Abridged Threatened Species Nomination Form

For nominations under the Common Assessment Method (CAM) where supporting information is available, but not in a format suitable for demonstrating compliance with the CAM, and assessment against the IUCN Red List threat status.

Cover Page *(Office use only)*

Species name (scientific and common name)**:**	***Lepidium catapycnon*** (Hamersley Lepidium)
Nomination for (addition, deletion, change)**:**	**Deletion**
Nominated conservation category and criteria:	**None**

Scientific committee assessment of eligibility against the criteria:			
This assessment is consistent with the standards set out in Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding.			Yes ☐ No ☐
A.	Population size reduction	•	
B.	Geographic range	•	
C.	Small population size and decline	•	
D.	Very small or restricted population	•	
E.	Quantitative analysis	•	

Outcome*:*			
Scientific committee Meeting date:			
Scientific committee comments:			
Recommendation:			
Ministerial approval:		*Date of Gazettal/ Legislative effect:*	

Nomination summary *(to be completed by nominator)*

Current conservation status				
Scientific name:	*Lepidium catapycnon*			
Common name:	Hamersley Lepidium			
Family name:	Brassicaceae	Fauna ☐	Flora ☒	
Nomination for:	Listing ☐	Change of status ☐	Delisting ☒	
1. *Is the species currently on any conservation list, either in a State or Territory, Australia or Internationally?* 2. *Is it present in an Australian jurisdiction, but not listed?*	*Provide details of the occurrence and listing status for each jurisdiction in the following table*			

Jurisdiction	**State / Territory in which the species occurs**	**Date listed or assessed (or N/A)**	**Listing category i.e. critically endangered or 'none'**	**Listing criteria i.e. B1ab(iii)+2ab(iii)**
International (IUCN Red List)				
National (EPBC Act)		16/12/2008	Vulnerable	
State / Territory	1. Western Australia	3 November 2015	Priority 4	N/A
	2.			
	3.			

Consistent with Schedule 1, item 2.7 (h) and 2.8 of the Common Assessment Method Memorandum of Understanding, it is confirmed that:	
• this assessment meets the standard of evidence required by the Common Assessment Method to document the eligibility of the species under the IUCN criteria;	Yes ☒ No ☐
Comments:	
• surveys of the species were adequate to inform the assessment;	Yes ☒ No ☐
Comments:	There have been general vegetation surveys and targeted surveys been 1999 and 2014. Survey methods, effort, time and vegetation quality related to climatic conditions and varied between years and surveys, but was usually conducted for the purposes of resource exploration or development projects. Surveys have mostly been focused on mining and pastoral lands, with few surveys of the broader area. Population and EOO estimates are likely to be underestimates, as future surveys are likely to continue identifying new populations of the species within suitable habitat. Despite the variation in survey effort, there are sufficient data available from these surveys to inform the assessment.
• the conclusion of the assessment remains current and that any further information that may have become available since the assessment was completed supports or is consistent with the conclusion of the assessment.	Yes ☒ No ☐

Comments:	The species was nominated and accepted for delisting by the WA TSSC at the May 2015 meeting. There is no further information that has come available since the assessment.

Nominated national conservation status: category and criteria

Presumed extinct (EX) ☐ Critically endangered (CR) ☐ Endangered (EN) ☐ Vulnerable (VU) ☐

None (least concern) ☒ Data Deficient ☐ Conservation Dependent ☐

What are the IUCN Red List criteria that support the recommended conservation status category?	Further surveys have found that the species no longer meets criteria for listing as a nationally threatened species.

Eligibility against the IUCN Red List criteria (A, B, C, D and E)

*Provide justification for the nominated conservation status; is the species eligible or ineligible for listing against the five criteria. For **delisting**, provide details for why the species no longer meets the requirements of the current conservation status.*

A.	Population size reduction (evidence of decline)	• Based on surveys, the number of mature individuals is estimated to be greater than 31,000. • There have been mining-associated impacts on some populations that have resulted in a decline in the number of mature individuals. However, approved applications to remove plants have only resulted in the removal of less than 809 mature individuals (<3% of the total population). • The species is a disturbance opportunist, and therefore the species expresses population variation dependant on season and appropriate disturbance events. It is recognised that road grading and track construction appears to increase the number of individuals. • The invasion of introduced species ruby dock *Acetosella vesicaria* may prevent establishment of *L. catapycnon* in some areas, but this competition is reduced in scree slope habitats favoured by the species. • **Does not meet criteria for listing**
B.	Geographic range (EOO and AOO, number of locations and evidence of decline)	• Originally, the species was only known from Wittenoom Gorge in the Pilbara, WA. Further surveys have found the species at numerous scattered localities, including on conservation estate, across the Hamersley Range area of the Pilbara, WA. • (B1) EOO is estimated to be 23,420 km^2 based on minimum convex polygon calculation. • (B2) Using a 2kmx2km grid, the AOO is calculated as 240km^2 based on existing survey data. • (a) Mapping of all records in the Threatened and Priority Flora (TPFL) database, rare flora report forms not yet entered into the database, and a variety of survey data from mining companies and consultants, the species is now known to occur at 83 subpopulations (subpopulation = plants that are >500m apart). New subpopulations of this species have been regularly discovered during botanical surveys of appropriate habitat.

		• (b) The species is found mostly on mining or pastoral leases. There have been mining-associated impacts on some subpopulations that have resulted in a decline of habitat area and quality and the number of mature individuals, but such decline is geographically small compared to the population, and does not justify an assessment of continuing decline. Approved applications to remove plants have only resulted in the removal of less than 809 individuals (<3% of the total population), and recolonization of disturbed areas has been observed placing the species at low risk from these activities across its range. • (c) Population sizes fluctuate considerably depending on fire and other disturbances. This is a natural occurrence, as the species is a short-lived pioneer with what is believed to be a long-lived soil seed-bank (Cochrane 2000; Darlington 1922) with its germination triggered by disturbances. Extreme fluctuation of population under IUCN criteria thus does not apply for this species. • **Does not meet criteria for listing**
C.	Small population size and decline (population size, distribution and evidence of decline)	• The number of mature individuals is estimated to be greater than 31,000. • **Does not meet criteria for listing**
D.	Very small or restricted population (population size)	• The number of mature individuals is estimated to be greater than 31,000. • **Does not meet criteria for listing**
E.	Quantitative analysis (statistical probability of extinction)	• No information to assess.

Summary of assessment information

EOO	23,420 km^2	AOO	240 km^2 (based on available survey data)	Generation length	Short-lived

No. locations	>10	Severely fragmented	Yes ☐ No ☒ Unknown ☐
No. subpopulations	83	No. mature individuals	>31,000

Percentage global population within Australia	100%
Percentage population decline over 10 years or 3 generations	Insufficient data. Given the ongoing discovery of new localities, the species' actual distribution and population size is likely to be an underestimate.

Threats *(detail how the species is being impacted)*

Threat	Extent	Impact
(describe the threat and how it impacts on the species. Specify if the threat is past, current or potential)	*(give details of impact on whole species or specific subpopulations)*	*(what is the level of threat to the conservation of the species)*

Vegetation clearing for mining • Proposed and existing mining activities involve the broad scale clearing of vegetation for infrastructure development and resource extraction, which has required the removal of some individuals of the species and potential disruption to the seed bank. The cumulative impact of applications to remove plants has been the removal of less than 809 individuals (approximately 3% of the total population). • Past, current and potential	Subpopulations within mining tenures. The species is found mostly on mining or pastoral leases.	Minor Mining in the Pilbara on landforms that support the *Lepidium* is generally in discrete areas that will not cause significant impact to the species across its range. Smaller scale disturbance has the potential to stimulate regeneration of the species. Future impact is not likely to cause the species to meet criteria for threatened.
Roadworks • Many subpopulations are on or adjacent to frequently graded mining and exploration tracks. As the species is a disturbance opportunist, it has been recognised that road grading and track construction can increase the number of individuals at a locality. • Past, current and potential	Subpopulations within mining tenures and road verges.	Nil-Minor Roadworks has resulted in the regeneration of this species and is thus not likely to cause the species to meet criteria for threatened in the future.
Weed invasion • Invasion of the introduced species ruby dock *Acetosa vesicaria* may prevent the establishment of the species in some areas. • Current and potential	Scattered localities	Unknown The scale and severity of weed invasion in the Pilbara on the rocky and scree landforms is not likely to pose a significant threat to this species, and in unlikely to cause the species to meet criteria for threatened in the future.

Management and Recovery

Is there a Recovery Plan (RP) or Conservation Management Plan operational for the species?	Yes ☐ No ☒

List all relevant recovery or management plans (including draft, in-preparation, out-of-date, national and State/Territory recovery plans, recovery plans for other species or ecological communities, or other management plans that may benefit or be relevant to the nominated species).

- Rio Tinto (2011). RTIO (WA) Significant Species Management Plan. [Online]. Available from: http://www.riotintoironore.com/documents/Appendix_4_-_significant_species_managment_plan.pdf
- Department of Conservation and Land Management (CALM) (1999). 'Karijini National Park Management Plan 1999-2009.' Prepared for the National Parks and Nature Conservation Authority, Perth, Western Australia.

List current management or research actions, if any, that are being undertaken that benefit the conservation of the species.

- Targeted and vegetation surveys in appropriate habitat have improved knowledge of the species distribution and increased the number of known localities and population size.

- Implementation of environmental management plans for the species and general vegetation within mine sites and for exploration activities.
- Maintain species on the Parks and Wildlife Priority Flora list to provide ongoing conservation attention, including environmental impact assessments for new development proposals.
- Minimise future loss of habitat through development activities.
- Undertake strategic weed control, targeting ruby dock *Acetosa vesicaria*, where this poses a threat to conservation values, including within Karijini National Park.

List further recommended management or research actions, if any, that would benefit the conservation of the species.

- Maintain species on the Parks and Wildlife Priority Flora list to provide ongoing conservation attention, including environmental impact assessments for new development proposals.
- Inclusion of the species in strategic biodiversity conservation initiatives for the Pilbara.

References	Cochrane, A. (2000) The germination requirements of seeds of the rare Hamersley *Lepidium catapycnon* (Brassicaceae). Unpublished report to BHP Iron Ore Pty. Ltd. Darlington, H. T. (1922) Dr W.J. Beal's seed-viability experiment. American Journal of Botany (5), 266-269
Nomination prepared by:	
Contact details:	
Date submitted:	15/07/2016

If the nomination has been refereed or reviewed by experts, please provide their names and contact details:

Department of
Parks and Wildlife

Form to nominate a Western Australian species for listing as threatened, change of category or delisting 2015.

SECTION 1. NOMINATION					
1.1. Nomination for:					
Flora ☒ **Fauna** ☐ as: **Threatened / DRF** ☐ **Change of category** ☐ **Delisting** ☒					
1.2. Scientific Name **This name will be used to identify the species on all official documentation. Use the approved name used by the Western Australian Museum or Herbarium, if possible.**					
Lepidium catapycnon Hewson					
1.3. Common Name **If the species has a generally accepted common name, please show it here.**					
Hamersley Lepidium					
1.4. Family Name					
Brassicaceae					
1.5. Current Conservation Status. If none, type 'None'.					
	IUCN Red List Category e.g. Vulnerable			**IUCN Red List Criteria e.g. B1ab(iv); D1**	
International IUCN Red List	None			-	
National EPBC Act 1999	Vulnerable			B1+3d	
State of Western Australia	Vulnerable			B1+3d	
State of WA Priority	1☐	2☐	3☐	4☐	5☐
1.6. Nominated Conservation Status.					
	IUCN Red List Category e.g. Vulnerable			**IUCN Red List Criteria e.g. B1ab(iv);D1**	
State of Western Australia					
State of WA Priority	1☐	2☐	3☐	4☒	5☐
Is the species listed as 'Threatened' in any other Australian State or Territory? If Yes, list these States and/or Territories and the status for each.					
No ☒ **Yes** ☐ **Details:**					
1.7. Reasons for the Nomination. **Briefly summarise the reasons for the nomination in dot points. Please include details relevant to the IUCN Category and each Criteria.**					
This species was gazetted as Rare Flora in 1987 when it was known from three collections (in 1972, 1985 and 1986) from a locality at Wittenoom Gorge that comprised two plants at the time of listing. These plants were not relocated during a search in 1988.					
Mapping of all records in the Threatened and Priority Flora (TPFL) database, a number of rare flora report forms not yet entered into the database (Department of Parks and Wildlife 2015), and a variety of externally held survey data (from mining companies and their consultants) allowed existing and putative 'populations' (i.e. localities >500 m apart) of *L. catapycnon* to be assessed. *Lepidium*					

catapycnon is now known from 83 localities (TPFL Populations = 38; new forms = 15; external data = 30). Its extent of occurrence is now c. 23,420km2.

When described in 1981 from a single specimen, nothing was known about the biology of *L. catapycnon* Hewson; however, it is now recognised as being a short-lived, disturbance opportunist that is an early coloniser of sites, eventually being outcompeted by taxa such as *Triodia* spp. (spinifex). When present, plants of *L. catapycnon* produce substantial quanities of seed that are stored in the soil and stimulated to germinate after a period of dormancy in response to disturbances such as fire and ground-breaking activities.

Although the majority of populations of *L. catapycnon* occur on mining or pastoral leases, new populations are regularly located during botanical surveys of appropriate habitat.

At least eight populations are now also known from Karijini National Park, with more expected to be located in this conservation reserve with comprehensive survey.

SECTION 2. SPECIES

2.1. Taxonomy.

Describe the taxonomic history, using references, and describe the key distinguishing features that can be used to separate this taxon from closely related taxa. Include details of the type specimen, changes in taxonomy, scientific names and common names used for the species.

Hewson (1981) revised the genus *Lepidium* in Australia, describing nine new species, including *L. catapycnon*. Her treatment of the genus for 'Flora of Australia' was published in 1982. *Lepidium catapycnon* is a distinctive species and was described from a single specimen, the type (McGuire 26, Wittenoom, Jan. 1972; PERTH 01007033). This specimen lacked mature fruits and the description of *L. catapycnon* was supplemented with information regarding the shape, size and surface characters of fruit and seed by Lepschi (1998) when additional material was available.

Hewson (1981) considered *L. catapycnon* to be closely related to the variable species *L. pedicellosum* F.Muell., but readily distinguished by its papillose stems, leaves and fruits (rather than glabrous or rarely hairy in L. pedicellosum). These species also differ in their leaf shape; L. pedicellosum has broad, flat, transversely linear leaves, while *L. catapycnon* has narrow, terete leaves (Lepschi 1998).

Lepschi (1998) noted that *L. catapycnon* displayed greater overall similarity to *L. platypetalum* Hewson, which also has linear, terete leaves; *L. platypetalum* can be distinguished by its glabrous stems, leaves and fruits, the fruits also being much larger than those of L. catapycnon (9–11 x 4–7 mm vs 5–5.5 x 4–4.5 mm).

Lepidium catapycnon has the vernacular names 'Hamersley Lepidium' and 'Hamersley Catapycnon' (Department of the Environment 2015) with the former being the most commonly used.

Is this species conventionally accepted? If no, explain why. For example, is there any controversy about the taxonomy? For undescribed species, detail the location of voucher specimens (these should be numbered and held in a recognised institution and be available for reference purposes).

No ☐ Yes ☒

Describe any known hybridisation with other species in the wild, indicating where this occurs and how frequently.

No hybrids have been recorded between *L. catapycnon* and any other species.

Natural hybridisation is reported rarely in *Lepidium*; however, fertile artificial hybrids have been generated and phylogenetic analysis suggests that reticulate evolution has been widespread in the genus in the past (Lee et al. 2002; Dierschke et al. 2009). This is supported by the identification of numerous allopolyploid species (i.e. species having double the number of chromosomes that is typical for the species, with the different sets of chromosomes having been inherited from different parental species) globally (Lee et al. 2002).

2.2. Description

Describe the physical appearance, habit, behaviour/dispersion and life history. Include anatomy or habit (e.g. size and/or weight, sex and age variation, social structure) and dispersion (e.g. solitary, clumped or flocks etc), and life history (eg short lived, long lived, geophytic, etc).

Lepidium catapycnon is an upright, short-lived perennial herb or shrub, to 70 cm wide x 50 cm high, with stems that zig-zag markedly between the leaf nodes. Its leaves are small (4 cm long x 2 cm wide), linear and terete (round in X-section), tapering slightly at both ends, and are succulent with a papillose surface (i.e. with small, rounded projections). The flowers are arranged in dense racemes at the tips of branches; flowers are white, up to 6 mm long, with rhomboid petals that are tubular in the lower half, and six stamens (male reproductive organs). The fruit is broadly elliptic to subcircular 5–5.5 mm long x 4–4.5 mm wide, winged, and has a sparsely papillose surface. (Hewson 1981, 1982; Lepschi 1998; Brown et al. 1998)

Plants of *L. catapycnon* are solitary (non-clonal) and, within populations, are usually found scattered across their distribution area. The density of plants is variable across populations, and is affected by time since germination (seedlings and immature plants more densely arranged than mature and senescing plants), and recent disturbance. Dispersion across the Pilbara region shows populations distributed according to the suitability of habitat.

2.3. Distribution

Describe the distribution of the species <u>in Australia</u> and, if possible, provide a map.

Lepidium catapycon is known only from the Pilbara bioregion of Western Australia where it has a scattered distribution across the Hamersley Range. It occurs within the Rangelands (Western Australia) Natural Resource Management Region.

Populations are broadly distributed between the Pilbara towns of Newman, Nullagine, Wittenoom and Tom Price over a range of c. 295 km east-west and c. 167 km north-south, with the total area of extent approximating 23,420 km2 (Figure 1).

In recent years an increasing number of new populations of L. catapycnon have been recorded during baseline flora and vegetation surveys across mining leases in the Pilbara (e.g. Onshore Environmental 2009, 2011a, 2011b, 2011c, 2011d, 2011e, 2011f); eight populations are now also known from Karijini National Park (Onshore Environmental 2013).

2.4. Habitat

Describe the non-biological habitat (e.g. aspect, topography, substrate, climate) and biological habitat (e.g. vegetation type, associated species, sympatric species). If the species occurs in various habitats (e.g. for different activities such as breeding, feeding, roosting, dispersing, basking etc) then describe each habitat. Note if the habitat has a special defining characteristic. If possible estimate the area of habitat, or the relative abundance of the habitat, and note if a critical habitat requirement (eg breeding habitat) is restricted in its availability to the species.

Non-biological habitat

Lepidium catapycnon occurs in the south-eastern Pilbara, an arid-tropical climate with hot, dry summers (Oct.–Apr.; av. 35–40oC) and mild winters with variable and unreliable rainfall (May–Sep.; av. 22–30oC;). Average annual rainfall is from 180mm to >400mm and precipitation occurs in summer and winter months. The majority of rain is associated with summer cyclones (Jan.–Mar.), while winter rain is lighter and is associated with southerly cold fronts. (Bureau of Meteorology 2014; Onshore Environment 2013)

The species has been recorded as growing on stony hill slopes, such as the uplands of the Hamersley Range plateau, more frequently located on south facing slopes. It has also been recorded as occurring along road verges and in cuttings. Soils in which *L. catapycnon* occurs are skeletal, red-brown and gritty.

Recent targeted surveys for *L. catapycon* have found this species has a strong habitat preference for the Jeerinah Formation (Fj) geology type, mudstone, or shaly Banded Iron Formation (BIF). Jeerinah Formation is described as interbedded mudstone and chert with minor felsic tuff dolomite and sandstone. Most commonly recorded on steep hilsides, this species also occurs in gullies,

gorges, drainage lines, footslopes, low undulating hills and alluvial plains; typically downstream from upland populations (Onshore Environmental 2013).

Biological habitat

Occurs in open woodland and hummock grasslands, with *Eucalyptus gamophylla, E. xerothermica, E. leucophloia, Acacia hilliana, A. adoxa, A. bivenosa, A. pruinocarpa, A. sibrica, A. spondylophylla, Triodia wiseana* and *T. basedowii*.

Does the (fauna) species use refuge habitat e.g. in times of fire, drought or flood? Describe this habitat.

N/A

Is the species part of, or does it rely on, a listed threatened ecological community? Is it associated with any other listed threatened species?

No. One plant of *L. catapycnon* has been collected from the Western Australian priority ecological community (PEC) 'Weeli Wolli Creek Spring Community' (Priority 1) (Woodman Environmental Consulting 2010), however this creekline habitat is atypical for the species and it is likely that propagules were transported downstream from typical upland habitat.

No. *Lepidium catapycnon* is not associated with any other listed threatened species.

2.5. Reproduction

Provide an overview of the breeding system.

For <u>fauna</u>: Provide an overview of the breeding system and breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?

For <u>flora</u>: When does the species flower and set fruit? Is the seed produced viable? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, ground disturbance) in order to reproduce?

Flowers mainly recorded from late August to late October, extending through to January, with records of plants flowering and seeding in March.

Seed has been collected from a number of populations with three collections from Mt Whaleback tested for viability and germination requirements by Cochrane (2000). It was found that there may be complex requirements for breaking seed dormancy, with no germination of fresh seed after five weeks under basic light, temperature and moisture conditions (Cochrane 2000). Seeds were stimulated to germinate when treated with gibberellic acid (GA), which has been found to override the effect of abscisic acid (ABA) on inhibiting the weakening and rupture of the seed endosperm in *Lepidium* (Muller et al. 2006). A period of storage within the soil may be required for germination success, which has some implications for rehabilitation of sites using the species as well as land management practices that involve too-frequent soil-seedbank disturbance. The soil seed-bank is presumed to be long lived. Studies on the related *Lepidium virginicum* found its seed to be still germinating 40 years after burial (Darlington 1922).

No specific pollination studies have been undertaken for *L. catapycnon* and there are no data available on whether the species is selfing or out-crossing, or which insects might be pollinators. While *Lepidium* contains a large number of species that are capable of self-pollination (Dierschke et al. 2009), this trait is usually linked to species with reduced floral structures (see pers comm. in Robertson & Klemash 2003), i.e. two or four stamens rather than six (Lee et al. 2002), as seen in L. catapycnon. High levels of fruit and seed production across all populations (indicated by high numbers of fruiting individuals in flora surveys and high numbers of seedlings emerging from the soil-stored seed bank following disturbance events) and flower morphology consistent with a generalist insect pollination syndrome (white, radially symmetrical, open-structured flowers) suggest that *L. catapycon* may be pollinated by a commonly available insect or a range of insects. Species-specific pollinators have not been recorded in *Lepidium*, and the rare species *L. papilliferum* (L.F.Hend.) A.Nelson & J.F.Macbr. (from Idaho, USA) was found to be visited by insects from 25 different families from five different orders (Robertson & Klemash 2003).

There are no reports of vegetative reproduction in *L. catapycnon*.

The species is a disturbance opportunist, though also occurs in undisturbed hummock grasslands; plants may be displaced by spinifex (*Triodia* spp.) as they mature. *Lepidium catapycnon* is recognised as being a pioneer species that responds rapidly to disturbance, especially fire, under favourable rainfall conditions. Many populations have been recorded in areas that were recently burnt (Onshore Environmental 2013) and repeat surveys of some populations show considerable fluctuations in plant numbers across years related to fire events (Department of Parks and Wildlife 2015). For example, the number of mature plants in TPFL Populations 3 and 4D increased significantly (from 60 to 1,200, and from 892 to 6,479 respectively) following fire, with a large number of juvenile plants also present; other populations decrease in size steadily with increasing years since fire (Appendix 1). Similarly, population sizes have been observed to increase following ground disturbance with new plants regenerating from the soil seed bank on the edges of graded tracks and recolonising exploration and extractions areas on mining leases (Department of Parks and Wildlife 2015).

2.6. Population dynamics
Provide details on ages of sexual maturity, extent of breeding success, life expectancy and natural mortality. Describe population structure (presence of juveniles/seedlings, mature and senescing individuals). Estimate generation length.

Based on observations of plants in situ during repeat flora surveys, the lifespan of plants of *L. catapycnon* has been estimated as c. 5–7 years, with plants flowering from their second year and producing large quantities of fruits and seed.

There have been scant surveys that have recorded the proportion of seedlings, mature, senescing and dead individuals separately, most recording plants as either living or dead. Where living plant counts have been separated into juvenile and mature individuals, data suggests that juveniles comprise between 1% and 25% of any population (Department of Parks and Wildlife 2015; Appendix 1). Many populations are recorded as having a very high proportion of dead plants, or only dead plants; however, they are recognised as having a persistent, soil-stored, seedbank.

Questions 2.7 and 2.8 apply to fauna nominations only

2.7. Feeding
Summarise food items or sources and timing/availability.

N/A

Briefly describe feeding behaviours, including those that may make the species vulnerable to threatening processes.

N/A

2.8. Movements
Describe any relevant daily or seasonal pattern of movement for the species, including relevant arrival/departure dates if migratory. Provide details of home range/territories.

N/A

SECTION 3. INTERNATIONAL CONTEXT

For species that are distributed both in Australia and in other countries.

3.1. Distribution
Describe the global distribution.

N/A

Provide an overview of the global population size, trends, threats and security of the species outside of Australia.

N/A

Explain the relationship between the Australian population and the global population. What percentage of the global population occurs in Australia? Is the Australian population distinct, geographically separate or does part, or all, of the population move in/out of Australia's jurisdiction? Do global threats affect the Australian population?

N/A

SECTION 4. CONSERVATION STATUS AND MANAGEMENT

Conservation status and management information is required for the national extent of the species, however, greater detail is expected for the WA occurrences. If the taxon is considered to be endemic to Western Australia, please provide supporting evidence.

4.1. Population

What is the total national/State population size in terms of number of mature individuals? Has the number of individuals been counted, or is this an estimate? Provide details of the method of determining the number of individuals. Are there other useful measures of population size and what are they? Or if these are unavailable, provide an estimate of abundance (e.g. scarce, locally abundant etc).

Note: The term 'population' is used in a specific sense in the Red List Criteria that is different to its common biological usage. Population is here defined as the total number of mature individuals of the taxon. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used. (IUCN 2001)

Threatened Flora Report Forms (TFRFs) submitted to the Department and recorded in the TPFL database document at least 31,428 mature plants of *L. catapycnon* (Appendix 1).

Many of the TFRFs reports are based on partial surveys (i.e. only an area immediately surrounding a site of proposed disturbance was surveyed) indicating that the number of individuals at these locations was potentially much higher than recorded, and there were additional numbers of juvenile plants at many sites also. Reports include a mixture of actual plant counts and estimations; this information is provided for each TPFL Population in Appendix 1.

How many subpopulations or locations do you consider the species occurs in and why?

Note: 'Subpopulations' are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less). 'Locations' are defined as a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat. (IUCN 2001) Refer to Red List Guidelines 9.0

Mapping of all records in the TPFL database, a number of rare flora report forms not yet entered into the database (Department of Parks and Wildlife 2015), and a variety of externally held survey data (from mining companies and their environmental consultants) allowed existing and putative 'populations' (i.e. localities >500 m apart; Department of Parks and Wildlife guidlines) of L. catapycnon to be assessed (Appendix 2). Lepidium catapycnon is now known from 83 localities (TPFL Populations = 38; new forms = 15; external data = 30). Of note is that distribution data held in external databases and the grey literature resulted in the recognition of a large number of new localities, and showed that plants of *L. catapycnon* occurred between many TPFL Populations indicating that they should be merged (Appendix 2).

Provide locations of: captive/propagated occurrences or *ex situ* collections; recent re-introductions or introductions to the wild; and sites for proposed re-introductions or introductions. Have these sites been identified in recovery plans?

Seed has been collected from a number of different populations of *L. catapycnon* to date (Department of Parks and Wildlife 2015). A substantial quantity of seed is held at the Western Australian Threatened Flora Seed Centre and the Millennium Seed Bank (UK). Seeds collected by the Botanic Gardens and Parks Authority (BGPA; Kings Park) in 1991 and 1993 were not able to be germinated, but a more detailed study by Cochrane (2000) achieved germination under experimental conditions. None of the germinants were grown on. BGPA took cuttings from plants in 1991 and 1995, however none survived and although sterile cultures were established, they were not able to be sustained (Department of Parks and Wildlife 2015).

No translocations have been proposed or implemented. It is expected that plants of *L. catapycon* will recolonise post-mining revegetation sites from seeds contained in stockpiled soil; this has been observed at Mt Whaleback (Department of Parks and Wildlife 2015).

No recovery plans have been prepared for *L. catapycnon*.

For flora, and where applicable, for fauna, detail the location, land tenure, estimated number of individuals, area of occupancy, and condition of site for each known date, location or occurrence. More specific detail is expected for WA occurrences for taxa that are not endemic to WA.

Date of survey	Location Description (include coordinates of the site)	Land status	Number of mature individuals at location	Area of occupancy at location	Condition of site
See attached (Appendix 1)					

What is the total area of occupancy (in km^2) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable, provide a range of values or a minimum or maximum area estimate. Where separate breeding habitat is applicable, if possible, also provide area of breeding habitat.

An accurate assessment of total area of occupancy cannot be made for *L. catapynon* due to wide variance in the available distribution data as well as confounding biological factors. Firstly, some localities for *L. catapycnon* are represented by a single geocode but an estimate of several 1,000 plants over an undisclosed area is given, while other localities are defined by a series of bounding geocodes, and yet others list GPS readings for each individual observed. The difficulties in interpreting these differences are compounded by a mixture of partial and actual survey results, and simple observation of occurrence records. Secondly, because population sizes of *L. catapycnon* fluctuate, it is not possible to assess area of occupancy without an understanding of the size of the seedbank from which populations are refreshed.

An attempt to calculate total area of occupancy from available, mapped distribution data (from a variety of sources and without adjusting for the discrepancies noted above) resulted in an estimate of c. 6.5km^2; this is certainly a significant underestimate.

What is the extent of occurrence (in km^2) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable, provide a range of values or a minimum or maximum area estimate.

Populations of *L. catapycnon* occur over a range of c. 295 km east-west and c. 167 km north-south, with the total area of extent approximating 23,420km2 (Department of Parks and Wildlife 2015; Figure 1).

The extent of occurrence has been calculated from population record data in the TPFL database (Department of Parks and Wildlife 2015), specimen record data from FloraBase (Western Australian Herbarium 1998–), data from consultants' reports, and unpublished survey records from the databases of external stakeholders including Rio Tinto Iron Ore, BHP Billiton Iron Ore and K. McCreery (One Tree Botanical).

Identify important occurrences necessary for the long-term survival and recovery of the species? This may include: key breeding populations, those near the edge of the range of the species or those needed to maintain genetic diversity.

Medium intensity fire appears to stimulate seed germination, and replenish populations, under appropriate rainfall conditions. A degree of ground disturbance also stimulates germination.

Is the distribution of the species severely fragmented? Why?

No. Areas of suitable habitat exist between all known populations.

Is the taxon subject to extreme fluctuations? If so, provide evidence.

Yes, population sizes fluctuate considerably. The number of plants and the extent of *L. catapyncon* communities vary depending on a variety of environmental factors, particularly fire and disturbance. Plants of L. catapycnon are short-lived pioneer species and germination from the soil-stored seed

bank is apparently stimulated by disturbance. Repeat surveys of populations show plant numbers varying upwards from (e.g.) 60 to 1,200 two years post-fire and downwards from (e.g.) 471 to 2 plants in the absence of fire or other ground disturbance over 17 years (Appendix 1). Fire may also alter the boundaries of populations over time by allowing the communities to expand or contract depending on the fire track (Onshore Environmental 2014). Survey of disturbed and rehabilitated areas near Mt Whaleback mine (Newman) noted 1,000s of plants had emerged (Department of Parks and Wildlife 2015) and physical soil disturbance has been proposed as the trigger for seed germination and subsequent plant recruitment along the South Parmelia powerline access track (Onshore Environmental 2009).

Other environmental factors such as climatic conditions, especially rainfall, overstorey vegetation and soil moisture may also affect the ability of populations to persist in particular areas (Onshore Environmental 2014).

Has there been any known decline in the species within WA or nationally, or is this likely in the future? – provide details in relation to the elements detailed below, including how the decline has been measured or inferred. Is there a presumption of continuing decline? If so, provide details of the decline and how it relates to the specific Red List Categories and Criteria version 3.1.

Note: A continuing decline is a recent, current or projected future decline (which may be smooth, irregular or sporadic) which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this. (IUCN 2001) Refer to Red List Guidelines 9.0

No. The overall number of populations known has increased, and with it the total number of plants known.

Has there been a decline in the size of the population (number of mature individuals)?

No. The overall number of plants known is significantly higher now than when the species was listed. Although some populations have seen a reduction in plant numbers through approved applications to take Threatened Flora (e.g. around the Tom Price, Yandicoogina, Eastern Packsaddle and Jinidi mines) and one population of one plant (TPFL Population 12) has become extinct through approved mining activities, there has been an overall increase in the number of populations and plants. NB: the inclusion of externally held distribution data has shown that TPFL Population 10 is continuous with the historical record for Population 12, and they should be treated as a single locality (Appendix 2).

- **can the rate of population size reduction be determined over the last 10 years or 3 generations (whichever is the longer)? If so, state whether the determination is based on quantitative data (observed), estimated (provide data and calculations), inferred or suspected.**

N/A - not in decline. Across all applications to take, the cumulative maximum number of plants of *L. catapycnon* proposed to be removed equalled 809; however, lower numbers of plants were usually reported as being actually taken (Department of Parks and Wildlife 2015).

- **can the rate of population size reduction be estimated for the next 10 years or 3 generations and in any 10 year or 3 generation period (up to a maximum of 100 years into the future)? If so, state how the reduction is estimated (provide data and calculations), inferred or suspected.**

No. It is not possible to estimate any reduction in population size for this species. Given the ongoing discovery of new localities its actual distribution is probably still under-estimated.

Has there been a decline in the number of locations, extent of occurrence or area of occupancy?

No. When originally gazetted as Rare in 1987, *L. catapycnon* was known from only one population area at Wittenoom Gorge comprising <20 plants; the species is now known from >80 locations spread across the Hamersley Range.

The extent of occurrence has also increased with additional survey effort; in 2008 *L. catapycnon* was found to occur over an area of 10,282 km2 whereas it is now known to occur over an area of 23,420 km^2.

Has there been a decline in the area or quality of habitat?

Yes. *Lepidium catapycnon* occurs primarily on mining leases on substrates prospective for mining and there have been mining-associated impacts on some populations that resulted in a decline of habitat area and quality.

4.2. Survey effort

Describe the methods to conduct surveys. For example, season, time of day, weather conditions; length, intensity and pattern of search effort (including where species not encountered); any limitations and expert requirements.

Surveys in which *L. catapycnon* has been detected include general vegetation surveys (ENV 2006, 2010; Onshore Environmental 2009) and targeted surveys (e.g. HGM 1999; BHPBIO Environment 1999a, 1999b; BHPBIO & Kaljuste 2001; BHPBIO 2008; GHD 2008; Mattiske Consulting 2008; Onshore Environmental 2013; Biota 2014). Survey methods, effort, times and vegetation quality related to climatic conditions varied between years and survey teams (see Appendix 3 for summary), but was usually directly linked to a resources exploration or development project and so concentrated on areas likely to be impacted rather than the broader landscape. Targeted surveys recorded the presence of plants either as an actual or estimated count within a bounding area, or as individual point locations. Appendix 3 also includes details of surveys in which *L. catapycnon* was not found, usually due to inappropriate habitat (i.e. lower, flat areas surveyed for infrastructure corridor development).

Limitations to full survey of suitable habitat in the Hamersley Range include difficult to access sites, high cost of helicopter surveys and inhospitable climate. The species does not require identification by a taxonomic specialist in the field.

Provide details on the distinctiveness and detectability of the species, or the distinctiveness of its habitat, that would assist survey success.

L*epidium catapycnon* is readily recognisable by its occurrence in upland, ironstone sites, its stems which zig-zag markedly between the leaf nodes and its papillose vegetative parts. The most similar species is *L. platypetalum* which occupies a broader range of habitats and is frequently found on lower slopes and flats, and which has glabrous vegetative parts and larger fruits. These two species can be mistaken for each other in the field but the differences in the vestiture of the stems and leaves allow them to be quickly separated.

Has the species been reasonably well surveyed? Provide an overview of surveys to date (include surveys of known occurrences and surveys for additional occurrences) and the likelihood of its current known distribution and/or population size being its actual distribution and/or population size. Include comments on potential habitat and surveys that were conducted, but where the species was not present/found.

Yes (see Appendix 3).

4.3. Threats

Identify past, current and future threats indicating whether they are actual or potential. For each threat describe:

a). how and where they impact this species

b). what the effect of the threat(s) has been so far (indicate whether it is known or suspected

c). present supporting information/research

d). does it only affect certain populations?

e). what is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?).

The main threat to *L. catapycnon* has been identified as mining, as the majority of populations occur on mining tenements on substrates and landforms that are prospective for mining. Proposed and existing mining activities involve the broadscale clearing of vegetation for infrastructure development and resource extraction, which includes the removal of plants of *L. catapycnon* and potential disruption of the seed bank.

A total of 26 applications to take plants/samples of *L. catapycnon* have been submitted to the Department for approval by the Minister for the Environment (Appendix 4); all have been approved. Of these, nine were applications to remove plants (and associated seed bank) and the cumulative impact on the species has been the removal of less than 809 individuals.

The main potential threats have been identified as roadworks, as many populations are on or adjacent to frequently graded mining/exploration tracks (Brown et al. 1998), as well as invasion of the introduced species *Acetosa vesicaria* (Ruby Dock), which may prevent establishment of *L. catapycnon* in some areas (Mattiske & Assoc. 1994). It is now recognised that road grading and track construction can increase the number of individuals at a locality.

If possible, provide information threats for each current occurrence/location:

Location	Past threats	Current threats	Potential threats	Management requirements (see section 4.4)
N/A				

Identify and explain why additional biological characteristics particular to the species are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing the survival of the species.

None identified.

4.4. Management

Identify key management documentation for the species e.g. recovery plans, conservation plans, threat abatement plans etc.

Although a Recovery Plan is not required for *L. catapycnon* (Department of the Environment 2008, 2015) and the species was included on the Not Commenced List on 1/11/2009, the 'RTIO (WA) Signficant Species Management Plan' (Rio Tinto 2011) includes *L. catapycnon* and management actions to help protect the species from mining impacts and the 'Karijini National Park Management Plan 1999–2009' (CALM 1999) includes actions to protect the species within the park's boundaries. As a Threatened species, *L. catapycnon* was included as a key flora taxon for assessing cost-benefit recovery actions in the Pilbara by Carwardine et al. (2014).

Other management actions identified (Department of Parks and Wildlife 2015) that relate to the protection of *L. catapycnon* during specific mining projects include: 1) the engagement of Halpern Glick Maunsell (HGM) by BHPBIO in 1997 to prepare a management plan for the species in the Mt Whaleback area; 2) implementation of a 'Rare Flora Protection Zone' and environmental management plan in 2000 as part of Robe's development plan for the West Angelas mine; 3) preparation by Hamersely Iron in 2001 of an environmental management plan for the protection and avoidance of the species during the Tom Price to Yandicoogina powerline project.

Does this species benefit from the management of another species or community? Explain.

No. *Lepidium catapycnon* occurs in similar habitat in the Pilbara to the Threatened species Thryptomene wittweri, but they have not been recorded from the same locations. The distribution of *L. catapycnon* is not known to overlap with any EPBC Act-listed threatened ecological communities. One population consisting of one plant was observed in the PEC 'Weeli Wolli Spring Community' (Priority 1).

During targeted surveys associated with an application to take plants of *L. catapycnon* in order to expand a tailings facility at Tom Price (Naaykens 2014; RTIO 2014) additional populations of the species were located, including a population of 1,248 individuals within and adjacent to 'Tom Price B2-Significant Species Management Area' just south of Mt Nameless; this area (and others locally also containing plants of *L. catapycnon*) are not proposed to be mined at any stage.

How well is the species represented in conservation reserves or covenanted land? Which of these are actively managed for this species? Provide details.

When nominated as Threatened Flora in 1987, *L. catapycnon* was known from only three collections from Wittenoom Gorge and had not been collected from any conservation reserves or covenanted land; however, collections had been made from immediately north and south of the Karijini National Park boundary and the species was thought to potentially exist within it.

In 2006 a collection (G.J. Keighery & B.J. Keighery 808; PERTH 07813139) was made from Karijini National Park, establishing that the species did occur within this conservation reserve. Opportunistic

discovery of a new population and the observation of more plants at the Keighery locality was then made in 2011 by S. van Leeuwen (Department of Parks and Wildlife 2015).

Targeted surveys for *L. catapycnon* within Karijini National Park in 2011 identified eight populations (six new) within the park's boundaries distributed across the park's full extent; these populations supported c. 1,345 plants across 42 point locations (Onshore Environmental 2013). These surveys were not exhaustive and it is very likely that additional populations occur within the park on suitable landforms.

This conservation reserve is not actively managed for *L. catapycnon*.

Are there any management or research recommendations that will assist in the conservation of the species? Provide details.

Long-term population monitoring and ecological studies to obtain specific data on population dynamics, responses to disturbance, and seed bank dynamics would be highly beneficial for ensuring this species' survival in an actively mined landscape. Baseline information on these aspects would help to alleviate concerns regarding significant fluctuations in population size and stability. In light of the large area under mining lease in the Pilbara, a better understanding of the actual distribution of *L. catapycnon* would greatly assist in conserving the species.

4.5. Other

Is there any additional information that is relevant to consideration of the conservation status of this species?

L*epidium catapycnon* has been recognised as a disturbance opportunistic species since 1988 (Mattiske & Assoc. 1994). The suggestion to remove *L. catapycnon* from the Threatened species list was first made in 1991 (Department of Parks and Wildlife 2015) following observations that population sizes fluctuated naturally due to plants being short-lived and germination being stimulated by disturbance under favourable climatic conditions. Since then it has been recommended an additional four times (in 1999, 2005, 2010, 2011; Department of Parks and Wildlife 2015) that *L. catapycnon* be delisted. These recommendations have come both from within the Department (as CALM, DEC and DPaW) and from within industry (RTIO and BHPBIO) based on observations of the species' biology (disturbance opportunist; colonising species; fire-responsive mass germination) and continual discovery of new populations in suitable habitat across its range, including at least eight populations within a conservation reserve (Karijini National Park).

SECTION 5. NOMINATOR

Nominator(s) name(s)	
Organisation(s)	
Address(s)	
Telephone number(s)	
Email(s)	
Date	28/01/2015

If the nomination has been refereed or reviewed by experts, provide their names and contact details.

SECTION 6. REFERENCES

What references or sources did you use to prepare your nomination? Include written material, electronic sources and verbal information. Include full references, address of web pages and the names and contact details of authorities with whom you had verbal communications.

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