

NSW Threatened Species Scientific Committee

Conservation Assessment of *Luturopa macleayensis* Stanistic, 2010 (Charopidae)

Christopher Portway 23/10/2025

NSW Department of Climate Change, Energy, the Environment and Water

***Luturopa macleayensis* Stanistic, 2010 (Charopidae)**

Distribution: Endemic to NSW

Current EPBC Act Status: Not Listed

Current NSW BC Act Status: Not Listed

Proposed listing on NSW BC Act and EPBC Act: Endangered

Summary of Conservation Assessment

Luturopa macleayensis was found to be eligible for listing as Endangered under IUCN Criteria B1ab(iii,v)+2ab(iii,v).

The main reasons for this species being eligible are: 1) it has a highly restricted extent of occurrence (408 km²) and area of occupancy (12 km²); 2) the population is found within one threat-defined location; and 3) there is an inferred continuing decline in the area, extent, and quality of habitat, and the number of mature individuals, due to adverse fire regimes, namely high and moderate severity fire and high frequency fire, and drought.

Description and Taxonomy

Luturopa macleayensis (common name: Macleay waxy pinwheel snail), was first described based on shell characters only in Stanistic *et al.* (2010) as follows:

“Shell very small, yellowish grey, depressedly trochoidal with a slightly raised spire; whorls subangulate and shouldered, sutures impressed; protoconch sculptured with weak radial ribs, teleoconch with irregular radial ribs and weak spiral lirae, microsculpture indistinct, consisting of microradial threads and low microspiral cords; umbilicus narrowly open, V-shaped; diameter 4.2 mm.”

Foon *et al.* (2022) provided the differential diagnosis as: “Distinguished by a combination of larger shell, more pronounced radial sculpture, and narrower umbilicus from *Luturopa kenilworth* (Stanistic *et al.* 2010).”

No *Luturopa macleayensis* molecular phylogenetic studies are available (Foon *et al.* 2022).

Distribution and Abundance

Luturopa macleayensis is currently known from the Macleay Valley in northeastern New South Wales (NSW) (Stanistic *et al.* 2010; Foon *et al.* 2022). Occurrence records are distributed west and northwest of Kempsey, extending to The Castles Nature Reserve approximately 50 km west of Kempsey, with one record slightly further northwest (Stanistic *et al.* 2010; Esri 2021; Foon *et al.* 2022; ALA 2024a). These are the traditional lands of the Dainggatti people (Horton 1996). The species is only known from five collection events at four sites (Table 1) (Stanistic *et al.* 2010; Foon *et al.* 2022;

NSW Threatened Species Scientific Committee

F. Köhler and J.K. Foon *in litt.* March 2023; ALA 2024a). *Luturopa macleayensis* occurs in the NSW North Coast Bioregion, and Macleay Hastings and Upper Manning IBRA Subregions (DAWE 2012; Commonwealth DCCEEW 2024). *Luturopa macleayensis* is unlikely to be found outside the Macleay Valley as charopid land snails are typically narrow-range endemics (Stanisic and Window 2020; F. Köhler and J.K. Foon *in litt.* March 2023). Furthermore, despite extensive land snail sampling in areas adjacent to and within the Macleay Valley, *L. macleayensis* has not been detected elsewhere (Stanisic 1990; Stanisic 1997; Hyman and Stanisic 2005; Stanisic *et al.* 2010; Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023; ALA 2024b, 2024c, 2024d, 2024e). Most of the species' known distribution is thought to have overlapped with the 2019–2020 bushfires fire zone (DPIE 2020; Foon *et al.* 2022). Due to site access restrictions following the fires and potentially inaccurate coordinates for historical records, none of the pre-fire sites have been revisited (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023), although one post-fire occurrence was recorded approximately 900 m east of one pre-fire record (Esri 2021; Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023).

Current survey data are insufficient to accurately assess *Luturopa macleayensis* abundance (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023) or the number of mature individuals, although the species appears to be naturally in low abundance and patchily distributed (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). Only seven individuals have ever been collected (Table 1) (F. Köhler and J.K. Foon *in litt.* March 2023; ALA 2024a; J.K. Foon pers. obs).

Table 1. All confirmed collection events of *Luturopa macleayensis*. *Land tenure uncertain due to inaccurate coordinates.

Land Tenure	Date of survey and collection event number	Number of individuals collected
Travelling Stock Reserve	27 December 1993 (QM MO52767)	1
	9 January 1996 (QM MO59793)	1
NSW National Parks and Wildlife Estate	28 July 2004 (QM MO75451)	1
Crown land (presumed)*	27 December 1993 (QM MO55878)	1
NSW National Parks and Wildlife Estate	19 May 2021 (AM C.591077)	3

Luturopa macleayensis is inferred to occur in four subpopulations as per the IUCN (2024) definition. This is based on the species' minute size and poor dispersal ability, inferred to be only several metres over their lifespan (F. Köhler and J.K. Foon *in litt.* March 2023), which is significantly less than distances between all sites. Further

NSW Threatened Species Scientific Committee

information on dispersal ability, genetics (Clark and Richardson 2002), abundance and density are required to more accurately determine the number of subpopulations.

Extent of Occurrence and Area of Occupancy

The Extent of Occurrence (EOO) of *Luturopa macleayensis* is estimated to be 408 km² and is calculated as a minimum convex polygon containing all known occurrences, the method of assessment recommended by IUCN (2024). The Area of Occupancy (AOO) is estimated to be 12 km² based on 2 x 2 km grid cells, the scale recommended by IUCN (2024). Based on these estimates, *L. macleayensis* has a highly restricted geographic distribution.

The spatial dataset used to inform the EOO and AOO estimates contains five occurrence records in total, sourced from Atlas of Living Australia (ALA 2024a) and Foon *et al.* (2022). No records were excluded from either data source.

Ecology

Habitat

Luturopa macleayensis occurs in dry vine thickets in rainforest and limestone habitats where it is found in leaf litter (Stanisic *et al.* 2010; Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). The species is more likely to be encountered on limestone outcrops compared to non-limestone habitats (Stanisic *et al.* 2010; Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). Rainforests and limestone outcrops provide favourable habitat for *L. macleayensis* and many other land snails (e.g. Foon *et al.* 2022) as they contain high levels of moisture, food and sheltering sites, specifically leaf litter, crevices, rock piles and debris (Stanisic 1997). Limestone substrates also provide calcium for shell production (Stanisic 1997).

Behaviour and Life History

Little is known about *Luturopa macleayensis* behaviour and life history. The species is only active at night but is also likely able to tolerate some drier weather via aestivation (F. Köhler and J.K. Foon *in litt.* March 2023). *L. macleayensis* is inferred to move < 50 m in its entire lifetime due to its relatively small size (F. Köhler and J.K. Foon *in litt.* March 2023). This inference is supported by several studies showing only marginally greater dispersal distances in larger eastern Australian camaenid species (Clark and Richardson 2002; Parkyn *et al.* 2014; Ridgeway *et al.* 2014). *Luturopa macleayensis* might be passively dispersed larger distances due to stochastic events such as flooding (F. Köhler and J.K. Foon *in litt.* March 2023).

Luturopa macleayensis is inferred to be a detritus feeder, feeding on various ground substrate items such as fungi and/or organic decaying matter found in its leaf litter habitat (F. Köhler and J.K. Foon *in litt.* March 2023). As with all pulmonate land snails, the species is hermaphroditic and lays eggs (F. Köhler and J.K. Foon *in litt.* March 2023), but no further reproductive information is known.

There is no longevity or generation length information available for the species. However, based on age of maturity and longevity observed in *Meridolum jervisensis* (two years and 5 years respectively) (McLauchlan 1951), and the suggested age of maturity for another charopid land snail, *Pseudocharopa lidgbirdi* (< 3–5 years) (DEWHA 2009), F. Köhler and J.K. Foon (*in litt.* March 2023) suggest that the

NSW Threatened Species Scientific Committee

generation length of *Luturopa macleayensis* is approximately three years, with maturity reached at approximately two years and a maximum lifespan of approximately six years.

Cultural Significance

This assessment is not intended to be comprehensive of the Traditional Ecological Knowledge that exists for *Luturopa macleayensis* 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). Although no specific information was available on *L. macleayensis*, it is acknowledged that there is Traditional Ecological Knowledge for all plants, animals and fungi connected within the kinship system (Woodward *et al.* 2020).

Threats

The primary threat to *Luturopa macleayensis* is adverse fire regimes, namely high and moderate severity fire and high frequency fire. Drought, particularly in combination with fire, is also considered a threat to the species.

Adverse fire regimes

Luturopa macleayensis is threatened by adverse fire regimes, namely high and moderate severity fire and high frequency fire. The species is highly susceptible to direct mortality from fire and associated heat due to its small, soft body and fragile, thin shell that provide minimal protection (Stanisic and Ponder 2004; Decker *et al.* 2023). Furthermore, the species' poor dispersal ability prevents escape from fires (Stanisic and Ponder 2004) and likely delays post-fire recovery as the species' capacity to recolonise previously burnt sites is limited (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). High and moderate severity fire destroys and degrades leaf litter and other potential ground layer shelter habitat such as woody debris, and can open the forest canopy layer, likely causing land snail declines in abundance (Foon *et al.* 2022; Decker *et al.* 2023) as habitat moisture is lost and desiccation risk increases (Baker 1958; Getz 1974; Martin and Sommer 2004; Foon *et al.* 2022). If high or moderate severity fires are too frequent, unburnt shelter habitat will become rarer over time and result in lower snail abundance decrease (Decker *et al.* 2023).

A number of studies have estimated the proportion of habitat impacted by the 2019/2020 fires and the population declines that resulted from that event (DAWE 2020, Legge *et al.* 2021, Marsh *et al.* 2021, Foon *et al.* 2022, DPIE 2020). Analyses immediately after the 2019–2020 bushfires identified *Luturopa macleayensis* as a priority species for urgent post-fire conservation management, including recommendations for on-ground rapid surveys (DAWE 2020; Legge *et al.* 2021). The priority listing was based on estimates that at least 50% of the species' modelled distribution overlapped with the 2019–2020 bushfires fire zone (DAWE 2020; Legge *et al.* 2021). A later study by Marsh *et al.* (2021) estimated 46% overlap. Post-fire ground surveys by Foon *et al.* (2022) found one *L. macleayensis* site in unburnt limestone habitat. Although most preferred (*i.e.*, limestone) habitat was only lightly burnt or unburnt (Foon *et al.* 2020 F. Köhler and J.K. Foon *in litt.* March 2023), most

NSW Threatened Species Scientific Committee

of the species' distribution was nonetheless within the fire zone and burnt to varying severity levels (DPIE 2020; Foon *et al.* 2022), including moderate to extreme in some patches (DPIE 2020). For this reason, a > 50% total population decline from increased mortality during and after the fires, and a decline in quality of habitat, is inferred (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). Another post-fire ground study by Decker *et al.* (2023) found high and moderate severity fires caused a 12–75% population decline in charopid land snails and a 75% decline in overall micro-snail (*i.e.* species less than 5 mm) abundance in southeastern Australia after the 2019–2020 bushfires.

Adverse fire regimes are exacerbated by pre-fire drought, which creates drier and more combustible fuel loads in the landscape (Abram *et al.* 2021). Pre-fire drought and low vegetation fuel moisture content were considered the main causes of the 2019–2020 bushfire's heightened severity and scale (Nolan *et al.* 2020).

A slight annual increase in severe fire weather days is projected for the NSW North Coast region, which includes all *Luturopa macleayensis* occurrence records, by 2079 due to climate change (Adapt NSW 2024). Increased risks of fire are also expected under future climates due to the effect of droughts on vegetation fuel moisture (Abram *et al.* 2021). Similarly, a harsher fire-weather climate is also projected for the region in the future, but the magnitude of the change is uncertain (CSIRO and BOM 2024). It is inferred that these changes will lead to more frequent and severe fires, further threatening the *L. macleayensis* population in the future.

Other risk factors that may cause adverse fire regimes within the distribution of *Luturopa macleayensis* include ignition by dry lightning and human ignition. Dry lightning is the leading natural cause of fires in NSW remote areas and started most of the fires during the 2019–2020 bushfires (EPA 2021). There has been an increase in the number of dry lightning events in coastal NSW since 1979 (Abram *et al.* 2021), and climate change is likely increasing the frequency of dry lightning events and creating more suitable conditions for fire-generated thunderstorms in southeast Australia (EPA 2021). Human ignitions from adjacent farmland and other rural areas could also spread into the species' distribution - arson, accidental ignition or escapes from prescribed burns are significant causes of bushfires in NSW (EPA 2021).

'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* 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*.

Drought

As with adverse fire regimes, the biological traits of *Luturopa macleayensis* (Stanisic *et al.* 2010; F. Köhler and J.K. Foon *in litt.* March 2023), make it prone to desiccation and mortality from drought conditions (Stanisic and Ponder 2004). Although the species may survive dry conditions by aestivating (Stanisic and Ponder 2004; F. Köhler and J.K. Foon *in litt.* March 2023), most Australian land snails are reliant on at least partial environmental moisture availability (Stanisic and Ponder 2004; Stanisic

NSW Threatened Species Scientific Committee

and Window 2020; Foon *et al.* 2022). Foon *et al.* (2022) suggested that extreme drought, which preceded the 2019–2020 bushfires and was exacerbated by climate change (Abram *et al.* 2021), might have caused significant pre-fire mortality in land snails. High or moderate severity fire, or high frequency fire, exacerbate the adverse effects of drought by destroying or degrading moisture-retaining habitat. Drought also reduces habitat and food resources pre- and post-fire (Keith *et al.* 2022).

The NSW North Coast region is projected to see a decline in average annual rainfall of approximately 6%, along with an annual increase of 6–13 hot days (over 35°C) by 2079 (Adapt NSW 2024). An increase in time spent in drought, the temperature reached on hot days and the duration of warm spells are also projected for the region through the 21st century (CSIRO and BOM 2024). It is therefore inferred that *Luturopa macleayensis* will be threatened by more frequent and extreme droughts due to climate change.

‘Anthropogenic climate change’ is listed as a Key Threatening Process under the *NSW Biodiversity Conservation Act 2016* 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*.

Number of Locations

When the threat of adverse fire regimes is considered, *Luturopa macleayensis* occurs within one threat-defined location, as per the IUCN (2024) definition. This is due to adverse fire regimes being the most serious plausible threat that results in the lowest number of locations for the taxon. Analyses including a remote-sensing study by DPIE (2020) has already shown that most or of the species’ distribution was burnt during the 2019–2020 bushfires (Foon *et al.* 2020). The species’ geographic distribution remains highly restricted, and with the projected future increase in fire weather due to climate change (Abram *et al.* 2021; Adapt NSW 2024, CSIRO and BOM 2024), it is highly plausible that a single fire event could adversely affect the species across its entire distribution within a very short time frame.

Assessment against IUCN Red List criteria

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

NSW Threatened Species Scientific Committee

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%
<p>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.</p> <p>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.</p> <p>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].</p> <p>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.</p>	<p>based on any of the following:</p>		<p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.</p>

Outcome

Luturopa macleayensis is considered Data Deficient under Criterion A.

Population reductions

The estimated three-generation timespan for *Luturopa macleayensis* is approximately nine years. There are not enough data on past or present population abundance or density to extrapolate and assess a population size reduction over nine years.

Conclusion

Luturopa macleayensis is considered Data Deficient under Criterion A because there are insufficient population data available over nine 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

Luturopa macleayensis is eligible for listing as Endangered under Criterion B1ab(iii,v)+ B2ab(iii,v).

EOO and AOO

Luturopa macleayensis has an EOO of 408 km² and an AOO of 12 km².

NSW Threatened Species Scientific Committee

Number of threat-defined locations

Luturopa macleayensis is found at one threat-defined location when considering the most serious plausible threat of adverse fire regimes, namely high and moderate severity fire.

Severely fragmented

Luturopa macleayensis is considered unlikely to be severely fragmented as the EOO contains large areas of continuous closed forest (Esri 2021; Foon *et al.* 2022). Charopid land snails also typically have narrow distributions (Stanisic and Window 2020), so are likely to be able to persist even in small habitat patches.

Continuing decline

A continuing decline in area, extent and quality of habitat and the number of mature individuals, is inferred due to recent adverse fire regimes, namely high and moderate severity fire and high frequency fire (Stanisic and Ponder 2004; Foon *et al.* 2022; Decker *et al.* 2023; F. Köhler and J.K. Foon *in litt.* March 2023). Foon *et al.* (2022) inferred a > 50% total population decline due to most of the species' distribution overlapping with the 2019–2020 bushfires fire zone and habitat quality reduction caused by fire. Declines of 12–75% in the post-fire abundance of other charopid land snail species in southeastern Australia have been attributed to high and moderate severity fires (Decker *et al.* 2023). Given that moderate, high and extreme burn intensities were mapped in the distribution of *Luturopa macleayensis* (DPIE 2020), it is reasonable to infer that similar declines may have occurred for this species.

Adverse fire regimes have not only caused a recent inferred continuing decline in the number of mature individuals from direct mortality, but also from indirect mortality via increased desiccation from loss of habitat moisture (Baker 1958; Getz 1974; Martin and Sommer 2004; Foon *et al.* 2022). High and moderate severity fires have also caused a recent inferred continuing decline in habitat area, extent and quality by destroying and reducing available ground sheltering habitat, both through direct burning and by decreasing ground layer moisture through canopy loss and resultant increased sunlight (Foon *et al.* 2022; Decker *et al.* 2023).

A continuing decline in area, extent and quality of habitat, and the number of mature individuals is also inferred due to drought in combination with fire (Nolan *et al.* 2020; Abram *et al.* 2021; Keith *et al.* 2022) and drought exacerbated by climate change (Abram *et al.* 2021; Foon *et al.* 2022). A slight annual increase in severe fire weather days is projected for the NSW North Coast region by 2079 due to climate change (Adapt NSW 2024). Similarly, a harsher fire-weather climate is also projected for the region in the future, but the magnitude of the change is uncertain (CSIRO and BOM 2024). It is inferred that these changes will lead to more frequent and severe fires, further threatening the *Luturopa macleayensis* population in the future.

A continuing decline in area, extent and quality of habitat, and the number of mature individuals is also inferred due to drought in combination with fire (Nolan *et al.* 2020; Abram *et al.* 2021; Keith *et al.* 2022) and drought exacerbated by climate change (Abram *et al.* 2021; Foon *et al.* 2022).

Extreme fluctuations

There are insufficient data to determine if *Luturopa macleayensis* experiences extreme fluctuations in EOO, AOO, number of subpopulations or number of mature individuals.

NSW Threatened Species Scientific Committee

The species is unlikely to experience extreme fluctuations in number of locations due to its very highly restricted geographic range and the identification of one threat-defined location.

Conclusion

Luturopa macleayensis is eligible to be listed as Endangered under Criteria B1ab(iii,v)+B2ab(iii,v) because the EOO and number of threat-defined locations all fall under the Endangered thresholds and continuing decline in the number of mature individuals and the area, extent and quality of habitat, is inferred due to adverse fire regimes (high and moderate severity fire and high frequency fire) and drought.

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

Luturopa macleayensis is considered Data Deficient under Criterion C.

Number of mature individuals

There are no population size data for *Luturopa macleayensis*.

Continuing decline

Continuing decline is inferred in the number of mature individuals of *Luturopa macleayensis* due to the threat of adverse fires regimes. The continuing decline is inferred, however, which 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 percent of mature individuals in any subpopulation.

Extreme fluctuations

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

Conclusion

NSW Threatened Species Scientific Committee

Luturopa macleayensis is considered Data Deficient under Criterion C because there are no population size data available and no estimated or projected data to measure continuing decline as required under Criterion C1. For C2, there are insufficient data for the number or percent of mature individuals in each subpopulation, or to determine if the species experiences extreme fluctuations.

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

Luturopa macleayensis is considered Data Deficient under Criterion D but is eligible for listing as Vulnerable under Criterion D2.

Number of mature individuals

There are no population size data for *Luturopa macleayensis*.

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

Luturopa macleayensis occurs at one threat-defined location (due to the threat of adverse fire regimes) and has an estimated AOO of 12 km². Foon *et al.* (2022) inferred a > 50% total population decline due to most of the species' distribution overlapping with the 2019–2020 bushfires fire zone (DPIE 2020), increased mortality during and after the fires, and increased indirect mortality from post-fire habitat loss and degradation (*i.e.* snail desiccation caused by reduced humidity and ground shelter) (Foon *et al.* 2022; F. Köhler and J.K. Foon *in litt.* March 2023). Large post-fire declines in charopid land snail abundance in southeastern Australia were caused by the same fires (Decker *et al.* 2023). An increase in fire weather across the species' distribution is also projected due to climate change (Adapt NSW 2024; CSIRO and BOM 2024). Therefore, the threat of adverse fire regimes, namely high or moderate severity fire, could plausibly drive the species 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

Luturopa macleayensis is considered Data Deficient under Criterion E.

Probability of extinction

NSW Threatened Species Scientific Committee

There are insufficient data available to undertake a quantitative analysis to determine the probability of extinction in *Luturopa macleayensis*.

Conservation and Management Actions

Luturopa macleayensis is currently not listed on the NSW Biodiversity Conservation Act 2016. Following publication of a Final Determination by the NSW Threatened Species Scientific Committee, a conservation project will be developed by the NSW Department of Planning and Environment under the Saving our Species (SoS) program. The conservation project will identify priority locations, critical threats and required management actions to secure the species in the wild for the next 100 years.

NSW Threatened Species Scientific Committee

References

- Abram NJ, Henley BJ, Sen Gupta A, Lippmann TJR, Clarke H, Dowdy AJ, Sharples JJ, Nolan RH, Zhang T, Wooster MJ, Wurtzel JB, Meissner KJ, Pitman AJ, Ukkola AM, Murphy BP, Tapper NJ, Boer MM (2021) Connections of climate change and variability to large and extreme forest fires in southeast Australia. *Communications Earth and Environment* **2** 8, 2662–4435.
- Adapt NSW (2024) Interactive climate change projections map. Available at: <https://www.climatechange.environment.nsw.gov.au/projections-map> (accessed 21 October 2024).
- ALA (Atlas of Living Australia) (2024a) *Luturopa macleayensis* occurrence download. Available at: <https://doi.org/10.26197/ala.c54759d5-c0c7-4dba-bca1-44540bf9468d> (accessed 3 December 2024).
- ALA (Atlas of Living Australia) (2024b) Charopidae occurrence records. Available at: https://biocache.ala.org.au/occurrences/search?q=taxa%3A%22Charopidae%22#tab_mapView (accessed 25 November 2024).
- ALA (Atlas of Living Australia) (2024c) Helicarionidae occurrence records. https://biocache.ala.org.au/occurrences/search?q=taxa%3A%22Helicarionidae%22#tab_mapView (accessed 25 November 2024).
- ALA (Atlas of Living Australia) (2024d) Camaenidae occurrence records https://biocache.ala.org.au/occurrences/search?q=taxa%3A%22Camaenidae%22#tab_mapView (accessed 25 November 2024).
- ALA (Atlas of Living Australia) (2024e) Punctidae occurrence records https://biocache.ala.org.au/occurrences/search?q=taxa%3A%22Punctidae%22#tab_mapView (accessed 25 November 2024).
- Baker HB (1958) Land snail dispersal. *Nautilus* **71**, 141–148.
- Bowler JM, Johnston H, Olley JM, Prescott JR, Roberts RG, Shawcross W, Spooner NA (2003) New ages for human occupation and climatic change at Lake Mungo, Australia. *Nature* **421**(6925), 837–840.
- Clark SA, Richardson BJ (2002) Spatial analysis of genetic variation as a rapid assessment tool in the management of narrow range endemics. *Invertebrate Systematics* **16**, 583–587.
- Clarkson C, Jacobs Z, Marwick B, Fullagar R, Wallis L, Smith M, Roberts RG, Hayes, E, Lowe K, Carah X, Florin SA (2017) Human occupation of northern Australia by 65,000 years ago. *Nature* **547**(7663), 306–310.
- Commonwealth DCCEEW (Commonwealth of Australia and Department of Climate Change, Energy, the Environment and Water) (2024) Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions), accessed from The Sharing and Enabling Environmental Data Portal. Available at: <https://datasets.seed.nsw.gov.au/dataset/b1284c2c-f3bd-4b50-ab07-e1b593b8ee67> (accessed 9 December 2024).
- CSIRO and BOM (Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology) (2024) Climate Change in Australia: East Coast South

NSW Threatened Species Scientific Committee

- projection summaries. Available at: <https://www.climatechangeinaustralia.gov.au/en/projections-tools/regional-climate-change-explorer/sub-clusters/?current=ECSC&tooltip=true&popup=true> (accessed 21 October 2024).
- DAWE (Commonwealth Department of Agriculture, Water and the Environment) (2012) Interim Biogeographic Regionalisation for Australia, Version 7. Department of Agriculture, Water and the Environment. Available at: <https://www.dcceew.gov.au/sites/default/files/env/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/ibra-subregions.pdf> (accessed 11 November 2024).
- DAWE (Department of Agriculture, Water and the Environment) (2020). Provisional list of priority invertebrate species requiring urgent management intervention or on-ground assessment. Canberra: Department of Agriculture, Water and the Environment, Australian Government. Available at: <https://www.dcceew.gov.au/sites/default/files/env/pages/9a6a5628-21b9-4a1b-9474-e953fc5138db/files/provisional-list-invertebrates-requiring-urgent-management-intervention.pdf> (accessed 21 October 2024).
- DECC (New South Wales Department of Environment and Climate Change) (2008) Carrai National Park and Carrai State Conservation Area Plan of Management. Available at: <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Parks-plans-of-management/carrai-nature-reserve-state-conservation-area-plan-of-management-080656.pdf> (accessed 16 December 2024).
- Decker O, Foon JK, Köhler F, Moussalli A, Murphy NP, Green PT (2023) Fire severity is an important driver of land snail declines after the black summer bushfires in Australia. *Biological Conservation* **279**, 109906.
- DEWHA (Department of the Environment, Water, Heritage and the Arts) (2009) Commonwealth Listing Advice on *Pseudocharopa lidgbirdi*. Available at: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/81248-listing-advice.pdf> (accessed 28 November 2024).
- DPIE (State Government of NSW and NSW Department of Planning, Industry and Environment) (2020) Fire Extent and Severity Mapping (FESM), accessed from The Sharing and Enabling Environmental Data Portal. Available at: <https://datasets.seed.nsw.gov.au/dataset/33c2ee86-d2f7-4aaf-8c40-76b6d393a35c> (accessed 16 December 2024).
- EPA (New South Wales Environment Protection Authority) (2021) NSW State of the Environment Report 2021. Available at: <https://www.soe.epa.nsw.gov.au/all-themes/land/fire#causes-of-fire-pressures> (Accessed 20 March 2025).
- Esri (Environmental Systems Research Institute) (2021) ArcGIS 10.8.2 for desktop. Redlands, California, USA. Esri Inc. 1999–2021.
- Forestry Corporation of NSW (2024) Coastal IFOA Native Forest operations Plan Portal. Available at: <https://planportal.fcnsw.net/> (accessed 16 December 2024).

NSW Threatened Species Scientific Committee

- Foon JK, Moussalli A, McIntosh F, Laffan S, Köhler F (2022) Assessing the immediate impacts of the 2019/2020 bushfires on land snails in north-eastern New South Wales. *Australian Zoologist* **42**(2), 386–461.
- Getz L (1974) Species diversity of terrestrial snails in the great Smoky Mountains. *Nautilus* **88**, 6–9.
- Horton DR (1996) The AIATSIS Map of Indigenous Australia. Australian Institute of Aboriginal and Torres Strait Islander Studies. Available at: <https://aiatsis.gov.au/explore/map-indigenous-australia> (Accessed 27 September 2024).
- Hyman I, Stanisic J (2005) New charopid land snails chiefly from limestone outcrops in NSW (Eupulmonata: Charopidae). *Memoirs of the Queensland Museum* **50**, 219–302.
- IUCN (2024) Guidelines for Using the IUCN Red List Categories and Criteria. Version 16 (March 2024). Standards and Petitions Committee of the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Keith DA, Allen SP, Gallagher RV, Mackenzie BDE, Auld, TD, Barrett S, Buchan A, English V, Gosper C, Kelly D, McIlwee A, Melrose RT, Miller BP, Neldner VJ, Simpson CC, Tolsma AD, Rogers D, van Leeuwen S, White MD, Yates CJ, Tozer MG (2022) Fire-related threats and transformational change in Australian ecosystems. *Global Ecology and Biogeography* **31**, 2070–2084.
- Legge S, Woinarski JCZ, Scheele BC, Garnett ST, Lintermans M, Nimmo DG, Whiterod NS, Southwell DM, Ehmke G, Buchan A, Gray J, Metcalfe DJ, Page M, Rumpff L, Leeuwen S van, Williams D, Ahyong ST, Chapple DG, Cowan M, Hossain MD, Kennard M, Macdonald S, Moore H, Marsh J, McCormack R B, Michael D, Mitchell N, Newell D, Raadik TA, Tingley R (2021) Rapid assessment of the biodiversity impacts of the 2019–2020 Australian megafires to guide urgent management intervention and recovery and lessons for other regions. *Diversity and Distributions* **28**, 571–591.
- Marsh J, Bal P, Fraser H, Umbers K, Greenville A, Rumpff L, Woinarski J (2021) Assessment of the impacts of the 2019-20 wildfires of southern and eastern Australia on invertebrate species. NESP Threatened Species Recovery Hub Project 8.3.1 Final report, Brisbane. Available at: https://www.nespthreatenedspecies.edu.au/media/b2oi2hyc/8-3-1-assessment-of-the-impacts-of-the-2019-20-wildfires-of-southern-and-eastern-australia-on-invertebrate-species-final-report_v3.pdf (accessed 21 October 2024).
- Martin K, Sommer M (2004) Relationships between land snail assemblage patterns and soil properties in temperate-humid forest ecosystems. *Journal of Biogeography* **31**(4), 531–545.
- McLauchlan CF (1951) Basic work on the life cycles of some Australian snails. *Proceedings of the Royal Zoological Society New South Wales* **14**, 26–36.
- Nolan RH, Boer MM, Collins L, Resco de Dios V, Clarke H, Jenkins M, Kenny B and Bradstock RA (2020) Causes and consequences of eastern Australia's 2019–20 season of mega-fires. *Global Change Biology* **26**, 1039–1041.

NSW Threatened Species Scientific Committee

- Parkyn J, Brooks L, Newell D (2014) Habitat use and movement patterns of the endangered land snail *Thersites mitchellae* (Cox, 1864) (Camaenidae). *Malacologia* **57**(2), 295–307.
- Ridgeway PA, Lindsay K, Pou D, Visintin A (2014) Indications of diverse behavioural ecologies in the morphologically conservative Australian land snails *Pommerhelix* and *Meridolum* (Stylommatophora: Camaenidae), *Molluscan Research* **34**, 25–39.
- Stanisic J (1990) Systematics and biogeography of eastern Australian Charopidae (Mollusca, Pulmonata) from subtropical rainforests. *Memoirs of the Queensland Museum* **30**, 1–241.
- Stanisic J (1997) An area of exceptional land snail diversity: the MacLeay Valley, northeastern New South Wales. *Memoirs of the Museum of Victoria* **56**, 441–448.
- Stanisic J, Ponder WP (2004) Forest snails in eastern Australia-one aspect of the other 99%. In 'Conservation of Australia's Forest Fauna' (Ed. D. Lunney) pp. 127–149. Royal Zoological Society of New South Wales, Mosman.
- Stanisic J, Shea M, Potter D, Griffiths, O (2010) Australian land snails. A field guide to eastern Australian species. Vol. 1. Bioculture Press, Rivière des Anguilles, Mauritius.
- Stanisic J, Window E (2020) Land snails of the Eungella plateau and environs, Clarke range, mid-eastern Queensland. *The Proceedings of the Royal Society of Queensland* **125**, 23–31.
- State Government of NSW and Forestry Corporation of NSW (2024) State Forest, accessed from The Sharing and Enabling Environmental Data Portal. Available at: <https://datasets.seed.nsw.gov.au/dataset/2098734a-9fdc-4610-b03e-7d2b18772b97> (accessed 16 December 2024).
- Woodward E, Hill R, Harkness P and R Archer (Eds) (2020) 'Our Knowledge Our Way in caring for Country: Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management, best practice guidelines from Australian experiences' (NAILSMA and CSIRO: Cairns, QLD).

Expert Communications

Junn Kitt Foon. Research Associate, Malacology, Australian Museum Research Institute, NSW. And PhD candidate, School of Science, Western Sydney University. Email: Junn.Foon@Australian.Museum

Frank Köhler. NSW Principal Research Scientist and Group Manager, Malacology, Australian Museum Research Institute, NSW.

NSW Threatened Species Scientific Committee

APPENDIX 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Luturopa macleayensis was found to be Endangered under Clause 4.3(b)(d)(e i,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, 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,
		(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:	

Established under the Biodiversity Conservation Act 2016

Locked Bag 5022 Parramatta NSW 2124 (02) 9585 6940

scientific.committee@environment.nsw.gov.au

NSW Threatened Species Scientific Committee

	(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.

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.

NSW Threatened Species Scientific Committee

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: Vulnerable under Clause 4.7

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.
-------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------