

NSW Threatened Species Scientific Committee

Conservation Assessment of *Senecio linearifolius* var. *dangarensis* Belcher ex I.Thomps (Asteraceae)

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Senecio linearifolius var. *dangarensis* Belcher ex I.Thomps (Asteraceae)

Distribution: Endemic to NSW

Current EPBC Act Status: Not listed

Current NSW BC Act Status: Endangered

Proposed listing on NSW BC Act: Delist

Reason for change: Non-genuine change based on new information on the population dynamics of the species and no evidence of continuing decline.

Summary of Conservation Assessment

Senecio linearifolius var. *dangarensis* Belcher ex I.Thomps. was found to be not eligible to be listed as a threatened species in any category under the Act.

In the two previous conservation assessments, infestations of weeds were inferred to be causing habitat decline, in particular Common Prickly Pear, *Opuntia stricta*. Since the 2018 conservation, six years of monitoring has provided new information about population dynamics in relation to natural weather cycles indicating that *S. l.* var. *dangarensis* is a resilient species capable of long-term persistence. There is no evidence that the species was experiencing continuing decline because of weed infestations.

Description and Taxonomy

The NSW Scientific Committee (2005) state that "*Senecio linearifolius* var. *dangarensis* Belcher ex I.Thomps. is an endemic Australian shrub. The species, *Senecio linearifolius* A.Rich., includes eight varieties and occurs in south-eastern Australia. Thompson (2004) described the species as "Aromatic perennials, often weakly shrubby, to 2 m high, glabrous or nearly so except on lower surface of leaves, sometimes glaucous. Stems becoming many-stemmed from base, branching mostly in upper half. Leaves commonly \pm thin to coriaceous, rarely somewhat fleshy; leaves in middle to upper third of stems narrow to very narrow-elliptic, narrow-ovate, lanceolate, or linear, 2-20 cm long, 1-40 mm wide, with l:w ratio c. 1.5-30, undivided; base attenuate, truncate, cordate, or variously auriculate, with auricles divided or not, slightly amplexicaul or not; margin entire, denticulate, dentate or serrate; upper surface glabrous, occasionally sparsely appressed-cobwebby, glabrescent, sometimes sparsely and minutely hispid; lower surface glabrous, or variously cobwebby to woolly, with hairs all fine and \pm appressed or sometimes spreading; secondary and tertiary venation variably distinct. Unit inflorescences of several to many capitula; peduncles finally to c. 15 mm long. Capitula: calycular bracteoles 2-6, 1.5-3.0 mm long; peduncle and margin of bracteole glabrous or cobwebby at anthesis, sometimes glaucous; involucre cylindric to weakly campanulate, 2.5-5.5 mm long, 1.5-3.0 mm diam.; phyllaries 7-12(-14); stereome slightly to moderately convex, usually glabrous. Florets 12-30; ligulate florets 4-8, ligules 3-8 mm long, with nerves commonly 4; disc florets 4.0-5.5 mm long; limb mostly slightly longer than tube. Achenes narrow-obloid or narrow oblong-ellipsoid, 1.3-2.5 mm long, brown, glabrous or with papillose hairs in

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bands, hairs with a l:w ratio of 2-3; carpopodium small, slightly exserted. Pappus 4-6 mm long."

Senecio linearifolius var. *dangarensis* Belcher ex I.Thomps. is distinguished from the other varieties of the species by Thompson (2004) as follows:

"Plants glaucous, in parts strongly so, on stems, lower surface of leaves, peduncles and capitula \pm glabrous. Upper-stem leaves narrow to very narrow-elliptic, with l:w ratio 5-8; base cuneate to broad-cuneate; auricles absent; margin denticulate; lower surface glabrous; secondary venation \pm distinct; tertiary venation distinct. Inflorescences: peduncles glabrous, or rarely cobwebby, at anthesis. Capitula: involucre 3.5-5.0 mm long 2.0-2.8 mm diam.; phyllaries mostly c. 12. Florets 20-31; ligulate florets mostly 7-9; disc florets 13-22. Achenes c. 2.0 mm long, with appressed papillose hairs in bands."

Senecio linearifolius var. *dangarensis* has previously been known as *Senecio* sp. C *sensu* Harden (1992), and *Senecio 'dangarensis'* (a manuscript name that was never published, Thompson pers. comm. in Zimmer 2018)."

Distribution and Abundance

Senecio linearifolius var. *dangarensis* is endemic to NSW. It has a very highly restricted geographic distribution, found only on two basalt peaks: Mt Dangar in Goulburn River National Park (NP) and an unnamed small peak in northern Wollemi NP referred to as 'Woodlands', located southeast of Woodlands Trig (Figure 1 in Appendix II; Bell and Lamrock 2021). The two peaks are separated by approximately 30 km. The site in Wollemi NP was discovered in 2017 by nearby residents (Bell 2017). The extent of *S. l.* var. *dangarensis* was mapped in 2017 and found to occupy 9 ha at Mt Dangar and 4.3 ha at Woodlands (Bell 2017).

No additional sites of *S. l.* var. *dangarensis* have been found despite many surveys. Recent aerial surveys have been conducted of many basalt peaks across central and eastern Goulburn River NP, northern Wollemi NP and Manobalai NR (S. Bell *in litt.* August 2022). The NSW Scientific Committee (2005) state that "Vegetation surveys in the Wollemi (Bell 1998) and Towarri National Parks (Hill *et al.* 2002); the Munghorn Gap (Hill 1999), Manobalai (T. Peake and S. Bell unpublished data), Cedar Brush and Wingen Maid Nature Reserves (Hill *et al.* 2002); on Crown (Bell 1997, Fallding *et al.* 1997, T. Peake and S. Bell unpublished data) and private land (T. Peake unpublished data) in the Hunter Valley have failed to locate any additional populations of the species."

Area of Occupancy and Extent of Occurrence

The Area of Occupancy (AOO) is 8 km² based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2022). The Extent of Occurrence (EOO) is 23 km² based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022). The EOO and AOO were calculated using Kew Geospatial Conservation Assessment Tool (GeoCAT; Bachman *et al.* 2011).

Population Size

The estimated size of the population at Mount Dangar is 10,000 plants and at Woodlands 15,000 plants (11,800 – 23,700 plants), giving a total population size of 25,000 plants (Zimmer 2018). Population size fluctuates widely with the seasons,

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making an accurate estimate difficult (S. Bell pers. comm. August 2018). The Woodlands site supports more plants than Mt Dangar, despite Woodlands being a considerably smaller hill (Bell 2018).

Senecio linearifolius var. *dangarensis* has been monitored at two plots at each of its localities since 2016, recording natural population fluctuations that appear linked to annual rainfall (Figure 2 in Appendix II; Bell and Lamrock 2021). In 2016, there were thousands of plants present at the two known sites, which all but disappeared from the above-ground flora through the 2017-2019 drought. New plants returned through multiple seedling recruitment events after the drought broke in 2020 (Bell 2017, 2018; Bell and Lamrock 2020, 2021; S Bell *in litt.* August 2022). Better post-drought recovery was recorded at Woodlands than at Mt Dangar (Bell and Lamrock 2021). The most recent assessment in 2022, found a continuing increase in numbers at Woodlands, and a slight decline at Mt Dangar (S Bell *in litt.* August 2022). These short-term trends are considered natural population fluctuations.

Ecology

Senecio linearifolius var. *dangarensis* is known from only two basalt cap peaks, which are disjunct in a region dominated by sandstone. It is unknown why this species is restricted to just two basalt peaks when there is apparently ample potential habitat elsewhere in the region (S. Bell *in litt.* August 2022). *S. l.* var. *dangarensis* is not restricted to basalt soils as it grows and germinates freely in a garden setting in non-basalt garden soil on the NSW mid north coast (S. Bell *in litt.* 2018). A study of the dispersal potential of this taxon found no physical impediments that might limit wide dispersal, and it is thought that surrounding vegetation and/or local wind patterns constrain further spread (Mickaill *et al.* 2020).

The NSW Scientific Committee (2005) state *S. l.* var. *dangarensis* “has been recorded growing on an open scree slope (Thompson 2004) and in woodland and rainforest communities on basalt (Hill 1999)”. On Woodlands *S. l.* var. *dangarensis* grows in the Plant Community Type (PCT) Western Hunter Basalt Cap Woodland (3512). On Mt Dangar, the species grows in the PCTs Hunter-Peel Dry Rainforest (3120), Mount Dangar Wattle Scrub (4121), Western Hunter Basalt Cap Woodland (3512) and Western Hunter Rocky Scrub (3784),

Flowering occurs in some individuals as early as seven months post-emergence, but more commonly between 12 and 18 months after germination (Bell and Lamrock 2021). Seedling recruitment events have been recorded when there has been a preceding annual rainfall >70% of the annual average (Bell and Lamrock 2021). Severe drought causes above-ground parts of *S. l.* var. *dangarensis* to die off and appear absent from the vegetation (Bell and Lamrock 2021). When rainfall returns, *S. l.* var. *dangarensis* resprouts from woody stems after partial dieback and many seedlings germinate. As *S. l.* var. *dangarensis* is quick to flower and fruit, the seed bank is continually replenished.

A study of seed ecology by Mackenzie and Auld (2020) found that the seeds of *S. l.* var. *dangarensis* were found to have a high level of fill and viability (~70%), which was found to decline >50% after one year of burial. The magnitude of decline suggests a relatively short-lived seed bank in the absence of regular inputs of new seeds. However, field observations suggest otherwise with seedlings germinating abundantly after a severe three-year drought (S. Bell *in litt.* August 2022). *Senecio linearifolius*

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var. *dangarensis* has remained on Mt Dangar despite numerous major droughts (>3 yrs), since at least 1825, suggesting a much higher resilience in the seed bank than found by Mackenzie and Auld (2020). Mackenzie and Auld (2020) found that fresh and buried seed are apparently non-dormant and have a germination that is strongly temperature dependant, faster and greater in winter and independent of fire cues (Mackenzie and Auld 2020). Germination and emergence was also found to occur at other times given sustained soil moisture. Moisture must remain available over the successive years to prevent desiccation and allow continued growth (Bell and Lamrock 2021). As in some other species of *Senecio* (e.g., *S. macrocarpus*; Davies 2009), fire does not appear to be a necessary stimulant to promote germination.

Senecio species are typically adapted to disturbance, including fire (Lawrence 1985), so it is likely that *S. l.* var. *dangarensis* would respond similarly (Bell 2016). *Senecio linearifolius* var. *dangarensis* response to fire is uncertain, although other related species respond positively to fire (Wapstra *et al.* 2008).

Pollination, seed dispersal and gene flow

Asteraceae species are typically pollinated by many generalist insects (Vanparys *et al.* 2011; Lachmuch *et al.* 2017). Observations of ex situ garden plantings of this species indicate that fertilisation of flowers is readily effected, and there are no limiting factors to pollination (Bell 2016). Hover Flies (possibly *Chrysotoxum* spp.) have been frequently observed visiting flowers and extracting pollen and/or nectar in this garden situation, as well as being recorded at the wild sites (Bell 2017). Observations suggest that flowering and fruiting is prolific throughout most of the year, and germination of seed occurs with no inducement (Bell 2016).

Seeds of *Senecio* are wind dispersed. The seeds are very light and enclosed within a dry, one-seeded fruit called an achene. The achene possesses an apical pappus of slender, predominantly deciduous bristles arranged in a three-dimensional cone-shaped structure which, when fully expanded, aids wind dispersal (Mickaill *et al.* 2020). The achene and pappus are together known as a propagule and its size affects its dispersal ability. The larger the propagule, the faster the settling velocity and vice versa. *Senecio linearifolius* var. *dangarensis* has relatively small propagules, suggesting an ability to spread widely that conflicts with its restricted distribution. Mickaill *et al.* (2020) suggest that the apparently poor dispersal ability of *S. l.* var. *dangarensis* suggests that rare disturbance events, such as wildfire, may be required to open up habitat and encourage successful establishment over a wider area.

Subpopulations

There are two subpopulations of *S. l.* var. *dangarensis*, one on each of the peaks. If one of these localities became extinct then the probability of recolonization is low. Mickaill *et al.* (2020) suggest that it is unlikely (although still plausible) that the subpopulation of *S. l.* var. *dangarensis* present in northern Wollemi National Park was sourced via wind-borne propagules from Mount Dangar (approximately 30 km) under exceptional environmental conditions, such as turbulent and strong winds following a major vegetation structure altering disturbance event like a wildfire.

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Threats

New information based on targeted monitoring over six years has shown there to be no active threats to either of the two known subpopulations, and both are in NPWS reserves (Bell and Lamrock 2021; S Bell *in litt.* August 2022). *Senecio linearifolius* var. *dangarensis* remains at potential risk from stochastic events due to its very highly restricted distribution. However, *S. l.* var. *dangarensis* is considered a very resilient species capable of long persistence; it has been known from Mt Dangar for nearly 200 years without any management intervention prior to the *O. stricta* control (S Bell *in litt.* August 2022).

Stochastic events due to very highly restricted geographic distribution

Senecio linearifolius var. *dangarensis* has a geographic distribution that is restricted to two small areas, 9 ha at Mt Dangar and 4.3 ha at Woodlands, separated by approximately 30 km of mostly cleared agricultural lands. This highly restricted distribution puts it at a potential risk from stochastic events, however, currently no future plausible threat has been identified that is considered likely to drive the taxon near or to extinction.

Weeds

Zimmer (2018) stated that “The most important threat may be *Opuntia stricta*, if it were to increase (S. Bell pers. comm. November 2017). Indeed, *O. stricta* may be already impacting recruitment by limiting available microhabitat (Bell 2017). There is less *Opuntia stricta* at the new Woodlands Trig site, compared to Mt Dangar (Bell 2017).” In contrast, the new understanding that the population dynamics of *S. l.* var. *dangarensis* is related to natural weather cycles indicates that weed infestations, including *O. stricta*, have not been responsible for changes in germination or persistence of the species (S. Bell *in litt.* August 2022, S. Bell *in litt.* November 2022). In addition, in 2017 and 2018, a species of Cochineal (*Dactylopius opuntiae*) was introduced at Mt Dangar as a biological control for *O. stricta* (Bell and Lamrock 2021). The Cochineal population expanded significantly following the release and *Opuntia* biomass declined significantly. By 2021, *O. stricta* was considered to have reached a natural level of stabilization (Bell and Lamrock 2021). Currently, no other species of weeds are considered a threat to this species (S. Bell *in litt.* August 2022).

Herbivory/Grazing

It is unknown whether *S. l.* var. *dangarensis* is threatened by grazing or browsing. Some species of *Senecio* have pyrrolizidine alkaloids and are therefore poisonous to livestock (e.g., *S. madagascarensis*, Gardner *et al.* 2006). It is unknown whether this compound is present in *S. l.* var. *dangarensis*, or whether goats (not recorded at the site but considered a potential threat) are affected similarly to livestock. Introduced herbivores have not been recorded at either locality in six years of monitoring (Bell and Lamrock 2021).

Adverse Fire Regimes

Senecio linearifolius var. *dangarensis* response to fire is uncertain, although other *Senecio* species respond positively to disturbance, including fire (Wapstra *et al.* 2008). The most likely threat from fire would be multiple, short interval fires that could potentially kill mature plants and deplete the seed bank. However, the species' short time to maturity of 7-18 months makes it very unlikely that multiple fires could occur at

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either site at intervals that would prevent seed production. Neither of the two sites has a history of high fire frequency. The known fire history of Mt Dangar area includes a patchy hazard reduction burn in 2010 on the slopes below the mountain, that did not affect the *Senecio* populations, and a burn of the peak in 1958-59 (NPWS Fire History Spatial Layer; S. Bell *in litt.* August 2022). The known fire history of the Woodlands site includes hazard reduction burns in 2003 and 2013 (NPWS Fire History Spatial Layer). Even with climate change projections of larger, more frequent fires after 2050/60 covering the distribution of *S. l. var. dangarensis*, multiple very short-frequency fires are unlikely to occur (Abatzoglou *et al.* 2019; AdaptNSW 2022; Clarke *et al.* 2011; Jones *et al.* 2022).

Lack of fire in the surrounding landscape may restrict successful seed dispersal and establishment of *S. l. var. dangarensis*. *Senecio linearifolius var. dangarensis* is very highly geographically restricted, despite its small seeds having potential for wide dispersal by wind, suggesting that a disturbance to the surrounding vegetation such as fire is needed to open up habitat for successful seed establishment (Mickaill *et al.* 2020).

Climate change impacts on habitat availability

Senecio linearifolius var. dangarensis is restricted to the tops of two peaks of 670-680m elevation, which could suggest some level of adaptation to a relatively cool mountain top climate. However, an ex-situ population of *S. l. var. dangarensis* thrives in a NSW mid-north coast garden, suggesting that even if there is a germination preference for cooler temperatures it is not restricted to cold climates (S. Bell *in litt.* August 2022). The region where *S. l. var. dangarensis* occurs is projected to become hotter and wetter with climate change (AdaptNSW 2022). Increased average rainfall is likely to lead to higher levels of seedling survivorship and may balance out any potential decrease in germination from increased temperatures. Habitat changes from ongoing climate change are not considered a limiting factor to the long-term persistence of *S. l. var. dangarensis*.

Assessment against IUCN Red List criteria

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

Criterion A Population Size reduction

Assessment Outcome: Criterion not met

Justification: Six years of monitoring recorded dramatic declines and increases in the number of individuals of *S. l. var. dangarensis* (Figure 2 in Appendix II; Bell 2017, 2018; Bell and Lamrock 2020, 2021; S Bell *in litt.* August 2022). These changes have been linked to average annual rainfall and are considered natural population fluctuations. As a result, *S. l. var. dangarensis* does not meet this criterion as there is no population decline.

Criterion B Geographic range

Assessment Outcome: Criterion not met

Justification: Both AOO and EOO meet the thresholds for Critically Endangered, with an AOO of 8 km² and EOO of 23 km². The AOO is 8 km² based on 2 x 2 km grid cells, the scale recommended for assessing area of occupancy by IUCN (2022). The EOO

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is 23 km² is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2022). However, *S. l. var. dangarensis* does not meet two of the three conditions that must be met for assessment under this Criterion. It has two locations based on the most serious plausible threat of potential impact (stochastic events due to small population size) but there is no evidence for continuing decline or extreme fluctuations.

In addition to these thresholds, at least two of three other conditions must be met. These conditions are:

- a) The population or habitat is observed or inferred to be severely fragmented or number of locations equals 1(CR), ≤5(EN), ≤10(VU).

Assessment Outcome: Subcriterion met at Endangered

Justification: *Senecio linearifolius* var. *dangarensis* is found at two locations, Mount Dangar and Woodlands. This assessment of number of locations is based on the potential impact of stochastic events due to small population size, the most serious plausible threat.

Senecio linearifolius var. *dangarensis* is not severely fragmented as despite a large, ~30 km separation of subpopulations, each is large enough to support a viable population of *S. l. var. dangarensis*. The numbers of individuals at each of these two locations is estimated to be 10,000 and 15,000 respectively. If one of these locations went extinct then the probability of recolonization is low.

- 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.

Assessment Outcome: Subcriterion not met

Justification: There is no evidence for continuing decline in *S. l. var. dangarensis*. This species was assessed as Endangered under B1ab(iii)+2ab(iii) by Zimmer (2018) with continuing decline inferred in the habitat based on the presence of infestation by Common Prickly Pear *O. stricta*. Changes in the number of mature adults recorded over six years of monitoring include declines, increases and above ground disappearance during severe drought. These changes are considered natural population fluctuations linked to annual rainfall (Bell and Lamrock 2021) and not influenced by the presence of *O. stricta* or other weeds species (*S. Bell in litt.* August 2022, *S. Bell in litt.* November 2022).

- c) Extreme fluctuations.

Assessment Outcome: Data deficient.

Justification: Currently there is no available data to assess the likelihood of extreme fluctuations in *S. l. var. dangarensis*. Extreme fluctuations appear unlikely as *S. l. var. dangarensis* has the capacity to resprout.

Criterion C *Small population size and decline*

Assessment Outcome: Criterion not met.

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Justification: There is an estimated total population of 25,000 for *S. l. var. dangarensis*. To be listed as threatened under Criterion C a species must have <10,000 mature individuals.

Criterion D *Very small or restricted population*

Assessment Outcome: Criterion not met.

Justification: *Senecio linearifolius var. dangarensis* does not meet the threshold for D1 as it has an estimated population size of 25,000. *Senecio linearifolius var. dangarensis* meets the threshold for D2 with AOO of 8 km² and number of locations of 2, however it does not meet this Criterion as there is no plausible threat that could drive the taxon CR or EX in a very short time.

To be listed as Vulnerable under Criterion D, a species must meet at least one of the two following conditions:

D1. Population size estimated to number ≤50 (CR), ≤ 250 (EN), or ≤1,000 (VU) mature individuals.

Assessment Outcome: Criterion not met.

Justification: *Senecio linearifolius var. dangarensis* has an estimated population size of 25,000.

D2. Restricted area of occupancy (typically <20 km²) or number of locations (typically <5) with a plausible future threat that could drive the taxon to CR or EX in a very short time.

Assessment outcome: Criterion not met.

Justification: *Senecio linearifolius var. dangarensis* meets the thresholds for listing under Criterion D2 with an AOO < 20 km² and number of locations ≤ 5. The AOO of *S. l. var. dangarensis* is 8 km² and it occurs at two locations. However, there is no known plausible future threat that could drive this taxon to extinction in a very short time.

Criterion E *Quantitative Analysis*

Assessment outcome: Data Deficient.

Justification: Currently there is not enough data to undertake a quantitative analysis to determine the extinction probability of *S. l. var. dangarensis*.

Conservation and Management Actions

This species is currently listed on the NSW BC Act and a conservation project has been developed by the NSW Department of Planning and Environment under the Saving our Species program. The conservation project identifies priority locations, critical threats and required management actions to ensure the species is extant in the wild in 100 years. *Senecio linearifolius var. dangarensis* sits within the Site-managed species stream of the SoS program and the conservation project can be viewed here: <https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20041#>

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Expert Communications

Stephen Bell, East Coast Flora Survey

Appendix 1

Assessment against *Biodiversity Conservation Regulation 2017* criteria

The Clauses used for assessment are listed below for reference.

Overall Assessment Outcome:

Senecio linearifolius var. *dangarensis* Belcher ex I.Thomps. was found to be not eligible to be listed as a threatened species in any category under the Act.

Clause 4.2 – Reduction in population size of species

(Equivalent to IUCN criterion A)

Assessment Outcome: Not met

(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: Not met

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:			

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	(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:
	(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: Not met

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

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Clause 4.5 - Low total numbers of mature individuals of species

(Equivalent to IUCN criterion D)

Assessment Outcome: Not met

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

Clause 4.6 - Quantitative analysis of extinction probability

(Equivalent to IUCN criterion E)

Assessment Outcome: Data deficient

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

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

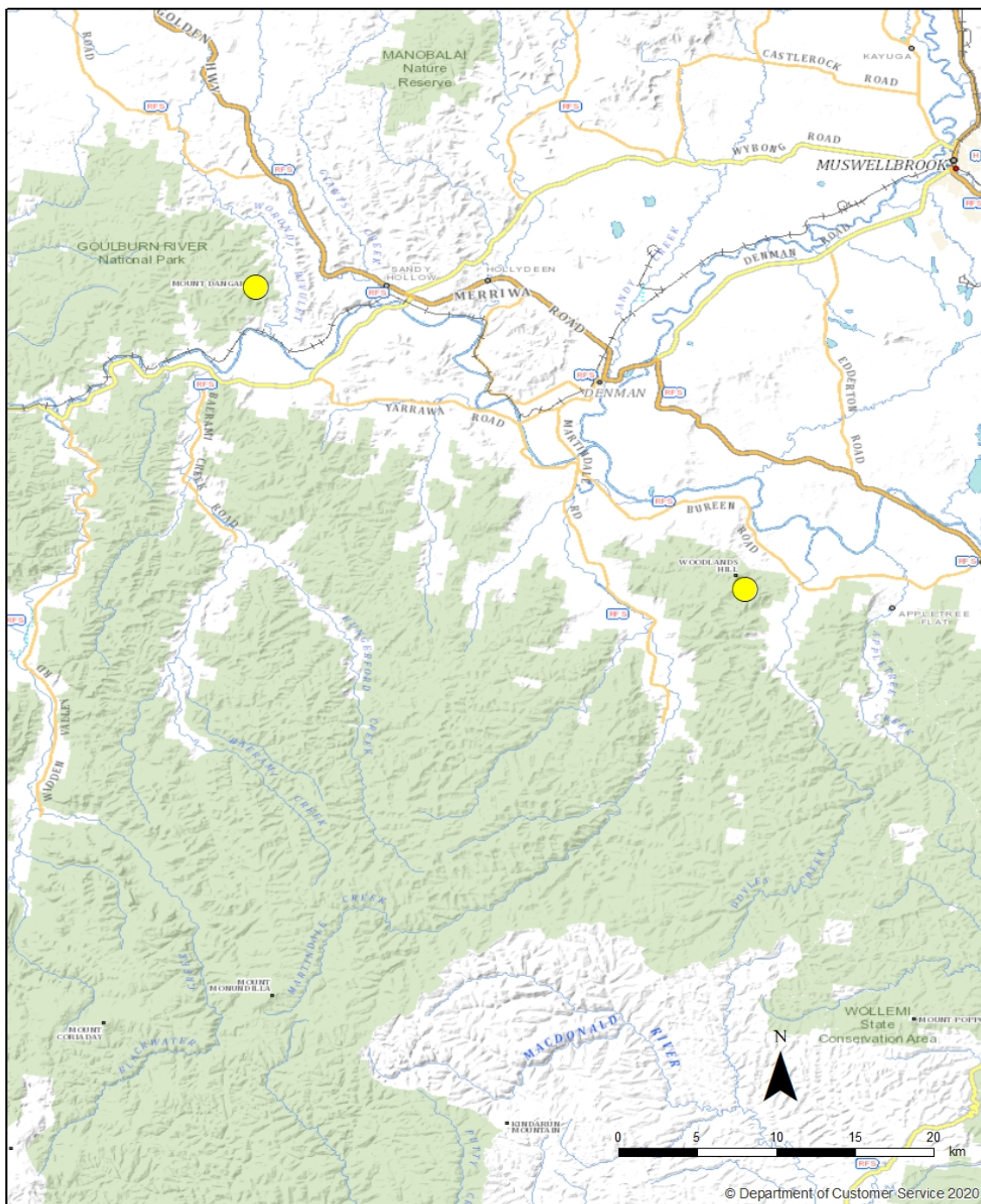
(Equivalent to IUCN criterion D2)

Assessment Outcome: Not met

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

Figure1. Map of the distribution of *Senecio linearifolius* var. *dangarensis*



Distribution of *Senecio linearifolius* var. *dangarensis*

Legend

-  *Senecio linearifolius* var. *dangarensis*

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liability for any act done on the information in the map and any consequences of such act or omissions.

Datum/Projection: GCS GDA 1994

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Figure 2. Change in number of resprouting and seedling individuals of *Senecio linearifolius* var. *dangarensis* within monitoring plots at Mt Dangar (SLD01-02) and Woollands (SLD03-04), October 2016 to May 2021 (Bell and Lamrock 2021)

