

NSW Threatened Species Scientific Committee

Conservation Assessment of *Leionema lamprophyllum* subsp. *fractum*

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***Leionema lamprophyllum* subsp. *fractum* S.A.J.Bell (Rutaceae)**

Distribution: Endemic to NSW

Current EPBC Act Status: not listed

Current NSW BC Act Status: Critically Endangered

Proposed listing on EPBC Act: List as Critically Endangered.

Conservation Advice: *Leionema lamprophyllum* subsp. *fractum*

Summary of Conservation Assessment

Leionema lamprophyllum subsp. *fractum* was found to be eligible for listing as Critically Endangered under Criterion B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v), C2a(i,ii) and D.

The main reasons for this species being eligible are: i) there are less than 50 known mature plants; ii) the species has a very highly restricted geographic distribution (AOO and EOO of 4 km²); iii) decline has occurred at one site (no plants are now known to occur at the site) and may occur at the other site if human visitation impacts worsen or continue; iv) the species is only known from one location.

Description and Taxonomy

Leionema lamprophyllum subsp. *fractum* is described in Bell and Walsh (2015) as a "Shrub to 1.5 m tall. *Branchlets* terete or angular when very young due to leaf decurrencies, prominently glandular-verrucose, densely pilose with simple or 2-8-rayed stellate hairs, leaf-decurrencies moderately- to densely stellate, glabrescent with age; branchlets becoming glabrous with age. *Leaves* alternate. *Petiole* mostly 0.5-1.3 mm long, sparsely stellate-hairy. *Lamina* strongly and pleasantly aromatic when crushed; rhomboidal or obtrullate, 6.0-9.0 mm long, 3.0-5.0 mm wide, glabrous but midrib usually sparsely stellate-hairy at least in the lower half, leaf base shortly attenuate to cuneate, margin usually crenate to dentate with 2-6 blunt teeth or shallow rounded lobes on each side in distal half but sometimes erose, apex obtuse; adaxial surface glossy and prominently glandular punctate, wrinkled on drying, midrib impressed with simple or stellate hairs in lower half, lateral veins not visible; abaxial surface paler and prominently glandular-punctate. *Inflorescences* of 2-4-flowered umbellate cymes in upper axils or terminal, occasionally reduced to a single flower and sometimes the cymes apparently lacking a peduncle. *Peduncle* (0.5-)1.4-3.5 mm long, flattened or angular, prominently glandular-verrucose, moderately to densely stellate-hairy. *Pedicel* 1.5-3.7 mm long, angular and prominently glandular-verrucose, moderately to densely stellate-hairy. *Flower buds* obovoid, yellow to yellowish-green, sometimes with rusty infusions. *Sepals* deltoid, concavo-convex, mostly 0.5-0.8 mm long, glandular-verrucose, margins and lower half prominently but minutely and densely simple- or stellate-haired. *Petals* narrow-elliptic, 2.3-3.1 mm long, white but sometimes with tips pink-infused, caduceus, glandular-punctate on abaxial surface, glabrous, apex inflexed, midrib prominent. *Stamens* shorter than or slightly exceeding petals, filaments slender and terete to flattened, tapering distally, 2.5-3.0 mm long, glabrous; anthers cordate-ovate, mostly 0.4-0.6 mm long, dorsifixed and versatile, pale yellow. *Gynophore* short-cylindrical, 0.3-0.5 mm long, reddish-brown, glabrous, slightly narrower than ovary. *Ovary* sub-spherical to cylindrical, 0.8-1.0 mm long, green, glabrous. *Style* terete, glabrous, 1.5-2.0 mm long, glabrous, gynobasic, usually shorter than stamens. *Fruiting cocci* mostly 1 or 2 (rarely to 4) per flower, spreading, 2.0--4.0 mm long, obliquely ovoid, sparsely glandular-punctate, outer edge minutely apiculate to shortly rostrate, beak 0.5- 1.0 mm long. *Seed* ovoid, 2.0- 2.2 mm long, raphe basal, testa smooth and minutely punctate, glossy black, aril cream-coloured."

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Leionema lamprophyllum subsp. *fractum* was previously considered to be included in *L. lamprophyllum* subsp. *obovatum*, a taxon that occurs in southeastern NSW, predominantly south of the Tidbinbilla Range, and in Victoria (NSW Threatened Species Scientific Committee 2017). It is now considered to be a distinct subspecies (Bell and Walsh 2015). *Leionema lamprophyllum* subsp. *fractum* "differs from its presumed closest relative *L. lamprophyllum* subsp. *obovatum* by the larger, rhomboidal or obtrullate leaves, the crenate to dentate leaf margins, the shortly attenuate to cuneate leaf bases, the densely stellate-hairy calyx and branchlets, and the yellow to yellowish-green flower buds." (Bell and Walsh 2015).

Distribution and Abundance

The NSW Threatened Species Scientific Committee (NSW TSSC) (2017) states that "*Leionema lamprophyllum* subsp. *fractum* is endemic to New South Wales (NSW) and is currently known from a single population near Pokolbin in the Hunter Valley." "It is currently known from the Broken Back Range in Pokolbin State Forest, in the Hunter Valley. It was also known from Munghorn Gap near Mudgee from a single collection in 1986 (Bell and Walsh 2015), but there have been no subsequent records from this location. Searches of the Munghorn Gap area were carried out in August 2015 (Bell and Walsh 2015) and in October 2016 (S. Clarke *in litt.* October 2016) but no individuals could be found. Possible reasons for not relocating the population include that all mature plants may have senesced (the area has not been burnt since 1951), grazing by goats may have impacted on mature plants and seedlings, road maintenance and related disturbances may have impacted on the plants or the population is very small and was missed in the survey. However, a soil seedbank may still be present and may enable regeneration following a disturbance such as fire."

The NSW TSSC (2017) states that "The geographic distribution of *Leionema lamprophyllum* subsp. *fractum* is very highly restricted. The extent of occurrence (EOO) is 4 km² for the known extant population at Broken Back Range or 140 km², if both the Broken Back Range and Munghorn Gap are included. The EOO estimate is based on a minimum convex polygon enclosing all mapped occurrences of the taxon, the method of assessment recommended by IUCN (2016). The area of occupancy (AOO) of the known extant distribution at Broken Back Range is 4 km², equivalent to a single 2 km x 2 km grid square, the scale recommended for assessing AOO by IUCN (2016). If the Munghorn Gap record is included, the taxon would then be estimated to occur in two 2 km x 2 km grid squares, equivalent to an AOO of 8 km²."

The NSW TSSC (2017) states that "The number of mature *Leionema lamprophyllum* subsp. *fractum* individuals is extremely low. Fewer than 50 plants were found when the population was surveyed in 2015. This count included mature, juvenile and seedling plants. Whilst much of the surrounding area was searched, the rocky terrain precludes access to many areas of similar habitat where the taxon may occur."

There is considered to be only 1 location for this species and the only known extant population is threatened by disturbance from campers and environmental and demographic stochasticity.

Ecology

The NSW TSSC (2017) states that "The population of *Leionema lamprophyllum* subsp. *fractum* at Broken Back Range is found on a rocky cliff line at 515 m a.s.l. elevation in sparse heathland to open eucalypt woodland (Bell and Walsh 2015). Common co-occurring species include *Corymbia maculata*, *Eucalyptus sparsifolia*, *Pultenaea spinosa*, *Leptospermum trinervium*, *Acacia parvipinnula*, *Dillwynia sieberi*, *Persoonia linearis*, *Leucopogon muticus*, *Astrotricha* sp. Quorrobolong (S. Lewer 40), *Correa reflexa* var. *reflexa*, *Patersonia sericea*, *Entolasia stricta*, *Cleistochloa rigida*, *Pomax umbellata*, *Lepidosperma gunnii* and *Lomandra confertifolia* subsp. *rubiginosa* (Bell and Walsh 2015). Flowering has been observed in September with fruits maturing in December (Bell and Walsh 2015). The response of *L. lamprophyllum* subsp. *fractum* to fire is unknown but it is thought to be an obligate seeder with the plants killed by fire (S. Bell *in litt.* June 2016) and regeneration from a persistent soil seedbank."

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Threats

The NSW TSSC (2017) states that “threats to *Leionema lamprophyllum* subsp. *fractum* at Broken Back Range appear to be minimal. Since the terrain is rocky, forestry activities are unlikely to impact the taxon and the proximity of the known population to a track does not currently appear to be adversely affecting the plants (Bell and Walsh 2015)”. However, they note that the site has been “occasionally used for camping which appears to have damaged the habitat” (S. Bell *in litt.* November 2017) and this may lead to a decline in the quality of habitat or the number of mature individuals. Further they note that “The potential *L. lamprophyllum* subsp. *fractum* population at Munghorn Gap, is likely to be threatened by an inappropriate fire regime (*i.e.* currently a lack of fire for regeneration), road maintenance activities and associated disturbances and feral goat grazing.”

Leionema lamprophyllum subsp. *fractum* was not burnt in the 2019/2020 fires. However, future adverse fire regimes (e.g. high fire frequency) remain a threat to the species.

Assessment against IUCN Red List criteria

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

Criterion A Population size reduction

Assessment Outcome: Data Deficient.

Justification: There are insufficient data to estimate if there is a reduction in the size of the *Leionema lamprophyllum* subsp. *fractum* population at the Broken Back Range. There may have been decline if the population at Munghorn Gap is considered to be extinct, although there are no historical data available on the size of the population there. However, further survey work following a fire event (that may promote germination from a persistent soil seed bank) would be required before the taxon would be considered to be extinct at that site.

Criterion B Geographic range

Assessment Outcome: Critically Endangered under Criterion B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)

Justification: *Leionema lamprophyllum* subsp. *fractum* has a very highly restricted geographic distribution. The area of occupancy was estimated to be 4 km², based on the species occupying a single 2 km x 2 km grid cell, the spatial scale of assessment recommended by IUCN (2017). The extent of occurrence (EOO) was also 4 km². The EOO is reported as equal to AOO despite the range of the species, measured by a minimum convex polygon containing all the known sites of occurrence, being less than AOO. This is to ensure consistency with the definition of AOO as an area within EOO, following IUCN Guidelines (2017). If the Munghorn Gap site is included, the upper bounds for AOO and EOO are 8 km², and 140 km², respectively.

Both EOO and AOO meet the threshold of Critically Endangered (<100 km² and 10 km² respectively) for lower bounds and AOO also for upper bound.

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 there is 1 (CR), ≤5 (EN) or ≤10 (VU) locations.

Assessment Outcome: Sub criterion met at Critically Endangered threshold.

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Justification: *Leionema lamprophyllum* subsp. *fractum* is known from a single location based on threat of human disturbance to the Broken Back Range population and environmental and demographic stochasticity.

- 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: Sub criterion met for (i,ii,iii,iv,v).

Justification: While threats are minimal, adverse habitat damage by campers can be expected to reduce habitat quality and is likely to continue. These impacts may also directly affect some mature individuals. Decline may also be inferred in the Munghorn Gap population (and hence, in extent of occurrence, area of occupancy and the number of locations or subpopulations), as no plants could be found in the recent survey.

- c) Extreme fluctuations.

Assessment Outcome: Sub criterion not met

Justification: There is no evidence to suggest the species is experiencing extreme fluctuations at present.

Criterion C *Small population size and decline*

Assessment Outcome: Critically Endangered under Criterion C2a(i,ii).

Justification: The total number of mature individuals is less than 50, which meets the threshold for Critically Endangered (<250).

At least one of two additional conditions must be met. These are:

- C1. An observed, estimated or projected continuing decline of at least: 25% in 3 years or 1 generation (whichever is longer) (CE); 20% in 5 years or 2 generations (whichever is longer) (EN); or 10% in 10 years or 3 generations (whichever is longer) (VU).

Assessment Outcome: Data Deficient.

Justification: There are insufficient data to quantify potential declines at present. Decline is inferred for the Munghorn Gap population, as no plants were found in a recent survey in 2016 (S. Clarke *in litt.* October 2016). The only record for this location is from 1986, and the number of plants occurring then was not recorded. Without knowing the previous abundance, it is not possible to determine the percentage decline.

- C2. An observed, estimated, projected or inferred continuing decline in number of mature individuals.

Assessment Outcome: Sub criterion met.

Justification: Decline may be inferred in the Munghorn Gap population, as no plants could be found in the recent survey. While no decline of mature individuals is known at Broken Back Range, decline may be inferred should habitat disturbance at the site continue.

In addition, at least 1 of the following 3 conditions must be met:

- a (i). Number of mature individuals in each subpopulation ≤ 50 (CR); ≤ 250 (EN) or ≤ 1000 (VU).

Assessment Outcome: Sub criterion met at Critically Endangered threshold.

Justification: There is a single subpopulation which consists of less than 50 mature individuals.

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- a (ii). % of mature individuals in one subpopulation is 90-100% (CR); 95-100% (EN) or 100% (VU)

Assessment Outcome: Sub criterion met at Critically Endangered threshold.

Justification: There is a single subpopulation in which all mature individuals occur.

- b. Extreme fluctuations in the number of mature individuals

Assessment Outcome: Data Deficient

Justification: There is no evidence to suggest the species is experiencing extreme fluctuations at present.

Criterion D Very small or restricted population

Assessment Outcome: Critically Endangered under Criterion D.

Justification: The total number of mature individuals is less than 50.

Criterion E Quantitative Analysis

Assessment Outcome: Data Deficient.

Justification: There are insufficient data to quantify the extinction risk for this species.

Conservation and Management Actions

There is a no NSW Saving our Species program for this subspecies and no National Recovery Plan. The following is derived from the threat information.

Habitat loss, disturbance and modification

- Prevent habitat disturbance and adverse impacts from campers at Broken Back Range.
- Prevent adverse disturbance to Munghorn Gap site.

Ex situ conservation

- Develop a targeted seed collection program for *ex situ* seed banking.
- Establish *ex situ* insurance population by propagating from cuttings or seed if possible.
- Continue to explore options for translocation to create back up wild populations.

Stakeholder Management

- Inform NSW Rural Fire Service of known location and fire requirements of the population in the event that they are involved in any fire control activities in the area.
- Should any site be burnt, ensure no further fires occur at the site before recovering plants have time to mature and adequately replenish their soil seed banks.
- Negotiate with landholders to minimise any adverse impacts at Broken Back range site.

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Survey and Monitoring priorities

- Monitoring for increased habitat degradation and any decline in mature plants at Broken Back Range site.
- Regular surveys to determine whether there is a decline in the population.
- Monitoring for individual plant survival and growth and for any recruitment.
- Survey and monitor plants at Munghorn Gap site should a fire occur at the site.

Information and Research priorities

- Research into the seed ecology of the species to determine, germination requirements, dormancy mechanisms and fire response.
- Research into response of juvenile and mature plants to fire, including identifying critical life history stages at which fire should be avoided.
- Research into the time to maturity and how long it may take to re-establish a soil seed bank should a fire occur.
- Subject to the outcomes of the above points, potentially implement an ecological burn to promote germination from a soil seed bank.

References

Bell SAJ, Walsh NG (2015) *Leionema lamprophyllum* subsp. *fractum* (Rutaceae); a new and highly restricted taxon from the Hunter Valley of New South Wales. *Telopea* **18**, 505–512.

IUCN Standards and Petitions Subcommittee (2016) Guidelines for Using the IUCN Red List Categories and Criteria. Version 12. Prepared by the Standards and Petitions Subcommittee.
<http://www.iucnredlist.org/documents/RedListGuidelines.pdf>.

NSW TSSC (NSW Threatened Species Scientific Committee) (2017) *Leionema lamprophyllum* subsp. *fractum* Critically Endangered species listing.
<https://www.environment.nsw.gov.au/resources/threatenedspecies/determinations/FDLeionlampCR.pdf> (accessed 5th March 2019)

Expert Communications

S. Bell – consultant botanist and co-author of the taxon. East Coast Flora Survey. Vegetation Assessment and Mapping. Kotara Fair NSW.

S. Clarke - botanist and contractor for NSW National Parks and Wildlife Service. Searched Munghorn Gap area in September and October 2016.