taxon occurs (i.e., Queensland Parks and Wildlife Rangers), or researchers who have published peer-reviewed or grey literature on the taxon. Efforts should be made to contact a representative list of experts, aiming to capture insight on the status of the taxon across its distribution. For example, if the taxon has a scatter distribution, assessors should attempt to contact an expert that knows the taxon in the north and south of its range. Once the list of possible threats has been refined to include only those threats that are actually relevant to the taxon, the threats should be classified.

3.2.1.3 Threat classification

Assessors should then classify the relevant threats and detail the threat attributes and threat impact for each threat as per the Threats table in the nomination form (Table 1). Assessors should classify each threat according to the IUCN – CMP Unified Classification of Direct Threats, which is summarised in Table 1 (IUCN 2022). Under this classification, each threat has up to three levels of classification, starting broad and becoming more specific. Assessors should attempt to assign a threat class that is as specific as possible (for example, IUCN threat 7.1.1 rather than IUCN threat 7.1). Where further detail is required to explain the threat, place it in brackets after the threat class. Take care to distinguish between 'threats' and 'symptoms'. A threat is the *process* that is causing a decline/impact, while a symptom is an outcome of the threat. For example, lack of recruitment may be symptomatic of inappropriate fire regimes. The Federal list of Key Threatening Processes provides useful guidance when describing threats.

Table 1. Example text for the threats table on the nomination form*.

Threat	Threat attributes	Evidence
IUCN threat 5.4.1 Biological resource use: Fishing and Harvesting Aquatic: Intentional Use (illegal fishing)	Timing: current, future Confidence: inferred Likelihood: almost certain Consequence: moderate Trend: increasing Extent: entire range	Illegal take of fish from no take zones removes mature individuals in areas where they are protected. A significant increase in targeting of Mary River cod by fishermen is evident through social media (tagging on Facebook) and an increase in the number of tagged Mary River cod on the Infofish database (Brooks et al. 2019). Tagged Mary River cod on Infofish increased from 28 in 2011 to 171 in 2013, demonstrating increased targeting including during the breeding season (Brooks et al. 2019). Removing fish from wild subpopulations jeopardises recovery efforts by directly depleting the population size. Illegal take of fish is likely to occur across the entire range of the species, particularly in the known strongholds.

* Parisi, M.A. (2022). DRAFT Nomination to change the conservation class of species *Maccullochella mariensis* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

Climate change as a threat

Assessors can review the risk of climate change for a species by relating its ecology or currently occupied climatic envelope to projected climate changes. Key resources to identify projected climate changes include:

- CSIRO Climate Change Cluster Reports.
    - Assessors should identify the NRM region relevant to the taxon based on the map here. There are shapefiles available to help identify the region your species occurs in if it is difficult to determine from the map alone. Assessors should then read the appropriate cluster report here.
    - A summary of the key climatic changes, along with the confidence with which they are projected to occur should be summarised into the threats table. Using this approach, the threat of climate change is only likely to be 'suspected' (see Data Quality, pg. 46).
- Queensland Future Climate Dashboard
    - Assessors can use this tool to explore how key climate variables are likely to change in the future (2030, 2050, 2070, 2090) depending on different climate scenarios (RCP 4.5, RCP 8.5).

Table 2. IUCN threat categories with descriptions (IUCN SPC 2022; Kearney et al. 2019).

Threat class	Threat	Description	Examples
1	Residential and commercial development	Threats from human settlements or other non-agricultural land uses with a substantial footprint.	Land clearing for urban settlements.
2	Agriculture and aquaculture	Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture and aquaculture.	Land clearing for agriculture.
3	Energy production and mining	Threats from production of non-biological resources.	Land use change associated with open-cut mining, construction of associated infrastructure.
4	Transportation and service corridors	Threats from long narrow transport corridors and the vehicles that use them.	Clearing for major roads and railways.
5	Biological resource use	Threats from consumptive use of 'wild' biological resources, including both deliberate and unintentional harvesting effects; also persecution or control of specific species.	Illegal collection of orchids/ reptiles.
6	Human intrusion and disturbance	Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive use of biological resources	Trampling and erosion on recreational tracks, 4wd disturbance.
7	Natural systems modifications	Threats from actions that convert or degrade habitat in service of 'managing' natural or semi-natural systems, often to improve human welfare. For example, fire and fire suppression, dams and water use.	Construction of dams, inappropriate fire regimes.
8	Invasive and other problematic species, genes and diseases	Threats from non-native and native plants, animals, pathogens/microbes, or genetic material that have, or are predicted to have harmful effects on biodiversity following their introduction, spread, and/or an increase in their abundance.	Hybridisation with cultivated plants. Vertebrate pests.
9	Pollution	Threats from introduction of exotic and/or excess materials or energy from point and non-point sources.	Nutrient excess near urban settlements causing proliferation of weeds.
10	Geological events	Threats from catastrophic geological events.	Volcano eruption; tsunami
11	Climate change and severe weather	Threats from long-term climate changes that may be linked to global warming and other severe climatic/weather events that are outside of the natural range of variation or potentially can wipe out susceptible species habitat.	Periods of prolonged drought combined with very hot days leading to an increase in extreme fire weather.

3.2.1.4 Threat attributes and evidence

Assessors should then assign parameters to each threat. These parameters describe the mechanism, timing, confidence/data quality, likelihood, consequence and trend for each threat and the effect on the taxon (Table 3).

- Assessors should describe how the threat is affecting the taxon under assessment by linking the available evidence to these key attributes. The key attributes do not have to be discussed in order within the evidence column.
- A summary of key attributes should be provided in Column 2 of the threats table on the nomination form.
- Assessors should take care to understand the definitions related to the 'data quality' threat attributes (observed, estimated, projected, inferred and suspected). These are detailed in the IUCN Guidelines and in *Understanding data quality* (pg. 46).
- Assessors should then detail the evidence that links to the key parameters in the 'Evidence' column of the threats table. Ensure this section is fully referenced.
- This section will directly feed into your Criteria assessment. Ensure you have a good understanding of the threats, and that any declines are clearly set out and well justified.

Table 3. List of threat attributes, descriptions and relevant parameter definitions to be entered into column two of the Threat attribute table in the nomination form.

Threat attribute	Description	Threat attribute parameter
Mechanism	The way the threat causes a decline in the population.	• Direct: via disruption of survival and reproduction • In-direct: via interactions with other threatening processes
Timing	The temporal nature of the threat, can be more than one.	• Past • Current • Future
Confidence/ data quality	The nature of the evidence about the impact of the threat on the species.	• Observed: based on census data (i.e. all individuals in population counted) • Estimated: based on statistical assumptions (i.e. sample of population) • Projected: based on statistical assumptions and extrapolated into time or space • Inferred: estimated from indirect evidence on variables of a same type • Suspected: estimated from indirect evidence on variables of a different type
Likelihood	The likelihood of the threat impacting on the whole population or extent of the species.	• Almost certain: expected to occur every year • Likely: expected to occur at least once every 5 years • Possible: might occur at some time • Unlikely: known to have occurred only a few times • Unknown: currently unknown how often the threat will occur
Consequence	The severity of the threat, should it be realised.	• Not significant: no long-term effect on individuals or population • Minor: individuals are adversely affected but no effect at population level • Moderate: population recovery stable or declining • Major: population decline ongoing • Catastrophic: population trajectory close to extinction
Trend	The extent to which the threat will continue to operate on the species.	• Decreasing • Static • Increasing • Unknown
Extent	The spatial context of the threat in terms of the range of the species.	• Entire range • Part of range • Unknown

3.2.1.5 Threat risk

Assessors should then use the Risk Matrix to rank the threats according to the risk (Table 4).

- Threats should be placed into the relevant cell in the Risk Matrix by using the 'consequence' and 'likelihood' threat attributes.
- Assessors should then use the determine the Risk Rating for each threat (low, moderate, high, very high).
- Threats listed in the threats table should then be re-ordered so they are presented in order from highest to lowest risk.

Table 4. Threats should be listed in the relevant cell of this Risk Matrix, according to their consequence and likelihood identified in the threats table.

Likelihood	**Consequence**				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	*Threat 1*				
Likely	*Threat 5*			*Threat 2, 7*	
Possible				*Threat 3*	
Unlikely					
Unknown		*Threat 6*		*Threat 4*	
Risk Matrix legend/Risk rating:					
Low Risk	**Moderate Risk**		**High Risk**	**Very High Risk**	

3.3 Conservation advice: threat abatement and recovery actions

Give an overview of recovery and threat abatement/mitigation actions that are underway, have been formally proposed or that you would like to recommend. Address all threats listed or state threats that lack conservation advice.

- Assessors should first review any existing recovery plans, Federal conservation advice or relevant threat abatement plans for relevant recovery actions to the threats for the species.
- Identify who is undertaking these activities and how successful the activities have been to date.
- Describe any mitigation measures or approaches that have been developed specifically for the taxon at identified locations. Identify who is undertaking these activities and how successful the activities have been to date.
- For taxa nominated as Extinct in the Wild, provide details for any naturalised or captive subpopulations and the level of human intervention required to sustain the taxon.

Present your overview following the format in Table 5 and Table 6. Note that threats should be presented in the order as listed in the previous threats table. Additional examples of recovery actions are provided in Table 7, but follow the format of Table 5 and Table 6.

Table 5. Format for presenting threat abatement and recovery action advice.

Threat	Abatement or recovery action underway
[Threat 1 description] (from threat table)	*Threat 1 current action 1* *Threat 1 current action 2* *Threat 1 current action 3*
Threat 2 description (from threat table)	*Threat 2 current action 1* *Threat 2 current action 2* *Threat 2 current action 3*
Threat 3 description (from threat table)	*Threat 3 current action 1* *Threat 3 current action 2* *Threat 3 current action 3*
	Abatement or recovery action proposed
Threat 1 description (from threat table)	*Threat 1 proposed action 1* *Threat 1 proposed action 2* *Threat 1 proposed action 3*
Threat 2 description (from threat table)	*Threat 2 proposed action 1* *Threat 2 proposed action 2* *Threat 2 proposed action 3*
Threat 3 description (from threat table)	*Threat 3 proposed action 1* *Threat 3 proposed action 2* *Threat 3 proposed action 3*

Some tips

- Ensure your recovery actions are communicated in concise, clear sentences.
- For each threat, ensure you list your actions in order of importance.
- For each threat, ensure you consider actions that encompass *land management-based tasks, survey requirements, stakeholder engagement and research priorities.*
- For most taxa, assessors should consider recommending a *time-series monitoring* program. Temporal monitoring is key to detecting trends in population size and demographics.
- Many key threatening processes also have targeted actions detailed in a Threat Abatement Plan – review these and see if they can be adapted to the taxon.
- Review management plans for areas where the taxon occurs to see what is happening in that area generally. Is the taxon specifically referred to?
- Check the Action Plans for Birds 2020 (Garnett and Baker 2021), Action Plan for Australia's Most Imperilled Plants 2021 (Silcock et al. 2021), Action Plan for Australian Mammals 2012 (Woinarski et al. 2014) and Action Plan for Australian Lizards and Snakes 2017 (Chapple et al. 2019) for guidance on appropriate threat abatement actions.
- Many threats will have similar required actions, in this case repetition is completely acceptable.

Table 6. Excerpt of conservation advice: threat abatement and recovery table from nomination form for *Commersonia inglewoodensis.**

Current threats	Abatement or recovery action underway
IUCN threat 5.3.4 Biological resource use: logging and wood harvesting: non-target species	No recovery actions currently address this threat.
IUCN threat 8.1.1 Invasive and other problematic species, genes and diseases: Invasive non-native/ alien species/ diseases: unspecified species	There is a management plan for Wondul Range National Park (Department of Environment and Resource Management 2011). However, no specific recovery actions currently address this threat.
IUCN threat 6.1 Human intrusions & disturbance (off-road vehicles)	There is a management plan for Wondul Range National Park (Department of Environment and Resource Management 2011). However, no specific recovery actions currently address this threat.
IUCN threat 7.1.1 Natural systems modifications: Fire and fire suppression: increase in fire frequency/ intensity	There is a management plan for Wondul Range National Park (Department of Environment and Resource Management 2011). However, no specific recovery actions currently address this threat.
IUCN threat 11 Climate change and severe weather	There is a management plan for Wondul Range National Park (Department of Environment and Resource Management 2011). However, no specific recovery actions currently address this threat.
	Abatement or recovery action proposed
IUCN threat 5.3.4 Biological resource use: logging and wood harvesting: non-target species	Incorporate *C. inglewoodensis* into the management plan for Bringalily SF (and the adjacent National Park if found there), including provisions for reducing impacts associated with human recreational activities. Ensure logging is excluded from areas where the species occurs in Bringalily SF. Determine a suitable buffer around occurrences of the species to exclude logging activities to prevent direct and indirect damage to the species and its habitat. Ensure all contractors are aware of the species' presence, and their obligations to protect it. Undertake surveys to document additional occurrences of the species. Precisely map the occurrences of the species throughout the State Forest and adjacent National Park to guide management actions.
IUCN threat 8.1.1 Invasive and other problematic species, genes and diseases: Invasive non-native/ alien species/ diseases: unspecified species	Partner with or support the Traditional Custodians to lead the recovery actions for this species to address the potential threat of invasive weeds. Undertake time-series monitoring and research to better understand the impact of invasive weeds, including their presence, and potential effects such as competition and interactions with fire regimes.
IUCN threat 6.1 Human intrusions & disturbance (off-road vehicles)	Incorporate *C. inglewoodensis* into the management plan for Bringalily SF (and the adjacent National Park if found there), including provisions for reducing impacts associated with human recreational activities. Exclude recreational vehicles or divert/re-route vehicle tracks to protect the species from damage associated with recreational vehicles.
IUCN threat 7.1.1 Natural systems modifications: Fire and fire suppression: increase in fire frequency/ intensity	Partner with or support the Traditional Custodians to lead the recovery actions for this species to address the threat of inappropriate fire regimes. Incorporate *C. inglewoodensis* into the management plan for Bringalily SF (and the adjacent National Park if found there), including provisions for fire management.

	Undertake research and time-series monitoring to quantify the impact of prevailing fire regimes on the population demographics of *C. inglewoodensis.* Identify a suitable fire regime for this species and determine the viability of implementing this management strategy. Undertake management to reduce the frequency and intensity of wildfires within the distribution of the species. Monitor the impacts on the health of the population, including mature individuals and recruitment. Undertake surveys (especially away from the tracks) to document additional occurrences of the species. Precisely map the occurrences of the species throughout the State Forest and adjacent National Park to guide management actions. Undertake research to better understand the conservation biology (genetic diversity) and ecology (fire ecology, pollination, habitat requirements, germination requirements, recruitment rates) of the species to inform targeted conservation actions. Manage the interactions between climate change and increased fire frequency, by adapting fire management approaches as necessary (ecological burns to reduce fuel loads on a semi-regular basis). Establish an *ex-situ* subpopulation of the species that represents the maximum range of genetic diversity possible.
IUCN threat 11 Climate change and severe weather	Partner with or support the Traditional Custodians to lead the recovery actions for this species to address the threat of climate change. Undertake surveys to document additional occurrences of the species. Precisely map the occurrences of the species throughout the State Forest and adjacent National Park to guide management actions. Undertake time-series monitoring to quantify the population demographics of the species (number of mature individuals at each subpopulation) and trends over time. Undertake research to better understand the species biology and ecology, including conservation genetics, fire ecology, reproductive strategies, germination cues and pollinator relationships, with a specific focus on the interactions with climate change. Establish an *ex-situ* population via seed banking or propagation for conservation and research, ensuring the maximum range of genetic diversity possible is represented.

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Commersonia inglewoodensis* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

Table 7. List of potential recovery actions that could be used in Qld threatened species assessments (adapted in part from DAWE 2021).

Threat category	Example recovery actions
Residential and commercial development	• Ensure the species and its habitat are adequately represented in the protected area estate. Investigate options to protect additional habitat under appropriate conservation covenants. • Prior to any land clearing, ensure thorough targeted surveys are undertaken by a suitably qualified person to identify occurrences of the species so that adequate mitigation can be undertaken. • Raise awareness of the species with the local community to encourage stewardship activities, such as habitat improvement via weeding, erosion control etc. • If any individuals are likely to be directly impacted by residential/commercial development, ensure they are adequately represented in an *ex-situ* conservation collection.
Agriculture and aquaculture	• If livestock grazing occurs in the area, landowners/managers to use an appropriate management regime and density that does not detrimentally affect this species and manage total grazing pressure at important sites through exclusion fencing or other barriers. • Develop and implement a stock management plan for <TAXON> for roadside verges and travelling stock route. Distribute this information to drovers and graziers in the area to increase awareness of the species requirement. • Does the species require a specific % of ground cover, i.e., some birds and reptiles? If so, add a conservation action to retain or enhance cover. • Undertaken extension/awareness activities to inform landholders of the presence (or potential presence) of the species, with the view to collaborate on protecting the species and its habitat.
Energy production and mining	• Ensure the species and its habitat are adequately represented in the protected area estate. Investigate options to protect additional habitat under appropriate conservation covenants. • Prior to any land clearing, ensure thorough targeted surveys are undertaken by a suitably qualified person to identify occurrences of the species so that adequate mitigation can be undertaken. • If any individuals are likely to be directly impacted by energy production/mining, ensure they are adequately represented in an *ex-situ* conservation collection.
Transportation and service corridors	• Ensure the species and its habitat are adequately represented in the protected area estate. Investigate options to protect additional habitat under appropriate conservation covenants. • Prior to any land clearing, ensure thorough targeted surveys are undertaken by a suitably qualified person to identify occurrences of the species so that adequate mitigation can be undertaken. • If any individuals are likely to be directly impacted by transportation corridors, ensure they are adequately represented in an *ex-situ*

	conservation collection.
Biological resource use	*Timber harvesting* • For target species – Investigate and establish sustainable take levels (if any) to ensure the species' population persists in the long term. • For non-target species – Ensure logging is excluded from areas where the species occurs in <STATE FOREST NAME>. Determine a suitable buffer around occurrences of the species to exclude logging activities to prevent direct and indirect damage to the species and its habitat. • Incorporate <TAXON> into the management plan for <STATE FOREST NAME>. • Ensure all contractors are aware of the species' presence, and their obligations to protect it. • Precisely map the occurrences of the species throughout <STATE FOREST NAME> to guide management actions. *Illegal take (overfishing, illegal seed/plant/animal collection)* • Undertake education and awareness activities to communicate the detrimental impact that illegal take has for the species. • Investigate the suitability/feasibility of reinforcing the wild population with translocated individuals. Ensure disease and genetic implications are carefully managed. • Ensure genetic diversity from areas targeted by poachers is adequately represented in *ex situ* conservation collections.
Human intrusion and disturbance	• Prevent habitat disturbance. Control access routes by installing gates/fences to suitably constrain <STOCK/VEHICLE/PUBLIC> access to known sites on public land and manage access on private land and other land tenure. • Improve the management of stream flows, water quality and riparian environments throughout catchments of existing and potential sites by... • Protect and rehabilitate riparian vegetation <OR OTHER KEY HABITAT> by... • Ensure land managers are aware of the species' occurrence and implement protection measures against key and potential threats. Add to references: SERA (Society for Ecological Restoration Australia (2017) National standards for the practice of ecological restoration in Australia. Standards reference group, Society for Ecological Restoration Australia. Viewed 11 April 2016. Available at: http://www.seraustralasia.com/standards/National%20Restoration%20Standards%202nd%20Edition.pdf
Natural systems modifications – fire	• Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of <SPECIES>, degrade the habitat of the species, promote invasion of exotic species, or increase impacts of grazing/predation. • Physical damage to the habitat and individuals of the <SPECIES> must be avoided during and after fire operations.

	• Fire management authorities and land management agencies should use suitable maps and install field markers to avoid damage to <SPECIES>. • Undertake active weed control after fire management along urban roadsides. *For orchids and other geophytes* Ensure that prescribed fires occur only within the habitat during the dormant phase of the <SPECIES> life cycle. *For obligate seeding shrubs (Serotinous obligate seeding shrubs are a small subset of genera that release seed in response to fire rather than spontaneously at seed maturation and include some Eucalypts, Hakea, Banksia, Melaleuca etc.)* • Ensure that fires do not occur within populations before an accumulation of a seedbank large enough to replace the number of fire-killed standing plants. Replacement estimates should incorporate expected post-fire rates of seedling survival. • Ensure that intervals between successive fires account for the longevity of the standing plant population, noting that serotinous seedbanks are unlikely to persist longer than the standing plant population. • Ensure that fires are sufficiently intense to trigger complete seed release from the serotinous fruits (i.e. by ensuring canopy combustion) and to trigger optimal germination. *Woody resprouting plants* • Avoid successive fire intervals that are shorter than the period required for burnt individuals to resprout and adequately recover. *Fire-killed long-lived plant species, or species that occur in communities dominated by them (e.g., alpine, rainforest and subalpine plant communities)* • Ensure fuel reduction and other planned fires are not implemented at the site. • Where appropriate, employ fuel reduction activities and other protective measures at strategic locations nearby to reduce the potential adverse impacts of wildfire on the species' population, but ensure these are well planned and implemented and do not constitute an increased risk (e.g. through escape of planned fires), and are of low intensity. *Groundcover-dependent vertebrates* • Ensure that a high proportion of the habitat is maintained with a post-fire age sufficient to provide adequate cover (or habitat) to the threatened species. • Ensure immediate and ongoing post-fire predator control within the habitat when fires do occur. • Ensure grazing by introduced herbivores is minimised or excluded post-fire until adequate vegetation recovery has occurred. • Ensure that areas of dense ground cover/leaf litter are retained within the habitat when prescribed fires are implemented. Reduce the frequency of high intensity fires to retain hollow logs and large woody debris on the ground.

	Arboreal mammals & hollow-dependent birds • Reduce the frequency of high intensity fires to limit the loss of hollow-bearing trees, and/or minimise bottlenecks in the recruitment of young trees to larger size classes. • Reduce the intensity of fires so that the canopy (and associated nesting sites) is retained during/after fire events. • Investigate the option to install carefully designed (species-specific) nest boxes if there is a shortage of hollows in some areas. *Seed-eating animals* • Manage fire to produce a fine-scale mix of vegetation of different ages (time-since fire), including some relatively long-unburnt vegetation. *Nectivorous animals and other canopy feeders* Reduce the frequency of high intensity fires that affect the timing and volume of flower production, and the canopy foliage. *Habitats in which invasive grasses and forbs are a threat* • Minimise use of prescribed fire and follow up with appropriate weed control. • For tropical and arid-tropical areas, use prescribed fire after invasive grass seed has germinated and before seed set has occurred to control invasive annual grasses. *Habitats in which invasive (exotic or native) shrubs or trees are a threat* • Where appropriate, use prescribed fire to manage the density and/or abundance of invasive species that may reduce the suitability of habitat for the taxon. • Where appropriate, use manual or chemical control methods as an alternative to prescribed fire. This should consider the probability of invasive species germinating in response to physical disturbance of soils. *For species with few individuals or single populations* • Avoid any management or research activities that may negatively impact the persistence of the population.
Invasive and other problematic species, genes and diseases	*General* • Develop and implement strategies to control predation by the <INVASIVE SPECIES>, as detailed in the relevant Threat Abatement Plans or management strategies. • Manage sites by... to identify, control and reduce the spread of invasive species particularly <INVASIVE SPECIES>. • Implement suitable hygiene protocols including... to protect known subpopulations from outbreaks of <DISEASE/PARASITE – scientific/common name>

	• Ensure appropriate hygiene protocols are adhered to when entering or exiting sites for survey, monitoring or management such as those outlined in the Arrive Clean, Leave Clean Guidelines (Department of the Environment 2015). Add to references: Department of the Environment (2015) Arrive Clean, Leave Clean: Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems. Canberra. Available at: https://www.environment.gov.au/biodiversity/invasive-species/publications/arrive-clean-leave-clean *Disease - phytophthora (*Phytophthora cinnamomi) • Implement a *P. cinnamomi* management plan to ensure that the fungus is not introduced into uninfected areas where the species occurs, and that the spread in areas outside of, but adjacent to population is mitigated (DoE 2014). • Ensure that appropriate hygiene protocols are adhered to when entering or exiting the known location of <TAXON>, such as those outlined in Podger et al. (2001). • Implement a hygiene management plan and risk assessment to protect known populations from further outbreaks of *P. cinnamomi*. This may include but is not limited to ensuring contaminated water is not used for firefighting purposes; contaminated soil is not introduced into the area as part of restoration, translocation, infrastructure development or revegetation activities; all areas where <TAXON> is known to occur that are free of *P. cinnamomi* are sign posted and hygiene stations are implemented and maintained. • Implement mitigation measures in areas that are known to be infected by *P. cinnamomi,* this may include but is not limited to application of phosphite (H3PO3), noting the potential deleterious effects as a fertiliser with prolonged usage. Add to references: Podger F.D., James S.H., & Mulcahy M.J. (2001). *Phytophthora cinnamomi* and disease caused by it- a protocol for identifying 'protectable areas' and their priority for management. *Draft report prepared for Department of Parks and Wildlife*. Available from www.dpaw.wa.gov.au/images/documents/conservation-management/pestsdiseases/disease-riskareas/Protecting_the_Protectable_and_Protocols_for_Defining_Protectable_Areas.pdf Commander L.E., Coates D., Broadhurst L., Offord C.A., Makinson R.O. & Matthes M. (2018) Guidelines for the translocation of threatened plants in Australia Third Edition. *Australian Network for Plant Conservation*, Canberra. *Disease - chytrid fungus* (Batrachochytrium dendrobatidis) *Assessors should refer to actions in the Threat abatement plan for infection of amphibians with Chytrid fungus resulting in Chytridiomycosis.* Add to references: Department of the Environment and Energy (2016). *Infection of amphibians with Chytrid fungus resulting in Chytridiomycosis (2016).* Commonwealth of Australia. Available at: https://www.dcceew.gov.au/sites/default/files/documents/tap-chytrid-fungus-2016.pdf *Disease - myrtle rust (*Austropuccinia psidii)

	Assessors should refer to the recovery actions outlined in Myrtle rust in Australia: a national action plan (Makinson et al. 2020) when considering recovery actions for myrtle rust-impacted species. • Follow the recommendations and actions outlined in the Myrtle rust in Australia: a national action plan (Makinson et al. 2020). This should include…<INSERT RELEVANT ACTIONS HERE> • Engage with experts on the pathogen and species to ensure a coordinated response to the impact of myrtle rust on this species. Add to references: Makinson RO, Pegg GS, Carnegie AJ (2020). *Myrtle rust in Australia – a national action plan.* Australian Plant Biosecurity Science Foundation. Canberra, Australia. Available at: http://www.apbsf.org.au/wp-content/uploads/2020/07/PBSF-Myrtle-Rust-National-Action-Plan-2020.pdf *Predators and feral herbivores* *Assessors should refer to relevant threat abatement plans for key predators and feral herbivores. If relevant add an action about the need to consider the impact of fox and cat control post any burn or large rain event.* • Ensure immediate and ongoing post-fire predator control within the species' habitat. • Protect vulnerable subpopulations from grazing/browsing pressure after fire events through targeting culling or exclosure fencing. *Invasive weeds* *Assessors should refer to relevant threat abatement plans for invasive weeds.* • Identify and remove new weeds or undertake weed control (identify which is relevant) in the local area that could become a threat to the species, using appropriate methods. Consider the possible disturbance/overspray threats associated with the control method.
Pollution	• Investigate options to limit or manage pollution to minimise the impact on the species. • Liaise with key stakeholders to develop a management strategy to address the negative impacts of pollution on the species. • Undertake extension and awareness activities to ensure key stakeholders are aware of the negative impacts of pollution on the species.
Geological events	• Develop a management strategy to guide recovery actions for the species after significant weather/geological events. • Establish an *ex-situ* subpopulation/seed bank/conservation collection that represents the maximum range of genetic diversity possible.
Climate change and severe weather	• Undertake research to better understand the conservation genetics of the species. Specifically, determine if the species demonstrates genetic sub structuring; the effective population size based on genetic variation; and whether some genetic variation is already infrequent or at threat of extinction. • Undertake research to better understand the biology and ecology of the species, and the implications that climate change may have for the species.

	• Establish an *ex-situ* population via seed banking or propagation for conservation and research, ensuring the maximum range of genetic diversity possible is represented
Recovery actions grouped by theme (i.e., these may apply to multiple threats and <u>should be repeated against all relevant threats</u> in the nomination form where applicable).	
Ex situ conservation (For plants)	*Ex-situ conservation collections/populations should be considered when there is a high extinction risk to the taxon in the wild. Translocations should always follow best-practice guidelines, and these should be referenced in the listed recovery actions accordingly.* • Establish plants in cultivation in appropriate institutions such as botanic gardens. • To manage the risk of losing genetic diversity, undertake appropriate seed and storage in long term custodial collections until no longer needed and determine viability of stored seed. Best practice seed storage guidelines and procedures should be adhered to, to maximise seed viability and germinability. Seeds from all natural populations to be collected and stored. • To manage risk of losing genetic diversity, undertake seed collections and store at appropriate institutions. Seeds from as many wild plants as possible across the majority of wild subpopulations should be collected and stored. • If deemed appropriate, undertake conservation translocations in suitable habitat with secure land tenure, to increase the number of subpopulations of <TAXON>, in accordance with the *Guidelines for the translocation of threatened plants in Australia* (Commander et al. 2018) OR equivalent guidelines for fauna.
Stakeholder engagement/ community engagement (relevant to many threats)	*Stakeholder engagement/extension activities should be included where a taxon is not wholly protected in conservation estate. Prior to listing actions regarding stakeholder engagement, assessors should identify the relevant stakeholders e.g., Traditional Custodians, landholders, public land managers, drovers (travelling stock routes), industry (e.g., mining, fishing), the general public (for high profile species), NGOs, and/or developers. Assessors should then determine the objectives for any public engagement, e.g., to improve management on private land, to avoid negative publicity, to ensure recent scientific knowledge is incorporated into public land management. Separate engagement processes (and thus recovery actions listed in the nomination form) will likely be required where there are different objectives.* • For small populations – prepare a <TAXON/WEED/FERAL PEST/DISEASE> management strategy with input from local experts or <OTHER STAKEHOLDER(S)>. Work with <STAKEHOLDERS> to implement the management strategy. • Actions must be stated for each engagement process identified, e.g., Indigenous engagement/consultation, a specific community consultation, or land manager consultation. • Engage and involve Traditional Custodians in conservation actions, including the implementation of Indigenous fire management and other survey, monitoring and management actions. • Ensure information on [TAXON] and their habitat is shared between state forest managers and government scientists. New population data and research should be available to all stakeholders to continue to implement best-practice land management that minimises the impacts of potential threats on the species. • Where research identifies potential habitat for the species in areas that are privately-owned, liaise with landholders to provide

	information on the species and its habitat requirements, and encourage reporting of any sightings. • Increase the recognition and support for the species' recovery by disseminating information on the species and its conservation status to the public.
Survey and monitoring priorities	*Time-series monitoring* *Time-series monitoring is critical for detecting changes in population over time, and therefore discerning whether the population is responding positively or negatively to threats and threat abatement actions. Consider including a recovery action related to time-series monitoring under any relevant threats where data is required to understand the threat or the species' response to the threat more comprehensively.* • Design and implement a time-series monitoring program (or if appropriate, support and enhance existing programs) to determine population size and trends in population demographics in relation to threats and management actions. Use data to assess population size and the viability of and status of the (sub)population(s). • Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary. • Where the public is involved in citizen science type monitoring (e.g., many birds, frogs, flying foxes), determine whether these data can be used in monitoring populations, or whether the methods could be adapted to generate more useful data. • For fire impacted species – establish and maintain a monitoring program to document post-fire recovery, determine minimum tolerable fire intervals, determine trends in population size and distribution, determine threats and their impacts; and monitor the effectiveness of management actions and the need to adapt them if necessary. • For plants threatened by fire – monitor the size, structure, and reproductive status of populations at different stages in the fire cycle, taking opportunities to monitor after planned and unplanned fires (where they occur) and improve understanding of the fire response of the species. Precise fire history records must be kept for the habitat and extant populations (confirmed and suspected) of the species. • For animals threatened by fire – monitor the response of the population to fire, using an appropriate measure (occupancy, population abundance, individual mortality, ranging behaviour, breeding success, etc.) based on knowledge of the ecology of the species, and with a monitoring design that aims to improve understanding of the species' response to fire. Precise fire history records must be kept for the habitat and extant populations (confirmed and suspected) of the species. • Predation – monitor the abundance of introduced predators across the species range and responses of the <TAXON> to predator control programs. Evaluate the use and effectiveness of management interventions and modify if required. *Poorly known species – survey requirements* *For taxa where population size or distribution are not comprehensively known, further targeted survey is typically required to better understand the distribution, population size, threats and required threat abatement actions for the species. Consider listing this recovery action against any threats that would rely on a better understanding of population size, distribution, and threats for appropriate management to occur.* • Undertake targeted surveys in suitable habitat to locate any additional occurrences of the species to assess population size and distribution more precisely.

Information and research priorities	*General* *For taxa with poorly known biology and ecology, further research is often required to adequately inform recovery planning (i.e. weed management strategies, fire management strategies) and also the listing (i.e. generation length). Consider listing this recovery action against any threats where further research is required to guide and inform effective threat management.* • For plants - investigate the ecological requirements of [TAXON] that are relevant to persistence and recruitment, including seed storage conditions in ex situ seed banks; population genetic structure, levels of genetic diversity and minimum viable population size; reproductive status, longevity, fecundity, and frequency and size of recruitment events; soil seed bank dynamics, particularly the longevity of seed in the soil seed bank; pollinator identity, biology, and requirements; the effect of drought on mortality rates of the species. • For fire impacted species – Identify an optimal fire regime for the species by assessing population-level responses to a range of fire regimes and modelling population viability across all fire scenarios. Assess the efficacy of management options in reducing the incidence, extent, and intensity of fire. *Species Distribution Modelling for estimating extent of occurrence (EOO)* *Species distribution modelling (SDM) is appropriate when the geographical range of a species is poorly known and is often used when limited presence records are available and data is often of a broad spatial resolution. Note that this requires a reasonably sized data set of species presence information plus the range of environmental variables that are known to influence the species distribution (Phillips et al. 2006). If this data is not available, then a research priority should be to collect and assimilate this information.* • Develop predictive models for the species' geographical distributions based on the environmental conditions of sites of known occurrences. Add to references: Phillips S.J., Anderson R.P., & Schapire R.E., (2006). Maximum entropy modelling of species geographic distributions. *Ecological Modelling*. 190,3-4, 231-259. *Habitat Suitability Modelling to assess Area of Occupancy (AOO)* *Habitat Suitability Modelling is used to identify the environmental variables a species prefers and requires finer scale data than the SDM but produces results of a much higher and more accurate resolution. Note that this requires a reasonably high number of presence records, plus the environmental variables located at this site and other sites chosen at random.* • Develop habitat suitability models to determine the ecological/environmental indices responsible for a species' distribution, and how it may change due to the impending threats (Guisan et al. 2000). Add to references: Guisan A. & Zimmermann N.E. (2000) Predictive habitat distribution models in ecology. *Ecological Modelling* 135, 147-186.

	Connectivity analysis *Connectivity analysis is used to identify and prioritize important areas for connectivity conservation between disconnected populations across a heterogeneous landscape. Note that this requires information on individual-based movement, or genetic diversity in the population. IF not available then collection of these data should be a research priority.* • Undertake connectivity analysis to priorities important areas for conservation, the location of critical habitat linkages and barriers to the movement of individuals and gene flow (McRae et al. 2008). Add to references: McRae B.H., Dickson B.G., Keitt T.H., & Shah V.B. (2008) Using circuit theory to model connectivity in ecology and conservation. *Ecology* 10, 2712-2724.

3.4 Listing class/category

3.4.1 Current listing class/category

Select the appropriate category for the *NC Act* and the *EPBC Act.*

- The status under the *NC Act* will be listed on WildNet.
- The status under the *EPBC Act* will be listed on the SPRAT database.

3.4.2 Nominated listing class

Assessors will need to return to this section after assessing the taxon against the criteria. Assessors should state the proposed category and criteria, along with a brief justification for why the species is assessed to meet these.

3.5 Nominating a species to transfer to another class

3.5.1 Reasons for nomination to transfer to another class

Identify and select the reason for the species' nomination. If the nomination results in a change in category/criteria, assessors should identify whether the change is because of a 'genuine' or 'non-genuine' change in the species status. Genuine change refers to an actual change in the status of the taxon due to threats or management actions. Non-genuine change typically refers an erroneous prior listing or taxonomic change. In many cases, assessors will select "other", reflecting an update to the species listing using the CAM-compliant methodology.

The following rules apply to category transfers:

- For genuine changes to a lower threat category, at least five years must have passed since the data show the taxon no longer meet the criteria for the category in which it is currently listed (this is not necessarily the date of previous assessment).
- If the original classification was erroneous or based on a nongenuine change, the taxon may be transferred immediately to the category it is currently eligible for listing under.

Assessors will need to justify any category transfers against the abovementioned rules.

3.5.2 Initial listing

Review the original listing for the taxon and follow the text format displayed in Box 7.

Box 7. Example text format for the Initial listing section of the nomination form.

[*Species name*] was listed as [Category] under Criterion [xxxx] on [DATE]. OR The initial listing information is not available for this species.

3.5.3 Changes in situation leading to the nomination to transfer to another class

Assessors will need to return to this section after assessing the taxon against the criteria. Assessors only need to fill this out if the taxon has changed from its initial listing category. Follow the format provided in Box 8.

Box 8. Example text format for the nomination transfer section of the nomination form.

[Species name] has been assessed under the CAM-compliant methodology and meets the thresholds for listing as [Category] under Criterion [XX], because X, Y, Z.

3.5.4 Impact of category transfer – 'downlisting' to NT or LC

Only complete this section if the nomination is for transfer of a taxon to Near Threatened or Least Concern from a class of nationally threatened wildlife (Extinct, Extinct in the Wild, Critically Endangered, Endangered or Vulnerable).

- Provide details of the expected impact on the taxon if conservation actions were ceased following its transfer from a threatened wildlife class.

3.6 Standard of scientific evidence and adequacy of survey

Assessors should consider the information compiled in the assessment up to this point. If it is sufficient to warrant a listing, insert the text from Box 9. Seek guidance from a manager if required.

Box 9. Standard statement on survey adequacy for the Standard of scientific evidence section on the nomination form.

For this assessment it is considered that the survey of the species has been adequate and there is sufficient scientific evidence to support the listing outcome.

3.7 Eligibility against the criteria

Some general rules and tips

- The IUCN Red List Guidelines are the authority for applying the Criteria and include detailed text and examples on their application.
- *Every section must be addressed. Under every Criterion, address every sub-criterion sequentially, as per the examples.*
- If assessors cannot make an assessment for a specific criterion due to lack of information, this should be stated. This is often the case.
- Sometimes, it is easy to start with the most familiar Criterion rather than working through them sequentially. It can also be helpful to start by making notes in each box.
- Make sure any references to key parameters are also presented and justified in the previous sections of the nomination form. That is, there should be *no new information* presented here, just a synthesis of what has already been outlined.
- Assessors should ensure they justify how/why the taxon meets the key definitions.

3.7.1 Understanding data quality

Although the IUCN Criteria are quantitative, detailed and relevant data are not always available for taxa that require assessment. To account for this, the IUCN Red List criteria incorporate several levels of data quality qualifiers, so that taxa without complete data can be assessed. The following terms are used to refer to the nature of the evidence for specific criteria (in order from highest to lowest quality).

3.7.1.1 Observed data

Data that has been *observed* refers to information that is based on well-documented observations (IUCN SPC 2022). For example:

- Population size based on a census
- Population reduction from two census periods (3 generations ago and current)
- Continuing decline of habitat derived from a survey of all known habitat, or aerial photography of all known habitat
- Continuing decline based on multiple census periods

3.7.1.2 Estimated data

Data that has been *estimated* refers to information based on calculations that may include statistical assumptions about sampling or biological assumptions about the relationship between an observed variable and the variable of interest (IUCN SPC 2022). For example:

- Transect counts of singing male birds combined with assumptions about sex ratios to calculate the number of mature individuals
- Population reduction or continuing decline in number of mature individuals derived from the estimated

number at two different time points.

- EOO or AOO calculations based on 'inferred sites of occurrence' (e.g., sites inferred from presence of known habitat)

3.7.1.3 Projected data

As with estimated data, *projected* data refers to information based on calculations that may include statistical assumptions about sampling or biological assumptions about the relationship between an observed variable and the variable of interest (IUCN SPC 2022). However, *projected data is extrapolated in towards the future or in space.* For example:

- Population reduction from census data extrapolated into the future using statistical methods or models
- Continuing decline in the area or extent of habitat predicted by a statistical model of land cover change, which is based on analysis of past land cover change from remote-sensed data.

3.7.1.4 Inferred data

Data that has been *inferred* refers to information in the same type of units but not a direct measure (IUCN SPC 2022). For example:

- Population reduction inferred from a change in catch statistics.
- Continuing decline in mature individuals inferred from trade estimates.
- Continuing decline in AOO inferred from rate of habitat loss.

3.7.1.5 Suspected data

Data that is *suspected* refers to information that is based on variables in different types of units (IUCN SPC 2022). For example:

- Percentage (%) population reduction based on decline in habitat quality or on incidence of a disease or circumstantial evidence.
- Population reduction based on information on trends in harvest, habitat quality, sightings (e.g., from structured expert elicitation).

3.7.1.6 Minimum data quality requirements

Consequential differences occur when selecting observed/estimated/projected OR inferred OR suspected, as the latter two are not permissible with some criteria (Table 8).

Table 8. Minimum data quality requirements for criteria A-E. If the data qualifier for the listed parameter is of lower quality than required, it cannot meet the criterion, even if the numerical value meets the threshold for that criterion. (Excerpt from IUCN SPC 2022, pg. 19).

Criterion	Parameter	Min. quality
A	Population reduction	Suspected
B	AOO	Estimated
B	EOO	Estimated
B1b, B2b	Continuing decline in EOO; AOO; area, extent and/or quality of habitat; number of locations or subpopulations; number of mature individuals	Inferred
C, D	Number of mature individuals	Estimated
C1	Estimated continuing decline	Estimated
C2	Continuing decline in number of mature individuals	Inferred
C2a(i)	Size of largest subpopulation	Estimated
E	Extinction probability	Estimated

Data used in assessments are often obtained with considerable uncertainty – this should not be confused with a lack of data for certain parameters. It is important to understand the difference between a precautionary and an evidentiary attitude. The IUCN Red List guidelines recommend resisting an evidentiary attitude by using plausible lower and upper bounds, rather than best estimates. However, assessors should also avoid using the worst-case scenarios. There is considerable detail on this issue available in the Red List Guidelines (IUCN SPC 2022).

3.7.2 Summary of key assessment parameters

Prior to assessing the taxon against the Criteria, assessors should collate the key assessment parameters into the table provided from the body of the nomination form. Definitions of these key terms follow the 'Guidelines for Using the IUCN Red List Categories and Criteria'. The table encourages assessors to specify 'plausible bounds' for each parameter. Plausible bounds are used to represent and manage uncertainty during the assessment process.

- Assessors should state the minimum and maximum plausible values for each parameter, along with the estimate used in the assessment.
- The estimate used in the assessment is likely to reflect the 'best guess'. However, it may also reflect the lower plausible value where a precautionary approach is warranted. For example, using the lowest plausible number of mature individuals when assessing a taxon that is known to be declining, but recent population estimates are not available.
- The estimate used in the assessment can be a range, but in any case the best estimate should always be included in the range of plausible values.
- The plausible range may be established using various methods, for example based on confidence or probability intervals, expert opinion, or the consensus view of a group of experts. Justify the method used and to represent uncertainty, along with the estimate used in the assessment in the table below.
- **Trend** may be decreasing, increasing, static or unknown, as per the Threats table (Table 1).
- For severe fragmentation and extreme fluctuations, the table cell should contain a statement indicating whether the condition has been met for the taxon being assessed, alongside a justification against the definition of the term.

Eliciting population size estimates from experts

When asking experts to provide a population estimate, most will not feel comfortable doing so due to lack of data. However, they may be more confident assigning plausible bounds. When completing an assessment, the key quantitative thresholds that will impact a category assigned to a species based on the number mature individuals are <250, <2500, <10 000 and <20 000 for Criterion C, and <50, <250, <1000, <3000 for Criterion D. Therefore, assessors should seek to clarify with experts whether the total number of mature individuals would fit in any of the following categories:

- <50
- 50-250
- 250-1000
- 1000-2500
- 2500-10 000
- 10 000-20 000.

Note that the threshold of 3000 mature individuals (relevant for NT under D1) has been omitted from these ranges for simplicity. It is unlikely that an expert would be able to differentiate between 2500 and 3000 if making a 'best guess'.

Then, if the population estimate is less than 10 000 mature individuals, and there is evidence of continuing decline, it is also appropriate to ask about the number of mature individuals in the largest subpopulation:

- <50
- 50-250
- 250-1000.

Table 9. Example text for the Summary of key parameters table in the nomination form. Ensure the justification is comprehensively referenced*.

Metric	Estimate used in this assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	1000-2000	1000	2000	Number of mature individuals is based on a field survey at both subpopulations. A census was completed on Mt Coochin, where only 1 mature individual has been located in recent years, which has declined from 2 mature individuals that were present in the past. At Mt Beerwah, the number of mature individuals is based on sites samples, which have been extrapolated over the area occupied by the species, accounting for the species being more abundant on the northern side of the mountain.
Trend	Stable (estimated; Mt Beerwah subpopulation), decreasing (observed; Mt Coochin subpopulation)			
Generation length	70 years	70 years	>200 years	*Eucalyptus kabiana* is a long-lived mallee that can resprout from a lignotuber after disturbance. Fensham et al. (2020) estimated the generation length of *Eucalyptus* spp. to be at least 70 years.
Extent of occurrence	8 km^2	8 km^2	8 km^2	The EOO is auto calculated on GeoCat as <0.5km^2. However, EOO cannot be <AOO, and therefore the EOO is 8 km^2. The EOO was calculated using expert verified herbarium specimen records, permanent monitoring plot data and a minimum convex polygon. The species is not likely to occur outside already recorded areas given the region has been relatively well surveyed and the species has a restricted habitat type.
Trend	Decreasing (projected)			
Area of occupancy	8 km^2	8 km^2	8 km^2	The AOO is estimated as 8 km^2 using expert verified herbarium specimen records and permanent monitoring plot data, and a 2 km grid cell in GeoCat. The species is not likely to occur outside already recorded areas given the region has been relatively well surveyed and the species has a restricted habitat type.
Trend	Decreasing (projected)			
Number of subpop'ns	2	2	2	*Eucalyptus kabiana* is known from two subpopulations: each on an isolated mountain peak >5 km apart. The degree of genetic exchange between these sites is determined by pollinator ranging

				and seed dispersal. For eucalypts generally, pollinators are highly mobile (e.g., insects, birds, bats; e.g. Byrne et al. 2008), and pollen can travel at least 1 km (Byrne et al. 2008; Booth 2017). However, seed dispersal is typically passive and usually falls <100 m from the parent plant (Byrne et al. 2008; Booth 2017). Therefore, it is likely that occurrences of this species at a distance greater than 1 km apart have limited genetic exchange and are therefore separate subpopulations. The likelihood of genetic exchange across both sites where *E. kabiana* occurs is further limited by the extremely low numbers of individuals at the Mt Coochin subpopulation.
Trend	Decreasing (suspected)			
Number of locations	2	2	2	The most serious plausible threat is considered lack of recruitment. This is only impacting one subpopulation. Where a threat impacts <50% of the population, it can be appropriate to defer to the number of subpopulations to determine the final location count (IUCN SPC 2022).
Trend	Decreasing (suspected)			
Severe fragmentation	Severe fragmentation occurs where >50% of the species' subpopulations occur in small, isolated areas, such that they are not likely to be viable (IUCN 2019). Given <2 individuals of *Eucalyptus kabiana* occur on Mt Coochin, the viability of this subpopulation (which comprises 50% of the two subpopulations) is likely to be very limited.			
Extreme fluctuations	*Eucalyptus kabiana* is a very long-lived perennial that has a persistent seedbank and can survive disturbance such as fire, and therefore extreme fluctuations are not likely.			

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Eucalyptus kabiana* under the *Queensland Nature Conservation Act 1992.* Queensland Department of Environment and Science.

3.7.3 Criterion A

Criterion A is used to assess taxa in the context of a *population reduction* based on direct observation, an appropriate index, decline in distribution and/or habitat quality, exploitation, and/or impacts of introduced or competing taxa. Taxa with a population reduction due to any of these factors may meet the category thresholds if the reduction occurs within a given timeframe (Table 10). Assessors should attempt to apply this criterion where there is sufficient evidence (suspected to observed) of a population reduction and the generation length of the taxon.

Table 10. Category thresholds for Criterion A (adapted from IUCN SPC 2022).

Population size reduction (reduction in total numbers) measured over the longer of 10 years or 3 generations based on any of A1 to A4				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**	**≥ 20%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**	**≥ 20%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [*(a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of (a) to (e)

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites

3.7.3.1 Population reduction

A decline in the number of mature individuals, which does not need to be continuing. Assessors will need some population metrics to define this for the taxon.

3.7.3.2 Generation length

The average age of parents of the current cohort (i.e., newborn individuals). This is used to scale time-based measures in the criteria against the reproductive rates (capacity for a taxon to replace itself) of a taxon. There are several ways to estimate this. A commonly used formula is:

*Age of first reproduction + (0.5 * length of reproductive period)*

For this formula, assessors will need to know (i) when the taxon becomes sexually mature, and (ii) when the taxon stops reproducing/senesces.

For plants with seed banks:

Juvenile period + ½ life of seeds in seed bank, OR median time to germination

Seed bank half-lives commonly range from <1-10 years.

Challenges

- Often there is not enough information to estimate generation length. However, an attempt should be made to address this. Review similar taxa in the genus with similar reproductive strategies to obtain more information if required. Ensure the level of uncertainty around the estimate is clearly stated.
- For plants that are strongly associated with a regional ecosystem or threatened ecological community, the level of decline in this ecosystem can often be used as a proxy for population reduction.

When responding to Criterion A, follow the text format and paragraph structure provided in Box 10

Box 10. Example response to Criterion A. A population reduction was calculated for *Rhodamnia maideniana* in relation to generation length, however there was insufficient data to apply this Criterion for *Acacia forsteri.**

***Rhodamnia maideniana* meets the thresholds for listing as Critically Endangered under subcriteria A3e.**

Generation length of *R. maideniana* is estimated to be at least 22.5 years (see Biology and Ecology section), with three generations equating to at least 67.5 years.

Although past population reductions may have occurred, the extent of this reduction relative to generation length cannot be quantified.

Recent population reductions have been observed due to Myrtle Rust infection and dieback. According to Fensham et al. (2021), decline to extinction is anticipated within one generation, based on a loss of reproductive capacity and widespread death of mature trees, due to the effects of introduced pathogens.

Following the recommendations of Fensham et al. (2021) a population reduction of at least 80% within 3 generations is estimated to occur with high certainty.

OR

***Acacia forsteri* is Data Deficient under Criterion A.**

Generation length for the species is not precisely known (see Biology and Ecology).

There are no data available to quantify past, current or future population reductions. However, the species is likely to have undergone a range reduction associated with land clearing in the east of its distribution (see Threats).

There are insufficient data available to assess population reductions relative to generation length.

*Excerpt adapted from Collingwood T.D. (2021). Nomination to change the conservation class of *Rhodamnia maideniana* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science; and Collingwood T.D. (2022). Nomination to change the conservation class of *Acacia forsteri* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

3.7.4 Criterion B

Criterion B is used to assess taxa in the context of spatial distribution, decline and/or an inherent susceptibility to decline. A taxon with a *restricted geographic range that is declining or has an inherent susceptibility to decline* due to a fragmented or fluctuating distribution, may meet the category thresholds (Table 11). Assessors should attempt to apply this criterion where high quality spatial records for the taxon are available, along with evidence of continuing decline.

NB: this is the most commonly mis-applied criterion. Care should be undertaken to understand all definitions, and that B1 and B2 are coupled with at least two of either (a), (b) or (c).

Table 11. Category thresholds for Criterion B (adapted from IUCN SPC 2022).

Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
B1. Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**	**< 40,000 km²**
B2. Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**	**< 4,000 km²**
AND at least 2 of the following 3 conditions for CR, EN or VU:				AND (b) for NT
(a) Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**	**Not applicable**
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals				**≥ 10% within the longer of 10 years or 3 generations**
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals				**Not applicable**

3.7.4.1 Extent of occurrence

Refers to **"**the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy" (IUCN SPC 2022).

- This is calculated as the minimum convex polygon in GeoCat.
- Measures spatial spread of risk.
- If EOO is less than AOO, EOO should be changed to make it equal to AOO to ensure consistency with the definition of AOO as an area within EOO.

3.7.4.2 Area of occupancy

The AOO is a scaled metric that represents the area of suitable habitat known, inferred or projected to be currently occupied by the taxon (IUCN SPC 2022). It is generally estimated by with a 2 x 2 km grid to enable comparison with the criteria thresholds. AOO is not designed to be a fine scale estimate of the actual area occupied by the taxon. The AOO is calculated by summing the area contained within the total number of 2 x 2 km grid cells occupied by the taxon.

- Measures 'insurance effect' (spatial spread of risk).
- Often correlates to population size.

3.7.4.3 Severely fragmented

Refers to the situation in which "*increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonisation*" (IUCN SPC 2022, pg. 48). A taxon's subpopulations must be both *small and isolated.* Population fragmentation is not the same as, but can be inferred from, habitat fragmentation. It must be assessed at scale appropriate to biological isolation. Required information includes:

- The distribution of area of occupancy (i.e., detailed maps of occupied habitat),

- Some aspect of the dispersal ability of the taxon (e.g., average dispersal distance), and
- Average population density in occupied habitat (e.g., information on territory size, home range size, etc.)

Then, a taxon can be considered severely fragmented if most (>50%) of its total AOO is in habitat patches that are:

- Smaller than would be required to support a viable population, and
- Separated from other habitat patches by a large distance relative to dispersal kernel of the taxon (see below).

If a taxon is considered 'severely fragmented', the nomination form should specify:

- What percentage, if >50%, of the taxon's total AOO consists of habitat patches that are too small to support a viable population and are separated from other habitat patches by a large distance relative to the dispersal capacity of the taxon;
- The habitat area estimated to be required to support a viable population;
- The threshold used to define 'small' subpopulations that are not considered to be viable and how it was estimated;
- The degree of isolation of patches; *and*
- The dispersal distance of the taxon.

3.7.4.4 Locations

Refer to a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. Relevant key points are:

- It is measured as the area covered by the most serious plausible threat.
- It may include one or many subpopulations.
- A rapid timescale equates to 1 generation length or 3 years, whichever is longer.

Where the most serious plausible threat does not affect all of the taxon's distribution, other threats can be used to define and count locations in those areas not affected by the most serious plausible threat. If there are two or more serious plausible threats, the number of locations should be based on the threat that results in the smallest number of locations. When parts of the distribution are not affected by any threat the following approaches may be applicable:

- The number of locations is not used (i.e., the subcriteria that refer to the number of locations consequently are not met), especially if the unaffected area is more than half the taxon's range; or
- The number of locations in the unaffected areas is set to the number of subpopulations in those areas, especially if there are several subpopulations; or
- The number of locations is based on the smallest size of locations in the currently affected areas; or
- The number of locations is based on the most likely threat that may affect the currently unaffected areas in the future.

In any case, the basis of the number of locations should be documented (IUCN SPC 2022, pg. 62).

If locations are applied in an assessment, the nomination form should specify:

- The most serious plausible threat, based on the threat that has the maximum product of probability and consequence (see Risk Matrix), unless that threat does not affect all of the taxon's distribution in which case other threats can be used to define and count locations in those areas not affected by the most serious plausible threat;
- The proportion of the distribution/population affected by the threat(s)**;**
- The nature of the effects (i.e., will it rapidly affect all individuals of the taxon present?); *and*
- The timeframe over which the threat(s) occur(s) and how that could be considered 'rapid' in the context of the life history of the taxon.

Some examples of application from Silcock et al. (2020):

Where the main threatening process operates at a landscape scale, the number of locations is defined as the number of discrete management units applicable to the threatening process. The delineation of management units may relate to the ability of the taxon to disperse between areas affected by the threat, the capacity for the threat to transition between units, or areas where different management practices are utilised to mitigate the threat.

- Taxa threatened by the airborne pathogen myrtle rust, where all subpopulations occur within the climatic range of the pathogen, are assessed as a single location.
- Often, where climate change is considered the major threat, all subpopulations are affected and considered a single location.
- Phytophthora (*Phytophthora* spp.) dieback is soil-borne, and fronts may move gradually through an area of contiguous, susceptible vegetation. However, spread to an uninfected area separated by an ecological barrier (e.g., farmland or urbanisation) would require a specific transport vector. Such geographically separated subpopulations would be considered multiple locations in relation to the threat of phytophthora.

Note that it is very important that this term is not used interchangeably. Only use it to refer to a location in this strict definition. Choose terms such as 'occurrence', 'sites' or 'subpopulations' as alternatives.

3.7.4.5 Extreme fluctuations

Extreme fluctuations occur when the population size or distribution varies widely or rapidly, typically by a 10-fold increase/decrease. A fluctuation must represent a true change in the population, not just a flux between life stages. Extreme fluctuations occur when:

- Population trajectories show a repeated pattern of increases and decreases
- Taxa have life histories prone to boom-bust dynamics (e.g., granivorous mammals of arid climates, plants that respond to stand replacing disturbances).

3.7.4.6 Continuing decline

Continuing decline refers to a *recent, current or projected future* decline that is liable to continue in the absence of threat management. This may be *observed, estimated, inferred or projected*, depending on the criteria/subcriteria. For projected declines (i.e., into the future), there must be a high degree of certainty that they will take place.

When responding to Criterion A, follow the text format and paragraph structure provided in Box 11.

Box 11. Example application of Criterion B, with key terms highlighted*.

***Acacia forsteri* meets the thresholds for listing as Critically Endangered under Criteria B1+2ab(iii).**

The species has an EOO and AOO of 4 km^2 (see Distribution). It is possible that the EOO and AOO will increase with further survey of nearby similar habitat. However, any increase is likely to be small, due to the species highly restricted habitat associations (see Distribution and Habitat). If additional occurrences were located with further survey, it is unlikely this will result in the EOO exceeding beyond the threshold of 100 km^2.

The species is not considered severely fragmented, although it does occupy an area of restricted habitat. There has been land clearing within the broader landscape, however the species occurs within habitat that is relatively well connected to other vegetation tracts within the region.

Acacia forsteri is known to occur on a single parcel of freehold land that has undergone past clearing, ongoing timber harvesting and is currently used for cattle grazing. One herbarium record of the species occurs within an area of vegetation mapped as 'non-remnant' indicating that clearing has occurred in very close proximity to the species. Although there is no direct evidence these threats are causing current declines, continuing decline has been inferred given the past impacts to habitat (land clearing) and ongoing impacts associated with the current land tenure and use (see Threats). When assessed against the threat of ongoing land clearing, the species occurs at 1 location, as the threat is directly related to land tenure. The same logic would apply to other threats including domestic stock grazing and timber harvesting (which are implicated in habitat degradation). This threat is liable to cause a decline in the (iii) area, extent and/or quality of habitat for the species.

Acacia forsteri is a perennial shrub. Therefore, extreme fluctuations are unlikely.

OR

***Commersonia leiperi* meets the thresholds for listing as Endangered under Criteria B1+2ab(i-v).**

The species has an EOO and AOO of 187.4 km^2 and 16 km^2, respectively (see Distribution). It is possible these parameters may increase slightly with additional survey, however not beyond the thresholds for Endangered.

The species occurs in a widespread habitat type, which has been extensively developed for agriculture and urbanisation (see Distribution). All subpopulations are separated by >20 km by non-remnant vegetation, and dispersal between subpopulations is extremely unlikely. There are several threats likely to be causing declines within each subpopulation, and re-colonisation is not likely if localised extinctions occur. Therefore, the species is considered severely fragmented.

A continuing decline has been inferred for the species' population based on the of current land management practices (Timber harvesting), and habitat degradation associated with inappropriate fire regimes and invasive weeds. When assessed against the most serious plausible threat, timber harvesting, the species occurs at 3 locations. These locations have been delineated based on the land tenure scale, with 1 location in Burrum Coast NP, 1 location in Wongi SF and 1 location in St Mary SF 1, as this is the scale that timber harvesting occurs at. Timber harvesting is inferred to cause a decline in the EOO, AOO, extent/quality of habitat, number of locations/subpopulations and number of mature individuals. At the same time, the threat of inappropriate fire regimes/weeds is likely to be threatening all subpopulations. When assessed against this threat, the species also occurs at 3 locations, as fire regimes and invasive weeds are managed at the land tenure scale. This threat is inferred to be causing a decline in the habitat quality and number of mature individuals of the species.

Commersonia leiperi is a perennial shrub and extreme fluctuations are unlikely.

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Acacia forsteri* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science; and Collingwood T.D. (2022). Nomination to change the conservation class of *Commersonia leiperi* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

Challenges

- *Is there evidence of decline?* Decline must be *observed, estimated, inferred or projected* to meet subcriterion (b). Decline cannot be *suspected* under Criterion B. This should be clearly set out in your Threats table.
- *Category thresholds and survey adequacy:* If the taxon's EOO and AOO are close to the thresholds for CR/EN, ensure the confidence level and/or survey adequacy and subpopulation counts are referred to. If the taxon is close to the threshold and more survey is needed, it may be precautionary to assess the taxon using the lower plausible bounds.

3.7.5 Criterion C

Criterion C is used to assess taxa in the context of population size and decline. Taxa with a *small population size and continuing decline* may meet the thresholds for listing under this criterion (Table 12). Assessors should attempt to apply this Criterion when there is sufficient information about the population size and evidence of decline.

Table 12. Category thresholds for Criterion C (adapted from IUCN SPC 2022).

Small population size and decline					
		Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
Estimated number of mature individuals		**< 250**	**< 2,500**	**< 10,000**	**< 20,000**
AND either (C1) or (C2) is true					AND (C1) is true
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in the future		**25% in 3 years or 1 generation (whichever is longer)**	**20% in 5 years or 2 generations (whichever is longer)**	**10% in 10 years or 3 generations (whichever is longer)**	**10% in 10 years or 3 generations (whichever is longer)**
C2 An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of (a) or (b):					
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**	**Not applicable**
	OR				
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**	**Not applicable**
(b) Extreme fluctuations in the number of mature individuals		**Applicable**	**Applicable**	**Applicable**	**Not applicable**

3.7.5.1 Continuing decline

See definition under Criterion B, pg. 55.

3.7.5.2 Extreme fluctuations

See definition under Criterion B, pg. 55.

3.7.5.3 Generation length

See definition under Criterion A, pg. 57.

3.7.5.4 Number of mature individuals

Refers to the number of individuals known, estimated or inferred to be capable of reproduction.

- Individuals that will never be capable of reproducing should be excluded (i.e., densities too low)
- Use lower plausible bounds where fluctuations occur

- For clonal taxa, use reproductive units (i.e., ramets) that can survive alone
- Re-introduced taxa must be self-sustaining (produced viable offspring)

3.7.5.5 Subpopulations

Refers to geographically distinct groups in the population between which there is limited demographic or genetic exchange (<1 individual per year). The method used to delineate subpopulations will vary between taxa. It is important to have an understanding of the taxon's dispersal capacity and reproductive mechanisms (e.g., water dispersed seeds). As an example:

- For a species of tree, a subpopulation can be defined as a spatially distinct segment of the population that experiences insignificant or reproductively unsuccessful migration of seed or pollen from other subpopulations.
- For a freshwater fish, subpopulations may be defined by catchments, between which would be low rates of gene transfer.
- For freshwater fish or plants that occur in very isolated habitat such as springs, subpopulations may be defined by each distinct spring.
- For terrestrial taxa that inhabit islands, subpopulations may be defined by each discrete island, as migration between these islands is likely to be limited by the ocean.

An example of how to justify assessment under Criterion C is provided in Box 12.

Box 12. Example application of Criterion C*. *Decaspermum struckoilicum* can be assessed under Criterion C as there are sufficient data available on population size and continuing decline is evident. While *Homoranthus brevistylis* meets the requirements under Criterion C for population size, there is no evidence of continuing decline so it is not eligible under this Criterion.

***Decaspermum struckoilicum* meets the thresholds for listing as Critically Endangered under criteria C2a(i,ii).**

The population of *D. struckoilicum* is currently estimated at 41 mature individuals.
Continuing decline is inferred due to the threat of ongoing land clearing, and a range of other threats including invasive weeds and inappropriate fire regimes.

All individuals (100%) occur in a single subpopulation, and therefore the largest subpopulation is currently estimated to contain 42 mature individuals.

Extreme fluctuations have not been documented for the species and are unlikely given it is a perennial tree.

OR

***Homoranthus brevistylis* is assessed as Not Eligible under Criterion C.**

The population is estimated to contain approximately 50 mature individuals, within a single subpopulation (100% in one subpopulation).

The species is not undergoing continuing decline. There are a number of potential threats to the species, including inappropriate fire regimes within its habitat, however there is no evidence these are causing declines.

Homoranthus brevistylis is a perennial shrub and extreme fluctuations are unlikely.

*Excerpt adapted from Collingwood T.D. (2021). Nomination to change the conservation class of *Decaspermum struckoilicum* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science. Collingwood T.D. (2022). Nomination to change the conservation class of *Homoranthus brevistylis* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

3.7.6 Criterion D

Criterion D is used to assess taxon in the context of population size or extent. Those taxa with very *small population sizes*, or populations that are *restricted* in the context of potential threatening processes may meet the category thresholds for subcriteria D1 or D2, respectively (Table 13).

3.7.6.1 Subcriterion D1

A taxon qualifies for listing under D1 if the population size is estimated to number fewer than 1000 mature individuals. This subcriterion is intended to capture those taxa with acute restriction in their population size, even if they are not declining.

3.7.6.2 Subcriterion D2

A taxon qualifies for listing under D2 if the population is sufficiently restricted (in either AOO or locations) AND has a plausible future threat. The subcriterion is intended to capture taxa with restricted distributions such that the population is prone to the effects of human activities or stochastic events in an uncertain future and thus is susceptible to becoming CR or EX in a very short time. Although quantitative thresholds are provided for D2, these are not exclusive but intended as a guide. The focus of subcriterion D2 is *the risk that the taxon could suddenly become CR or EX.*

Taxa with very restricted ranges or small populations that do not meet the data quality requirements under Criteria A-C may often meet the threshold for Vulnerable under Criterion D2. Rather than having a clear line of evidence for continuing decline, a 'plausible future threat' can be used to assess the taxon. For a listing of Vulnerable, the plausible future threat must have the potential to drive the taxon to CR or EX in a short time. For a listing of Near Threatened, the plausible future threat must have the potential to drive the taxon to EN or VU in a 'very short time'.

Table 13. Category thresholds for Criterion D (adapted from IUCN SPC 2022).

Very small population				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
D1. Number of mature individuals	**< 50**	**< 250**	**D1. < 1,000**	**D1. < 3,000**
OR				
D2. [Only applies to the VU and NT categories] Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time (for VU), or EN or VU in a very short time (for NT).	**Not applicable**	**Not applicable**	**D2. Typically: AOO < 20 km^2 or number of locations ≤ 5**	**D2. Typically: AOO < 40 km^2 or number of locations ≤ 10**

3.7.6.3 Number of mature individuals

Refer to definition under Criterion C, pg. 57.

3.7.6.4 Area of occupancy

Refer to definition under Criterion B, pg. 53.

3.7.6.5 Locations

Refer to definition under Criterion B, pg. 54.

3.7.6.6 Plausible future threat

A plausible threat is defined as the effects of human activities or stochastic events in an uncertain future. Plausible threats include *both natural and anthropogenic events*. There must be a substantial possibility of these activities or events occurring. The following examples would *not* suffice as plausible future threats:

- Unlikely events, such as the eruption of an inactive volcano
- Non-specific events that were not observed in similar taxa (e.g., an unspecified disease epidemic)
- Events unlikely to cause extinction (e.g., because the taxon has survived many cyclones, or is likely to adapt to climate change, or fire regimes that have not deviated from historical norms)
- Events unlikely to occur rapidly enough to result in a CR or EX listing in a very short time *after the event occurs* (or VU or EN for NT).

3.7.6.7 Very short time

A *very short time period* is defined as the longer of 1-2 generations or 3-5 years *after the threatening event occurs.* That is, the taxon would deteriorate to meet the listing thresholds for CR or EX under any criteria, after the potential threat occurred within the longer of 1-2 generations or 3-5 years.

An example of how to justify assessment under Criterion C is provided in Box 13.

Box 13. Example application of subcriteria D1 and D2*.

***Homoranthus coracinus* meets the threshold for listing as Endangered under Subcriterion D1 and Vulnerable under D2**.

The population is estimated to contain approximately 100 mature individuals.

The species has an AOO of 4 km^2 (see Distribution). It is possible this may increase with additional survey.

The species has a number of plausible future threats that could drive the taxon to CR or EX in a short time, including successive wildfires combined with climate change (stochastic events). When assessed against these threats the species occurs at a single location, as all individuals would be simultaneously impacted by a fire given their close proximity.

OR

***Boronia grimshawii* meets the threshold for listing as Vulnerable under Subcriterion D2.**

The number of mature individuals is not known (see Distribution).

The species has an AOO of 4 km^2 (see Distribution). The distribution is unlikely to increase beyond the threshold of 40 km^2 with further survey.

Boronia grimshawii has several plausible threats that could drive the taxon to CR or EX in a very short time. It is known to occur on a single parcel of freehold land that has undergone past clearing, ongoing timber harvesting and is currently used for cattle grazing. When assessed against the threat of ongoing land clearing, the species occurs at 1 location, as the threat is directly related to land tenure. The same logic would apply to other threats including domestic stock grazing and timber harvesting. If land clearing occurred, the impact would be realised immediately, thus qualifying as a very short time.

*Excerpt adapted from Collingwood T.D. (2022). Nomination to change the conservation class of *Boronia grimshawii* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science; and Collingwood T.D. (2022). Nomination to change the conservation class of *Homoranthus coracinus* under the *Queensland Nature Conservation Act 1992*. Queensland Department of Environment and Science.

3.7.7 Criterion E

Criterion E is used to assess taxa using a *quantitative analysis* related to the probability of extinction in the wild. Those taxa with a high probability of extinction, measured as a loss within a given timeframe, may meet the category thresholds (Table 14). The process is typically quite involved, usually related to a peer-reviewed publication. There are few examples of Criterion E application in Queensland, but it has been applied for *Grevillea caleyi* in New South Wales (Regan et al. 2003). An example of how to justify assessment under Criterion C is provided in Box 14.

Table 14. Category thresholds for Criterion E (adapted from IUCN SPC 2022).

Quantitative Analysis				
	Critically Endangered (CR)	**Endangered (EN)**	**Vulnerable (VU)**	**Near Threatened (NT)**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% within 100 years**	**≥ 5% within 100 years**

Box 14. Example application of Criterion E (example extracted from TSSC 2018).

***Grevillea caleyi* meets the thresholds for listing as Critically Endangered under Criterion E.**

"Regan and Auld (2004) suggest that extinction risk currently varies from 60% (low fire frequency 15-30 years between fires) to 96% (high fire frequency – five years between fires) in 50 years due to the risk of wildfire burning over any planned fires. Most decline is predicted to occur in the first 25-30 years of the models developed by Regan and Auld (2004). A generation in G. caleyi *is thought to between 8-15 years (and 3 generations 24-45 years). However, given that generations are triggered by fire events (and do not occur independently of fire) and that the average fire return interval in the habitat is approximately 7-17 years (Bradstock and Kenny 2003), 3 generations is most likely to be 21-60 years. Although uncertain, this suggests that the probability of extinction is likely to be ≥ 50% in 3 generations. Consequently,* Grevillea caleyi *would meet Criterion E as Critically Endangered".*

3.8 Summary of criteria under which the species is eligible

To complete this section, assessors should

- Select the Criterion or Criteria under which the taxon meets *any* threat category
- Select the Subcriteria for each Criterion met
- Write the highest Category the taxon is eligible for listing as in bold under the Criteria.

A worked example is provided in Figure 13.

☒Criterion A **Endangered**	☐A1 (specify at least one of the following) ☐**a)** ☐**b)** ☐**c)** ☐ **d)** ☐**e); AND/OR** ☐A2 (specify at least one of the following) ☐**a)** ☐**b)** ☐**c)** ☐**d)** ☐**e); AND/OR** ☒A3 (specify at least one of the following) ☐**a)** ☐**b)** ☒**c)** ☐**d)** ☐**e); AND/OR** ☒A4 (specify at least one of the following) ☐**a)** ☐**b)** ☐**c)** ☐**d)** ☐**e)**
☒Criterion B **Critically Endangered**	☒B1 (specify at least two of the following) ☒**a)** ☒**b)** ☐**c); AND/OR** ☒B2 (specify at least two of the following, other than NT) ☒**a)** ☒**b)** ☐**c)**
☒Criterion C **Endangered**	☐estimated number of mature individuals **AND** ☐C1 **OR** ☒C2 ☐**a (i) OR** ☒**a (ii) OR** ☐C2 ☐**b)**
☒**Criterion D** **Vulnerable**	☐**D1 OR** ☒ **D2**
☐**Criterion E** **Data Deficient**	
☐**EX**	
☐**EW**	
☐**LC**	**Species nominated to change from a higher conservation class to Least Concern. No above boxes apply.**

Figure 13. Example of filled criteria summary section in the nomination form.

3.9 Other considerations

3.9.1 Indigenous cultural significance

Refer to the information gathered regarding the Traditional Custodians for the land on which the taxon occurs from the map created in the Distribution section (pg. 16). Alternatively, the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) website https://aiatsis.gov.au/explore/map-indigenous-australia can provide useful information on engaging with Traditional Custodians and link to maps of Indigenous Australia. Note that it is not appropriate to reproduce (screenshot) the AIATSIS map for use in the nomination. Rather, assessors should provide a link to the website within the text as appropriate.

With support from a suitably qualified or experienced leader, efforts should be made to contact the Indigenous representatives who are the custodians for the taxon. However, if this is not feasible, enter the statement in Box 15.

Box 15. Example text for the Indigenous cultural significance section of the nomination form.

The cultural, customary and spiritual significance of species and the ecological communities they form are diverse and varied for Indigenous Australians and their stewardship of Country. This section describes some examples of this significance but is not intended to be comprehensive or applicable to, or speak for, Indigenous Australians. Such knowledge may be held by Indigenous Australians who are the custodians of this knowledge and have the rights to decide how this knowledge is shared and used.

[SPECIES] is known from occurrences on the lands of the [FIRST NATIONS GROUP] People (whilst acknowledging that other peoples may have a connection to the Country). There is little published information on how the [FIRST NATIONS GROUP] relate to Country in this region and what that may mean for the cultural significance of *[SPECIES]*.

Additional text example:
The species occurs within the XXX Native Title Aboriginal Corporation cultural heritage body boundary (Figure 6). The area is on the *Register of the National Estate* in recognition of its cultural significance. It is also registered as "The Mount Mulligan Aboriginal Cultural Heritage Area" under the *Aboriginal Cultural Heritage Act* 2006 (Qld).

3.9.2 Further studies

Insert *references* to any management plans or action plans here.

3.9.3 Additional comments/ information

Insert an abbreviated table of records used to calculate the EOO and AOO here. Ensure the source of the records is attributed. See Appendix 1 for an example.

3.9.4 Images of the species

Often, species' experts will have personal photographs saved of the taxon. These can be very helpful for future science communication purposes. Ask the expert reviewers if they have any photos they would be happy to share. Make sure they are attributed correctly.

3.10 Reviewers and references

3.10.1 Reviewers

By this stage, assessors should have identified some experts for the taxon. These will be people who have collected the taxon, or whose names feature strongly in publications regarding the taxon. Reach out to them and ask if they would be willing to review the nomination.

This is not always possible or feasible. In this case, ask for guidance.

3.10.2 Reference list

Ensure a comprehensive and reference list is included with consistent formatting.

3.11 Publication approval and citation

- Assessors should select the appropriate checkbox according to whether they approve their details to be published alongside the nomination on the Queensland Government website.
- Assessors should edit the suggested citation to include their name, the date and the taxon name as per Box 16. Required citation format.Box 16.

Box 16. Required citation format.

Surname, X.X. (YYYY) Nomination form to change the conservation class of *Genus species* under the Queensland *Nature Conservation Act 1992*. Department of Environment and Science: Brisbane.

4 References

If not explicitly referenced, all information in this assessment manual was based on IUCN SPC (2022).

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Regan H.M., Auld T.D., Keith D.A. & Burgman M.A. (2003). The effects of fire and predators on the long-term persistence of an endangered shrub, *Grevillea caleyi. Biological Conservation* 109, 73-83.

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Threatened Species Scientific Committee (2018). *Conservation Advice* Grevillea caleyi *(Caley's grevillea)*. Canberra: Department of the Environment and Energy. Available at: http://www.environment.gov.au/biodiversity/threatened/species/pubs/9683-conservation-advice-11052018.pdf

Woinarski J., Burbidge A. & Harrison P. (2014). *The action plan for Australian mammals 2012.* CSIRO Publishing.

5 Key resources

Resource	Web link
Action Plans with example recovery actions	Imperilled Plants 2021 https://www.nespthreatenedspecies.edu.au/publications-and-tools/action-plan-for-australia-s-imperilled-plants-2021 Lizards and snakes 2017 https://www.publish.csiro.au/book/7823/ Birds 2020 https://www.publish.csiro.au/book/7905/ Mammals 2012 https://www.publish.csiro.au/book/7010/
auNSL	https://biodiversity.org.au/nsl/
Australasian Virtual Herbarium	https://avh.ala.org.au/#tab_simpleSearch
Austrobaileya	https://www.jstor.org/journal/aust
Census of the Queensland Flora 2021	https://www.data.qld.gov.au/dataset/census-of-the-queensland-flora-2021
Climate change cluster reports	https://www.climatechangeinaustralia.gov.au/en/communication-resources/reports/ (remember to scroll to bottom of page for cluster report links)
QBEIS database (formerly CORVEG)	http://aekos.org.au/index.html#/search-results/list/dataset-details-a?datasetId=au.org.aekos.transform.generated.subgraph.impl.entities.SURVEYSUBGRAPH:T1558058576915
CSIRO cluster report NRM regions – including shapefiles	https://www.climatechangeinaustralia.gov.au/en/overview/methodology/nrm-regions/
DCCEWW - Common Assessment Method	https://www.dcceew.gov.au/environment/biodiversity/threatened/cam#national-scale
GeoCat	http://geocat.kew.org/
GeoResGlobe	https://georesglobe.information.qld.gov.au/
IUCN threat classification scheme	https://www.iucnredlist.org/resources/classification-schemes
Key threatening processes	http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl
LongPaddock Climate Dashboard	https://longpaddock.qld.gov.au/qld-future-climate/dashboard/
Northern Australia Fire Information (NAFI)	https://www.firenorth.org.au/nafi3/
Queensland Globe	https://qldglobe.information.qld.gov.au/
Red List Criteria Summary Sheet	https://www.iucnredlist.org/resources/summary-sheet
Share library	Internal (DES)
The Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) website	https://aiatsis.gov.au/explore/map-indigenous-australia
Threat Abatement Plans	https://www.dcceew.gov.au/environment/biodiversity/threatened/threat-abatement-plans/approved
WildNet	https://apps.des.qld.gov.au/species-search/
WildNet confidential species records	https://www.data.qld.gov.au/dataset/queensland-confidential-species
Nomination form	https://www.qld.gov.au/environment/plants-animals/conservation/threatened-wildlife/threatened-species/conservation-status/species-technical-committee

6 Appendices

6.1 Appendix 1

Table 15. Example of cleaned herbarium specimen records for *Acacia argentina* extracted from Australasian Virtual Herbarium. Duplicates are represented by red text and identified by comparing 'record numbers'. Removal of duplicates leaves four specimen records for *A. argentina*. Note that valuable information on population size is present in the 'Event remarks' column. Information about habitat type should also be reviewed and detailed in the biology/ecology section of the nomination form.

Catalog Number	Record Number	Recorded By	Event Date	Latitude	Longitude	Precision	Reproductive Condition	locality	Occurrence Remarks	habitat	Event Remarks
BRI AQ0588589	PIF19673	Forster, P.I.	24/09/1996	-25.32619402	150.019978	100	Flowers and fruit	Jarwood Station (GPS 25 19 40 150 01 08).	Blue-silver leaved shrub to 1.5m high, yellow flowers, young fruit.	Woodland of Eucalyptus melanophloia.	Very common in area.Type specimen-Austrobaileya 7:348(2006)
BRI AQ0588593	PIF19649	Forster, P.I.	23/09/1996	-25.21481002	149.457498	100	Flowers and fruit	Gwambagwine, Ruined Castle Creek catchment (GPS 25 12 59 149 27 23).	Shrub to 3m high, silver-blue foliage, yellow flowers, young fruit.	Woodland of Corymbia bunites, Eucalyptus fibrosa and Angophora leiocarpa on sandstone.	Very common in area.
BRI AQ0639552	FC2	Carter, F.	1/07/1995	-25.21953202	149.451387	100	Flowers	Ruined Castle Creek catchment, Murphy Range, Gwambagwine (GPS 25 13 16 149 27 01).	Shrub to 4m high, yellow flowers.	Open forest/woodland Eucalyptus watsoniana, Angophora leiocarpa, Lysicarpus angustifolius, Acacia spp., Triodia sp. and Xanthorrhoea sp.	Common in area.

BRI AQ0588599	PIF19740	Forster, P.I.	24/09/1996	-25.32397202	150.023867	100	Flowers and fruit	Precipice National Park, catchment of Precipice Creek (GPS 25 19 32 150 01 22).	Shrub to 2m high, blue-silver foliage.	Woodland of Eucalyptus acmenoides, E. crebra and Angophora leiocarpa on sandstone cliff lines along seasonal watercourse.	
NSW842940	19649	Forster, P.I.	23/09/1996	-25.2147	149.4575	100		Gwambagwine, Ruined Castle Creek catchment (GPS 25 12 59 149 27 23).	Shrub to 3 m high, silver-blue foliage, yellow flowers, young fruit. Very common in area.	Woodland of Corymbia bunites, Eucalyptus fibrosa and Angophora leiocarpa on sandstone.	
MEL 2327287A	19649	Forster, P.I.	23/09/1996	-25.2	149.45	10000	flowers | fruit	Gwambagwine, Ruined Castle Creek catchment. (GPS 25 12 59 149 27 23).	Very common in area.	Woodland of Corymbia bunites, Eucalyptus fibrosa and Angophora leiocarpa on sandstone.	
CANB 687998.1	19673	Forster, P.I.	24/09/1996	-25.327778	150.018889	50	flowers|fruit|leaf	Jarwood Station.	Blue-silver leaved shrub to 1.5 m high, yellow flowers, young fruit. [Photographed for GPI 2013.]	Woodland of Eucalyptus melanophloia.	
NSW842724	19673	Forster, P.I.	24/09/1996	-25.3261	150.02	100	buds|flowers|fruits	Jarwood Station.	Blue-silver leaved shrub to 1.5 m high, yellow flowers, young fruit. Very common in area. Isotype- Austrobaileya 7:348(2006).	Woodland of Eucalyptus melanophloia.	
AD 203216	19673	Forster, P.I.	24/09/1996	-25.32633482	150.0197116	15		Jarwood Station		Woodland of {Eucalyptus melanophloia}	

DNA D0186190	19673	Forster, I. Paul	24/09/1996	-25.32479281	150.0207956		fruit	Jarwood Station.	Woodland of Eucalyptus melanophloia. Blue-silver leaved shrub to 1.5m high; yellow flowers; young fruit. Very common in area. Isotype- Austrobaileya 7;348(2006). ISOTYPE		
MEL 2313184A	19673	Forster, P.I.	24/09/1996	-25.3278	150.0189	1000	flowers | fruit	Jarwood Station (GPS 25 19 40 150 01 08).	Very common in area.	Woodland of Eucalyptus melanophloia.	
MEL 2327281A	19740	Forster, P.I.	24/09/1996	-25.3167	150.0167	10000	flowers | fruit	Precipice National Park, catchment of Precipice Creek. (GPS 25 19 32 150 01 22)		Woodland of Eucalyptus acmenoides, E. crebra and Angophora leiocarpa on sandstone cliff lines along seasonal watercourse.	