DYURRITE AND MITRE ROCK TARGETED THREATENED FLORA SURVEY

March 2022

Prepared for Parks Victoria

dellbotany

Dyurrite and Mitre Rock targeted threatened flora survey

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Summary

Dyurrite (Mt Arapiles) and Mitre Rock are visited by thousands of park users each year, for rock climbing, bushwalking, picnicking and other park use. These areas make up part of the Mount Arapiles-Tooan State Park and contain a range of biodiversity values. Such values include the presence of 38 state or nationally threatened plant taxa which have been confirmed from reliable database records. Information about threatened plants has been recorded in herbaria over the last approximately 200 years with the first now threatened plant collection lodged in 1836. More recent non-vouchered survey data has also been added to databases.

The objective of the current assessment was to undertake targeted surveys for threatened plants, focusing on areas used for rock climbing activities. Much of the east facing cliff bases and surrounds were surveyed by two botanists in October 2021. Surveys included transect-based targeted surveys for of a suite of taxa. Twelve of the previously recorded threatened plant taxa were recorded during the current assessment. An additional two taxa of regional significance were mapped and are discussed—*Pterostylis biseta* and *Brachychiton populneus*—both being the first vouchered records of these taxa within the study area.

The conservation and statutory risk to threatened species has been assessed with a focus on potential impacts from rock climbing activities. Twelve of the 50 taxa assessed were determined to have a medium to high relative risk of impacts. They are regarded priority species for planning as it relates to rock climbing and associated activities within the areas surveyed. An evaluation of the risk and distribution of each species revealed that most taxa have some capacity to avoid direct impacts from rock climbing; due to their lifecycle, form or by occupying a range of habitats including areas that have less visitor traffic. Only two species—*Psilotum nudum* Skeleton Fork-fern and *Parietaria australis* Western Pellitory—were determined to be predominantly dependant on cliff and rock outcrops habitats. Herbaceous weeds presented the most widespread and abundant weed threat. These weeds occupy almost all areas accessible to park users. The most problematic weed for its ecological implications and tractability is *Asparagus asparagoides* Bridal Creeper. Woody weeds have much lower abundance and are generally rare within the study area.

There were few clear patterns on the spatial relationship between the distribution of threatened plants and the level of use of areas for climbing. The distribution of habitat types is perhaps more important however further habitat mapping and analysis is required.

It is recommended that park management considers plant protection measures for some taxa, as well as the suitability of ecological and cultural burns to assist recruitment of obligate seeders. Further monitoring is recommended in five years to determine the longer-term status of threatened plant populations observed during the current assessment.

1. Introduction

Dyurrite (Mt Arapiles) and Mitre Rock attract thousands of visitors each year, many of which visit for rock climbing, hiking and camping activities. Park management considers how park activities interact with various values including biodiversity, cultural heritage and landscape values.

Management involves conservation strategies and on-ground actions for the protection of threatened plant populations. Parks Victoria has an obligation as the land manager to protect listed plant taxa in accordance with state and national legislation. Parks Victoria is also a key stakeholder in implementing the State Government's Biodiversity 2037 policy, which outlines the strategic actions for the conservation of biodiversity in Victoria. Nationally listed species are protected under the *Environment Protection and Biodiversity Conservation Act 1999* and state listed species are protected under the *Flora and Fauna Guarantee Act 1998*. Native plants are also protected under the Horsham Planning Scheme and the incorporated Permitted Clearing Guidelines[1] (DELWP 2017). The Permitted Clearing Guidelines outline rules for determining whether native vegetation can be cleared under a permit. In circumstances where the guidelines require consideration by permit trigger under 52.17, Parks Victoria may instead use the Procedure[2] which has been developed for use in applications by DELWP and Parks Victoria. Various exemptions apply for the above legislation, depending on the circumstances, including existing land use rights. In the context of rock climbing, park users have the same obligation to not remove, destroy or lop native plants without a permit. The management issue however is less about permit requirements but rather strategies which can be used to prevent inadvertent impacts to biodiversity, caused by permitted activities on public land. A management plan for Mt Arapiles outlines local consideration and management actions relating to significant species (DCE 1991).

European reports on the flora of Mt Arapiles commenced in the 1800s (ALA 2021). Several species which are currently listed as threatened were first collected during the 1880s, however location accuracy make some earlier collection records difficult to resolve. The shrub *Prostanthera arapilensis* Arapiles Mint-bush was first collected from Mt Arapiles in 1836. First collections of other significant species for the study area followed over the next 70 years including *Acacia rupicola* Rock Wattle (1885) *Cyphanthera anthocercidea* Large-leaf Ray-flower (1860), *Goodia medicaginea* Western Golden-tip (1860), *Pimelea hewardiana* Forked Rice-flower (1860), *Goodenia benthamiana* Small-leaf Goodenia (1860), *Eucalyptus hawkeri* Arapiles Peppermint-box (1968), *Eucalyptus wimmerensis* Wimmera Mallee-box (1968), *Eremophila gibbifolia* Coccid Emu-bush (1887), *Senecio hypoleucus* Pale Groundsel (1887), *Ptilotus erubescens* Hairy Tails (1887), *Parietaria australis* Western Pellitory (1895) and *Comesperma polygaloides* Small Milkwort (1968). D'Alton (1898) documented the occurrence of several other significant plant species including *Howittia trilocularis* Blue Howittia (regionally significant) and the first Victorian collection of *Psilotum nudum* Skeleton Fork-fern (at Mitre Rock). The collection of *P. nudum* was made from amongst 'a few bunches' observed at Mitre Rock. The predominantly coastal shrub *Adriana quadripartita* Coast Bitter-bush was first collected and lodged by D'Alton for Mt Arapiles in the late 1800s; one of its few inland localities and noted as represented by a single shrub for the district at the time. D'Alton also collected the type specimen of

[1] Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017).
[2] Procedure for the removal, destruction or lopping of native vegetation on Crown Land (DELWP 2018).

Diuris daltonii Western Purple Diuris, which was described by Walter (1907) as a subspecies of *Diuris punctata*. The Field Naturalist Club of Victoria included Mt Arapiles in an expedition to the region in October 1927 (Pescott 1928). The expedition noted significant plant species; *P. hewardiana* and *C. anthocercidea*, the latter of which was noted as having declined since an earlier visit by Pescott in 1899. Pescott (1928) also noted the occurrence of *P. nudum* as abundant at Mitre Rock.

Threats to these species operate at the local and regional scale. Local threats such as recreational land use, pest animals, weeds, wildfire, erosion and plant collecting can be managed with various strategies and actions. Regional threats such as climate change and associated drought, heat stress and extreme weather events are less tractable. The long-term absence of fire is also regarded as a threat as several of the listed plant taxa are obligate seeders, and their recruitment is stimulated by fire. Potential threats to listed plants caused by rock climbing include removal of plants to fix ropes and gain footings, trampling plants around the bases of cliffs and spreading weeds and pathogens along access routes. Of note is the grazing history at Mt Arapiles. Pescott (1928) commented on the adverse impacts which stock grazing was having on the native plants, both on the plateau and on lower slopes and plains. An image in Pescott (1928) of an area labelled “Castled Crags” at Mt Arapiles shows an area devoid of all vegetation but pasture, and occupied by stock. The establishment of pasture species and the composition of the remaining flora is likely significantly impacted from this period of European land use.

The objective of the current assessment is to map the occurrence of significant plant taxa within rock climbing areas of Mt Arapiles (Dyurrite) and Mitre Rock. The assessment adds to provisional surveys (Parks Victoria 2021) under the same program, to provide more comprehensive information for the management and alleviation of tension between park use and biodiversity assets. Management also equally considers the potential impacts of rock climbing on culturally significant sites (Gunn et al. 2020) and is considered further in separate assessments.

2. Methods

2.1 Study area

The study area comprises the eastern parts of Dyurrite and the area of Mitre Rock nearby to the north (Figure 1). These sites together are approximately 1470 ha. Dyurrite and Mitre Rock are 40 km west of Horsham and are accessible by the Wimmera Hwy and the Natimuk-Frances Road. They are part of the broader Mt Arapiles-Tooan State Park which lies between Mitre, Miga Lake and Tooan. The study area also lies within the Wimmera and Greater Grampians bioregions, Wimmera Catchment Management Authority area and Horsham Rural City local government area.

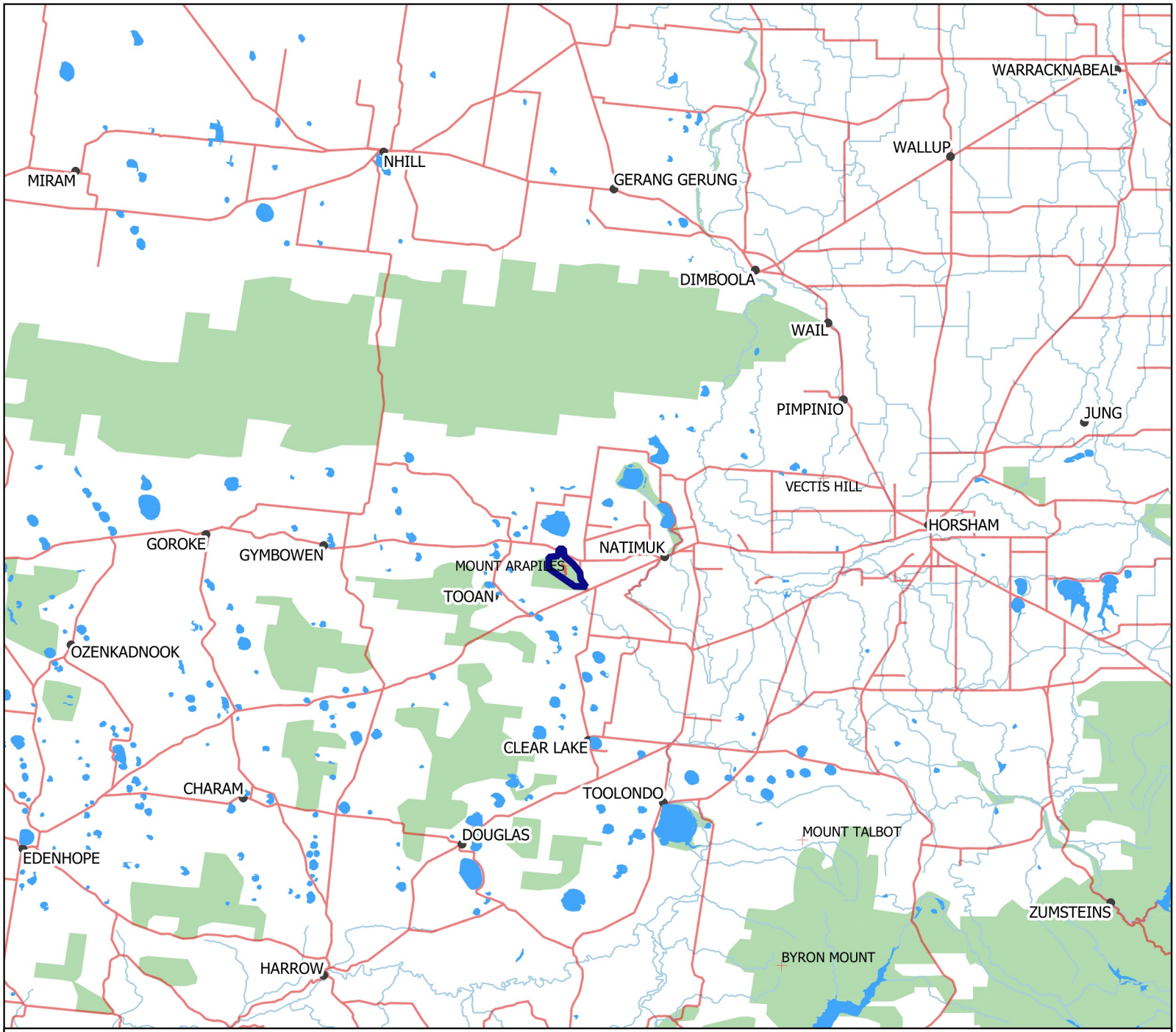
Horsham has a mean maximum temperature in January of 31.2 deg C and July of 13.7 deg C. Mean monthly rainfall in January is 29.7 mm and July is 40.6 mm (BOM 2021).

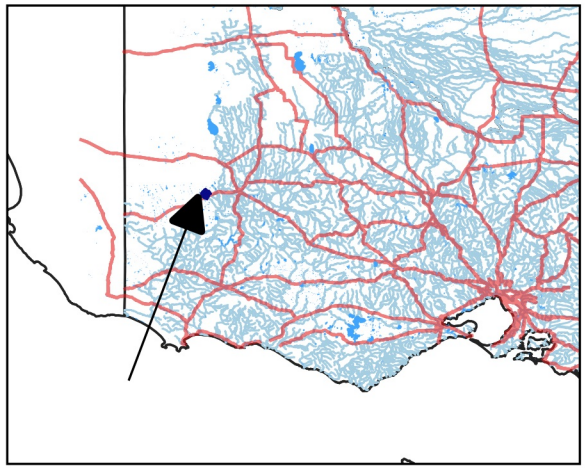
2.2 Database searches

Prior to undertaking surveys, a list of significant plant taxa was compiled from preliminary survey results (Parks Victoria 2021) and a search of the Victorian Biodiversity Atlas (VBA) (DELWP 2021a). The VBA was searched for records of threatened plant taxa within the study area and for the area within 10 km of the study area. The combined list was reviewed to determine the validity of taxonomic concepts and potential erroneous records (e.g. spatial errors). Following the review of data quality, a unique list of taxa was produced and used as a list of candidate taxa for targeted surveys. Consideration was also given to published information about habitat preferences in VicFlora (2021) and some other sources. An additional search of the Atlas of Living Australia (ALA) was undertaken for the same search area, in a bid to add any additional taxa which have a different source to the VBA. NatureKit (DELWP 2021b) was accessed for Ecological Vegetation Class mapping and other relevant spatial data.

2.3 Field surveys

Targeted surveys were undertaken from 25–29th October 2021. Areas for survey were prioritised in discussion with Parks Victoria staff. Prioritisation included targeting areas of higher intensity rock climbing activities and to search areas which had previously a lower coverage of surveys. The surveys were done simultaneously by the authors who targeted species in a range of lifeforms, from small herbs to canopy trees. Each rock face was searched along its length, with one botanist staying as close to the base of the wall as possible and the other botanist walking parallel between 5 and 20 m away, depending on accessibility amongst boulders and other obstacles. Each gorge intercepted along the face of the main wall was surveyed by both botanists to the highest elevation possible and within safety protocols outlined for the fieldwork. The eastern face of Mt Arapiles was prioritised for survey due to its high use for rock climbing, of which most accessible areas within 30 m of the base of the climbing areas were surveyed. The first main gully to the northwest of the mobile phone tower was surveyed to gauge the abundance and richness of threatened plants in a low use rock climbing area. Mitre Rock was surveyed within 30 m around the base of the main rock massif, also due to its high use. Some sections of lower elevation at Mt Arapiles were surveyed around higher use access tracks. The presence of high threat weeds was recorded within the same survey areas. Widespread introduced herbaceous weeds were not mapped.





Study area

Roads

Main

Waterways

Public land

N

0 10 20 km

VicMapLite spatial data.
The State of Victoria through the
Department of Environment, Land, Water and Planning (DELWP)
Information Services Division (ISD)
PO Box 500, East Melbourne VIC 8002
https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure 1.
Study area - Dyuurite and Mitre Rock

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2.4 Data collection

Spatial data for threatened species were collected using the Android app Memento on a Samsung Galaxy tablet. A custom library was built to allow the co-ordinates of each plant taxon detected, a quantity category and date of record. A complete list of the Victorian flora was added from the VBA to the Memento library, to ensure that current names and taxonomic concepts were being entered. The Sumsung Galaxy tablet uses a standard GPS and is prone to the usual spatial error for this type of GPS (usually +/- 7 m). It was found that in some gorges or when close to tall cliffs, the GPS error may have increased. Spatial data were checked once downloaded to rectify any such errors; however, these were few and did not significantly affect the results of the mapping.

2.5 GIS

Mapping was completed with QGIS version 3.6. All point locations for plant records were summarised to a 20 x 20 m grid. Each cell from the grid was then used as a location for each record and formed the basis for spatial analysis and mapping. The locations of vehicle and foot trails, rubbish and other threats were also mapped. Final layers are in GDA94.

2.6 Assessing risk to threatened plant taxa from recreational activities

A risk assessment has been undertaken to provide a measure of relative risk to threatened taxa as a result of recreational activities. The activities focus on rock climbing and camping. Risk evaluates statutory risk and conservation risk to each taxon. The assessment includes several factors which contribute to these risks, outlined in the following.

Candidate taxa for the risk assessment are those which are listed on the Threatened List (DELWP 2020) and have been recorded at any time within the study area plus a 10 km radius, or have been observed during the current assessment within the study area.

The **Conservation status** (C) of each taxon was ranked according to their listing under the *Flora and Fauna Guarantee Act 1988*. Values used were 0 – not listed, 0.25 – conservation dependant (not applicable to flora), 0.5 – vulnerable, 0.75 – endangered, 1 – critically endangered.

The **Extinction risk** (Er) of each taxon was ranked according to their listing under the Threatened List (DELWP 2020). Values used were 0 – not listed, 0.33 – FFG listed and not endemic to Victoria, 0.66 – FFG listed and endemic to Victoria, 1 – EPBC Act listed.

Probability of presence (p) was estimated between 0–1 independently by two botanists. The objective of this element is to provide an average probability based on the subjective professional opinion of two or more professional botanists. The rationale in providing the probability estimate is not required for the assessment and is undertaken blindly by each assessor. The confidence level (c) of each botanist was also recorded (0–1) to contribute as a factor to risk. The inclusion of confidence allows for uncertainty in components of the risk assessment where heuristic decision-making is derived from and relies upon a range of empirical evidence, which inherently varies between assessors. Risk increases as differences in opinion on presence and confidence widens between assessors.

Database records (D) were assessed as evidence of other observations of threatened taxa within the study area and surrounds. Records were obtained from the Victorian Biodiversity Atlas. A score was

provided as a factor in the risk calculation according to Table 1. Database records were reviewed for the type of record (vouchered versus observations) and their reliability.

Table 1. Factors for number of database records and their distance from the study area

Maximum radius from study area	Total number of records	Time since last record				
		<5 yrs	6–10 years	11–20 years	20+ years	200+ years
10 km	<5	0.5	0.25	0.25	0.25	0
10 km	5 to 20	0.5	0.5	0.25	0.25	0
10 km	>20	0.5	0.5	0.5	0.25	0
5 km	<5	0.75	0.75	0.5	0.25	0
5 km	5 to 20	1	0.75	0.75	0.5	0
5 km	>20	1	1	0.75	0.75	0

Exposure (Ep) was ranked which provides an estimate of the level of risk to a taxon based on the consequence of its ecological susceptibility to the activity being considered (Table 2). Susceptibility is varied between taxa and depends on the type of activity. This element is ranked by a senior botanist and requires consideration of various factors. For example, a listed species may have multiple recent records within 0.5 km of the study area, but is confined to brackish wetland which is absent from the site being impacted. It therefore takes into consideration habitat on a micro scale but also whether a species is resilient or not to impacts from the activity.

The standard deviation (σ) of probability of presence contributes to risk with the rationale that greater variation in expert judgement introduced additional risk in assessments. There are a range of complex considerations which affect expert judgement. Differences in opinion are an indication of greater uncertainty when providing an estimate of whether a taxon is likely to occupy a site (due to interpretation of habitat suitability, landscape composition, level of experience with the taxon etc). When a taxon has been observed by a both botanists within the assessment area, probability of presence is 1 and standard deviation is zero.

Table 2. Factors for levels of exposure to taxa

Exposure	Definition
0	No action or activity
0.25	Population predominantly isolated from primary and secondary impacts
0.5	Populations with small-moderate chance of secondary impacts only
0.75	Populations with moderate-high chance of secondary impacts OR low chance of primary impacts
1	Populations with moderate-high chance of primary impacts

A primary impact applies when at least part of the population is physically removed, displaced, buried or other loss in direct contact with an action. A secondary impact applies when at least part of the population is lost due to processes which follow an action e.g. sedimentation, changes to hydrology, exposure, change to soil conditions, plausible introduction of high threat weeds or pathogens, loss of symbiotic partner etc. For secondary impacts, populations are retained

immediately following the action, but are highly likely to be impacted in time after as a direct result of the project (short or long term).

Risk (R) to a taxon was calculated by:

$$\mathrm{R} = (\mu p \times \mu \mathrm{c}) + (\mathrm{C} \times \mathrm{Er}) + (\mathrm{D} \times \mathrm{Ep}) + \sigma p$$

Relative risk (Adjusted z_i) is provided as follows, using zero as the minimum adjusted value so not to imply zero risk for any of the taxa assessed. That is, some residual risk to a taxon, even if negligible, is assumed on the basis that candidate taxa have qualified for consideration in the first instance, due to their occupancy in the landscape.

$$\text{Adjusted } z_i = \frac{\mathrm{R}}{\max(\mathrm{R})}$$

The difference in relative risk between taxa is more important than the value for each. However, based on the evaluation for several datasets, relative risk of >0.5–0.75 can be considered useful for identifying taxa that have moderate risk and >0.75 a high risk of being impacted by the relevant activity.

Relative risk is provided for management purposes. It should be used a tool to determine the risk that an action will contribute to the extinction risk and, in some applications, the risk that a statutory breach may occur. The latter element of risk requires a further examination of planning matters and does not inherently consider what actions are permitted.

2.7 Plant conservation status

Plant conservation status is determined according to their listing under the *Flora and Fauna Guarantee Act 1988* (State) and/or *Environmental Protection and Biodiversity Conservation Act 1999*(Commonwealth). Regional significance has been applied to some taxa based on their rarity within the Greater Grampians and Wimmera bioregions.

2.8 Plant nomenclature and taxonomy

Plant nomenclature follows the Victorian Biodiversity Atlas. If a taxonomic concept disagrees with the online VicFlora (2021) then the concepts and names from VicFlora are used.

2.9 Limitations

October is considered an ideal time of year for detecting most plant taxa at Mt Arapiles. However, some specimens such as grasses, *Galium* spp. and *Parietaria* spp. were either not fertile or insufficiently developed for reliable identification at the time of survey. There was little rainfall in the days leading up to the first four days of survey. Resurrection species including *Fossombronia* spp. were not detectable for survey purposes during this period. Only on the last day of survey following heavy rain could resurrection bryophytes be more easily surveyed. Despite the limitations, most target species were fertile and could be located using standard targeted survey methods.

3. Existing native vegetation values

The study area contains eight modelled Ecological Vegetation Classes (EVCs) (DELWP 2021b). Plains surrounding the rock massifs are largely modelled as Shallow Sands Woodland (882) and Plains Woodland (803). Rock outcrops, cliffs, gorges and other predominantly rocky areas are occupied by Rocky Outcrop Shrubland (28) and Rocky Outcrop Herbland (193), often in a mosaic at site scale. The plateau on Mt Arapiles is modelled as Heathy Woodland (48) and colluvial slopes in the southwest of the range are modelled as Hills Herb-rich Woodland (71) and Grassy Dry Forest (22). Steep slopes on the eastern side of the east rock faces are modelled as and largely occupied by Scree-slope Woodland (709). The massif of Dyurrite is part of the Greater Grampians bioregion while the surrounding plains are within the Wimmera bioregion. The bioregional conservation status of each EVC in each bioregion (Table 3) is provided for context.

Table 3. Modelled EVCs and their conservation status for the study area

EVC	Bioregional conservation status
Grassy Dry Forest 22	Greater Grampians – Depleted Wimmera – Depleted
Rocky Outcrop Shrubland 28	Greater Grampians – Least Concern Wimmera – Rare
Heathy Woodland 48	Greater Grampians – Least Concern Wimmera – Least Concern
Hills Herb-rich Woodland 71	Greater Grampians – Least Concern Wimmera – Depleted
Rocky Outcrop Herbland 193	Greater Grampians – Least Concern Wimmera – not assessed
Scree-slope Woodland 709	Greater Grampians – Endangered Wimmera – Endangered
Plains Woodland 803	Greater Grampians – Endangered Wimmera – Endangered
Shallow Sands Woodland 882	Greater Grampians – Vulnerable Wimmera – Vulnerable

The distribution of modelled EVCs is generally consistent with boundaries observed in the field. Most of the areas where rock climbing activities are concentrated are not within threatened EVCs. Scree-slope Woodland however contains most of the access tracks between the camping areas and rock-climbing areas.

Some plant communities within and surrounding the study area may include FFG Act or EBPC Act listed communities, although these were not assessed for the current assessment.

4. Information about threatened plants

4.1 Summary of assessed taxa

Fifty threatened plant taxa were considered for potential impacts within the broader Dyurrite and Mitre Rock area. Of these, 12 taxa were recorded during the current assessment (Table 4). Another two taxa have been included as significant species given their regional importance, as determined from database records and other considerations.

Of all taxa considered, nine are listed as critically endangered, 36 as endangered and five as vulnerable in Victoria (FFG Act). Two are EPBC listed as vulnerable—*Acacia glandulicarpa* and *Tecticornia flabelliformis*—however neither were recorded within the study area.

The nearest records of *Acacia glandulicarpa* are from 1974 in the vicinity of Centenary Park Road, near Natimuk-Francis Road. The spatial accuracy of the records is 4 km so it is uncertain where these plants may have been recorded. The next nearest records within the last 30 years are from 2008 at Nurcoung Flora Reserve, approximately 9 km to the northeast. *Tecticornia flabelliformis* has an extant population at Mitre Lake Flora and Fauna Reserve approximately 2 km to the north of the study area. This reserve includes a large brackish wetland which provides suitable habitat for this species. The two EPBC Act listed species were given an average probability of presence of 0.35 and 0.1 respectively. A greater probability for *Acacia glandulicarpa* may be given with further consideration of surrounding habitats, and with consideration to the numerous opportunities still for survey within parts of Dyurrite.

Amongst the 12 taxa observed, two are critically endangered, eight are endangered and one is vulnerable in Victoria. The two critically endangered plants that were observed comprise one tree species *Eucalyptus wimmerensis* and one shrub species *Prostanthera arapilensis.* The ecology and impact considerations are discussed for 10 species (Section 4.2) which were observed to be within areas most affected by rock climbing (20 m from cliff faces and main access tracks). The two regionally significant species are also discussed to provide context for conservation management. There has been no other analysis of regional significance for the purpose of the project. Those discussed are to provide information where it has been previously lacking for the study area, and which should be considered further for threats to populations.

4.2 Observed significant species descriptions and exposure to threats

The following provides a summary of observed threatened (listed) and regionally significant species within the survey area. *Eucalyptus hawkeri* and *Eucalyptus wimmerensis* were observed in lower elevation areas away from the primary target area, and were not mapped or summarised for the purpose of this assessment. Threats to these tree species would be likely greater from other processes such as climate change rather than recreational use of the park.

***Acacia rupicola* - Rock Wattle**
FFG Act Endangered. Figure A1

Description: Shrub to 2.5 tall with narrow, tapering and sharply-pointed phyllodes. **Distribution**: Mt Arapiles and Grampians region. Also SA. **Recruitment**: This species is an obligate seeder which has prolific regeneration following fire and can grow to mature size in 2–3 years (Lang et al. 2009). **Exposure**: In both parts of the study area, this species occupies a range of vegetation types, occurring as a rocky outcrop species and also on alluvial clays closer to waterways. It occupies areas which are used for access tracks and climbing, however it likely deters some impacts from visitors due to its sharp phyllodes. It may be considered as having moderate to high exposure to rock climbing activities. It is given a sensitivity rating for the study area of 4/5 by Parks Victoria (2021). **Other threats**: Plants may be removed from rock crevices for securing anchor points. Large mature plants are likely less prone to threats from recreational activities. Other threats include an inappropriate fire regime and with potential also for the compounded effects of climate change (reduced rainfall, increase temperature).

***Cyphanthera anthocercidea* - Large-leaf Ray-flower**
FFG Act Endangered. Figure A2

Description: Shrub to 3 m tall with leaves to 75 x 20 mm. **Distribution**: Mt Arapiles, Grampians, East Gippsland. **Recruitment**: Likely obligate seeder. **Exposure**: Habitat for this species includes shallow soils within 30 m of rock walls, making it somewhat susceptible to accidental damage. It some sections of the park, shallow soils at the upper parts of gullies were heavily infested with introduced grasses and other herbaceous weeds. These weeds are no doubt spread between sites by rock climbers and other visitors, as most access routes to climbing areas have at least some level of herbaceous weed cover. Areas with high weed cover are potentially impacting on the recruitment of *C. anthocercidea*. It was noted as rare in the landscape which presents both a conservation risk as well as an opportunity to protect documented plants with exclosure fencing. It is given a sensitivity rating for the study area of 5/5 by Parks Victoria (2021). **Other threats**: Little is documented about the ecology

and threats to this species. Its susceptibility to browsing in uncertain. Members of the Solanaceae family variably contain a suite of chemicals, many of which are toxic to mammals (Pomilio et al, 2008), although the toxicity of *C. anthocercidea* is not known. Browsing was not observed. Its small population sizes at Dyurrite make it susceptible to stochastic processes. Seed dispersal is unknown however it is assumed based on the fruit type in this genus that most seed would disperse within a few metres of the parent plant. Seed are expected to be long-lived in soil (>10 years) and fire may be important for pulse germination. A long-term absence of fire may therefore limit population size.

***Galium curvihirtum* - Tight Bedstraw**
FFG Act Vulnerable. Not mapped

Description: Herb to 40 cm, scrambling, leaves narrow in whorls, flower cream amongst leaves. **Distribution**: Mostly western Vic, SA, NSW. **Recruitment**: Uncertain. **Exposure**: The distribution of this species within the study area is uncertain due to an abundance of the superficially similar *Galium gaudichaudii* Rough Bedstraw. Of the Australian *Galium* species, *G. curvihirtum* is most similar to *G. gaudichaudii* (Thompson 2009). Both have narrow leaves and are scabrous to hairy over stems and branches. Differences require closer examination of the ovaries and fruit, leaf hairs and subtle leaf shape differences (Thompson 2009). Targeted surveys are challenging in this regard, at least in the context of broader multi-species surveys. A more focused assessment of *Galium* at Dyurrite and Mitre Rock may be required to gain a better idea of its distribution and habitat. These two species are also known to hybridise (Thompson 2009). *Galium curvihirtum* was confirmed from several plants on the eastern scree-slopes and amongst soil in rock crevices, however not all material of interest was able to be examined in detail within the scope of this assessment. It can be assumed present and scattered within the study area. The typical habitat of *H. curvihirtum* is sandy soils in forests and woodland (Thompson 2009). Plants may be trampled or inadvertently removed from soil in rock crevices by rock climbing activities. **Other threats**: Other threats are uncertain. Plants may be browsed by rabbits.

***Goodia medicaginea* – Western Golden-tip**
FFG Act Endangered. Figure A3

Description: Shrub to 1.5 m tall. **Distribution**: VIC, NSW, SA, WA. **Recruitment**: Obligate seeder. **Exposure**: Most plants were observed in shallow soils of minor gullies and upper scree slopes. This species had relatively low abundance with only seven sites observed between Dyurrite and Mitre Rock (Figure A3). It tends not to grow immediately under rock climbing faces, instead found amongst other shrubs and typically 20–50 metres from areas of regular foot traffic. It was given moderate to high exposure in the risk assessment on the basis that most of the plants observed were not directly in the path of rock-climbing activities. It is given a sensitivity rating for the study area of 2/5 by Parks Victoria (2021). **Other threats**: This species has a similar fire sensitivity and ecology to *P. patellifolia* in that its generation length would be largely determined by fire intervals. In the absence of fire, loss of mature plants and soil-stored seed would likely diminish. It was noted in the Mount Arapiles – Tooan State

Park Management Plan (DCE 1991) that, at the time, more than half the management area had remained unburnt for decades. Such intervals can exceed the period of natural senescence of a cohort, resulting in only rare (sporophyte) occurrences in the landscape. This species is also likely browsed by wallabies. It is prone to stochastic processes due to small population size. It may also be susceptible to competition from woody weeds which occur occasionally within the study area. In western Victoria, it is otherwise found scattered in the Grampians, West Wimmera, Horsham and Portand areas, however with similar low density of records in each region. A more detailed investigation of recruitment processes is required for this species' conservation.

***Parietaria australis* – Western Pellitory**
FFG Act Endangered. Figure A4

Description: Medium-size annual herb with leaves 3 x 1.5 cm, hairy. Flowers inconspicuous. **Distribution**: Western Victoria and SA. **Recruitment**: Seed. **Exposure**: This species was given the highest exposure rating in the risk assessment on the basis that it predominantly occupies sheltered places between rock crevices and outcrops. As these habitats are targeted for climbing, the risk of plants being dislodged is high. It has a weak root system and plants are easily pulled out of the soil by hand. There was only one confirmed observation (Figure A4). *Parietaria* species were observed in moderate abundance in most of the study area, indicating that rock climbing and occupancy of this species are not entirely in conflict. It was often observed deeper in rock crevices as it is shade tolerant, occupying a niche where few other species persist. *Parietaria australis* is a medium risk species because it is endangered in Victoria and generally has high exposure to rock-climbing activities. Despite only one confirmation, it is most likely in various areas of rock outcrop at Dyurrite. *Parietaria debilis* is a similar but not threatened species that was also observed at various locations. Without flowers, these two species may be confused, or at least the former may not be confidently determined to species level. Some material observed did not have flowers or fruit developed for identification. Habitat of both species is in well protected and shaded rock crevices, near the entrance of small caves or on the protected side of rock outcrops. Any such areas should be regarded as habitat and may contain *P. australis*. **Threats**: There are few other threats to this species, owing to its annual lifecycle and niche which likely assist with resilience. It occurs in fire protected microhabitats and many plants observed in the population are out of reach of most herbivores. It may be prone to impacts from climate change if conditions in microhabitats change accordingly. Despite conditions at Dyurrite, this species is widely distributed in western Victoria, but seldom recorded (20 records). It is also lacking records since 1989. The paucity of records may be partly due to this species being overlooked for *Parietaria debilis* or because it is not a high-profile species in general.

***Pimelea hewardiana* – Forked Rice-flower**
FFG Act Endangered. Figure A5

Description: Shrub to 70 cm tall, opposite narrow leaves, yellow flowers. **Recruitment**: Predominantly seed with capacity to resprout. **Distribution**: Southwestern Victoria and SA. **Exposure**: *Pimelea hewardiana* occupies deeper colluvial soils below cliff faces and in gullies and was less commonly observed amongst coarse scree. Plants were occasionally observed in rock crevices amongst cliffs. The reported habitat in Victoria is rocky habitats west of Melbourne (VicFlora 2021), however the habitat is broader than this and it is reported from woodland with sandy soils in South Australia (Te et al, 2009). It was found typically >10 m away from the rock wall in most places but also occupies rock crevices. Several plants were observed alongside foot trails where it may be exposed to trampling and weed infestation. It was given moderate exposure on the basis that several large populations are in higher traffic areas, but other population (some large) are in areas seldom visited (northwestern-most stand in Figure A5). **Other threats**: This shrub is susceptible to browsing from wallabies. Seedlings may be eaten by rabbits and possums. It was often observed in partial shade of eucalypts or *Callitris* and may be susceptible to climate change if canopy tree cover is reduced as a result. There are currently good-sized stands in some parts of Dyurrite (>1000 individuals over entire study area). Stands tended to have fewer plants on the eastern side of the range, which may be an indication of habitat preference rather than a reduction in population due to threats.

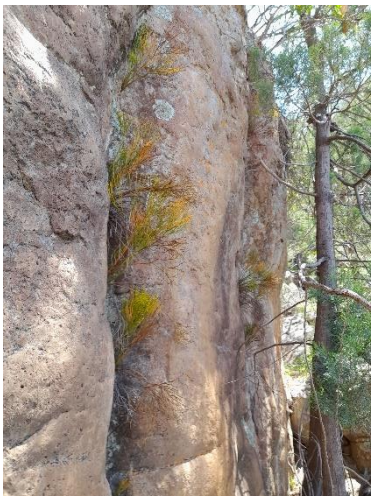
***Prostanthera arapilensis* – Arapiles Mint-bush**
FFG Act Critically Endangered. Figure A6

Description: Shrub to 1.5 m tall with hairy leaves to 6 mm and spiny branches. **Recruitment**: Recruitment processes for this species are not documented. The related species *Prostanthera spinosa* is killed by fire (NSWSC 2006) and reported to regrow from seed (Lang et al, 2009). *Prostanthera arapilensis* may have the same mode of recruitment. **Distribution**: Endemic to Mt Arapiles. **Exposure**: This species is distributed over a range of habitats within the study area. It was observed in two areas growing close to the base of cliff faces. For most part, plants were observed on scree, or in woodland away from cliff faces. Plants may be susceptible in a few areas to trampling alongside walking tracks, particular in the northern part of the east side of Dyurrite. It is unlikely that rock climbing would have an adverse impact on this species. If impacts were occurring from recreational uses, these would more likely be associated with general visitor use. It was given moderate to high exposure in the following risk assessment on the basis that some plants occur in rock climbing areas. It is given a sensitivity rating for the study area of 5/5 by Parks Victoria (2021). **Other threats**: *Prostanthera arapilensis* is likely browsed by wallabies. Seedlings

may be eaten by rabbits and possums. There is little information about its physiology or ecology to be able to estimate potential impacts of climate change; specifically drought tolerance. As a likely fire sensitive species, it may be adversely impacted by high fire frequency. Many parts of the study area are rocky and fire protected, even in the event that fire frequency increased within the broader landscape.

***Psilotum nudum* – Skeleton Forkfern**
FFG Act Endangered. Figure A7

Description: Wiry shrub-like fern ally to 60 cm tall. **Recruitment**: Primarily spores, also root fragments and gemmae of gametophytes. **Distribution**: Mainland Australia, New Zealand and surrounds. **Exposure**: This species has the highest exposure rating in the risk assessment below. Within the study area, it occurs only within rock crevices of outcrops and cliff faces, at all elevations. The highest density of plants was observed on rock faces closest to the main campsite (to southwest). It is susceptible to being dislodged by rock climbers when gaining a footing or anchor point. It may also be dislodged by ropes being dragged over rocks. It may be regarded as having the highest exposure to rock climbing than any other plant species within the study area. It is given a sensitivity rating for the study area of 5/5 by Parks Victoria (2021). **Other threats**: There are few other direct threats to this species due to its mostly inaccessible habitat and niche which has narrow overlap with other species. The implications of climate change are difficult to predict. It displays traits of tolerance to high solar radiation yet likely has a regular supply of water which is shed from rock surfaces and accumulated in crevices. It is reported as drought tolerant (NZPCN 2011). This species was not observed in the wettest rock crevices. It requires an accumulation of soil in rock crevices (or tree trunk), as the gametophyte and sporophyte require a mycorrhizal associated for persistence. Gametophytes are also tiny and subterranean, and entirely dependent on mycorrhizae (Chinnock 1998). Spores are wind dispersed and trapped in crevices where the gametophyte may persist for some time before fertilisation. Soil disturbance and introduction of exotic species in rock crevices and ledges will likely lead to a decline in habitat quality. It is noteworthy that neither D'Alton (1898) or Pescott (1928) reported *P. nudum* from Mt Arapiles during their visits, where it is currently widespread on the east side of the range.



***Pultenaea patellifolia* – Mt Byron Bush-pea**
FFG Act Vulnerable. Figure A8

Description: Shrub to 1.5 m tall with rounded leaves to 3.5 m. Flowers yellow and red. **Distribution**: Grampians and Mt Arapiles. **Recruitment**: Obligate seeder. **Exposure**: One plant was observed at the base of a rock face, which may be used on occasion for climbing. This species was very rare amongst the current survey data, however it is likely that other plants occur within the survey area. It is not easily detected when not flowering due to its small leaves and overall low surface area, and may therefore be less visible amongst other vegetation. Their size makes them susceptible to damage from trampling or being broken from climbing ropes. In the risk assessment, it was given the highest exposure level on the basis that plants were only observed in the vicinity of rock faces. It is understood that other plants occur in woodland/mallee on the plateau area around the lookout. **Other threats**: This species has a generation length of 45–75 years based on dependence on fire for recruitment. It is a fire sensitive species with a long-lived seed bank (Cameron pers. comm.). Long-term absence of fire is therefore a threat to its persistence. This species would likely be browsed by wallabies. It is also highly susceptible to stochastic processes.

Note – the origin of *P. patellifolia* has been disputed for Mt Arapiles. VicFlora (2021) states that an isolated population of a few plants near a picnic ground at Mt Arapiles is believed to have been deliberately introduced. This is based on a 1977 Beauglehole collection (NSW503407) which has the occurrence remark 'no doubt result of deliberate introduction at picnic area'. This collection was made from the top of Mt Arapiles on the east side. Other collections at Mt Arapiles include 1969 (184258), 1976 (MEL 0535057A), 1982 (MEL 2231788A) and a 1996 collection (MEL 2034883A) where growing on exposed rocky summit. All records have low spatial accuracy and may account for the same population near the picnic ground. If so, the observation from the current survey is the first observation that is not on the summit, but at the cliff base on the east side (Figure A8). It is approximately 200 m north from the mobile phone tower. It raises the question as to whether the population is introduced or remnant and naturally rare. The disturbance associated with picnic ground activity may have stimulated the germination of soil-stored seed in an otherwise dormant population. The 1977 observation "without doubt" that is from a deliberate introduction, should be treated as speculative without further survey data to confirm its distribution more widely within Dyurrite. The survey of the northern gully for the current assessment demonstrated that significant areas of the park have no flora records associated. In this area, some species within similarly low and infrequent observations were observed within minimal survey effort. Photo right shown in fruit.

***Senecio hypoleucus* – Pale Groundsel**
FFG Act Endangered. Figure A9

Description: Robust herb to 1 m tall, blue-green leaves to 8 cm. **Recruitment**: Obligate seeder. **Distribution**: Mt Arapiles and Grampians region, also SA. **Exposure**: This species was observed over the extent of the study area on scree-slopes, cliff bases, in gorges and in accumulate soil amongst

cliffs. It also occurs on the lower plains to some extent, outside of the mapped area. The highest plant density areas were observed in lower traffic zones; between Dune Buttress and Fang Buttress and in the northwest mapped gully. This does not necessarily imply visitor impacts but rather that the preferred habitat and preferred areas for rock climbing access are partially exclusive. It occupies zones used directly for climbing activity as well as other areas which are less commonly accessed. It is a medium risk species because it is endangered in Victoria and has moderate to high exposure. In Victoria, this species is localised around the Dyurrite area but also common around Adelaide. Its limited distribution in Victoria may warrant assigning it additional significance and managing for its conservation accordingly. **Other threats:** As for other obligate seeders, recruitment after fire is likely to be significantly higher compared with recruitment by seed without fire. There is evidence that this species is capable of recruitment without fire, and that this may be sufficient to sustain the population between long fire intervals. It appeared more abundant in sheltered locations and may be at risk as such from climate change. Plants were more vigorous where amongst a higher cover of other tall herbs and ferns, or in the shade of canopy trees. These sites likely correspond with areas of higher soil moisture. Thinning of understorey vegetation in exposed sites may reduce habitat quality. Plants may be prone to browsing from wallabies, rabbits and hares.

Table 4. Threatened species recorded within 10 km of the study area

FFG status	Extinction Risk	EPBC status	Scientific Name	Common Name	Lifeform	Recorded in current survey	Confirmed from reliable records within Dyurrite and Mitre Rock
Endangered	Australia	Vulnerable	*Acacia glandulicarpa*	Hairy-pod Wattle	Shrub		
Endangered	Victoria		*Acacia rupicola*	Rock Wattle	Shrub	✓	✓
Critically Endangered	Victoria		*Amyema linophylla* subsp. *orientalis*	Buloke Mistletoe	Parasitic shrub		✓
Endangered	Victoria		*Asperula wimmerana*	Wimmera Woodruff	Forb		✓
Vulnerable	Victoria		*Austrostipa hemipogon*	Half-bearded Spear-grass	Graminoid		✓
Vulnerable	Victoria		*Austrostipa macalpinei*	Annual Spear-grass	Graminoid		✓
Endangered	Victoria		*Austrostipa mundula*	Neat Spear-grass	Graminoid		✓
NA	NA		*Brachychiton populneus* subsp. *populneus*	Kurrajong	Tree	✓	✓
Endangered	Victoria		*Callitriche umbonata*	Winged Water-starwort	Forb		✓
Endangered	Victoria		*Cardamine lineariloba*	Western Bitter-cress	Forb		✓
Endangered	Victoria		*Cardamine papillata*	Forest Bitter-cress	Forb		
Endangered	Victoria		*Centipeda crateriformis* subsp. *compacta*	Compact Sneezeweed	Forb		✓
Critically Endangered	Victoria		*Comesperma polygaloides*	Small Milkwort	Forb		✓
Endangered	Australia		*Cyphanthera anthocercidea*	Large-leaf Ray-flower	Shrub	✓	✓
Critically Endangered	Victoria		*Daviesia pectinata*	Thorny Bitter-pea	Shrub		✓
Critically Endangered	Victoria		*Dianella longifolia* var. *grandis*	Glaucous Flax-lily	Forb		
Endangered	Victoria		*Digitaria divaricatissima* var. *divaricatissima*	Umbrella Grass	Graminoid		✓
Critically endangered	Victoria		*Diuris daltonii*	Western Purple Diuris	Forb		✓
Vulnerable	Victoria		*Eremophila gibbifolia*	Coccid Emu-bush	Shrub		✓
Critically Endangered	Australia		*Eucalyptus froggattii*	Kamarooka Mallee	Shrub		✓
Endangered	Australia		*Eucalyptus hawkeri*	Arapiles Peppermint-box	Tree	✓	✓
Critically Endangered	Victoria		*Eucalyptus wimmerensis*	Wimmera Mallee-box	Tree	✓	✓
Vulnerable	Victoria		*Galium curvihirtum*	Tight Bedstraw	Forb	✓	✓
Endangered	Victoria		*Gnephosis drummondii*	Slender Cup-flower	Forb		
Endangered	Victoria		*Goodenia benthamiana*	Small-leaf Goodenia	Shrub		✓
Endangered	Victoria		*Goodia medicaginea*	Western Golden-tip	Shrub	✓	✓

FFG status	Extinction Risk	EPBC status	Scientific Name	Common Name	Lifeform	Recorded in current survey	Confirmed from reliable records within Dyurrite and Mitre Rock
Endangered	Victoria		*Grevillea rosmarinifolia* subsp. *glabella*	Smooth Grevillea	Shrub		✓
Critically Endangered	Victoria		*Haegiela tatei*	Small Nut-heads	Forb		
Endangered	Victoria		*Isolepis congrua*	Slender Club-sedge	Graminoid		✓
Endangered	Victoria		*Leucopogon virgatus* var. *brevifolius*	Common Beard-heath	Shrub		✓
Endangered	Victoria		*Melaleuca halmaturorum*	Salt Paperbark	Shrub / small		
Endangered	Victoria		*Parietaria australis*	Western Pellitory	Forb	✓	✓
Endangered	Victoria		*Phebalium stenophyllum*	Narrow-leaf Phebalium	Shrub		
Endangered	Victoria		*Pimelea hewardiana*	Forked Rice-flower	Shrub	✓	✓
Critically Endangered	Australia		*Prostanthera arapilensis*	Arapiles Mint-bush	Shlub	✓	✓
Endangered	Victoria		*Prostanthera spinosa*	Spiny Mint-bush	Shrub		
Endangered	Victoria		*Psilotum nudum*	Skeleton Fork-fern	Fern	✓	✓
NA	NA		*Pterostylis biseta*	Bristled Rustyhood	Forb	✓	✓
Critically Endangered	Victoria		*Ptilotus erubescens*	Hairy Tails	Forb		✓
Vulnerable	Australia		*Pultenaea patellifolia*	Mt. Byron Bush-pea	Shbub	✓	✓
Endangered	Victoria		*Quinetia urvillei*	Grey Zig-zag	Forb		✓
Endangered	Victoria		*Rytidosperma monticola*	Small-flower Wallaby-grass	Graminoid		
Endangered	Victoria		*Rytidosperma richardsonii*	Straw Wallaby-grass	Graminoid		✓
Endangered	Victoria		*Schoenus nanus*	Tiny Bog-sedge	Graminoid		✓
Endangered	Victoria		*Senecio hypoleucus*	Pale Groundsel	Forb	✓	✓
Endangered	Australia	Vulnerable	*Tecticornia flabelliformis*	Bead Glasswort	Shrub		
Endangered	Australia		*Thryptomene calycina*	Grampians Thryptomene	Shrub		✓
Endangered	Victoria		*Triglochin minutissima*	Tiny Arrowgrass	Forb		✓
Endangered	Victoria		*Tripogonella loliiformis*	Rye Beetle-grass	Graminoid		✓
Endangered	Victoria		*Vittadinia condyloides*	Club-hair New Holland	Forb		✓
Endangered	Victoria		*Vittadinia megacephala*	Giant New Holland Daisy	Forb		
Endangered	Victoria		*Vittadinia pterochaeta*	Winged New Holland Daisy	Forb		
Vulnerable	Victoria		*Wahlenbergia planiflora* subsp. *planiflora*	Flat Bluebell	Forb		

4.3 Risk to threatened plants

The relative risk of 50 listed plant taxa indicates that three taxa have a high risk, nine have a medium risk and the remainder have a lower risk. This includes the 12 observed species, indicated in Figure 3 as having a probability of presence of 1. Reasons for the risk rating are analysed for further discussion.

Risk relating to exposure is also previously discussed under Section 4.2 for the observed species. Other species are discussed with some context provided also to those observed.

High risk species

Acacia glandulicarpa was not observed during the current survey. The probability of presence within the areas assessed was relatively low (mean 0.35) however other factors increase the risk. There are recent records in the landscape surrounding Dyurrite and Mitre Rock, it is nationally listed and there is also moderate uncertainty with nearby records and its apparent absence within the study area. The current survey has demonstrated that the occurrence of database records is not entirely indicative of plant distribution information. For example, the tree *Brachychiton populneus* Kurrajong (discussed further below) was not previously recorded in databases however was located in three separate gullies, including observations of mature trees. The management risk for *A. glandulicarpa* is that it may be present and become more abundant with a suitable disturbance regime. In Victoria it is known from mallee with *Eucalyptus incrassata* Yellow Mallee, *Eucalyptus dumosa* Dumosa Mallee, *Eucalyptus wimmerensis* Wimmera Mallee-box and *Eucalyptus behriana* Bull Mallee, as well as woodland with *Eucalyptus leucoxylon* Yellow Gum, *Eucalyptus largiflorens* Black Box and *Allocasuarina luehmannii* Buloke (Carter 2011). If *A. glandulicarpa* is detected within Dyurrite or Mitre Rock it is more likely to be found in mallee where there is less traffic associated with rock climbing activities. Without further targeted surveys in these areas, the statutory and conservation risk remains high, while exposure for rock climbing specifically is moderate.

Cyphanthera anthocercidea is a high-risk species because it has high exposure to rock climbing activities, is endangered, endemic to Victoria and was observed at two locations (Figure 2.7) during the current assessment. Mature plants tend to occur in the rocky shrubland around the bases of climbing walls, although observed away from the immediate base of the wall. This species was given high sensitivity by Parks Victoria (2021). It should be considered amongst the highest priority for conservation management with the study area.

Prostanthera arapilensis is a high-risk species because it is endemic to Victoria, is critically endangered and has moderate to high exposure to rock climbing activities. It was observed at multiple locations (Figure A6) however not often within the immediate vicinity of rock walls. It is otherwise scattered in shrubland and mallee on the plateau, on the scree slopes surrounding rock walls and in gullies. It is exposed to impacts from traffic along foot trails and in assembly areas.

Medium risk species

Acacia rupicola is a medium risk species because it was observed at numerous locations (Figure A1), has medium to high exposure to rock climbing activities and is endangered in Victoria. This species commonly occupies rock crevices but is also found on scree slopes, in gullies and on lower plains within the study area. Its prickly phyllodes and size offer some protection against trampling around

trails and camping areas. Some plants may be impacted on rock walls and ledges during climbing, however this is not expected to have a significant impact on the broader population. Numerous mature plants were observed in protected areas which are not of interest for rock climbing or camping.

Comesperma polygaloides is a medium risk species because it critically endangered, has records from the Dyurrite and surrounds within ten years and has some probability of presence. It is a relatively small herb and may be easily overlooked amongst grassy vegetation. Additional surveys targeting other areas away from rock faces would likely reveal this species. It occurs at various locations at Dyurrite although there are no records on the eastern side of the range. It typically occupies grassland and grassy woodland on heavier soils elsewhere (VicFlora 2021). There is some risk that plants could be impacted around walking trails however this is unlikely to be significant.

Goodia medicaginea is a medium risk species because it is endangered in Victoria, has a high exposure to rock-climbing activities and was recorded at seven sites (including Mitre Rock) during the current assessment (Figure A3). It occurs close to rock wall faces where younger plants in particular are susceptible to potential damage from trampling.

Parietaria australis is a medium risk species because it is endangered in Victoria and has high exposure to rock-climbing activities. It was confirmed only once at Mitre Rock based on suitable fertile material, but is most likely in various areas of rock outcrop at Dyurrite.

Pimelea hewardiana is a medium risk species because it is endangered in Victoria and has moderate to high exposure to rock-climbing activities. It was recorded in several sites during the current assessment and there are a number of previous reports for the study area.

Psilotum nudum was recorded at numerous locations within assessed areas where it occupies rock crevices and ledges on cliff faces. It is a medium risk species because it is endangered in Victoria and has high exposure to rock-climbing activities. It may however be regarded as relatively secure at Mt Arapiles on the basis that there are several areas of habitat which do not appear to be popular climbing routes. This species is also well dispersed at Dyurrite and Mitre Rock and appears also to persist in some more popular climbing areas.

Ptilotus erubescens is a medium risk species because it has been recorded within Dyurrite and Mitre Rock (most recent record 1995), is critically endangered in Victoria and has a moderate probability of occurring within the assessed areas. This species typically occupies fertile grassland and woodland rather than mallee (VicFlora 2021). It is most likely to be found in *Themeda-Aristida* grassy areas on the east side of the range (e.g. amongst the camp site and climbing areas). This vegetation type was not a high priority area for targeted surveys and, as such, further surveys may likely reveal records on the east side of Dyurrite. It has a low likelihood of presence around the main climbing areas.

Pultenaea patellifolia was recorded at two locations during the current assessment (Figure A8). Based on the results of the survey, it appears to be one of the rarer species at Dyurrite, at least on the eastern rock faces and surrounding vegetation. The two locations represent two plants, which were both fertile. The most easterly record is of an individual ~40cm tall growing on a low ledge. It has medium risk because it is vulnerable in Victoria where endemic, has high exposure and

susceptible to impacts from climbing activities. Its rarity at Dyurrite alone might make it worthy of greater consideration for conservation planning.

Senecio hypoleucus was recorded scattered within the study area (Figure A9) and was observed most abundant between Dune Buttress and Fang Buttress. It was observed amongst rock ledges in some locations, however more commonly observed on scree slopes and colluvial soils amongst smaller rocks in the upper slopes leading to climbing areas. It occupies zones used directly for climbing activity as well as other areas which are less commonly accessed. It is a medium risk species because it is endangered in Victoria and has moderate to high exposure.

Lower risk species

The remaining taxa in Figure 3 have a lower risk of significant adverse impacts due to rock climbing activities, and less risk that this in turn will affect their conservation position. Several of these have either not been previously recorded within the study area or have not been recorded for many decades. Some are also associated with the saline wetlands at Mitre Lake nearby to the north, of which there are no such habitat within the study area. Lower risk taxa with insufficient data are considered in the confidence ratings given to their likelihood. Records of orchid *Diuris punctata* var. *punctata* likely account for *Diuris daltonii*. Both are recorded at Dyurrite although *Diuris punctata* var. *punctata* is represented only as part of a regional list. Smith *et al.* (2008) argue that the morphological differences between the two are not worthy of *D. daltonii* being elevated to species rank (cf. Jones and Clements 2004). VicFlora (2021) includes *D. daltonii* as an accepted taxon. It is also represented by a vouchered record within the study area, hence this species has been determined to represent observations of each species for the purpose of this assessment. It typically occurs in heathy forests and *Eucalyptus camaldulensis* woodland on water retentive soils (VicFlora 2021). Such habitat occurs in parts of the plain surrounding the massif and scree slopes. *Eucalyptus hawkeri* occurs scattered in woodland and mallee areas at Dyurrite. It was not observed directly in the vicinity of rock-climbing areas and is unlikely to be impacted from rock-climbing alone. It is a medium risk species because it is endemic to Victoria, endangered but has only moderate exposure to recreational activities.

4.4 Risk to plants of regional significance

A locality for the orchid *Pterostylis biseta* was recorded for the first time within the study area during the current assessment. A population of 30+ plants was recorded within an area of approximately 200 m^2 (represented by one 20 m cell in Figure A11). Previously this species was known from Dyurrite and nearby surrounds by a record in a regional list of Cliff Beauglehole's from 1980. Such Beauglehole lists occur throughout the state and were compiled from Beauglehole observations, other survey data, local reports and other observations. Its inclusion in the list indicates that a population was previously known at some stage, however the details of locality and population were not known. The Beauglehole record was made as *Pterostylis biseta* sensu Willis (1970) and is assumed to fit the concept of *Pterostylis biseta* Blackmore & Clemesha in the ALA (referred to hereafter as *P. biseta*). The taxonomic history of this group of *Pterostylis* ('rufa group') is complex and not easy to assign synonymy as such. The material examined at Dyurrite fits the key characters and description of *Pterostylis biseta* in VicFlora (2021) which accounts for the same taxon used to represent the Beauglehole record in the ALA. Reiter et al. (2021) undertook a survey in northwest

Victoria for *Pterostylis* species from the 'rufa group' and determined amongst other findings that *P. biseta* was widespread in their study area. They also described two new, closely related taxa which are putatively rare. Further examination of the material at Dyurrite should be made to confirm its taxonomy in light of recent observations of the group more broadly. The nearest vouchered records currently assigned to *P. biseta* in Australia's Virtual Herbarium (AVH) are from the Little Desert to the north of the study area. The next vouchered record south is at Portland and the next vouchered record east is at Maryborough. It is oddly absent from the Grampians. While *P. biseta* is not listed as threatened, the population at Dyurrite is significant due to its apparent rarity in the Mount Arapiles – Tooan State Park / Jilpanger Nature Conservation Reserve and Kalingur State Forest areas, as well as more broadly in the Greater Grampians and Wimmera bioregions. All collections in the West Wimmera and Horsham region are pre-1994. One observation record of *P. biseta* was made in 2011 to the west of Dyurrite near Nhill-Harrow Road (ALA 2021). This may account for the same taxon although it is unvouchered and therefore not clear which taxon it may represent. Regardless of how widespread *P. biseta* is in northwest Victoria, populations are subject to a range of threats including impacts by grazing animals, drought, land clearing, recreational land use and competition with weeds.

Figure 2. *Pterostylis biseta* at Dyurrite.

The current assessment resulted in the first database records of *Brachychiton populneus* Kurrajong within Dyurrite and the local area. The nearest database records are from Dimboola to the northeast (the nearest and approximately 30 km away), Langkoop to the west and Moori Moori Nature Conservation Reserve area to the east (ALA 2021). This tree was recorded in three well-spaced gorges on the east side of Mt Arapiles (Figure A10). These comprised four mature individuals. The habitat and landscape context were much the same for each observation. The trees were in generally fire protected rocky sites with associated canopy usually *Eucalyptus goniocalyx* subsp. *viridissima* and *Callitris* species, with a low cover of understorey shrubs and graminoids. A small

amount of charcoal evidence was observed in one of the gullies. It is uncertain what the extend of that fire was as little other evidence of fire was observed.

Brachychiton populneus is a medium size tree and is native to eastern Australia where it occupies various habitat with well-drained soils, rock outcrops and some areas of deeper soil, from the coast to semi-arid regions (ANBG 2015). It is reported as invasive in Western Australia, where it has naturalised from horticultural plantings via bird and other animal dispersal (Buist et al. 2001). Its capacity to spread from plantings raises doubt regarding the origin of this species in some locations. It is peculiar that this species has avoided historical records within Dyurrite and surrounds. The absence of records extends to a vast area of the surrounding landscape. It may be present as a roadside planting but was not observed as such during the current assessment. Its occupancy within its reported natural habitat at Dyurrite, and absence from more fire prone areas, allow for speculation that the population is a relic, as much as it is introduced to the region. Without direct evidence of its introduction, it should be treated as indigenous and incorporated into the conservation planning of the reserve. It should not be discounted that this species may have been transported by aboriginal occupants and visitors between regions prior to European occupancy. Based on the current assessment, it is apparently rare in the landscape. The largest tree (right) is 8–10 m tall and its age is uncertain. Further investigation is required regarding the origin of *Brachychiton populneus* at Dyurrite. It should be regarded as having regional significance, particularly for its functional roles in the context of future climate driven changes to vegetation.

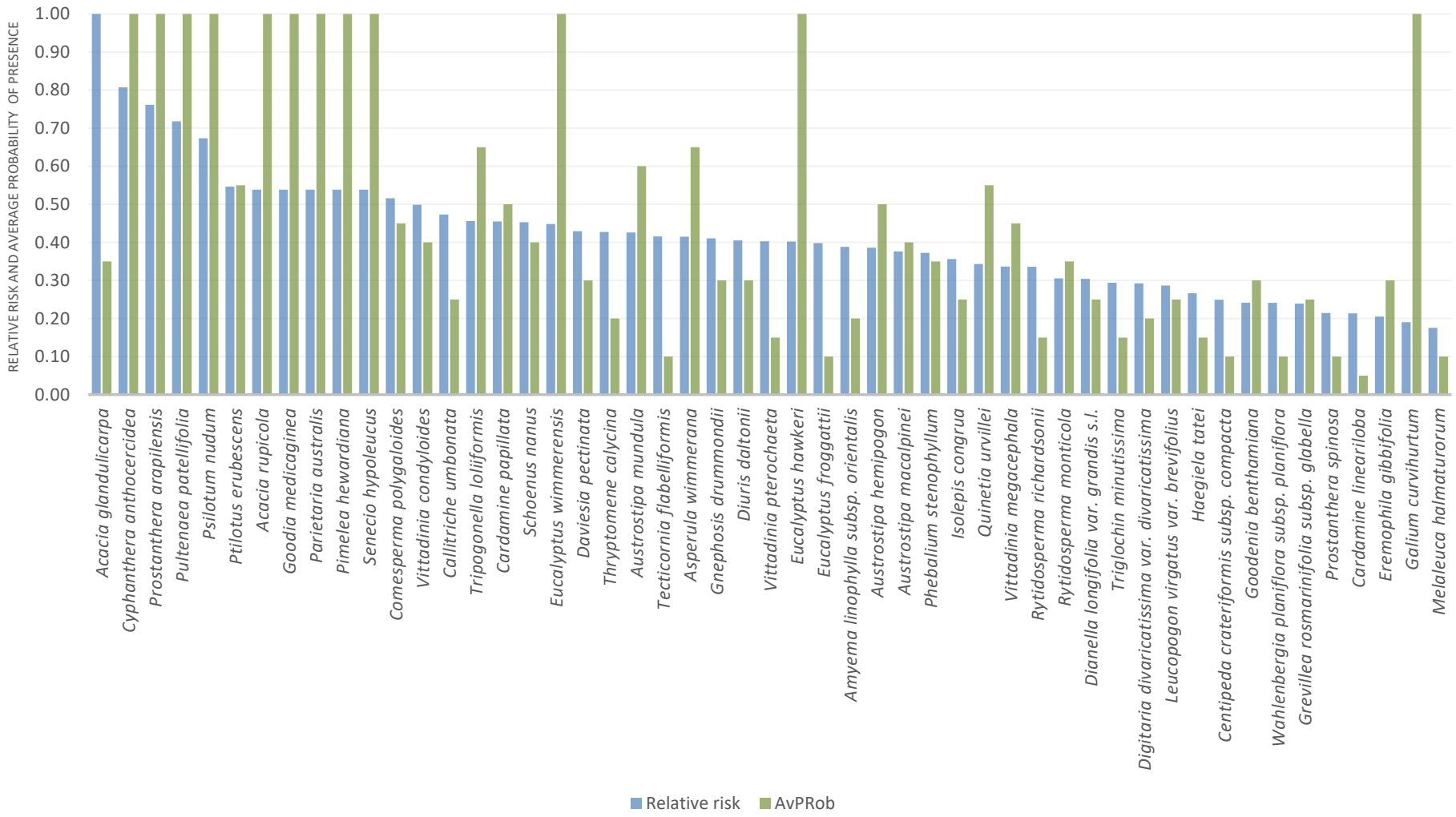


Figure 3. Relative risk to threatened plant taxa AvProb = average probability of presence

4.5 Management recommendations

Table 5. Advisory management recommendations for significant species

The species in Table 5 are those which have at least 0.5 average probability of presence, estimated from the risk assessment. Confidence in the probability of presence rating ranges from 0.5 to 1.

Scientific Name	Common Name	Management options
Acacia rupicola	Rock Wattle	• Determine time since last fire for zones within the park. In areas of woodland containing *A. rupicola* in low abundance, and burnt >30 years ago, undertake moderate intensity burn in autumn. Max 50 ha. Undertake assessment for benefit or impact to other species. • Maintain woody weeds in woodlands to <0.5% total cover.
Asperula wimmerana	Wimmera Woodruff	• No specific additional management is recommended.
Austrostipa hemipogon	Half-bearded Spear-grass	• Control woody weeds in woodlands to <0.5% total cover.
Austrostipa mundula	Neat Spear-grass	• Control woody weeds in woodlands to <0.5% total cover.
Brachychiton populneus subsp. *populneus*	Kurrajong	• Survey additional gullies and gorges within Dyurrite. Map any additional plants if found.
Cardamine papillata	Forest Bitter-cress	• Control woody weeds in woodlands to <0.5% total cover.
Cyphanthera anthocercidea	Large-leaf Ray-flower	• Control woody weeds in woodlands to <0.5% total cover. • Propagate and revegetate with *C. anthocercidea*, in suitable habitat requiring restoration.
Eucalyptus hawkeri	Arapiles Peppermint-box	• Monitor population every five years for tree condition and population structure.
Eucalyptus wimmerensis	Wimmera Mallee-box	• Monitor population every five years for tree condition and population structure.
Galium curvihirtum	Tight Bedstraw	• No specific additional management is recommended. Further assessment of its distribution and habitat would assist to gain a better understanding of threatened plant values within the park.
Gnephosis drummondii	Slender Cup-flower	• Control woody weeds in woodlands and Rocky Outcrop Herbland to <0.5% total cover.
Goodenia benthamiana	Small-leaf Goodenia	• Survey in the vicinity of existing records to determine current status of population, including population size.
Goodia medicaginea	Western Golden-tip	• Determine time since last fire for zones within the park. Burn patches of Scree-slope Woodland in autumn, in the vicinity of mapped *G. medicaginea*. Max 50 ha. Undertake assessment for benefit or impact to other species.
Parietaria australis	Western Pellitory	• Database any new records of *P. australis.*
Pimelea hewardiana	Forked Rice-flower	• Determine time since last fire for zones within the eastern side of the park. In areas of woodland containing *P. hewardiana* in low abundance, and burnt >30 years ago, undertake moderate intensity burn in autumn. Max 50 ha. Undertake assessment for benefit or impact to other species. • Maintain woody weeds in woodlands to <0.5% total cover.

Scientific Name	Common Name	Management options
		• Control rabbits beyond CaLP requirements.
Prostanthera arapilensis	Arapiles Mint-bush	• Undertake research to determine the recruitment and physiological requirements. • Control woody weeds to negligible levels. • Control rabbits beyond CaLP requirements.
Psilotum nudum	Skeleton Fork-fern	• Include on interpretive sign for rock climbers to be aware of and protect when climbing.
Pterostylis biseta	Bristled Rustyhood	• Place low bollards along the walking track adjacent to population and attach sign to indicate area of unspecified conservation significance, stay on track. This aims to deter visitors from taking a shortcut across the grassy area between the road and climbing sections. • Survey the same habitat more widely to search for additional plants. • Survey population every 5 years to determine trajectory of the population. • Control rabbits
Pultenaea patellifolia	Mt. Byron Bush-pea	• Determine time since last fire for zones within the park. Burns patches of Scree-slope Woodland in autumn, in the vicinity of mapped *P. patellifolia*. Max 50 ha. Undertake assessment for benefit or impact to other species. • Monitor any other area burnt within Dyurrite for recruitment of this species, 2 yrs in Oct post burn.
Quinetia urvillei	Grey Zig-zag	• Maintain woody weeds in woodlands and Rocky Outcrop Herbland to <0.5% total cover.
Senecio hypoleucus	Pale Groundsel	• Determine time since last fire for zones within the park. Burn patches of Scree-slope Woodland and other woodland in autumn, in the vicinity of low density mapped *Senecio hypoleucus*. Target east to southeasterly aspects. Max 50 ha. Undertake assessment for benefit or impact to other species.
Tripogonella loliiformis	Rye Beetle-grass	• Maintain woody weeds in woodlands to <0.5% total cover. • Database new records.

4.6 Weed distribution

Threatened species within the study area are affected variously by environmental weeds. Within the sections of park assessed, herbaceous weeds made up the vast majority of total weed cover and diversity. Herbaceous weeds were observed over most parts of the study area. In some areas that are more frequency accessed by visitors, herbaceous weeds made up most of the ground vegetation and commonly comprised *Ehrharta calycina* Perennial Veldt-grass, *Ehrharta erecta* Panic Veldt-grass, *Marrubium vulgare* Horehound, *Briza maxima* Large Quaking-grass, *Arctotheca calendula* Capeweed, *Helminthotheca echioides* Ox-tongue, *Avena fatua* Wild Oat, *Fumaria bastardii* Bastard's Fumitory, *Bromus rubens* Red Brome, *Sonchus oleraceus* Sow Thistle and *Carduus pycnocephalus* Slender Thistle. The introduced orchid *Disa bracteata* South African Orchid, was observed within the study area. This species has not been previously recorded in the VBA and was moderately common around the camping areas and scree-slopes.

The interaction between weed threats and biodiversity values is multifaceted. Their combined effect includes changes to alpha diversity and community composition. They may impact habitat quality at community or species level. All herbaceous species observed are naturalised within their observed habitats. Once established, they are difficult to manage and efforts to do so across the park would likely not warrant the cost for the ecological gains achieved. Management of herbaceous weeds can instead be targeted to local areas of high conservation value. Their suitability to the landscape and abundance of propagules will no doubt ensure that they persist and remain dominant in some areas.

Weeds have been ranked in Victoria for their invasiveness and other attributes (White *et al* 2018). A VBA list of weed taxa from the study area and immediate surrounds is provided in Table 6, with state-level risk ratings provided from White *et al*. (2018). These risk ratings can be used as a guide for management at Dyurrite and Mitre Rock. At the local scale, planning should also consider what values are at risk and how tractable the threat is when prioritising management. Table 6 is ordered by risk rating classes. The risk ratings for a small number of taxa were inferred from synonyms or related taxa in White *et al*. (2018). Some of the taxa in Table 6 do not typically occupy the habitats which were the focus for this field assessment. Those species in bold have a higher likelihood of occupying the cliffs, cliff bases, gullies and scree-slope communities.

Weeds were not comprehensively assessed and mapped for this project however some species stood out as being of greater management concern than others. One of these species within the study area is *Asparagus asparagoides* Bridal Creeper (Figure A14), which is a climber that has the capacity to smother any understorey plant which it can use to grow on for structural support. It was recorded by Parks Victoria (2021) in the greatest number of climbing sites, second only to *Briza maxima* Large Quaking-grass. It poses a risk to all threatened shrub species within the study area. A large number of seedlings were observed, and mapping only reflects areas where this species was more conspicuous or abundant.

Woody weeds were uncommon in the study area. The occasional *Malus pumilio* Apple was observed where established from discarded cores. *Schinus molle* Pepper Tree is a bird-dispersed tree which was observed very rarely in the landscape. The management of woody weeds is relatively simple compared with herbaceous weeds. There were no woody weed species which were determined to be a direct threat to significant plant populations.

Table 6. Weed list and risk rating for Dyurrite, Mitre Rock and ~200 m buffer.

Scientific Name	Common Name	Risk
Brachypodium distachyon	**False Brome**	**Very High Risk**
Lophopyrum ponticum	**Tall Wheat-grass**	**Very High Risk**
Typha latifolia	Lesser Reed-mace	Very High Risk
Asparagus asparagoides	**Bridal Creeper**	**High Risk**
Avena barbata	**Bearded Oat**	**High Risk**
Avena fatua	**Wild Oat**	**High Risk**
Bromus alopecuros	**Mediterranean Brome**	**High Risk**
Bromus catharticus	**Prairie Grass**	**High Risk**
Bromus madritensis	**Madrid Brome**	**High Risk**
Bromus rubens	**Red Brome**	**High Risk**
Catapodium rigidum	**Fern Grass**	**High Risk**
Cenchrus longispinus	Spiny Burr-grass	High Risk
Centaurea melitensis	Malta Thistle	High Risk
Ehrharta calycina	**Perennial Veldt-grass**	**High Risk**
Erodium moschatum	**Musky Heron's-bill**	**High Risk**
Fumaria bastardii	**Bastard's Fumitory**	**High Risk**
Fumaria capreolata	**White Fumitory**	**High Risk**
Hainardia cylindrica	Common Barb-grass	High Risk
Helminthotheca echioides	**Ox-tongue**	**High Risk**
Hordeum hystrix	**Barley-grass**	**High Risk**
Hordeum leporinum	**Barley-grass**	**High Risk**
Hordeum murinum	**Barley-grass**	**High Risk**
Leontodon rhagadioloides	**Hedypnois**	**High Risk**
Lycium ferocissimum	**African Box-thorn**	**High Risk**
Malva parviflora	**Small-flower Mallow**	**High Risk**
Marrubium vulgare	**Horehound**	**High Risk**
Moraea flaccida	One-leaf Cape-tulip	High Risk
Parapholis incurva	Coast Barb-grass	High Risk
Phalaris aquatica	Toowoomba Canary-grass	High Risk
Phalaris minor	Lesser Canary-grass	High Risk
Phalaris paradoxa	Paradoxical Canary-grass	High Risk
Plantago bellardii	**Silky Plantain**	**High Risk**
Plantago coronopus* subsp. *commutata	**Buck's-horn Plantain**	**High Risk**
Poa bulbosa	Bulbous Meadow-grass	High Risk
Polypogon monspeliensis	**Annual Beard-grass**	**High Risk**
Romulea rosea	**Onion Grass**	**High Risk**
Rosa rubiginosa	**Sweet Briar**	**High Risk**
Silene gallica	**French Catchfly**	**High Risk**
Silene gallica* var. *gallica	**French Catchfly**	**High Risk**
Silene nocturna	Mediterranean Catchfly	High Risk
Trifolium cernuum	Drooping-flower Clover	High Risk
Trifolium scabrum	Rough Clover	High Risk

Scientific Name	Common Name	Risk
Trifolium striatum	Knotted Clover	High Risk
Trifolium subterraneum	**Subterranean Clover**	**High Risk**
Acetosella vulgaris	**Sheep Sorrel**	**Moderately High Risk**
Aira caryophyllea* subsp. *caryophyllea	**Silvery Hair-grass**	**Moderately High Risk**
Aira cupaniana	**Quicksilver Grass**	**Moderately High Risk**
Aira elegantissima	**Delicate Hair-grass**	**Moderately High Risk**
Avellinia festucoides	Avellinia	Moderately High Risk
Briza maxima	**Large Quaking-grass**	**Moderately High Risk**
Briza minor	**Lesser Quaking-grass**	**Moderately High Risk**
Carduus pycnocephalus	**Slender Thistle**	**Moderately High Risk**
Carthamus lanatus	**Saffron Thistle**	**Moderately High Risk**
Centaurium erythraea	**Common Centaury**	**Moderately High Risk**
Centaurium maritimum	**Sea Centaury**	**Moderately High Risk**
Centaurium tenuiflorum	**Slender Centaury**	**Moderately High Risk**
Cerastium diffusum	Sea Mouse-ear Chickweed	Moderately High Risk
Cirsium vulgare	**Spear Thistle**	**Moderately High Risk**
Dittrichia graveolens	Stinkwort	Moderately High Risk
Erodium botrys	**Big Heron's-bill**	**Moderately High Risk**
Erodium cicutarium	**Common Heron's-bill**	**Moderately High Risk**
Galium divaricatum	**Slender Bedstraw**	**Moderately High Risk**
Galium murale	**Small Goosegrass**	**Moderately High Risk**
Hypochaeris glabra	**Smooth Cat's-ear**	**Moderately High Risk**
Hypochaeris radicata	**Flatweed**	**Moderately High Risk**
Juncus capitatus	Capitate Rush	Moderately High Risk
Lamium amplexicaule	Dead Nettle	Moderately High Risk
Lepidium africanum	**Common Peppercress**	**Moderately High Risk**
Lysimachia arvensis	**Pimpernel**	**Moderately High Risk**
Lysimachia minima	**Chaffweed**	**Moderately High Risk**
Medicago minima	**Little Medic**	**Moderately High Risk**
Medicago polymorpha	**Burr Medic**	**Moderately High Risk**
Moenchia erecta	**Erect Chickweed**	**Moderately High Risk**
Pentameris airoides* subsp. *airoides	**False Hair-grass**	**Moderately High Risk**
Petrorhagia dubia	**Velvety Pink**	**Moderately High Risk**
Petrorhagia nanteuilii	**Childling Pink**	**Moderately High Risk**
Plantago coronopus	**Buck's-horn Plantain**	**Moderately High Risk**
Polycarpon tetraphyllum	Four-leaved Allseed	Moderately High Risk
Polypogon maritimus var. subspathaceus	Coast Beard-grass	Moderately High Risk
Psilurus incurvus	Bristle-tail Grass	Moderately High Risk
Rapistrum rugosum	**Giant Mustard**	**Moderately High Risk**
Rumex pulcher subsp. *pulcher*	Fiddle Dock	Moderately High Risk
Sagina procumbens	Spreading Pearlwort	Moderately High Risk
Sonchus asper* subsp. *asper	**Rough Sow-thistle**	**Moderately High Risk**
Sonchus oleraceus	**Common Sow-thistle**	**Moderately High Risk**

Scientific Name	Common Name	Risk
Stellaria media	**Chickweed**	**Moderately High Risk**
Trifolium dubium	**Suckling Clover**	**Moderately High Risk**
Trifolium glomeratum	**Cluster Clover**	**Moderately High Risk**
Urtica urens	**Small Nettle**	**Moderately High Risk**
Vellereophyton dealbatum	**White Cudweed**	**Moderately High Risk**
Vulpia bromoides	**Squirrel-tail Fescue**	**Moderately High Risk**
Vulpia ciliata	**Fringed Fescue**	**Moderately High Risk**
Vulpia myuros* f. *megalura	**Fox-tail Fescue**	**Moderately High Risk**
Vulpia myuros* f. *myuros	**Rat's-tail Fescue**	**Moderately High Risk**
Vulpia myuros* f. *myuros	**Rat's-tail Fescue**	**Moderately High Risk**
Arctotheca calendula	**Cape Weed**	**Medium Risk**
Artemisia arborescens	Silver Wormwood	Medium Risk
Bellardia latifolia	**Red Bartsia**	**Medium Risk**
Bellardia viscosa	**Yellow Bartsia**	**Medium Risk**
Bromus diandrus	**Great Brome**	**Medium Risk**
Bromus hordeaceus	**Soft Brome**	**Medium Risk**
Bupleurum semicompositum	Hare's Ear	Medium Risk
Cardamine hirsuta	**Common Bitter-cress**	**Medium Risk**
Carduus tenuiflorus	**Winged Slender-thistle**	**Medium Risk**
Cerastium glomeratum	**Sticky Mouse-ear Chickweed**	**Medium Risk**
Chondrilla juncea	Skeleton Weed	Medium Risk
Cicendia filiformis	**Slender Cicendia**	**Medium Risk**
Cucumis myriocarpus subsp. *myriocarpus*	Paddy Melon	Medium Risk
Galium spurium	**False Cleavers**	**Medium Risk**
Gomphocarpus fruticosus subsp. *fruticosus*	Swan Plant	Medium Risk
Isolepis levynsiana	Tiny Flat-sedge	Medium Risk
Lagurus ovatus	**Hare's-tail Grass**	**Medium Risk**
Logfia gallica	French Cudweed	Medium Risk
Lolium loliaceum	**Stiff Rye-grass**	**Medium Risk**
Lolium rigidum	**Wimmera Rye-grass**	**Medium Risk**
Molineriella minuta	Small Hair-grass	Medium Risk
Nicotiana glauca	**Tree Tobacco**	**Medium Risk**
Poa annua	**Annual Meadow-grass**	**Medium Risk**
Rostraria cristata	**Annual Cat's-tail**	**Medium Risk**
Salvia verbenaca* var. *verbenaca	**Wild Sage**	**Medium Risk**
Solanum nigrum	**Black Nightshade**	**Medium Risk**
Soliva sessilis	**Jo**	**Medium Risk**
Spergularia bocconei	Boccone's Sand-spurrey	Medium Risk
Spergularia rubra	Red Sand-spurrey	Medium Risk
Trifolium angustifolium* var. *angustifolium	**Narrow-leaf Clover**	**Medium Risk**
Trifolium arvense* var. *arvense	**Hare's-foot Clover**	**Medium Risk**
Trifolium campestre* var. *campestre	**Hop Clover**	**Medium Risk**
Trifolium incarnatum* var. *incarnatum	**Crimson Clover**	**Medium Risk**

Scientific Name	Common Name	Risk
Trifolium tomentosum* var. *tomentosum	**Woolly Clover**	**Medium Risk**
Urospermum picroides	False Hawkbit	Medium Risk
Verbascum virgatum	**Twiggy Mullein**	**Medium Risk**
Zaluzianskya divaricata	Spreading Night-phlox	Medium Risk
Avena sativa	**Oat**	**Lower Risk**
Filago pyramidata	Filago	Lower Risk
Lactuca serriola	**Prickly Lettuce**	**Lower Risk**
Onopordum tauricum	**Taurian Thistle**	**Lower Risk**
Sagina apetala	Common Pearlwort	Lower Risk
Scilla peruviana	Cuban Lily	Lower Risk
Triticum aestivum	Wheat	Lower Risk

4.7 Interaction between threats and values

Threats other than weed threats were observed sporadically within the study area, with some threats being more prominent in one area and not another. The study area may be divided into four zones for consideration of how these threats interact with values; the rock massif and cliff bases, the plateau, scree-slopes and the lowland plains. Some larger items of hard rubbish were mapped (Figure A13). Larger items of rubbish were not common on scree-slopes. Items includes transmission wire offcuts, clothing and metal can.

4.7.1 Rock massif and cliff bases

The main threat in this zone is from park visitor use. There are several locations where small retaining walls have been constructed to provide a base area for climbing. These may assist also to slow erosion but have reduced the habitat types that were present prior to the disturbance. Most of their area is occupied by herbaceous weeds. The exposure to species in this zone were the main focus of this assessment. Few species are restricted to this zone. Notable exceptions are *Psilotum nudum* and *Parietaria australis*. Weeds management is not a high priority in this zone and most are ubiquitous herbaceous species. Woody weed cover is negligible and only periodic maintenance is required.

4.7.2 Plateau

Most park use over the plateau area would be likely be for general recreation and access the picnic areas, to undertake short hikes and access the main lookout. Some areas at the top of popular climbing faces are accessed by rock climbers. Soil erosion is a notable threat in and around rock shelves and in depressions occupied by Rocky Outcrop Herbland. Most of the ephemeral plants observed within the study area occupy these habitat types. This zone was assessed in less detail and not mapped for threatened plants, but should be investigated further for values and threats.

4.7.3 Scree-slopes

Scree-slopes have a high level of interaction between threats and values. This zone contains most of the foot trails to access the popular climbing sites from the main camp. Most of these trails were mapped during the current assessment (see maps in appendix 1) and there are additional lower-use

trails into most gullies and gorges, as well as trails which take short cuts between the more obvious and worn trails. The amount of access into this zone makes it susceptible to weed introduction and spread. If offers foraging and refuge areas for rabbits and hares. It also accumulates small items of rubbish such as food packaging, however not common. Most of the threatened species observed occupied scree-slopes to some extent. Gorges and scree-slopes at higher elevation and with regular runoff and part shade have a high cover of herbaceous weeds (Figure 4). These are a source of weed propagules to lower scree-slopes (Figure 5). Scree-slopes around Mitre Rock had a moderate cover of herbaceous weeds.

Figure 4. Gorge with high cover of herbaceous weeds, above Scree-Slope Woodland.

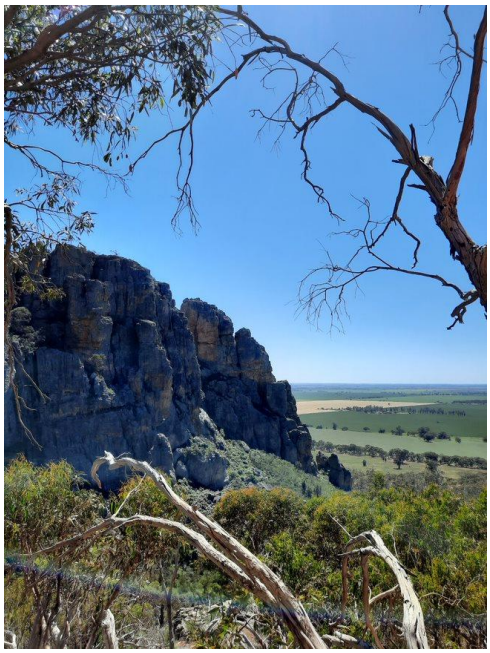


Figure 5. Landscape showing cliff faces with lower scree-slope

4.7.4 Lowland plains

The lowland plains have undergone the most amount of vegetation clearing and disturbance relating to infrastructure within the study area. This zone was not the focus of the current assessment but is noted for encompassing populations of some of the threatened plants within Dyurrite. Most individuals of *Eucalyptus wimmerensis* and *Eucalyptus hawkeri* occupy the lower plains. Other threatened species such as *Acacia rupicola* and *Prostanthera arapilensis* occur in patches. Threatened plant populations on these plains are most at risk from soil disturbance, camping activities, clearing for park maintenance and fire management, competition from some weeds and climate change.

4.7.5 Interaction between level of rock-climbing use and threatened species distribution

There was no clear pattern between the level of rock-climbing use and the distribution of threatened plants. High use climbs at Watchtower Face and Castle Crag tended to have fewer threatened plant observations compared with many other lower use climbs. climbs had *Senecio hypoleucus*, *Psilotum nudum* and *Pimelea hewardiana* within their vicinity. These climbs at Mitre Rock had mostly *Senecio hypoleucus*, *Psilotum nudum* and a confirmation of *Parietaria australis* within their vicinity. To the south, high use climbs at Organ Pipes Gully has mostly *Psilotum nudum, Acacia rupicola* and *Senecio hypoleucus* in their vicinity. This southern area had some of the higher density of threatened plant point records compared with some other areas. Pilot Error Cliffs climb had several *Psilotum nudum* in its vicinity and *Senecio hypoleucus* was rare. Species generally not associated with high use climbs were *Prostanthera arapilensis*, *Cyphanthera anthocercidea* and threatened eucalypts.

The cause and effect implied is not able to be determined with the few observations made, and the correlation may be coincidental. Additional surveys of low use areas would allow a better assessment of the correlation between climbing activity and distribution of threatened plants.

5. Advisory recommendations

Investigate undertaking additional surveys including:

- Surveys and mapping of the distribution of threatened plants within 500 m of the main campsite and along the main road into Dyurrite.
- A wider survey for *Pultenaea patellifolia* and resolve status of the population at Dyurrite.
- Additional surveys for *Brachychiton populneus* to determine the extent and size of the population.

Plant protection

- Prevent or discourage access to native grass-dominated areas in Scree-slope Woodland and Shallow Sands Woodland, to prevent impacts to *Pterostylis biseta* and other threatened plants in this habitat type.
- Include suitable species in revegetation mix, which are currently rare in the landscape such as *Cyphanthera anthocercidea* and *Goodia medicaginea*.
- Provide interpretation for the public on where threatened plants generally occur and how to avoid impacting them.

Fire

- Investigate undertaking an assessment of ecological and cultural burn requirements within the park. This may include some areas of scree-slopes and lower plains to encourage recruitment of obligate seeders. Develop a plan which accounts for risks to the public, assets, weed control and soil protection.

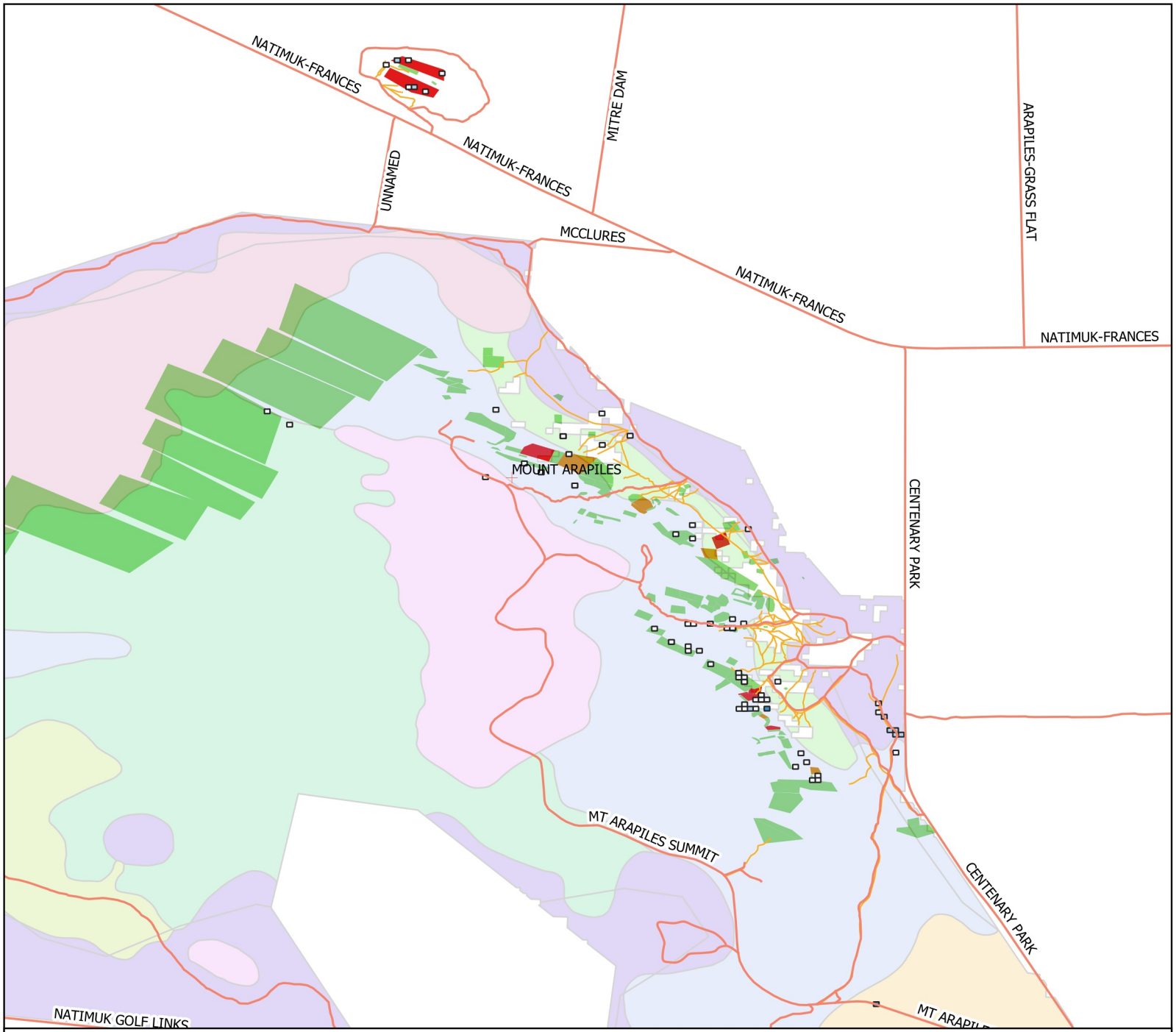
Rabbits and hares

- Control rabbits and hares to above standards required of the *Catchment and Land Protection Act 1994*.

Monitoring

- Monitor threatened plant populations on an ongoing basis. Consider remapping threatened plant species' distribution using the same methods applied here, in five years. Compare the extent and abundance of those species mapped.
- Inform the Royal Botanic Gardens Victoria of the *P. biseta* population for consideration in future taxonomic work.
- Where possible, survey all burnt vegetation at Dyurrite and Mitre Rock for the occurrence of threatened species. Survey in spring two years following fire.

Appendix 1 – Maps

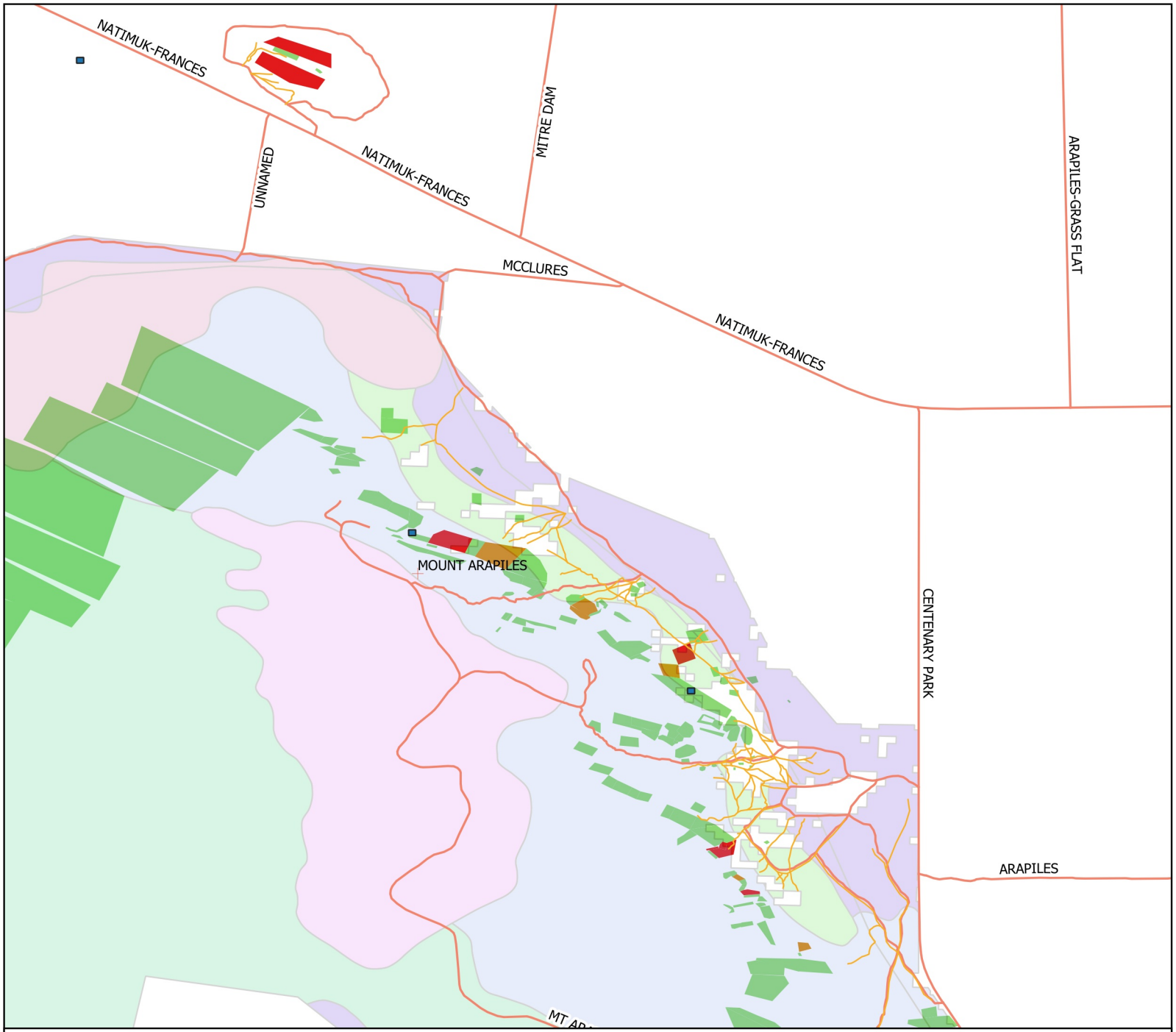


VicMapLite spatial data.
The State of Victoria through the
Department of Environment, Land, Water and Planning (DELWP)
Information Services Division (ISD)
PO Box 500, East Melbourne VIC 8002
https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure A1
Distribution of Acacia rupicola

dellbotany
www.dellbotany.com.au



Cyphanthera anthocercidea distribution

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

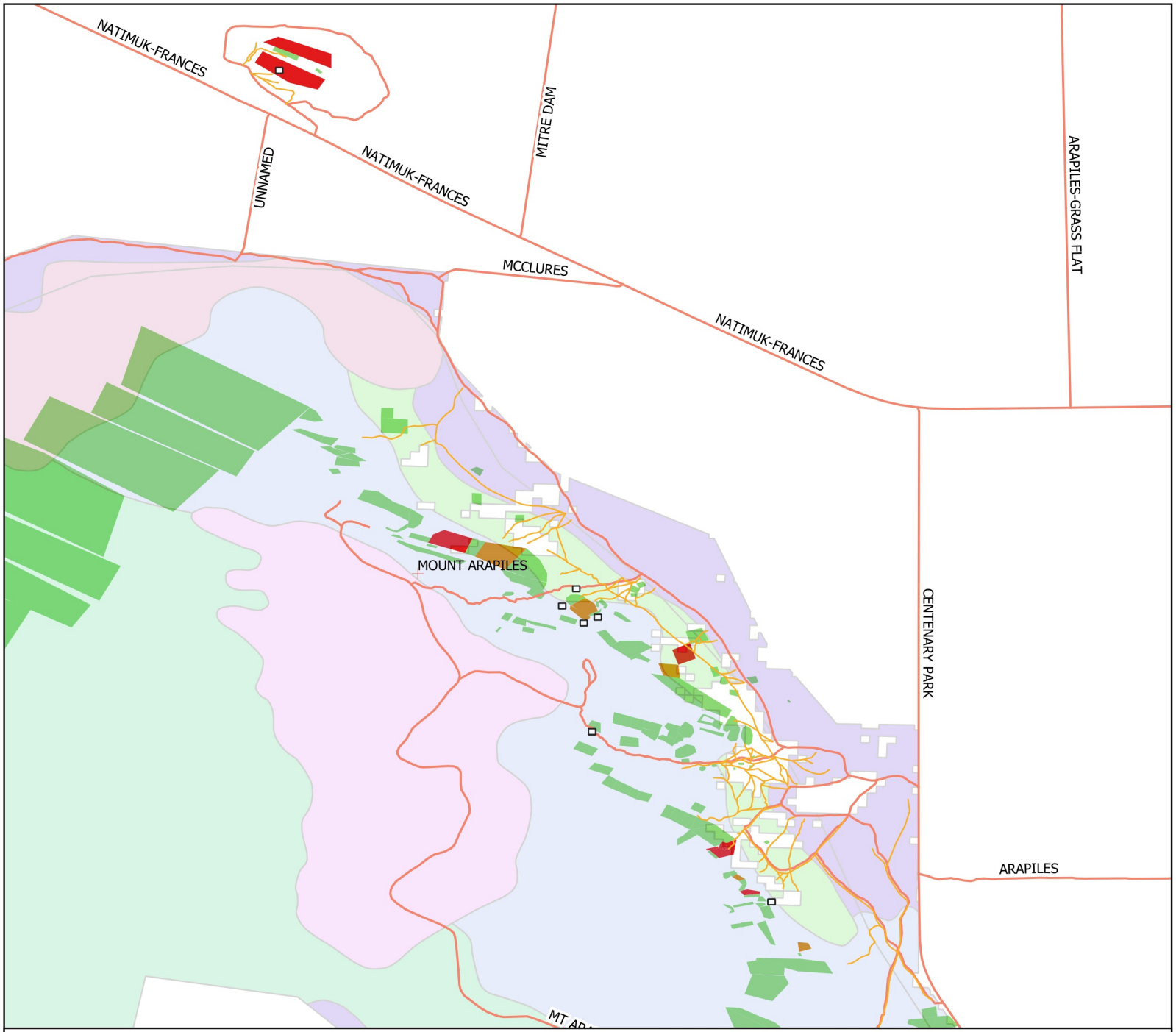
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A2
Distribution of Cyphanthera anthocercidea



Goodia medicaginea abundance

1

Climb Sites (use)

- High
- Medium
- Low
- Roads
- Tracks
- Waterway

Ecological Vegetation Classes

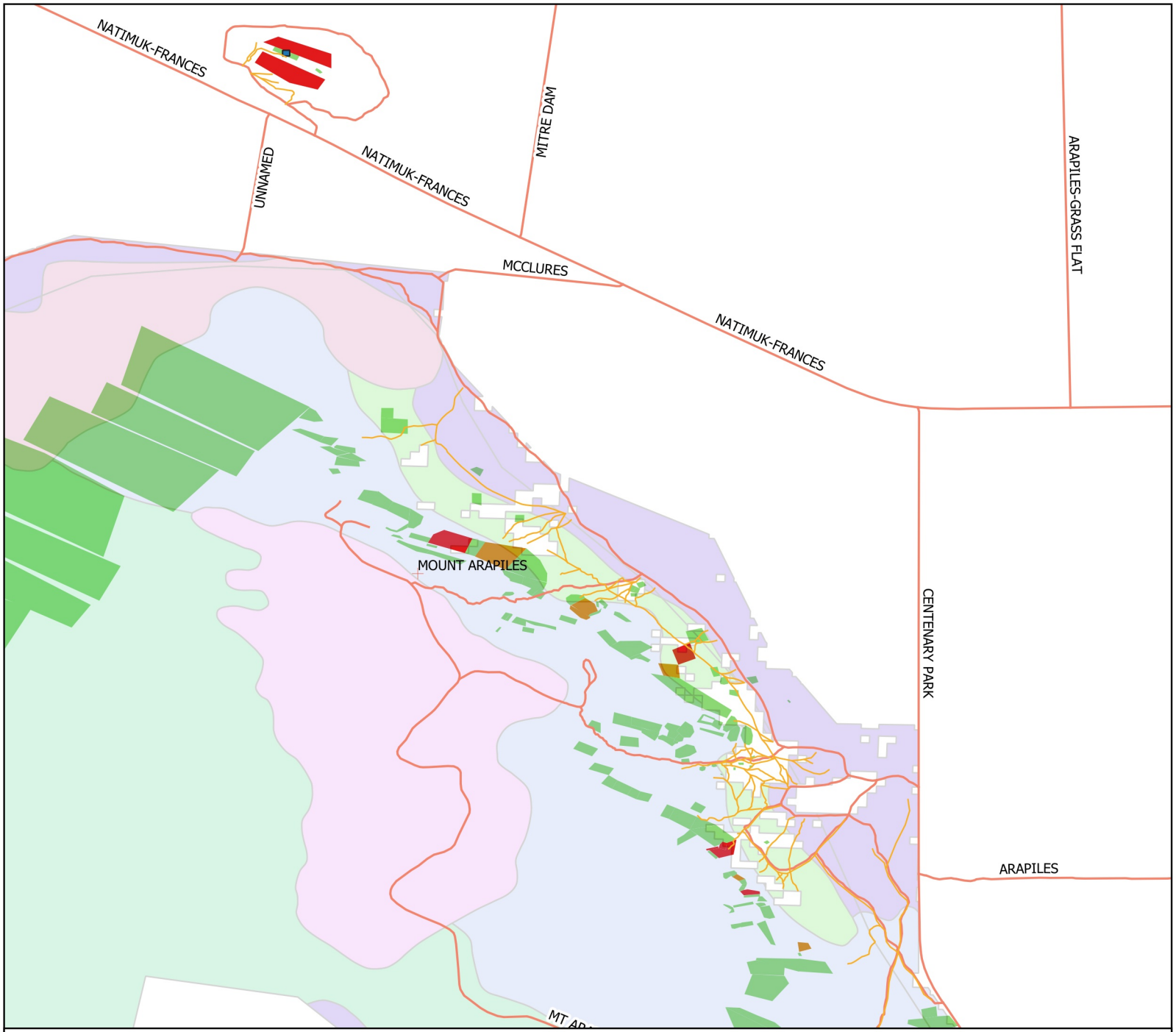
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A3
Distribution of Goodia medicaginea



Parietaria australis

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

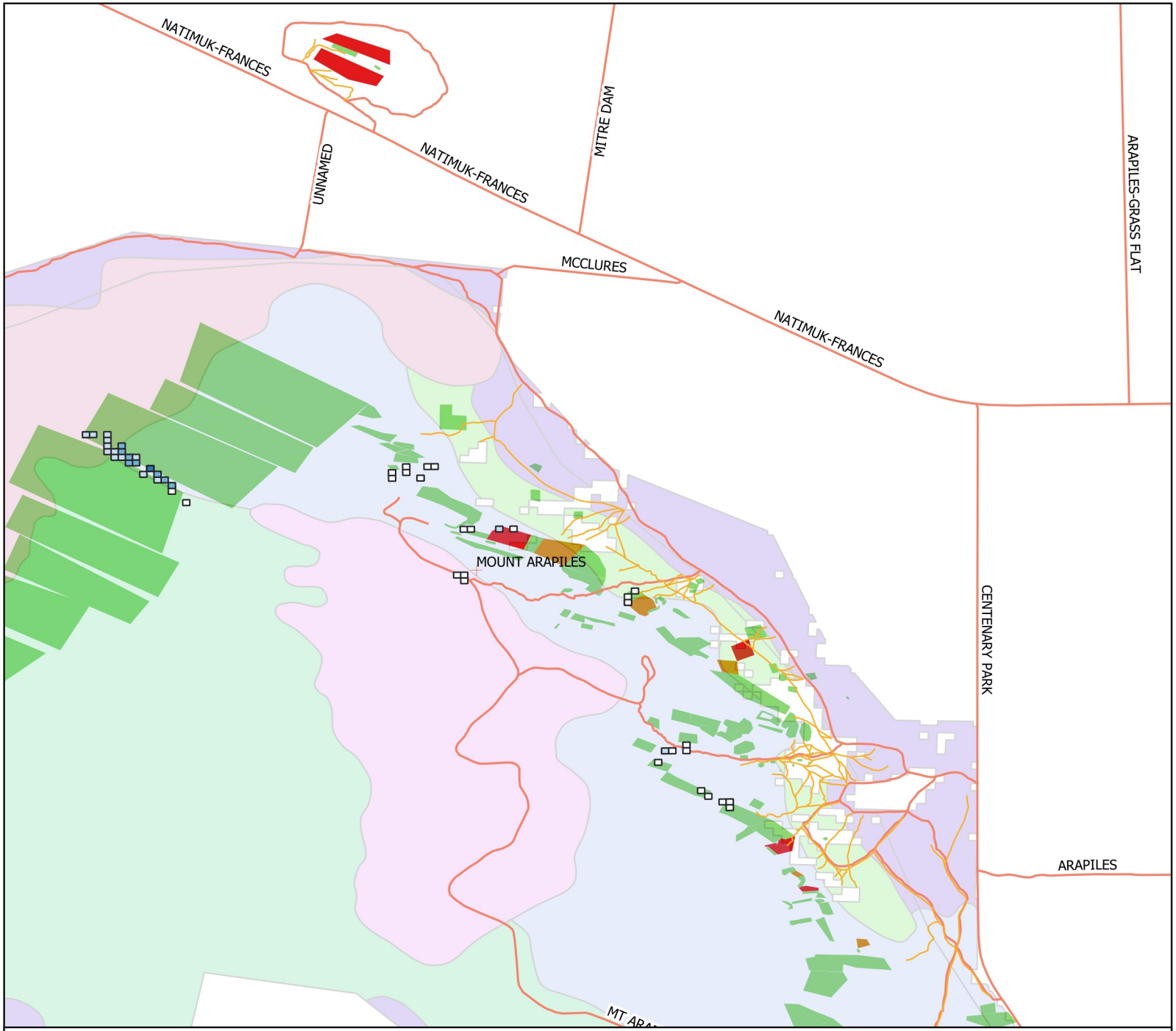
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A4
Distribution of Parietaria australis



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https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure A5
Distribution of Pimelea hewardiana

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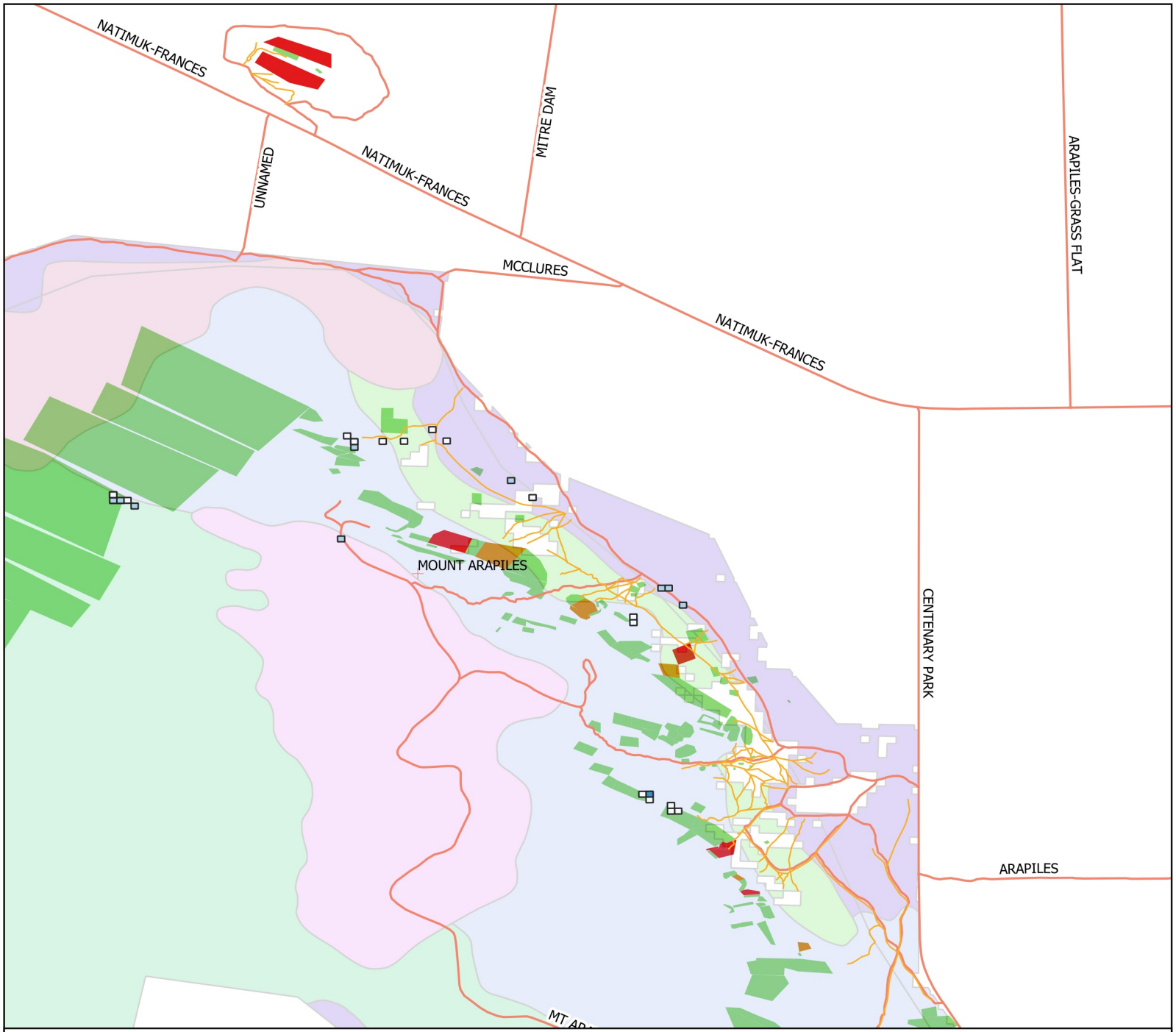

Prostanthera arapilensis abundance

- 1
- 2-3
- 4-5

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

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https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure A6
Distribution of Prostanthera arapilensis

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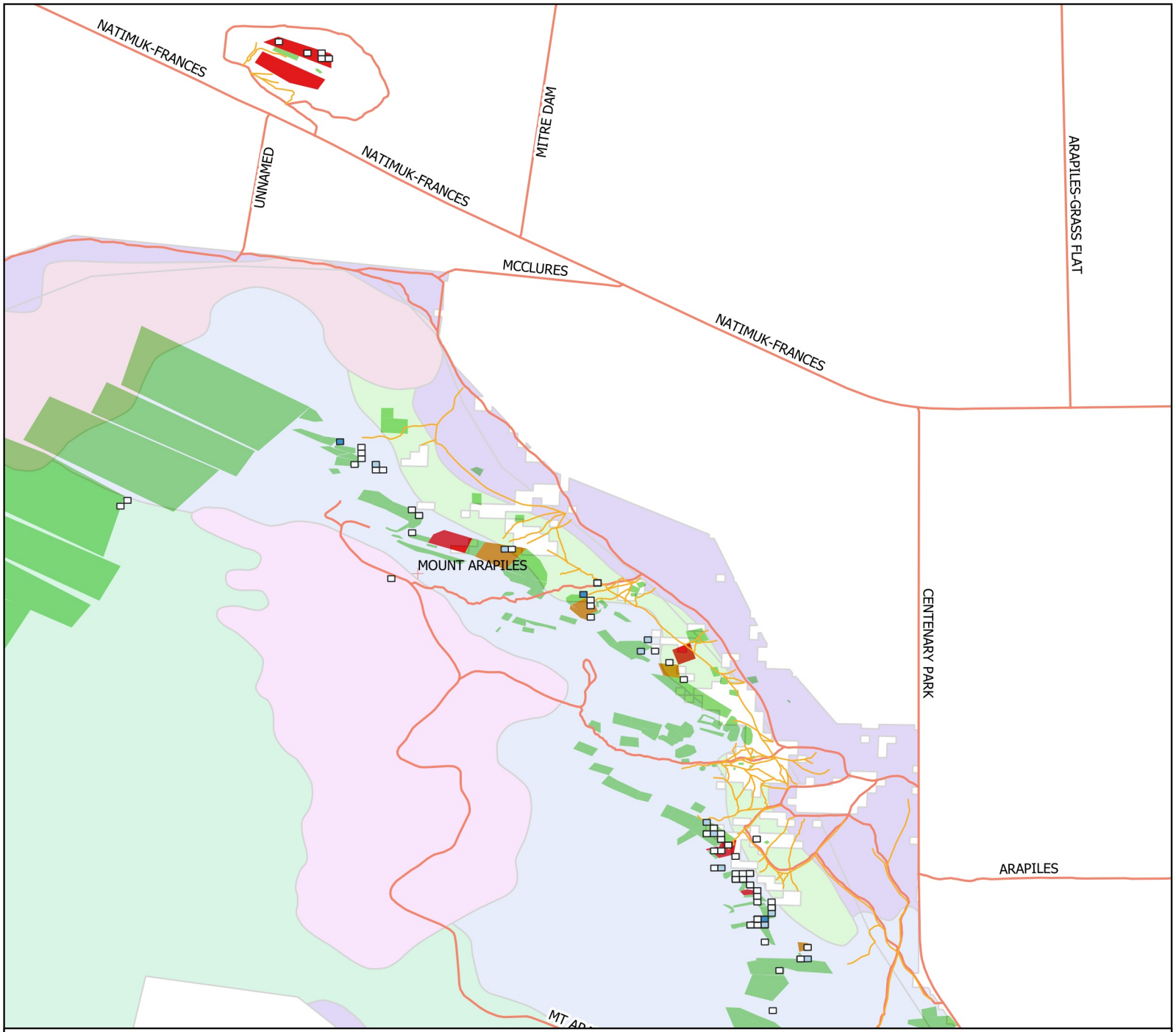

Psilotum nudum abundance

- 1
- 2-3
- 4-5

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

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https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure A7
Distribution of Psilotum nudum

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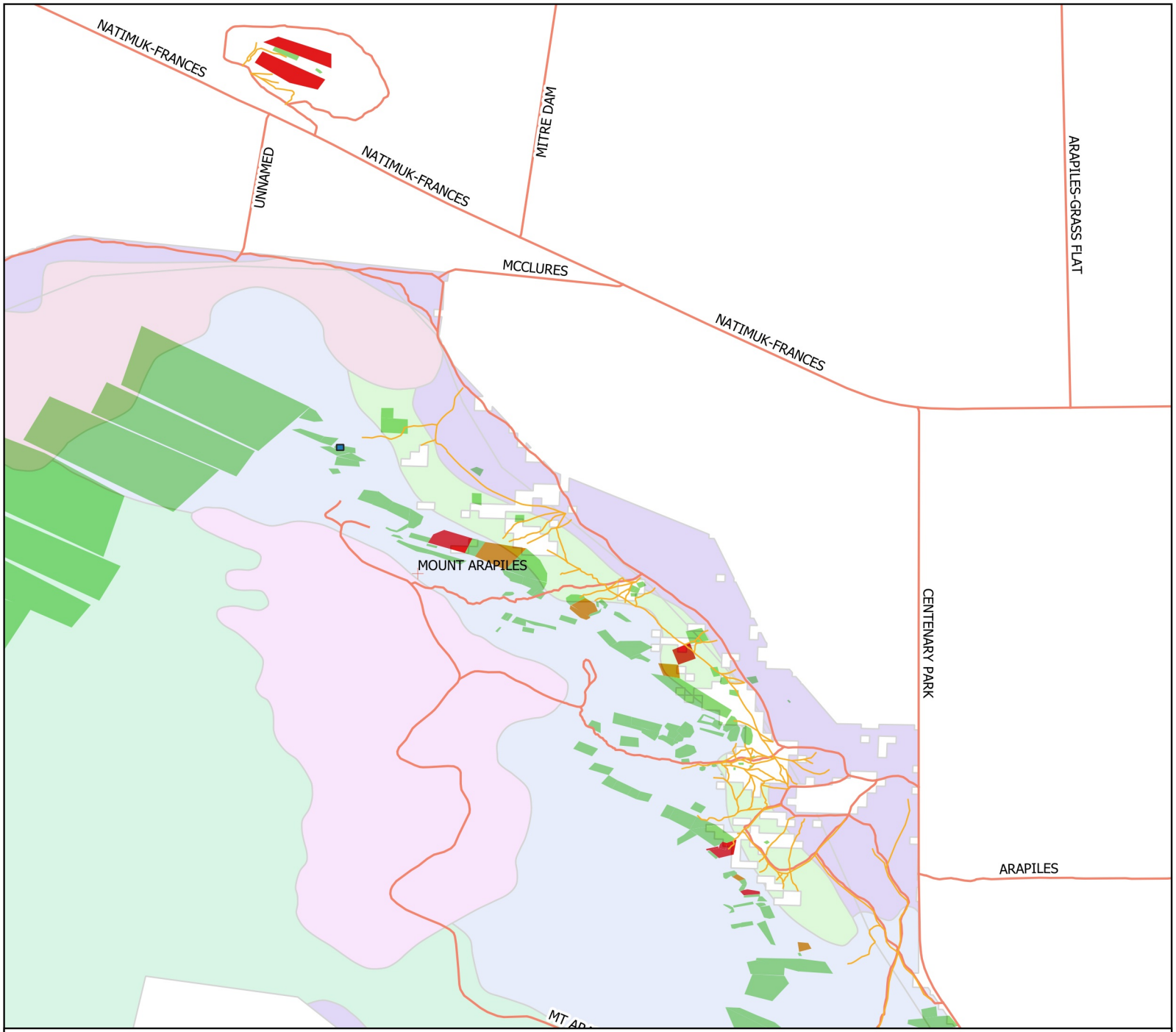


Pultenaea patellifolia

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

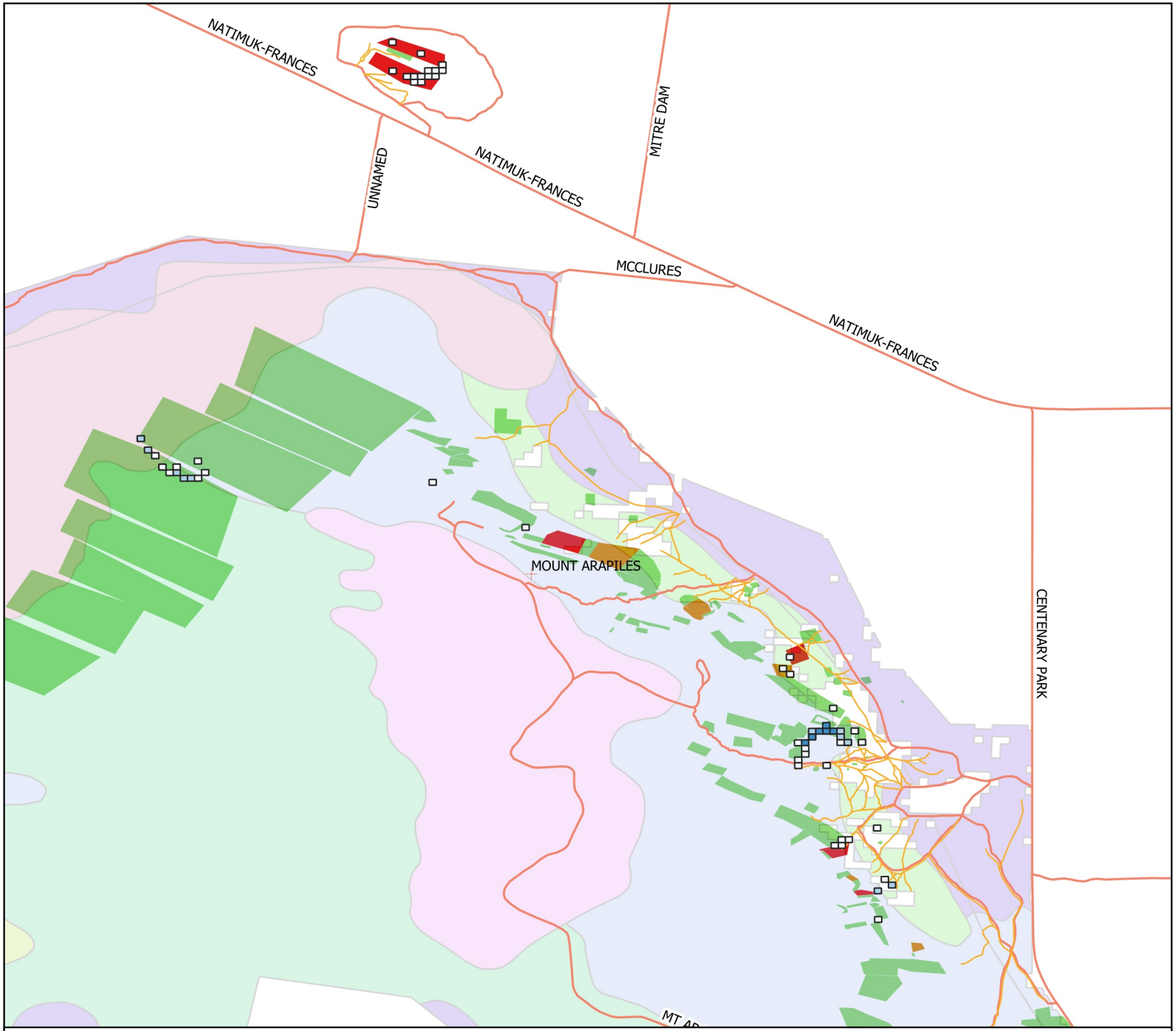
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A8
Distribution of Pultenaea patellifolia



Senecio hypoleucus abundance

- 1
- 2-3
- 4-5

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

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Geocentric Datum of Australia 1994 (UTM)

Figure A9
Distribution of Senecio hypoleucus

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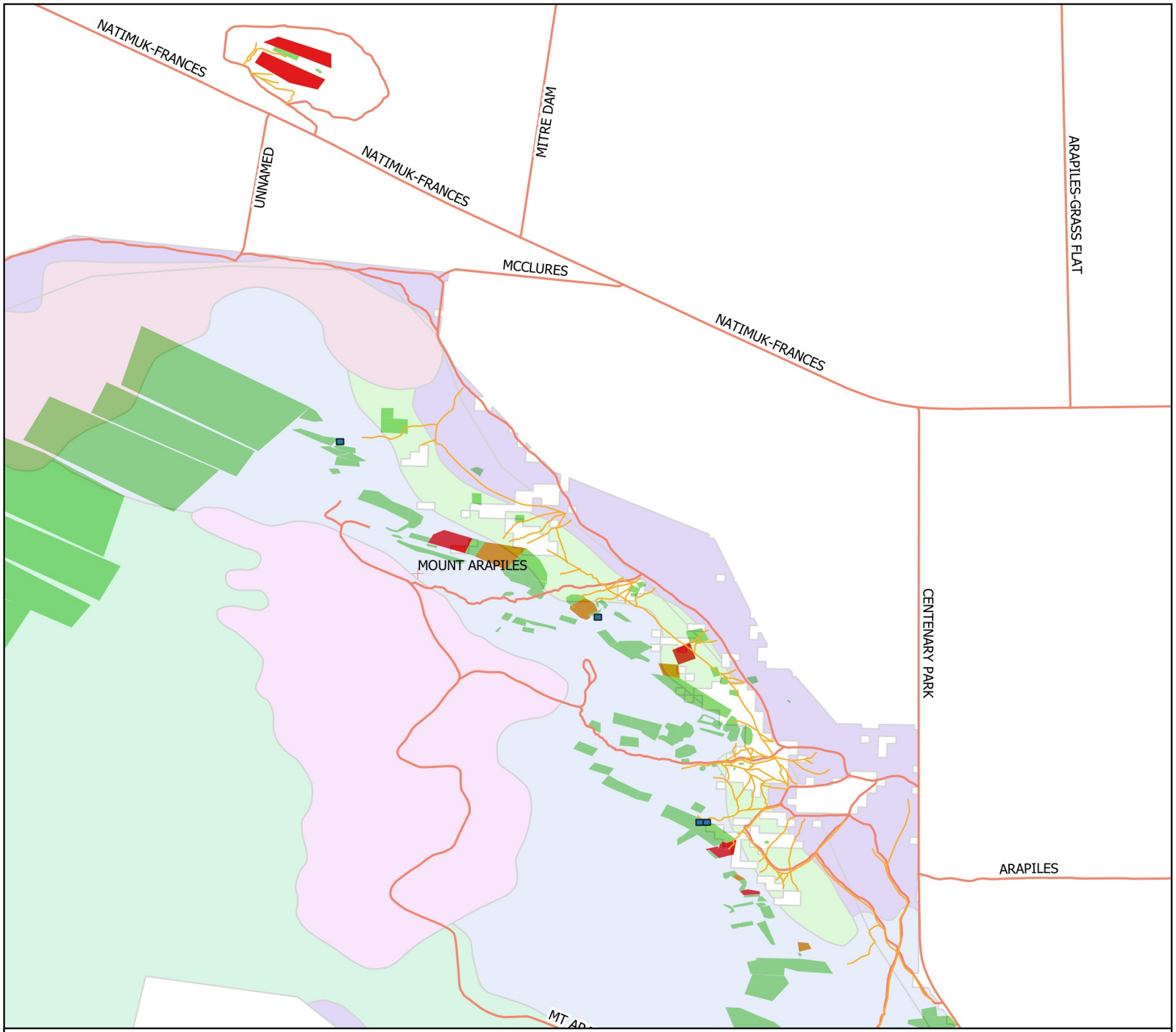


Brachychiton populneus

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

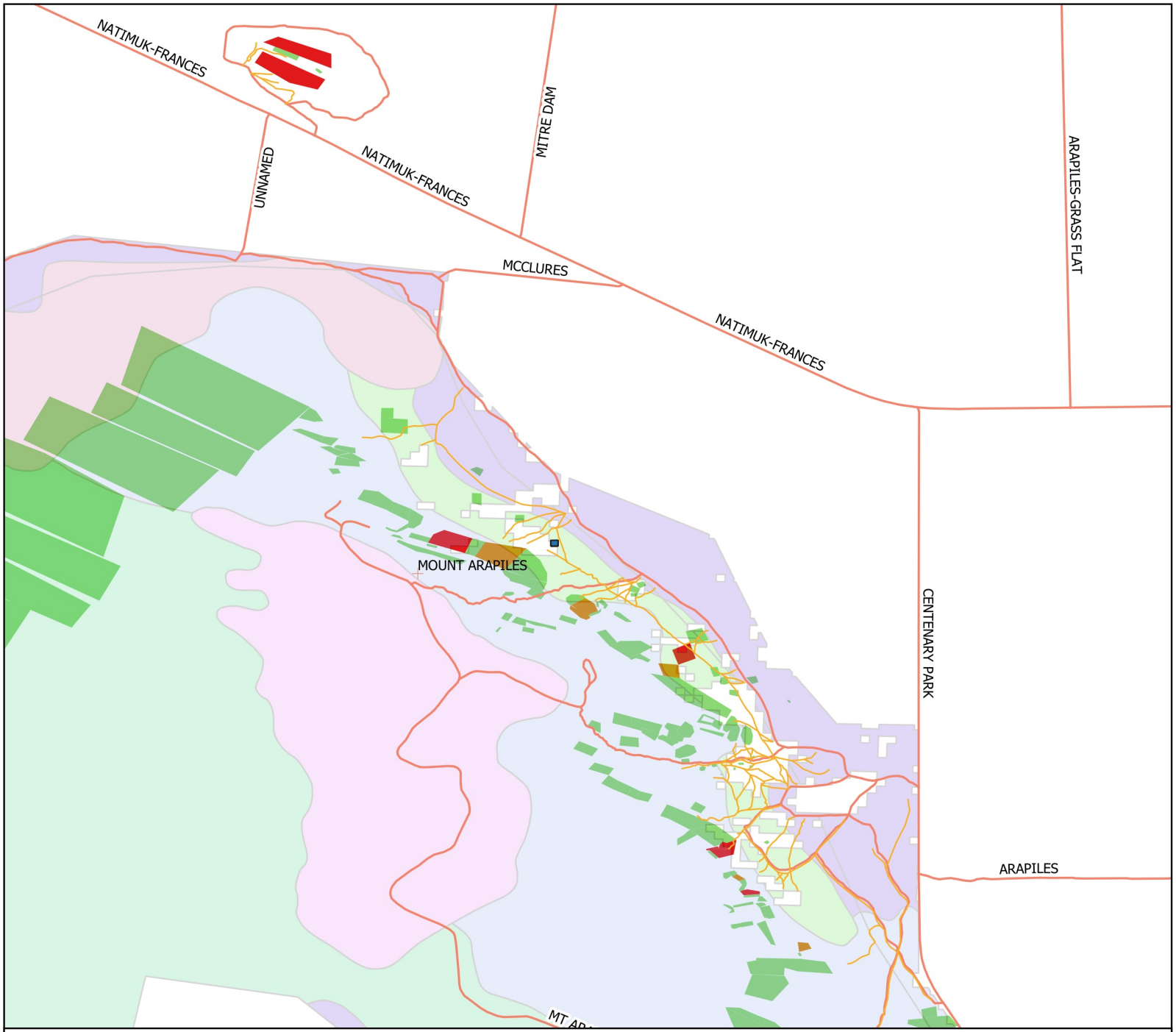
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A10
Distribution of Brachychiton populneus



Pterostylis biseta

Climb Sites (use)

- High
- Medium
- Low

Ecological Vegetation Classes

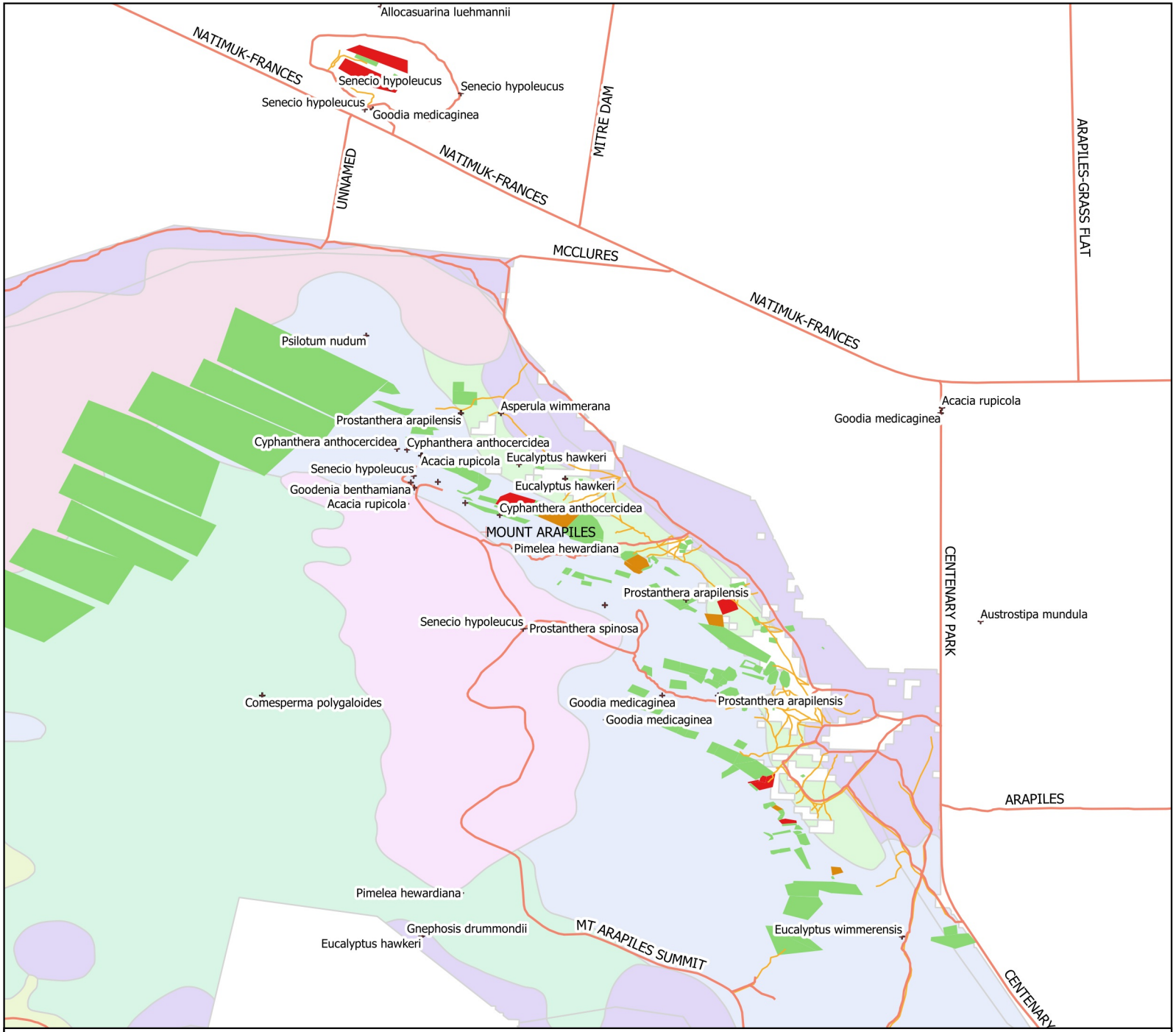
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic
- Roads
- Tracks
- Waterway

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A11
Distribution of Pterostylis biseta



VBA records

Climb Sites (use)

- High
- Medium
- Low
- Roads
- Tracks
- Waterway

Ecological Vegetation Classes

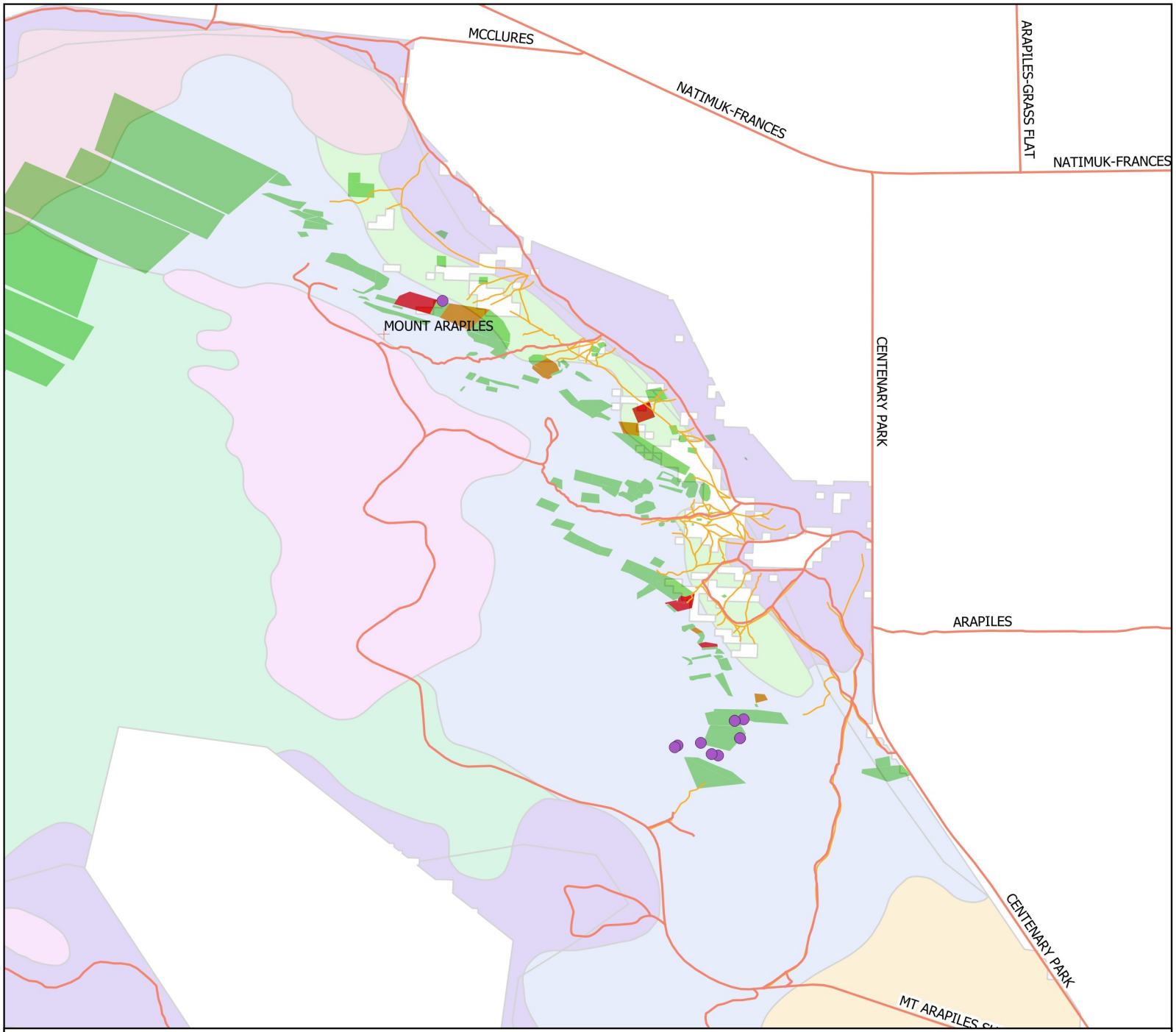
- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic

N

0 250 500 750 1000 m

Geocentric Datum of Australia 1994 (UTM)

Figure A12
Threatened plant records in VBA



Rubbish

Climb Sites (use)

- High
- Medium
- Low
- Roads
- Tracks
- Waterway

Ecological Vegetation Classes

- Heathy Woodland
- Hills Herb-rich Woodland
  Grassy Dry Forest Complex
- Plains Woodland
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Heathy Woodland Mosaic
- Rocky Outcrop Shrubland
  Rocky Outcrop Herbland
  Sandstone Ridge Shrubland Mosaic
- Scree-slope Woodland
- Shallow Sands Woodland
- Shallow Sands Woodland
  Heathy Woodland Mosaic

N

0 250 500 750 1000 m

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Geocentric Datum of Australia 1994 (UTM)

Figure A13
Distribution of hard rubbish

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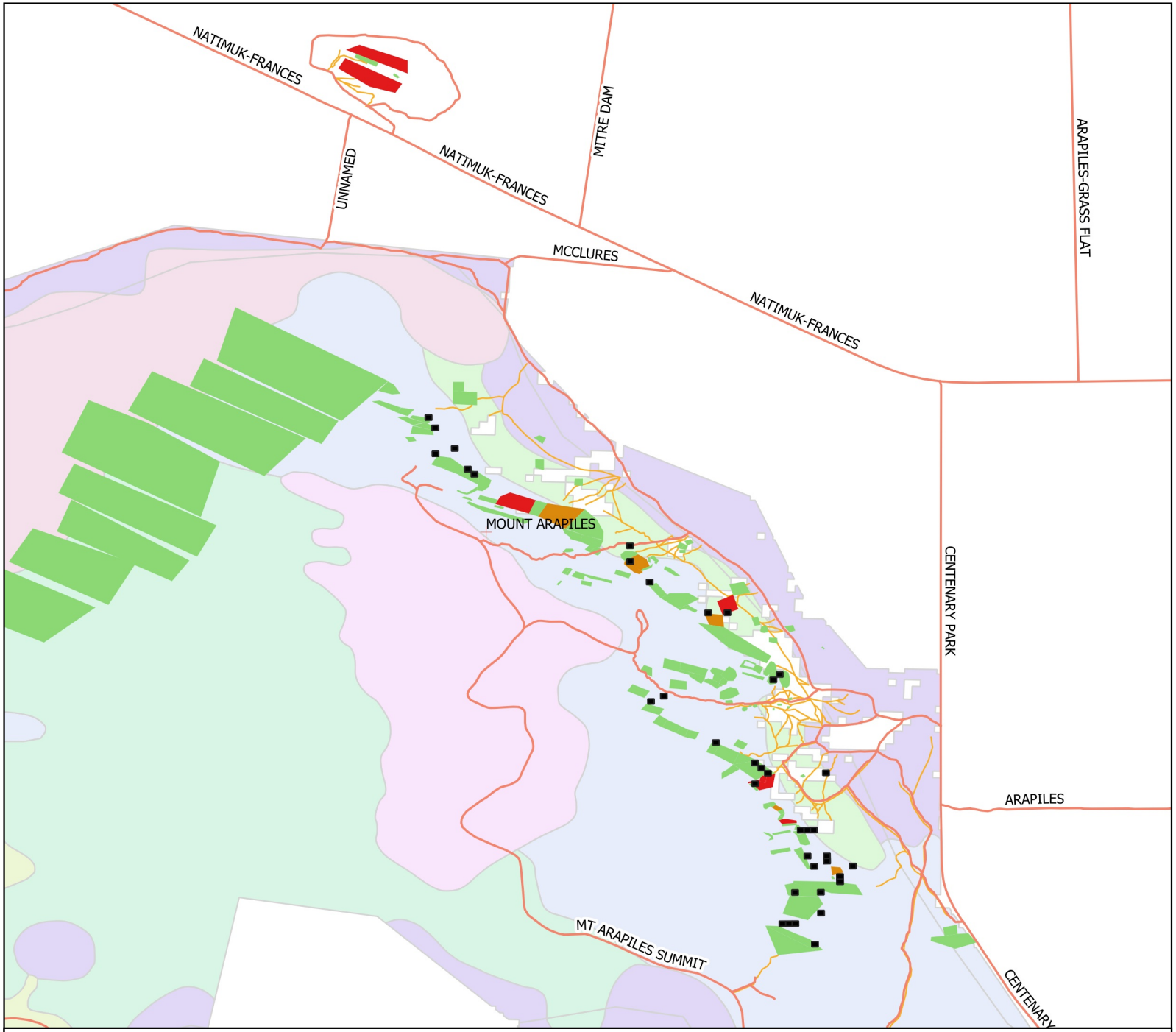

VicMapLite spatial data.
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https://www2.delwp.vic.gov.au/maps/spatial-data/victorian-spatial-data/licensing#DSP

Geocentric Datum of Australia 1994 (UTM)

Figure A14
Distribution of Asparagus asparagoides

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