

NSW Threatened Species Scientific Committee

Conservation Assessment of the Cumberland Plain land snail *Meridolum corneovirens* (Pfeiffer, 1851) (Camaenidae)

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Cumberland Plain land snail *Meridolum corneovirens* (Pfeiffer, 1851) (Camaenidae)

Distribution: Endemic to the Sydney Region, NSW

Current EPBC Act Status: Not Listed

Current NSW BC Act Status: Endangered

Proposed listing on NSW BC Act and EPBC Act: Endangered

The NSW Threatened Species Scientific Committee published a notice of final determination for *Meridolum corneovirens* in 1997 (NSW Scientific Committee 1997). This Conservation Assessment report has found that there is no change to the listing status of this taxon on the *Biodiversity Conservation Act 2016* schedules. The report provides an updated assessment for the risk of extinction for the taxon against the criteria in the *Biodiversity Conservation Regulation 2017* using the [Common Assessment Method](#). The Common Assessment Method is the agreed method for assessing the extinction risk of species by the Australian Government and all state and territory governments. This document should be read in conjunction with the 1997 [final determination](#).

Summary of Conservation Assessment

The Cumberland Plain land snail *Meridolum corneovirens* was found to be eligible for listing as Endangered under IUCN Criterion B1ab(ii,iii,v).

The main reasons for this species being eligible are: 1) it has a highly restricted geographic range with an EOO of 2,449 km²; 2) the population is severely fragmented and is found at no more than four threat-defined locations; 3) there is an estimated and inferred continuing decline in: area, extent, and quality of habitat, AOO, and the number of mature individuals, due to habitat clearing and modification for urban and rural development, removal of ground cover, increased frequency and duration of inclement dry and hot weather due to climate change and increased weed invasion.



Cumberland Plain Land Snail, *Meridolum corneovirens* inhabiting the Cumberland Plain Woodland in the Sydney Basin Bioregion. Photo: Marie-Claire Demers/DCCEEW

Description and Taxonomy

Helix corneovirens was initially described by Pfeiffer (1851) as being from the Cape Verde Islands, West Africa, due to a labelling error. The type locality was later corrected to Mulgoa, New South Wales by Iredale (1938), who placed it in *Meridolum* Iredale, 1938. The species was re-described by Clark (2009) in a review of *Meridolum*. *Meridolum corneovirens* shows significant genetic and morphological variation across its range (Clark 2005, 2009), but the 2009 species description remains valid (S. Clark pers. comm. January 2024).

Clark (2009) describes the species as having a “subglobose shell, 13.5–23.9 mm in height and 18.0–28.4 mm in width. Spire moderately elevated. Aperture roundly ovate, height 10.0–13.5 mm and width 10.8–18.7 mm. Total number of whorls 4.8–5.7. Last teleoconch whorl rounded, or with slight angulation; height 12.3–21.3 mm. Shell sculpture consists of coarse growth lines and weak pustules. Teleoconch periostracal sculpture of weak zigzag ridges. Protoconch sculpture weakly pustulose. Shell uniform brown to tan or olive green, darker coloured individuals not uncommon. Red umbilical patch typically absent, occasionally faintly present. Red subsutural band very thin. Supraperipheral band absent. Inner lip white (rarely pale pink), strongly reflected, largely occluding umbilical depression. Outer lip moderately deflected below midline of last whorl. Umbilicus closed to slightly open”.

Distribution and Abundance

Meridolum corneovirens is restricted to the Cumberland Plain in Western Sydney, New South Wales (NSW). This area is encompassed by the Sydney Basin Bioregion and primarily includes the Cumberland IBRA Subregion (DAWE 2012). The distribution is approximately bounded by Cattai to the north, Oakdale to the west, Bankstown to the east, and Wilton to the south (ALA 2024; BioNet 2024). While the species is widespread within this distribution, it is restricted to fragmented patches of native vegetation throughout, some of which are in protected areas, but most of which remain unprotected (DEC 2005; DEWHA 2010; Esri 2021). All habitat patches exist in a matrix of urban, peri-urban, suburban, and rural development (Tozer 2003; Fitzgerald 2009; Eldridge 2021; Esri 2021). Local Government Areas (LGAs) in *Meridolum*

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corneovirens' distribution include: Blacktown, Blue Mountains, Camden, Campbelltown, Canterbury-Bankstown, Fairfield, Hawkesbury, Liverpool, Penrith, The Hills Shire, and Wollondilly (DCS 2024). The distribution is within the traditional lands of the Dharug, Gundungarra, Eora, Tharawal and Wodiwodi people (AIATIS 1996).

Few surveys have recorded Cumberland Plain land snail abundance. For example, over 90 individuals were found during an Environmental Impact Assessment (EIA) for the western Sydney Airport at Badgerys Creek, potentially representing a significant population (SMEC 2014). Twenty-eight individuals were found during an assessment for a residential development in Macarthur (TBE 2016) and a survey of Wianamatta Regional Park found 14 individuals, including a mating pair (S. Clark unpubl. data 2021).

There are multiple other surveys that have no abundance information and instead only recorded the species' presence (e.g. Biosis 2005; P & J Smith Ecological Consultants 2013; Eco Logical Australia 2020). Ridgeway *et al.* (2014) noted that the species can be moderately abundant, yet it has also been noted as appearing to be declining in smaller habitat patches (M. Shea pers. comm. October 2024). Several factors may make detecting the species difficult. Non-optimal weather conditions (S. Clark unpubl. data 2021) and daytime surveys may underestimate Cumberland land snail abundance, as it has been demonstrated that the related Dural land snail *Pommerhelix duralensis* (Cox, 1868), can be abundant in humid conditions on nights after rainfall (S. Clark pers. comm. Jan 2024). The species' ability to burrow up to 10 cm depth (Clark 2009; Ridgeway *et al.* 2014) also likely inhibits detection.

It is unclear how many subpopulations comprise the species' total population. *Meridolum corneovirens*' dispersal ability is limited such that the number of suitable habitat patches more than 350 m apart could be used as a proxy for the number of subpopulations, as 350 m is the maximum distance that the snail can travel in a generation and is the radius of its genetic neighbourhood *i.e.* individuals greater than 350 m apart are likely to be genetically divergent compared with individuals within close proximity (Clark and Richardson 2002; Clark 2004). However, the large number of occurrence records and the complex matrix of suitable and unsuitable habitat patches within the Cumberland Plain make it impractical to measure the number of subpopulations in this way. This means that the number of subpopulations is unknown, particularly when there is no accurate information on overall population abundance or density, the number of mature individuals, or what number may comprise a minimum viable population. Further research and monitoring are therefore required to determine population abundance and genetic distribution across its range.

Extent of Occurrence and Area of Occupancy

The Area of Occupancy (AOO) is estimated to be 1,212 km² based on 2 x 2 km grid cells, the scale recommended by the IUCN (2024). The Extent of Occurrence (EOO) is estimated to be 2,449 km² and is calculated as a minimum convex polygon containing all known occurrences, the method of assessment recommended by IUCN (2024). Both EOO and AOO were calculated from spatially and expert validated records using ArcGIS version 10.8.2 (Esri 2021). Based on these estimates, *Meridolum corneovirens* has a highly restricted EOO and moderately restricted AOO. While the majority of 2 x 2 km grid cells contain occupiable habitat, the AOO presented may be an overestimate as overlaying BioNet (2024) records with satellite imagery in ArcMap (Esri 2021) shows there is a high chance that some historical occurrence records are now lost to urban development.

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Ecology

Habitat

Meridolum corneovirens is restricted to woodlands and dry sclerophyll forests in western Sydney, many of which are listed as Threatened Ecological Communities (TECs) (Leary *in litt.* August 2007; Clark 2009; DEWHA 2009; NSW Scientific Committee 2009; NSW Scientific Committee 2011a). Where the species' AOO intersects with mapped TECs, nearly 95% of the intersects are with Cumberland Plain Woodland (~50%), River-Flat Eucalypt Forest on Coastal Floodplains (~18%), Shale/Sandstone Transition Forest (~14%), Cooks River/Castlereagh Ironbark Forest (~8%) and Castlereagh Scribbly Gum Woodland (~4%) TECs (Esri 2021; NSW DCCEEW 2021). These TECs (herein referred to simply as Cumberland Plain Woodland) are typically characterised by tall eucalypts with open grassy understorey, although understorey layers can vary from grasses to denser shrubs depending on the disturbance history of a particular patch (DEWHA 2009). The three most common plant community types (PCTs) that overlap with Cumberland Plain land snail records are Cumberland Shale Plains Woodland (PCT3320), Cumberland Red Gum Riverflat Forest (PCT4025) and Castlereagh Ironbark Forest (PCT3448), however the species is not restricted to these PCTs and is likely to be found in other PCTs in the area (DPE 2022a, 2022b).

Cumberland Plain Woodland is mostly associated with clay soils, as well as shale-gravel and shale-sandstone soils, on mostly flat terrain (Tozer 2003; Tozer *et al.* 2006; Esri 2021). The Cumberland Plain receives approximately 700–900 mm annual rainfall (Tozer 2003). *Meridolum corneovirens* likely benefits from more ground layer habitat cover and complexity within Cumberland Plain Woodland as it commonly uses fallen logs, leaf litter and bark, and sometimes even rubbish for sheltering sites (NPWS 2000; Clark 2004, 2009; DPE 2019). Locally, the species also appears to have a strong association with the presence of Nodding Geebung *Persoonia nutans* (Kayne Moreton *in litt.* September 2024).

Behaviour and Life History

Meridolum corneovirens has been observed eating dead native insects and fungus in the field, and lichen, leaves and detritus in captivity (Ridgeway *et al.* 2014). It has also been observed to eat conspecifics (S. Clark pers. comm. in Ridgeway *et al.* 2014).

Meridolum corneovirens can burrow up to 10 cm underground (potentially as an adaptation to drought), primarily under logs and at the bases of large trees and grass stems, but only in loose soil (Clark 2009; Ridgeway *et al.* 2014; Kayne Moreton pers. comms. June 2024). The species can also produce a mucous membrane as a survival adaptation to drought (Australian Museum, undated cited in Ridgeway *et al.* 2014). The species has some ability to climb short vertical surfaces and, although typically nocturnal (NPWS 2000; Clark 2004, Clark 2009), it does exhibit occasional daytime activity (Ridgeway *et al.* 2014). The species has a low dispersal ability (Clark and Richardson 2002; Ridgeway *et al.* 2014). Populations greater than 350 m apart are less likely to be closely related to each other than if within this distance (Clark and Richardson 2002; Clark 2004).

Meridolum corneovirens lays 18–25 eggs (NPWS 2000; Clark pers. comm.; Fuller pers. comm. cited in Ridgeway *et al.* 2014), which may take approximately 10–21 days to hatch (NPWS 2000; Clark pers comm. cited in Ridgeway *et al.* 2014). The species is hermaphroditic (NPWS 2000; Clark 2004). There is no longevity or generation length

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information available for the species. However, the related Jervis Bay forest snail *Meridolum jervisensis* (Quoy & Gaimard, 1832) is reported as mature at two years with a maximum lifespan of five years and 50% survivorship at to 2–4 years in captivity, decreasing to less than 1% survivorship at 4–5 years (McLauchlan 1951). If the two species have similar life histories, the generation length for *Meridolum corneovirens* is approximately 2.5 years, with the midpoint of age at first breeding (two years) and average longevity (three years).

Cultural Significance

This assessment is not intended to be comprehensive of the traditional ecological knowledge that exists for *Meridolum corneovirens* or to speak for Aboriginal people. Aboriginal people have a long history of biocultural knowledge, which comes from observing and being on Country, and evolves as it is tested, validated, and passed through generations (Woodward *et al.* 2020). Aboriginal peoples have cared for Country for tens of thousands of years (Bowler *et al.* 2003; Clarkson *et al.* 2017). There is traditional ecological knowledge for all plants, animals and fungi connected within the kinship system (Woodward *et al.* 2020). Traditional ecological knowledge referenced in this assessment belongs to the relevant knowledge custodian and has been referenced in line with the principals of the NSW Indigenous Cultural and Intellectual Property protocol (ICIP) (Janke and Company 2023).

Threats

Meridolum corneovirens is confined to native vegetation communities in the Cumberland Plain, in particular, Cumberland Plain Woodland (Clark 2009; Ridgeway *et al.* 2014; NSW DCCEEW 2021). Therefore, most threats to Cumberland Plain Woodland and associated vegetation communities similarly threaten *Meridolum corneovirens*. This is especially acute as the snail has a poor dispersal ability (Ridgeway *et al.* 2014) and so is unable to effectively relocate away from any threats. The primary threat to the species is habitat clearing for urban and rural development. A projected increase in inclement hot and dry weather due to climate change also threatens the species. Other threats that result in the modification and degradation of habitat and an inferred loss of mature individuals are increasing due to urban development and other cleared land increasingly bordering Cumberland Plain Woodland. These threats include removal of ground cover and weed invasion. High severity and high frequency fire and predation by exotic rat species are also identified as potential threats in this context.

Habitat clearing for urban and rural development

Cumberland Plain Woodland and associated vegetation communities have been heavily cleared historically, and clearing is ongoing and likely in the future (DEC 2005; Tozer *et al.* 2015; DPE 2022). It is estimated that 6–12% of the original Cumberland Plain vegetation remains (Benson and Howell 1990b; Tozer 2003; DEH 2005; DEWHA 2009), and as a result the Cumberland Plain Woodland has been classified as a Critically Endangered Ecological Community since 2009 under both Commonwealth and New South Wales legislation (DEWHA 2009; NSW Scientific Committee 2009). What remains is now heavily fragmented (Tozer 2003; Tozer *et al.* 2015) and mostly unprotected (DEC 2005; NSW Scientific Committee 2009).

The Cumberland Plain has had a history of clearing due to agricultural development that started soon after European settlement and has continued to the present day (Benson and Howell 1990a, 1990b; DEC 2005). Urban development has more recently

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exacerbated clearing and is also ongoing (Tozer 2003; DEC 2005; DPE 2022). Four areas in the Cumberland Plain are targeted for priority large future urban growth projects as part of the Cumberland Plain Conservation Plan (DPE 2022). Cumberland Plain Woodland also continues to be cleared for smaller developments that may not attract public attention (NSW Scientific Committee 2009; Wotherspoon and Burgin 2010). An intersection of land-use layers related to urban development with the species' AOO shows there has been a 10% increase in urban and peri-urban land-uses within the species' AOO from 2013–2017 (State Government of NSW and NSW DCCEEW 2017, 2019; Esri 2021). Once Cumberland Plain Woodland is cleared for agricultural and other rural purposes, restoration remains difficult even if the threat of clearing has ceased (Nichols *et al.* 2010). One study demonstrates this is because the seedbank contains a low proportion of native species (Morris 2022), while another concludes that alterations in soil chemistry are responsible (Fitzgerald 2009). The threat of clearing of habitat is therefore ongoing and resulting in an estimated decline in the area, extent, and quality of habitat, and an inferred decline in the number of mature individuals.

'Clearing of native vegetation' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016*. 'Land Clearance' is listed as a Key Threatening Process under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (DEH 2001) and 'Clearing of native vegetation' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016* (NSW Scientific Committee 2001).

Habitat modification resulting from the removal of ground cover

A continuing decline in quality of habitat for *Meridolum corneovirens* is inferred due to the continuing removal of ground cover that the species uses for shelter (NPWS 2000; Clark 2004, Clark 2009; Ridgeway *et al.* 2014; DPE 2019; S. Clark unpubl. data 2021). Ground cover is reduced by direct removal of woody debris and other ground cover in the Cumberland Plain (NPWS 2000; Tozer *et al.* 2015). Logs are often removed to reduce fire fuel load or for firewood collection (DEWHA 2010) and to maintain neater appearance for private land holdings (NSW TSSC 2020). Ground layer cover and complexity is also reduced when Cumberland Plain Woodland has been previously cleared, as a denser canopy layer or high densities of mid-storey shrubs such as *Bursaria spinosa* can result and reduce density and diversity of ground layer plants (NSW Scientific Committee 2009).

'Removal of dead wood and dead trees' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016* (NSW Scientific Committee 2003).

Increased frequency and duration of inclement dry and hot weather due to climate change

Although *Meridolum corneovirens* is somewhat adapted to dry and hot conditions (Ridgeway *et al.* 2014), it is reliant on wet and humid conditions for breeding (S. Clark pers. comm. January 2024). Observations of reliance on wet weather aligns with Aboriginal knowledge of the species (Kayne Moreton June 2024). Like other land snail species, *Meridolum corneovirens*' small and soft body and poor dispersal ability make it prone to desiccation and death from dry and hot weather (Stanisic and Ponder 2004; Ridgeway *et al.* 2014). A decline in the number of mature individuals from increased frequency in dry and hot weather due to climate change is therefore inferred.

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Metropolitan Sydney, which covers the species' distribution, is projected to experience an increase of approximately 6.5–14 hot days over 35°C and a 1.3–2.5°C increase in annual average maximum temperatures by 2079 (Adapt NSW 2024), a trend exacerbated by urban heat island effects (Phelan *et al.* 2015). Time spent in drought and duration of warm weather is also projected to increase in the region through the 21st century (CSIRO 2024; CSIRO and BOM 2024).

'Anthropogenic climate change' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016* (NSW Scientific Committee 2000b) and 'Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases' is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999*.

Weed invasion

A continuing decline in quality of habitat for *Meridolum corneovirens* is also inferred due to the increase in weed invasion into Cumberland Plain Woodland. Invasive weeds, particularly the African olive *Olea europaea* subsp. *cuspidata*, reduce habitat quality by inhibiting the growth of native plant species via dense infestations (NSW Scientific Committee 2010). African olive is expanding its range (Tozer 2003; Tozer *et al.* 2015) and poses an ongoing threat to *Meridolum corneovirens*.

Other weed species can also form a dense ground layer that prevents native plant recruitment (NSW Scientific Committee 2009) and reduces Cumberland Plain land snail habitat via decreased ground layer habitat complexity and sheltering sites (NPWS 2000; Clark 2004, 2009; DPE 2019). The threat of weed invasion from highly invasive garden plants is continuing and increasing as adjacent urban edges expand throughout the Cumberland Plain, in turn increasing the chance of garden plant escapees via green waste dumping into bushland and urban runoff (DEH 2005). Common weeds in the Cumberland Plain include: Fireweed *Senecio madagascariensis*, Spear thistle *Cirsium vulgare*, Catsear *Hypochaeris radicata*, Pigeon-grass *Setaria parviflora*, Plantain *Plantago lanceolata*, Paddy's lucerne *Sida rhombifolia*, Bridal creeper *Asparagus asparagoides* and Sow thistle *Sonchus oleraceus* (DEH 2005; NSW Scientific Committee 2009). Other land snail species are likely similarly threatened by weed invasion into their habitat (Shea *et al.* 2016; NSW TSSC 2020).

'Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata* (Wall. Ex G. Don) Cif.' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as a Key Threatening Processes under the *NSW Biodiversity Conservation Act 2016* (NSW Scientific Committee 2010; Scientific Committee 2011b). 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is listed as a Key Threatening Process under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (DoE 2010).

Adverse fire regimes

Meridolum corneovirens is likely to be threatened by adverse fire regimes if they occur, particularly high severity or high frequency fire. Individuals may be directly killed by fire due to the fact they move very slowly, although their nocturnal habit and burrowing ability may somewhat offset this risk (Ridgeway *et al.* 2014). The small and soft bodies and thin shell structure of land snails also makes them susceptible to desiccation and

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death from fire (Stanisic and Ponder 2004). High severity fires destroy and degrade essential ground-layer shelter habitat, such as leaf litter and woody debris (Decker *et al.* 2023). Following the 2019–2020 bushfires in southeastern Australia, large declines in the post-fire abundance of other land snail species were documented (Decker *et al.* 2023). Given the Cumberland plain land snail's similar morphology and reliance on similar habitat features, it is reasonable to infer that exposure to high-severity fire would result in significant population declines. If high severity fires occur too frequently, unburnt shelter habitat, will become increasingly scarce, likely leading to a sustained decrease in snail abundance over time (Decker *et al.* 2023). The threat of fire may be increased in the species' fragmented distribution near urban development as fire frequency increases from planned fuel reduction burns, arson, car dumping and accidental ignition (NSW Scientific Committee 2009). A projected increase in average and severe fire weather due to climate change in the species' distribution potentially also exacerbates the threat of mortality from fire (Adapt NSW 2024). However, there have been minimal prescribed burns or bushfires in the species' distribution for at least the last 30 years (NPWS 2024) and the fragmentation of Cumberland Plain Woodland may reduce fire frequency in some patches by reducing fire spread (NSW Scientific Committee 2009), therefore the overall threat posed by high severity and high frequency fire is likely reduced.

'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016* (NSW Scientific Committee 2000a) and 'Fire regimes that cause declines in biodiversity' is listed as a Key Threatening Process under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (DAWE 2022).

Predation by introduced rats

Predation by exotic rat species is a possible threat to *Meridolum corneovirens*. Urban bushland reserves in Sydney contain high densities of exotic rats (*Rattus rattus* and *R. norvegicus*) (Banks and Smith 2015). Although there is no direct evidence that *Rattus* species are preying upon *Meridolum corneovirens*, they are known to prey upon land snails (e.g. Parkyn and Newell 2013; Hyman and Köhler 2024), and there is evidence from other habitats that they can strongly reduce abundance and species richness of large-bodied land snails (e.g. Barker 2016). It is possible that high densities of *Rattus* species apply ongoing predation pressures upon *Meridolum corneovirens* particularly in small, isolated urban bushland patches, resulting in a suspected decline in the number of mature of individuals.

Number of Locations

The most serious plausible threat that results in the lowest number of locations for the taxon is considered to be habitat clearing for development. Therefore, the Cumberland Plain land occurs across four threat-defined locations, as per the IUCN definition (IUCN 2024). The four priority development areas in the approved Cumberland Plain Conservation Plan (CPCP) (DPE 2022) are considered to be one threat-defined location. These areas are:

- Greater Penrith to Eastern Creek Investigation Area
- Western Sydney Aerotropolis
- Greater Macarthur Growth Area

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- Wilton Growth Area

Urban development could happen throughout the priority development footprints simultaneously, and could plausibly severely reduce or eliminate the *Meridolum corneovirens* population in any priority development area within three years. The following areas outside of those defined in the CPCP can also each be defined as separate threat-defined locations:

- The entire area north of location 1 comprising the remaining sections of Penrith LGA and part of Hawkesbury LGA. The main threat here is urban development localised in effect to that area (Penrith City Council 2022).
- Records within Canterbury-Bankstown, Fairfield and Liverpool LGAs that are already within heavily developed areas. These are treated as one threat-defined location on the basis that the most serious plausible threat to the species are the secondary threats from urban development, including ground cover removal, increased weed invasion and potentially increased exotic rats.
- The area remaining outside the two southern CPCP priority development areas is considered one additional threat-defined location due to the threat of urban development and rural localised in effect to that area (Wollondilly Shire Council 2020).

These locations are shown in Appendix 2.

Severely Fragmented

The species is severely fragmented according to IUCN (2024) guidelines. More than 50% of the AOO is considered to be in small habitat patches (Tozer 2003; DEC 2005). Isolation due to habitat fragmentation and poor dispersal ability prevents recolonisation in the event of localised extinctions and also compromises long-term population viability. With such a low dispersal ability (Clark and Richardson 2002; Clark 2004), most development barriers, particularly roads that are now common throughout the Cumberland Plain (Esri 2021), are likely to be impassable (Baur and Baur 1990; Balbi *et al.* 2018; Bergey 2018). Most habitat patches are surrounded by roads (Esri 2021; BioNet 2024) and therefore *Meridolum corneovirens* cannot move between habitat patches.

Additionally, the habitat of *Meridolum corneovirens*, Cumberland Plain Woodland, is itself considered to be severely fragmented (NSW Scientific Committee 2009). More than half of the remaining tree cover occurs in patches smaller than 80 hectares and half of these are smaller than three hectares (Tozer 2003; Tozer *in litt.* October 2007). Another source states more than 70% of habitat patches are less than five hectares in size (DEWHA 2010). Although the species may not necessarily experience any deleterious genetic effects in a small habitat patch (Clark 2004), habitat fragmentation exposes *Meridolum corneovirens* to significant probability of localised extinction via urban and rural development, and by secondary threats caused by ongoing urban and rural development, including loss of ground cover, increased weed invasion, stochastic events, or a combination of these.

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Assessment against IUCN Red List criteria

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

Criterion A Population Size reduction

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased. A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible. A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]. A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.		based on any of the following: (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality (d) actual or potential levels of exploitation (e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.	

Outcome

Data Deficient under Criterion A.

Population reductions

The estimated generation length for *Meridolum corneovirens* is approximately 2.5 years. Although an intersect of land-use layers related to development with the species' AOO shows a 10% increase in the intersect from 2013–2017, there are not enough past or future population abundance, density or trend data to extrapolate and assess a population size reduction over 10 years.

Conclusion

Meridolum corneovirens is considered Data Deficient under Criterion A because there are insufficient population data available over 10 years.

Criterion B Geographic range

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Outcome

Eligible for listing as Endangered under Criterion B1ab(ii,iii,v)

EOO and AOO

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Meridolum corneovirens has an EOO of 2,449 km² and an AOO of up to 1,212 km².

Severely fragmented

Meridolum corneovirens is classified as severely fragmented under the IUCN (2024) guidelines. More than 50% of its area of occupancy (AOO) occurs in small, relatively isolated habitat patches (Tozer 2003; DEC 2005). These patches are too small to support species' long-term viability, resulting in a severely fragmented population. Cumberland Plain Woodland habitat is considered severely fragmented (NSW Scientific Committee 2009) and is continuing to be lost (Tozer 2003; DEC 2005; DPE 2022). Most habitat patches are also separated from other habitat patches by a large distance relative to the dispersal kernel of the species (Baur and Baur 1990; Clark and Richardson 2002; Clark 2004; Balbi *et al.* 2018; Bergey 2018; Esri 2021).

Number of threat-defined locations

Meridolum corneovirens is found at no more than four threat-defined locations when considering the most serious plausible threats that result in the minimum number of locations. Those threats are habitat clearing for urban and rural development, and the secondary threats from urban development including ground cover removal, increased weed invasion and increased exotic rats.

Continuing decline

The threat of habitat clearing and modification is resulting in an estimated continuing decline in the area, extent, and quality of habitat, AOO, and the number of mature individuals. Additionally, a continuing decline in the area, extent, and quality of habitat is inferred due to habitat modification caused by the removal of ground cover sheltering sites (NPWS 2000; DEWHA 2010; Tozer *et al.* 2015) and weed invasion across the Cumberland Plain (Tozer 2003; DEH 2005; NSW Scientific Committee 2009; Tozer *et al.* 2015). A continuing decline in the number of mature individuals is inferred due to a projected increase in the frequency and duration of inclement dry and hot weather due to climate change (Adapt NSW 2024; CSIRO 2024; CSIRO and BOM 2024).

Extreme fluctuations

There are insufficient data to determine if *Meridolum corneovirens* experiences extreme fluctuations in EOO, AOO, number of locations or number of mature individuals.

Conclusion

Meridolum corneovirens is eligible to be listed as Endangered. EOO falls under the Endangered threshold, the species is severely fragmented and found at no more than four threat-defined locations, and there is an estimated and inferred continuing decline in the area, extent, and quality of habitat, AOO, and the number of mature individuals.

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Criterion C

Small population size and decline

C. Small population size and decline			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals	< 250	< 2,500	< 10,000
AND at least one of C1 or C2			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Outcome

Data Deficient under Criterion C.

Number of mature individuals

The minimum estimated population for *Meridolum corneovirens* is unknown.

Continuing decline

While a continuing decline in the number of Cumberland Plain land snail mature individuals is inferred due to habitat clearing for urban and rural development, this does not meet the minimum data quality requirements (estimated or projected) for listing under C1.

Mature individuals in each subpopulation

There are insufficient data to determine the number of mature individuals in each subpopulation.

% of mature individuals in a single subpopulation

There are insufficient data to determine the % of mature individuals in any subpopulation.

Extreme fluctuations

It is unknown if *Meridolum corneovirens* experiences extreme fluctuations as insufficient data has been collected over time.

Conclusion

Meridolum corneovirens is considered Data Deficient under Criterion C because there are no data that meet the minimum data quality requirements (estimated or projected) to determine percentage declines under C1, and while a continuing decline in the number of mature individuals is inferred due to habitat clearing for urban and rural development under C2, the number of mature individuals is unknown.

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Criterion D Very small or restricted population

D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 1,000
D2. Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	D2. typically: AOO < 20 km ² or number of locations ≤ 5

Outcome

Data Deficient under Criterion D.

Number of mature individuals

The minimum estimated population for *Meridolum corneovirens* is unknown.

Risk of future extinction in a very short amount of time (D2)

Meridolum corneovirens occurs at four threat-defined locations and has an estimated AOO of up to 1,212 km². This indicates that the species' range is sufficiently large that it is not exposed to a future plausible threat that could drive the taxon to Critically Endangered or Extinct in a very short time.

Criterion E Quantitative Analysis

E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Outcome

Data Deficient under Criterion E.

Probability of extinction

There are insufficient data available for *Meridolum corneovirens* to undertake a quantitative analysis to determine the probability of extinction under Criterion E.

Conservation and Management Actions

Meridolum corneovirens is currently listed on the NSW *Biodiversity Conservation Act 2016* and a conservation project has been developed by the NSW Department of Climate Change, Energy, the Environment and Water under the Saving our Species (SoS) program. The conservation project identifies priority locations, critical threats and required management actions to ensure the species is extant in the wild in 100 years. *Meridolum corneovirens* sits within the Landscape species management stream of the SoS program and the conservation project can be viewed [here](#).

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APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Meridolum corneovirens was found to be Endangered under Clause 4.3(b)(d)(e i,ii,iii).

Clause 4.2 - Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Data Deficient.

(1) - The species has undergone or is likely to undergo within a time frame appropriate to the life cycle and habitat characteristics of the taxon:			
	(a)	for critically endangered species	a very large reduction in population size, or
	(b)	for endangered species	a large reduction in population size, or
	(c)	for vulnerable species	a moderate reduction in population size.
(2) - The determination of that criteria is to be based on any of the following:			
	(a)	direct observation,	
	(b)	an index of abundance appropriate to the taxon,	
	(c)	a decline in the geographic distribution or habitat quality,	
	(d)	the actual or potential levels of exploitation of the species,	
	(e)	the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.	

Clause 4.3 - Restricted geographic distribution of species and other conditions (Equivalent to IUCN criterion B)

Assessment Outcome: Endangered under Clause 4.3(b)(d)(e i,ii,iii).

The geographic distribution of the species is:			
	(a)	for critically endangered species	very highly restricted, or
	(b)	for endangered species	highly restricted, or
	(c)	for vulnerable species	moderately restricted,
and at least 2 of the following 3 conditions apply:			
	(d)	the population or habitat of the species is severely fragmented or nearly all the mature individuals of the species occur within a small number of locations,	
	(e)	there is a projected or continuing decline in any of the following:	
		(i)	an index of abundance appropriate to the taxon,

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	(ii)	the geographic distribution of the species,
	(iii)	habitat area, extent or quality,
	(iv)	the number of locations in which the species occurs or of populations of the species,
	(f)	extreme fluctuations occur in any of the following:
	(i)	an index of abundance appropriate to the taxon,
	(ii)	the geographic distribution of the species,
	(iii)	the number of locations in which the species occur or of populations of the species.

Clause 4.4 - Low numbers of mature individuals of species and other conditions

(Equivalent to IUCN criterion C)

Assessment Outcome: Data Deficient.

The estimated total number of mature individuals of the species is:			
	(a)	for critically endangered species	very low, or
	(b)	for endangered species	low, or
	(c)	for vulnerable species	moderately low,
and either of the following 2 conditions apply:			
	(d)	a continuing decline in the number of mature individuals that is (according to an index of abundance appropriate to the species):	
	(i)	for critically endangered species	very large, or
	(ii)	for endangered species	large, or
	(iii)	for vulnerable species	moderate,
	(e)	both of the following apply:	
	(i)	a continuing decline in the number of mature individuals (according to an index of abundance appropriate to the species), and	
	(ii)	at least one of the following applies:	
		(A)	the number of individuals in each population of the species is:
		(I)	for critically endangered species extremely low, or
		(II)	for endangered species very low, or
		(III)	for vulnerable species low,
		(B)	all or nearly all mature individuals of the species occur within one population,
		(C)	extreme fluctuations occur in an index of abundance appropriate to the species.

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Clause 4.5 - Low total numbers of mature individuals of species

(Equivalent to IUCN criterion D)

Assessment Outcome: Data Deficient.

The total number of mature individuals of the species is:			
	(a)	for critically endangered species	extremely low, or
	(b)	for endangered species	very low, or
	(c)	for vulnerable species	low.

Clause 4.6 - Quantitative analysis of extinction probability

(Equivalent to IUCN criterion E)

Assessment Outcome: Data Deficient.

The probability of extinction of the species is estimated to be:			
	(a)	for critically endangered species	extremely high, or
	(b)	for endangered species	very high, or
	(c)	for vulnerable species	high.

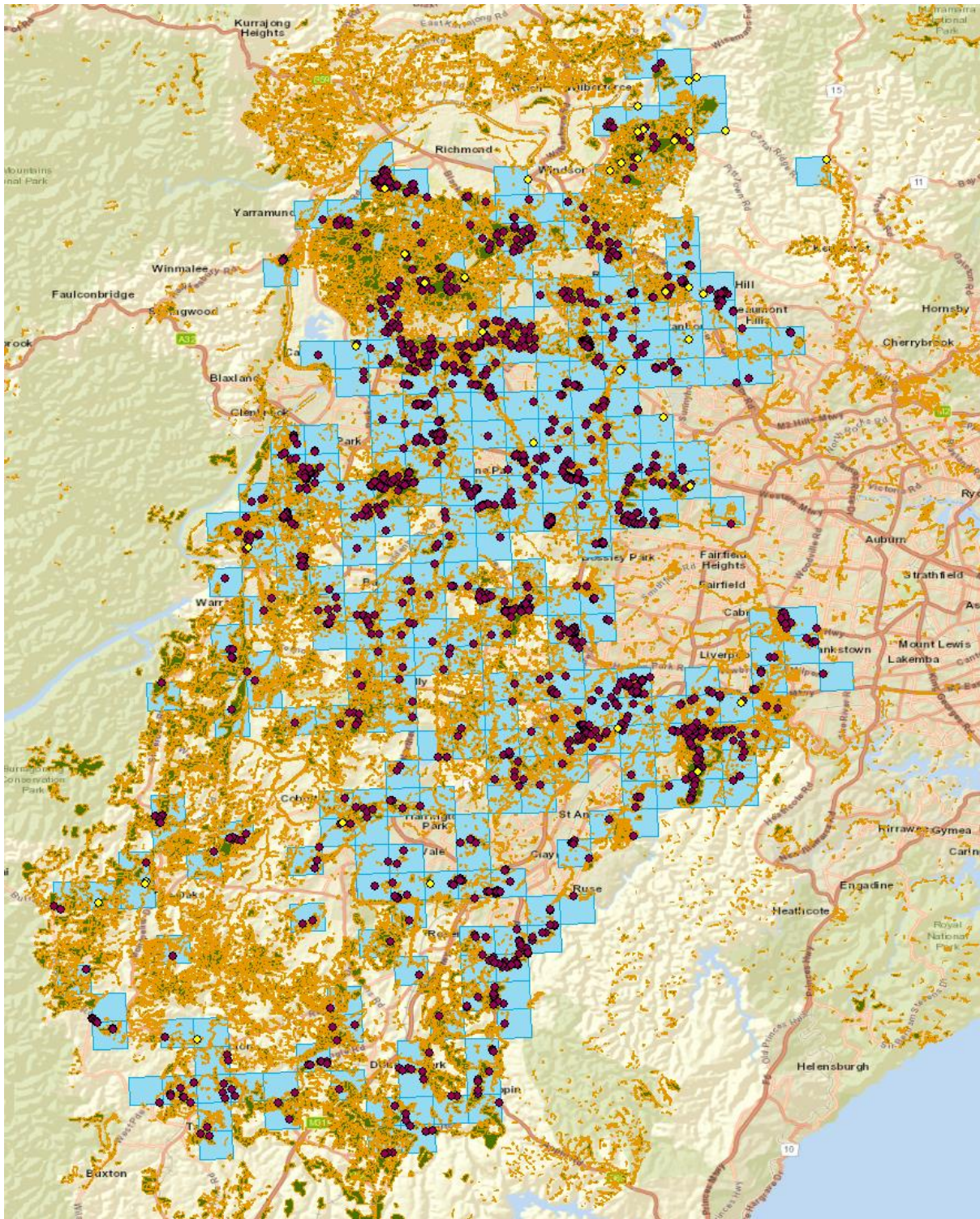
Clause 4.7 - Very highly restricted geographic distribution of species—vulnerable species

(Equivalent to IUCN criterion D2)

Assessment Outcome: Not Met.

For vulnerable species,	the geographic distribution of the species or the number of locations of the species is very highly restricted such that the species is prone to the effects of human activities or stochastic events within a very short time period.
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APPENDIX 2 – MAP



Map 1. Cumberland Plain land snail distribution map. Purple dots are BioNet occurrence records. Yellow dots are ALA occurrence records. Light Blue squares are AOO 2 x 2 km grid cells. Orange areas with green fill are Threatened Ecological Communities for Greater Sydney.