



Consultation on Species Listing Eligibility and Conservation Actions

Bertya mollissima

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Bertya mollissima* for inclusion on the EPBC Act threatened species list in the Endangered category; and
- 2) the necessary conservation actions for the above species.

The purpose of this consultation document is to elicit additional information to better understand the status of the species and help inform on conservation actions and further planning. As such, the below draft assessment should be considered to be **tentative** as it may change following responses to this consultation process.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing by email to:
species.consultation@environment.gov.au

Please include species scientific name in Subject field.
or by mail to:

The Director
Bushfire Affected Species Assessments Section
Department of Agriculture, Water and the Environment
John Gorton Building, King Edward Terrace
GPO Box 858
Canberra ACT 2601

Responses are required to be submitted by 29 June 2022.

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General background information about listing threatened species

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at: <http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at: <http://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2018.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at: <http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at: <http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the '[Common Assessment Method](#)' (CAM). As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <https://www.awe.gov.au/about/commitment/privacy> .

Information about this consultation process

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

CONSULTATION QUESTIONS FOR *BERTYA MOLLISSIMA*

SECTION A - GENERAL

1. Is the information used to assess the nationally threatened status of the species robust? Have all the underlying assumptions been made explicit? Please provide justification for your response.
2. Can you provide additional data or information relevant to this assessment?
3. Have you been involved in previous state, territory or national assessments of this species? If so, in what capacity?

PART 1 – INFORMATION TO ASSIST LISTING ASSESSMENT

SECTION B DO YOU HAVE ADDITIONAL INFORMATION ON THE ECOLOGY OR BIOLOGY OF THE SPECIES? (If no, skip to section C)

Biological information

4. Can you provide any additional or alternative references, information or estimates on longevity, average life span and generation length?
5. Do you have any additional information on the ecology or biology of the species not in the current advice?

SECTION C ARE YOU AWARE OF THE STATUS OF THE TOTAL NATIONAL POPULATION OF THE SPECIES? (If no, skip to section D)

Population size

6. Has the survey effort for this taxon been adequate to determine its national adult population size? If not, please provide justification for your response.
7. Do you consider the way the population size has been derived to be appropriate? Are there any assumptions and unquantified biases in the estimates? Did the estimates measure relative or absolute abundance? Do you accept the estimate of the total population size of the species? If not, please provide justification for your response.

8. If not, can you provide a further estimate of the current population size of mature adults of the species (national extent)? Please provide supporting justification or other information.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate:

Number of mature individuals is estimated to be in the range of:

☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

SECTION D **ARE YOU AWARE OF TRENDS IN THE OVERALL POPULATION OF THE SPECIES? (If no, skip to section E)**

9. Does the current and predicted rate of decline used in the assessment seem reasonable? Do you consider that the way this estimate has been derived is appropriate? If not, please provide justification of your response.

Evidence of total population size change

10. Are you able to provide an estimate of the total population size during the early 1990s or earlier? Please provide justification for your response.

If, because of uncertainty, you are unable to provide a single number, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of possible species numbers, and also choose the level of confidence you have in this estimate.

Number of mature individuals is estimated to be in the range of:

☐ 1–50 ☐ 51–250 ☐ 251–1000 ☐ >1000 ☐ >10 000

Level of your confidence in this estimate:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on

- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, information suggests this range
- ☐ 95–100% - high level of certainty, information indicates quantity within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

11. Are you able to comment on the extent of decline in the species' total population size over the last approximately 30 to 60 years? Please provide justification for your response.

If, because of uncertainty, you are unable to provide an estimate of decline, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of decline, and also choose the level of confidence you have in this estimated range.

Decline estimated to be in the range of:

- ☐ 1–30% ☐ 31–50% ☐ 51–80% ☐ 81–100% ☐ 90–100%

Level of your confidence in this estimated decline:

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much information to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, suggests this range of decline
- ☐ 95–100% - high level of certainty, information indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data are accurate within this range

12. Please provide (if known) any additional evidence which shows the population is stable, increasing or declining.

SECTION E ARE YOU AWARE OF INFORMATION ON THE TOTAL RANGE OF THE SPECIES? (If no, skip to section F)

Current Distribution/range/extent of occurrence, area of occupancy

13. Does the assessment consider the entire geographic extent and national extent of the species? If not, please provide justification for your response.
14. Has the survey effort for this species been adequate to determine its national distribution? If not, please provide justification for your response.
15. Is the distribution described in the assessment accurate? If not, please provide justification for your response and provide alternate information.
16. Do you agree that the way the current extent of occurrence and/or area of occupancy have been estimated is appropriate? Please provide justification for your response.
17. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of extent of occurrence, and also choose the level of confidence you have in this estimated range.

Current extent of occurrence is estimated to be in the range of:

☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

- ☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on
- ☐ 31–50% - more than a guess, some level of supporting evidence
- ☐ 51–95% - reasonably certain, data suggests this range of decline
- ☐ 95–100% - high level of certainty, data indicates a decline within this range
- ☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of area of occupancy, and also choose the level of confidence you have in this estimated range.

Current area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

SECTION F **ARE YOU AWARE OF TRENDS IN THE TOTAL RANGE OF THE SPECIES? (If no, skip to section G)**

Past Distribution/range/extent of occurrence, area of occupancy

18. Do you consider that the way the historic distribution has been estimated is appropriate? Please provide justification for your response.

19. Can you provide estimates (or if you disagree with the estimates provided, alternative estimates) of the former extent of occurrence and/or area of occupancy?

If, because of uncertainty, you are unable to provide an estimate of past extent of occurrence, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past extent of occurrence, and also choose the level of confidence you have in this estimated range.

Past extent of occurrence is estimated to be in the range of:

☐ <100 km² ☐ 100 – 5 000 km² ☐ 5 001 – 20 000 km² ☐ >20 000 km²

Level of your confidence in this estimated extent of occurrence

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% - high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

If, because of uncertainty, you are unable to provide an estimate of past area of occupancy, you may wish to provide an estimated range. If so, please choose one of the ranges suggested in the table below of ranges of past area of occupancy, and also choose the level of confidence you have in this estimated range:

Past area of occupancy is estimated to be in the range of:

☐ <10 km² ☐ 11 – 500 km² ☐ 501 – 2000 km² ☐ >2000 km²

Level of your confidence in this estimated extent of occurrence:

☐ 0–30% - low level of certainty/ a bit of a guess/ not much data to go on

☐ 31–50% - more than a guess, some level of supporting evidence

☐ 51–95% - reasonably certain, data suggests this range of decline

☐ 95–100% -high level of certainty, data indicates a decline within this range

☐ 99–100% - very high level of certainty, data is accurate within this range

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

SECTION G DO YOU HAVE INFORMATION ON THREATS TO THE SURVIVAL OF THE SPECIES? (If no, skip to section H)

20. Do you consider that all major threats have been identified and described adequately?
21. To what degree are the identified threats likely to impact on the species in the future?
22. Are the threats impacting on different populations equally, or do the threats vary across different populations?
23. Can you provide additional or alternative information on past, current or potential threats that may adversely affect the species at any stage of its life cycle?
24. Can you provide supporting data/justification or other information for your responses to these questions about threats?

SECTION H DO YOU HAVE INFORMATION ON CURRENT OR FUTURE MANAGEMENT FOR THE RECOVERY OF THE SPECIES? (If no, skip to section I)

25. What planning, management and recovery actions are currently in place supporting protection and recovery of the species? To what extent have they been effective?
26. Can you recommend any additional or alternative specific threat abatement or conservation actions that would aid the protection and recovery of the species?
27. Would you recommend translocation (outside of the species' historic range) as a viable option as a conservation action for this species?

**SECTION I DO YOU HAVE INFORMATION ON STAKEHOLDERS IN THE
RECOVERY OF THE SPECIES?**

28. Are you aware of other knowledge (e.g. traditional ecological knowledge) or individuals/groups with knowledge that may help better understand population trends/fluctuations, or critical areas of habitat?
29. Are you aware of any cultural or social importance or use that the species has?
30. What individuals or organisations are currently, or potentially could be, involved in management and recovery of the species?
31. How aware of this species are land managers where the species is found?
32. What level of awareness is there with individuals or organisations around the issues affecting the species?
 - a. Where there is awareness, what are these interests of these individuals/organisations?
 - b. Are there populations or areas of habitat that are particularly important to the community?

PART 3 – ANY OTHER INFORMATION

33. Do you have comments on any other matters relevant to the assessment of this species?



Consultation Document of Listing Eligibility and Conservation Advice for *Bertya mollissima*

***This draft document is being released for consultation on the species
listing eligibility and conservation actions***

The purpose of this consultation document is to elicit additional information to better understand the eligibility of the species for listing and inform conservation actions, further planning and the potential need for a Recovery Plan.

The draft assessment below should therefore be considered **tentative** at this stage, as it may change as a result of responses to this consultation process.

Note: Specific consultation questions relating to the below draft assessment and preliminary determination have been included in the consultation cover paper

This document combines the approved conservation advice and listing assessment for *Bertya mollissima*. It provides a foundation for conservation actions and further planning.



Bertya mollissima © Copyright, Fagg, M. (Australian Plant Image Index)

Conservation status

Bertya mollissima is proposed to be listed in the Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999*

Bertya mollissima was assessed by the Threatened Species Scientific Committee to be eligible for listing under any of the listing criteria as Endangered under criteria 2 and 3. The Committee's assessment is at Attachment A. The Committee's assessment of the species' eligibility against each of the listing criteria is:

- Criterion 1: Insufficient data
- Criterion 2: B2ab(i,ii,iii,iv): Endangered
- Criterion 3: C2a(i): Endangered
- Criterion 4: D: Vulnerable
- Criterion 5: Insufficient data

The main factors that make the species proposed for listing in the Endangered category are: a restricted Area of occupancy (AOO) below 500 km²; a severely fragmented population that occurs at two locations; continuing estimated decline in number of locations and habitat quality; and an estimated low number of mature individuals.

Species can also be listed as threatened under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the [Species Profile and Threat Database](#).

Species information

Taxonomy

Conventionally accepted as *Bertya mollissima* Blakely (1941), family: Euphorbiaceae.

Description

Bertya mollissima is a shrub growing to 3 m tall, completely covered with a medium to dense layer of soft hairs, which they lose with age. The leaves are 5–20 mm long by 2–5 mm wide, dark green on the upper surface and paler on the lower surface, with a prominent midrib. The species have both male and female flowers on the same plant, although can be predominantly male or female. The flowers are shortly pedunculate; male flowers with five small tomentose bracts, two outer ones narrower than the three inner ones; female flowers with two or four bracts. The fruits are oblong in shape, up to 8 mm long by 3.6 mm wide, hairy, and usually single seeded (Halford & Henderson, 2002; PlantNET 2021).

Distribution

Bertya mollissima is endemic to north-eastern New South Wales (NSW) and has been known to occur historically from Mount Kaputar, Warrumbungle and Liverpool Ranges to the Scone and Singleton districts (Halford & Henderson, 2002). The species appears to be most common within Mount Kaputar National Park (NP) and Warrumbungle NP (Halford & Henderson, 2002). Historically, the species was known from at least eight subpopulations (Bionet 2021). However, within the last ~20 years only four subpopulations have been known to be extant: Mount Kaputar summit and Waa Gorge in Mount Kaputar NP, Ukerbarley Aboriginal Area, and Bundella Lookout in Coolah Tops NP (Bionet 2021). As the species occurs in remote locations, it is possible that historical subpopulations are extant and/or that undocumented subpopulations

exist. However, some subpopulations were only observed once in the late 1800s or early 1900s, and with no records since it is possible that the species no longer occurs in these areas. The 2019–20 bushfires encompassed 69 percent of the locations where herbarium specimens have been collected for the species, and 10 percent of the species' modelled distribution (Gallagher et al. 2021). Auld et al. (2020) estimated a maximum of 75 percent of the species' range was burnt in the 2019–20 fires.

Post-fire data on the density of mature individuals are available only for the Mount Kaputar summit subpopulation, where a survey was undertaken in 2020. Pre-fire survey data are unavailable; however, it is estimated that 95 percent of mature individuals were killed by the 2019-20 fires at this site (RBGDT 2020) with only two mature plants surviving and over 100 seedlings observed.

The Waa Gorge subpopulation was not burnt in the 2019-20 bushfire and is believed to still be extant (DPIE 2021; Phillips 2021. pers comm 26 November).

It is possible that there is a subpopulation within the Warrumbungle NP, as the species has historically been found within this area. However, the species has not been collected or observed in the area since 1978 (Halford & Henderson, 2002; Bionet 2021).

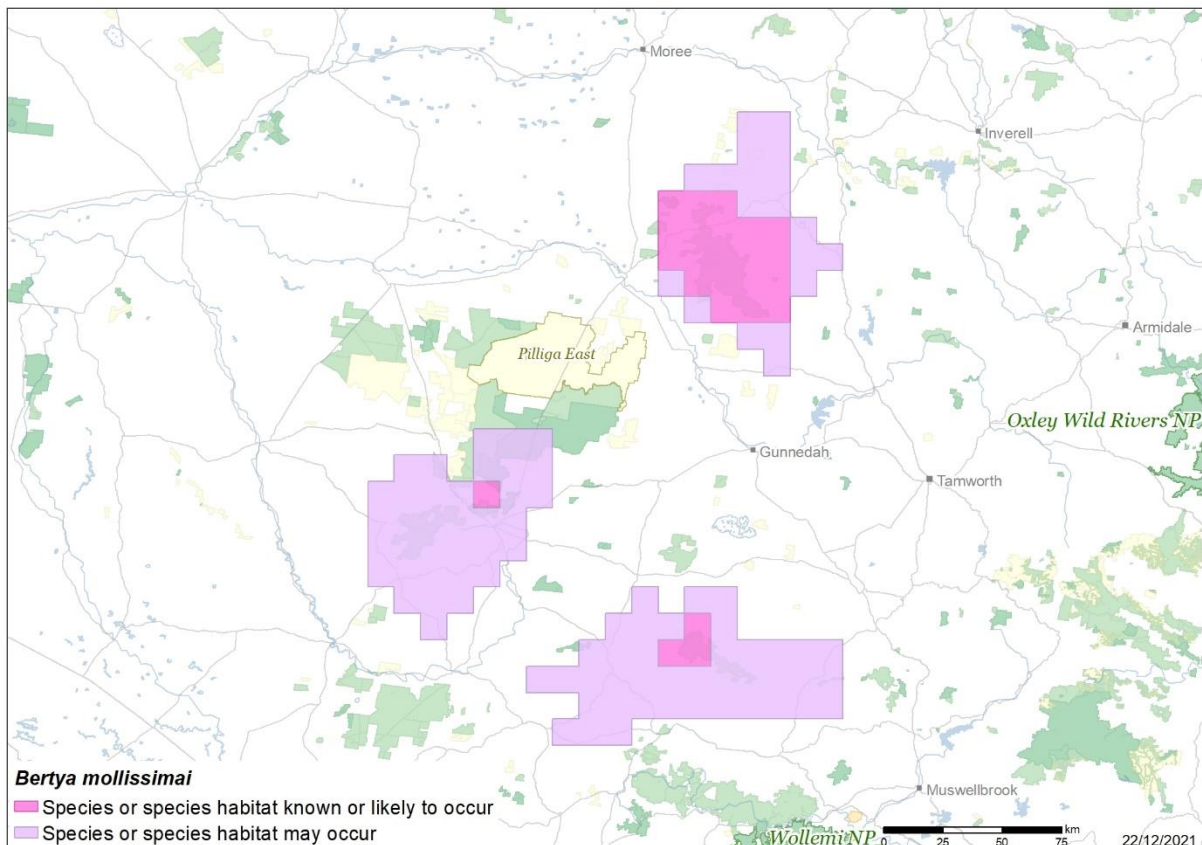
There is insufficient information available to describe the species' distribution in more detail.

Table 1: Details on confirmed subpopulations of *Bertya mollissima*

Subpopulation	Year collected	Abundance	Fire history	Habitat Notes
Mount Kaputar summit, Mount Kaputar NP	1992 1993 1997 2000 2013 2020	Locally frequent Very common Locally occasional	1951-52: wildfire 1957-58: wildfire 1974-75: wildfire 2006-07: wildfire 2019-20: wildfire	Steep rocky slope. Growing in cracks among boulders and scree. Open woodland on basalt rock outcrops.
Waa Gorge, Mount Kaputar NP	2000	Unknown	1937-38: wildfire 1957-58: wildfire 1984-85: wildfire	Soil loam, chocolate brown. No recent evidence of fire. No apparent recent disturbance.
Ukerbarley Aboriginal Area	2002	Unknown	1964-65: wildfire 2010-11: prescribed burn 2019-20: wildfire	White-Box ridge approximately 1km east of creek crossing.
Bundella lookout, Coolah Tops NP	2001	Locally occasional	No documented history of fire	Edge of north facing escarpment. Shallow loamy soil over basalt. Shrubby woodland.

Source: Bionet 2021; DPIE 2021

Map 1 Modelled distribution of *Bertya mollissima*



Source: Base map Geoscience Australia; species distribution data [Species of National Environmental Significance](#) database.

Caveat: The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

Species distribution mapping: The species distribution mapping categories are indicative only and aim to capture (a) the habitat or geographic feature that represents to recent observed locations of the species (known to occur) or habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

Cultural and community significance

The significance of the ecological community, particular species, spiritual and other cultural values are diverse and varied for the many Indigenous peoples that live in the area and care for Country. This section described some examples of this significance but is not intended to be comprehensive or applicable to, or speak for, all Indigenous people. Such knowledge may be only held by Indigenous groups and individuals who are the custodians of this knowledge.

Bertya mollissima occurs on the lands of the Gamilaraay (or Kamilaroi) Nation (NSW NPWS 2002b; 2012; 2021; OEH 2018). The cultural significance of *B. mollissima* is currently undocumented. However, given the acknowledged importance to Aboriginal peoples of Connection to Country and the widespread importance of Caring for Country (which includes biodiversity, 'place', custom and totemic elements), it is considered likely that the species has, or is associated with, some cultural and/or community significance.

Relevant biology and ecology

Habitat

Bertya mollissima grows on steep hillsides and mountain summits in shallow sandy or gravelly soil in rock cracks and among boulders. The species typically occurs within heath or open woodland communities surrounded by *Eucalyptus* spp. between 500 to 1500 m above sea level (Halford & Henderson 2002; PlantNET 2021). Surveys in 2020 of habitat at the Mount Kaputar NP site recorded the area as a rocky mountain summit with *Eucalyptus nobilis* (ribbon gum), *Kunzea ambigua* (tick bush), *Olearia* sp., *Muehlenbackia* sp. 'Mt Norman' and *Pelargonium inodorum*.

Reproductive Ecology and Life History

Little is known about the reproductive ecology of *B. mollissima*. However, other *Bertya* species in northern NSW are wind-pollinated, including *B. opposens* (Coolabah bertya), *B. ingramii* (narrow-leaved bertya) and *B. rosmarinifolia* (Fatemi & Gross 2009; DoEE 2016). As all of these species are found in similar habitats and share morphological traits with *B. mollissima*, it is probable that they also share reproductive traits. The dispersal distance of pollen is unknown for the species. Flowers have been observed on *B. mollissima* from September to December, with fruits in December (Halford & Henderson 2002; PlantNET 2021).

Little is known about the life history of *B. mollissima*. The generation length of *Bertya findlayi* (mountain bertya) is suspected to be 20 to 30 years, the generation length of *Bertya grampiana* (Grampians bertya) is estimated to be 10 to 30 years and the generation length of *Bertya cunninghamii* subsp. *pubiramula* (sticky bertya) is estimated to be 35 to 50 years (DELWP 2021a, b, c), suggesting that *B. mollissima* has a generation length within this timeframe. Age to reproductive maturity in the related Coolabah bertya is inferred to be less than three years based on its fire response (OEH 2020). The exact age to reproductive maturity of *B. mollissima* is unknown, but it is probable that it is similar to that of the Coolabah bertya.

Other *Bertya* species have physically dormant seeds, as indicated by its hard seed coat that requires heat or abrasion to assist with germination (Scott 1997 cited in NSW NPWS 2002a; Scott & Gross 2004; Copeland 2008), and it is probable that *B. mollissima* shares this seed trait. The nature of seed dispersal in the species is unknown, however, post-fire observations at the Mount Kaputar subpopulation found seedlings germinating immediately adjacent to parent material (RGBDT 2020). This may suggest that seed dispersal is limited as some seeds stay in close proximity to the maternal plant, although seed may be moved around the landscape through other dispersal mechanisms.

Observations of *B. mollissima*, as well as those from other *Bertya* species, show that mature individuals are usually killed by fire and germination should occur from a soil seedbank in the months following fire in suitable abiotic conditions (Copeland 2008; RGBDT 2020). Obligate seeder species may be at increased risk of decline when fires recur within the minimum tolerable fire interval, which is defined as the time required for seedlings to reach reproductive maturity. As described above, the time to reproductive maturity for this species, and hence the minimum tolerable fire interval, is probably approximately three years.

Habitat critical to the survival

Bertya mollissima grows on steep hillsides and mountain summits in shallow sandy or gravelly soil, in cracks and among boulders between 500 to 1500 m above sea level. Given that the four subpopulations have a restricted distribution, habitat critical to the survival of *B. mollissima* includes area occupied by all known populations, areas of similar habitat surrounding the subpopulations (as these areas provide potential habitat for pollinators or other biota essential to the continued existence of the species, and enables the movement of pollinators between localities), areas of similar habitat that may contain other individuals or be suitable sites for future conservation translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the taxon. Further research is needed to define habitat critical to the survival of *B. mollissima* (see conservation actions). Until such information is available, all habitat for this species, in and around all known extant and historical subpopulations, should be considered important for the species' long-term survival.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat.

Important populations

In this section, the word 'population' is used to refer to a subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation. Given the restricted distribution and small area of occupancy, every wild population of the species should be considered as an important population of this species under particular pressure of survival and which therefore require protection to support the recovery of the species.

Threats

Bertya mollissima is threatened by inappropriate fire regimes (high frequency fire), trampling by humans, unmanaged (feral) goats (*Capa hircus*), and climate change. These threats may act synergistically, such as the potential for increased seedling herbivory or trampling by feral goats in post-fire environments. Increased erosion due to extreme rainfall events as a result of climate change may deplete the soil seedbank, or placing the remaining seeds at risk of mortality from high-severity fire as the remaining soil may be too shallow to insulate the seeds from extreme heat.

Table 2 Threats

Threats in Table 1 are noted in approximate order of highest to lowest impact, based on available evidence.

Bertya mollissima Conservation Advice

Threat	Status ^a	Evidence
Climate Change		
Changes to temperature and precipitation patterns	<ul style="list-style-type: none"> • Timing: current/future • Confidence: suspected • Likelihood: likely • Consequence: catastrophic • Trend: increasing • Extent: across the entire range 	<p>The CSIRO & Bureau of Meteorology (2015) predicted that eastern Australia will be exposed to increased average temperatures, and increased frequency of droughts due to climate change. Mount Kaputar NP occurs within the New England Tablelands region of NSW, where maximum temperatures are projected to increase by 0.7 – 1°C by 2030 and 1.9 – 2.7°C by 2070 compared to temperatures from 1990 to 2009, with more hot days and fewer cool nights (OEH 2014b). Ukerbarley Aboriginal Area occurs with the Central West and Orana region of NSW, where similar projections of temperature change are made (OEH 2014a). Coolah Tops NP is found on the border of these two regions.</p> <p>Increasing temperature and changing precipitation patterns will likely impact the suitability of currently occupied habitat of <i>B. mollissima</i>. The incidence of moist conditions in high altitude forests like those found on Mount Kaputar are projected to contract under future climates (DECCW, 2010).</p> <p>The long-term impact of more frequent and/or severe drought on <i>B. mollissima</i> is unknown. Assessments of other <i>Bertya</i> species suggest that they may be threatened by climatic drying and warming which act synergistically with inappropriate fire regimes to increase the risk of repeat fire events at intervals below or approaching the tolerable fire interval for the taxon, leading to seedbank depletion, exhaustion and local extinction. Post-fire recruitment and seedling survival may be threatened by drought conditions, which can lead to seedbank depletion, exhaustion and local extinction (Auld et al. 2020; Gallagher et al. 2021). The frequency and intensity of extreme rainfall events and east coast lows are projected to increase under future climates, potentially resulting in increased soil erosion, particularly directly after fire events (Climate Council 2014). <i>Bertya mollissima</i> was assessed as vulnerable to post-fire erosion after the 2019-20 fire season which may result in the loss or depletion of the soil seed bank (DPIE 2020). The species is found in soil deposits between boulders, and erosion of these deposits may result in a depletion of the seedbank and removal of suitable habitat for seedling germination.</p>
Habitat disturbance and modification		
Inappropriate fire regimes	<ul style="list-style-type: none"> • Timing: current/future • Confidence: inferred • Likelihood: likely • Consequence: major • Trend: increasing • Extent: across the entire range 	<p><i>Bertya mollissima</i> is an obligate seeder, and recruits from seed after fires kill mature plants (RBGDT 2020). Keith (1996) identified several fire driven mechanisms of plant population decline and extinction for obligate seeder shrubs. These mechanisms included death of standing plants and seeds, failure of seed release and/or germination, failure of seedling establishment, interruption of maturation or developmental growth, and failure of seed production. Keith (1996) also identified fire regimes associated with multiple mechanisms of plant population decline and extinction, including both high frequency and low frequency fires.</p> <p>As an obligate seeder, <i>B. mollissima</i> requires an appropriate interval between fires to reach</p>

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Threat	Status ^a	Evidence
		<p>reproductive maturity and produce sufficient seed for the next generation whilst not senescing (tolerable fire interval). Little is known about the life history of <i>B. mollissima</i>, however, in the related <i>Coolabah bertya</i> there is a risk of population decline if fires occur more than once every three years and less than once every 20 years (OEH 2020). It is plausible that <i>B. mollissima</i> has similar fire requirements. Determining the required fire interval for the species is a research priority that is needed to inform proper management. However, management strategies should utilise a precautionary approach that ensures ecosystem health does not decline due to fire management practises targeted at this species.</p> <p><i>High fire frequency</i></p> <p><i>Bertya mollissima</i> subpopulations are threatened by a high frequency fire regime that does not allow plants to reach reproductive maturity and replenish the soil seedbank, ultimately leading to a lack of recruitment. However, the juvenile period of <i>B. mollissima</i> is unknown, but reasonably suspected to be ~3 years. Bradstock et al. (1998) found that extinction probabilities in obligate seeder shrubs increased with fire frequency and scale, indicating that too-frequent fire is responsible for extinction more often than too-infrequent fire. Subpopulations may also be threatened by too infrequent fire that leads to the senescence of mature plants and a decline in the seed bank prior to recruitment (Whelan 1995; Bond & van Wilgen 1996). However, this depends on the rate of decay of the soil-stored seedbank, which is currently unknown.</p> <p><i>Fire severity</i></p> <p>The response of obligate seeders to fire severity varies among species (Wright & Fensham 2016; Palmer et al. 2018; Gale & Cary 2021). Many obligate seeding species produce dormant seeds that require high temperatures at short durations to trigger germination (Palmer et al. 2018). However, for this to occur, the seed bank must be heated to a temperature hot enough to trigger germination, without causing seed mortality. Many species have been shown to have significantly higher recruitment in sites exposed to high-severity fire than those exposed to low-severity fire (Palmer et al. 2018; Gale & Cary 2021). However, the shallow soils on which <i>B. mollissima</i> occurs have poor insulating capacity in high severity fires, which may lead to seed mortality. Temperature requirements for seed germination in <i>B. mollissima</i> are unknown, and therefore, the extent to which high or low severity fire threatens the species is also unknown.</p> <p><i>Fire-herbivore interactions</i></p> <p>Browsing of seedlings by feral goats post-fire may be a threat to <i>B. mollissima</i> (see below). Leigh and Holgate (1979), and Leigh et al. (1991) found empirical evidence of strong fire-herbivore interactions suppressing survival, growth and reproduction in a range of forest and woodland understorey plants in temperate and subalpine climates.</p> <p>The 2019-20 bushfires burnt two of the four known subpopulations (DPIE 2021). Recruitment was observed at one of the two sites, however, the second</p>

Threat	Status ^a	Evidence
		<i>has not been surveyed. It is unknown if these sites have been affected by herbivores.</i>
Trampling by humans	<ul style="list-style-type: none"> • Timing: current • Confidence: suspected • Likelihood: possible • Consequence: moderate • Trend: unknown • Extent: across part of the range 	<i>Bertya mollissima</i> seedlings are vulnerable to trampling by humans, as the species occurs on summits and grows in cracks between boulders. The extent of this threat is unknown. However, the Mount Kaputar summit subpopulation occurs within close proximity to the summit lookout and summit walking track.
Invasive species		
Grazing and trampling by feral goats	<ul style="list-style-type: none"> • Status: current • Confidence: suspected • Likelihood: likely • Consequence: moderate • Trend: unknown • Extent: across parts of the range 	<p>Feral goats are considered a threat to <i>B. mollissima</i> (RBGDT 2020). Unlike many other feral herbivores, goats graze on the rocky outcrops and slopes that the species grows on, and are known to occur in the areas surrounding known subpopulations (NSW NPWS 2002b; 2012; 2021). Grazing by herbivores can act to significantly limit recruitment by affecting the establishment of seedlings, which constrains post-fire recovery (Legge et al. 2019).</p> <p>The extent to which feral goats threaten <i>B. mollissima</i> is unknown as only one of the four known subpopulations have been surveyed. Mount Kaputar NP, Coolah Tops NP, and Warrumbungle NP are all known to have feral goat populations present. These populations are culled via aerial and occasional ground shooting (NSW NPWS 2002b; 2012; 2021).</p>

^aTiming—identifies the temporal nature of the threat

Confidence—identifies the nature of the evidence about the impact of the threat on the species

Likelihood—identifies the likelihood of the threat impacting on the whole population or extent of the species

Consequence—identifies the severity of the threat

Trend—identifies the extent to which it will continue to operate on the species

Extent—identifies its spatial context in terms of the range of the species

Categories for likelihood are defined as follows:

Almost certain – expected to occur every year

Likely – expected to occur at least once every five years

Possible – might occur at some time

Unlikely – known to have occurred only a few times

Unknown – currently unknown how often the threat will occur

Categories for consequences are defined as follows:

Not significant – no long-term effect on individuals or populations

Minor – individuals are adversely affected but no effect at population level

Moderate – population recovery stable or declining

Major – population decline is ongoing

Catastrophic – population trajectory close to extinction

Each threat has been described in Table 2 in terms of the extent that it is operating on the species. The risk matrix (Table 3) provides a visual depiction of the level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; the spatial extent, and the efficacy of current management regimes, assuming that management will continue to be applied

appropriately. The risk matrix and ranking of threats has been developed in consultation with experts and using available literature.

Table 3 Risk Matrix

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain					
Likely			Grazing and trampling by feral goats	Changes to temperature and precipitation patterns Inappropriate fire regimes	
Possible			Trampling by humans		
Unlikely					
Unknown					

Risk Matrix legend/Risk rating:

Low Risk	Moderate Risk	High Risk	Very High Risk
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Priority actions have then been developed to manage the threats, particularly where the risk was deemed to be 'very high' (red shading) or 'high' (orange shading).

Conservation and recovery actions

Primary conservation objective

By 2030, the population of *Bertya mollissima* will have increased in abundance and viable subpopulations are sustained in habitats where threats are managed effectively.

Conservation and management priorities

Fire impacts

- Implement a fire management strategy to protect all known subpopulations from fire within three to five years of the previous fire. Exclude planned fire (and bushfire where possible) from all subpopulations until seedlings mature and the soil-stored seed bank is rebuilt. If planned or unplanned fire impacts the subpopulations, managers must ensure that subsequent unplanned fires do not occur within the critical regeneration period to allow the species to rebuild its soil seed bank to sustain the population through the next fire event.
- If required, undertake supplementary watering of post-fire seedlings to protect against drought-induced mortality.

Climate change and severe weather impacts

- Identify and protect habitat likely to remain or become suitable for the species under future climate change scenarios.
- Implement an erosion management strategy to protect all known subpopulations from future severe rainfall events that may negatively impact the seed bank.

Habitat loss, disturbance and modifications impacts

- Ensure that the locations of all subpopulations are recorded on relevant state databases, including those used by land management and fire response agencies.
- Protect subpopulations near tracks from trampling and accidental damage using signage, track markers or fencing.

Invasive species impacts (including from grazing, trampling, predation)

- Install and maintain cages or fencing around subpopulations impacted, or with the possibility to be impacted, by feral goats to protect against grazing, trampling, and habitat disturbance.
- Maintain feral goat population control measures in place in National Parks where *B. mollissima* is found, including through the use of aerial and ground shooting, mustering and trapping (DEWHA 2008).

Ex situ recovery actions

- Collect and store seed from known subpopulations to preserve genetic material.
- Investigate the requirements of the species for ex situ recovery, including the establishment of a seed orchard if current seed collections are limited.
- Identify additional sites suitable for the establishment of new subpopulations through translocation.
- If appropriate, undertake ex situ propagation and translocations in accordance with the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander et al. 2018). Monitor all translocated individuals to maturity, seed set and recruitment to ensure they are viable and are contributing to a reduction in the extinction risk for the species.

Stakeholder engagement/community engagement

- Engage and involve Traditional Owners in conservation actions, including the implementation of Indigenous fire management, surveying for new populations, and management actions.
- As one of the lesser-known subpopulations occurs within the Ukerbarley Aboriginal Area, communication with Traditional Owners should be established with the goal of surveying the subpopulation.
- Liaise with relevant land managers to ensure that subpopulations are not accidentally damaged or destroyed. The approval and assistance of land managers should also be sought to implement recovery actions, and recent population data should inform management.
- Engage community groups by encouraging participation in surveys or monitoring for the species.

- Promote public awareness of biodiversity conservation and protection through dissemination of information through print and digital media.
- Where research identifies potential habitat for the species in areas that are privately-owned, liaise with landholders to provide information on the species and its habitat requirements, and encourage reporting of any sightings.

Survey and monitoring priorities

- Establish and maintain a monitoring program to:
 - monitor species recruitment and plant health after fire events (including the 2019–20 bushfires);
 - determine minimum tolerable fire interval;
 - determine trends in population size;
 - document the post-fire recovery;
 - determine threats and their impacts; and
 - monitor the effectiveness of management actions and the need to adapt them if necessary.
- Survey suitable habitat for new subpopulations and to locate suitable sites for translocations.
- Keep precise fire history records for the habitat and extant subpopulations (confirmed and suspected) of *B. mollissima*.

Information and research priorities

- Investigate the ecological requirements of *B. mollissima* that are relevant to persistence and recruitment, including:
 - population genetic structure, levels of genetic diversity and minimum viable population size.
 - reproductive status, longevity, fecundity, and frequency and size of recruitment events.
 - soil seed bank dynamic, particularly the longevity of seed in the soil seed bank.
 - the effect of drought on mortality rates of the species.
 - pollinator identity, biology and requirements.
- Identify an optimal fire regime for *B. mollissima* by assessing population-level responses to a range of fire regimes and modelling population viability across all fire scenarios.
- Investigate the presence of feral goats and determine which subpopulations are most likely to be impacted.
- Understand the potential influence of climate change on the long-term survival prospects of *B. mollissima*, due to altered temperatures, rainfall patterns, bushfires, and environmental stressors.
- Engage with Indigenous people to understand the cultural significance of *B. mollissima*.

Recovery Plan decision

As an approved, updated, and detailed Conservation Advice for the species would provide sufficient direction to implement priority conservation actions, mitigate against key threats,

enable recovery and provide foundation for further planning, a national Recovery Plan is not required at this time.

Consequently, the Threatened Species Scientific Committee has not recommended that a recovery plan be required (see Attachment A for TSSC recommendations regarding the need for a recovery plan).

Links to relevant implementation documents

[Threat Abatement Plan for competition and land degradation by unmanaged goats](#)

This Conservation Advice is developed to be able to subsequently inform other planning instruments such as a Bioregional Plan or a multi-entity Conservation Plan.

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THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Threatened Species Scientific Committee finalised this assessment on DD Month Year.

Attachment A: Listing Assessment for *Bertya mollissima*

Reason for assessment

This assessment follows prioritisation of a nomination from the TSSC.

Assessment of eligibility for listing

This assessment uses the criteria set out in the [EPBC Regulations](#). The thresholds used correspond with those in the [IUCN Red List criteria](#) except where noted in criterion 4, sub-criterion D2. The IUCN criteria are used by Australian jurisdictions to achieve consistent listing assessments through the Common Assessment Method (CAM).

Key assessment parameters

Table 4 includes the key assessment parameters used in the assessment of eligibility for listing against the criteria. The definition of each of the parameters follows the [Guidelines for Using the IUCN Red List Categories and Criteria](#).

Table 4 Key assessment parameters

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Number of mature individuals	<2500	Unknown	Unknown	<p>Data on population size is available from only one of the sites occupied by <i>B. mollissima</i>. Occurrence records for the species state that the species is 'locally occasional' at other sites however specific data on population size are unavailable at this time, therefore the maximum and minimum values are unknown.</p> <p>The Mount Kaputar subpopulation was burnt in the 2019-20 bushfires. Surveys post-fire found two mature individuals, with >100 seedlings immediately adjacent to parent plants. It is estimated that 95 percent of mature individuals were killed by the fire (RBGDT 2020). Given only two mature plants remained, the pre-fire subpopulation is estimated at 40 mature individuals. The subpopulation on the summit of Mount Kaputar is the only subpopulation to have multiple observation records. This may be because it is the most accessible of all the subpopulations, or that a significant number of individual plants occur at the site. Given this, as well as the low number of mature individuals estimated at the Mount Kaputar summit subpopulation, it is unlikely that other subpopulations would contain significantly more individuals. However, there are insufficient data available to estimate population size at the remaining sites. Therefore, there are insufficient data available to make an exact estimate of population size. However, given the low estimated number of mature individuals before the 2019-20 bushfires, it is considered very likely that the entire population contains <2500 mature individuals.</p>
Trend	Unknown			<p>There are insufficient data available to determine the trend of population size at this time. Two of the four known subpopulations were burnt in the 2019-20 bushfires, with one showing post-fire recruitment. However, the remaining sites are yet to be surveyed.</p>
Generation time (years)	20	10	50	<p>The generation length of <i>B. mollissima</i> is unknown. However, other <i>Bertya</i> species are estimated to have a generation length of 10 to 50 years (DELWP 2021a, b, c). Accordingly, the generation length of <i>B. mollissima</i> is tentatively suggested to be between 10 and 50 years.</p>

Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Extent of occurrence	7672 km ²	7672 km ²	>32,200 km ²	The extent of occurrence (EOO) is estimated at 7672 km ² . This figure is based on the mapping of point records from 2000 to 2021 (Bionet 2021). There were a small number of observations made in the early 1990s, as well as a number of records dating back to the early 1970s. These points were discarded as the majority had only been observed once and given the continuing threats of inappropriate fire regimes, climate change, and herbivory, it is possible that the species no longer persists at these sites. The EOO was calculated using a minimum convex hull, based on the IUCN Red List Guidelines (IUCN 2019). As the species occurs in remote areas, additional subpopulations could exist, which could result in a slightly larger EOO. The maximum plausible value represents the plausible EOO if all historic subpopulations are extant. This figure comes from mapping of point records from all historically recorded observations (Bionet 2021).
Trend	Declining			<i>Bertya mollissima</i> is a rarely observed species. Historically the species was known from at least eight subpopulations. However, within the last 20 years only four of these have been observed. It is unknown how much survey effort there has been. This lack of observations may be due to a lack of sampling effort as the species occurs in remote locations or be the result of subpopulations going extinct. However, given the historical data available, EOO is estimated to be declining.
Area of Occupancy	20 km ²	20 km ²	>60 km ²	The current Area of Occupancy (AOO) is estimated at 20 km ² . This figure is based on the mapping of point records from the last 20 years (Bionet 2021). The historical AOO, using all historically known subpopulations, is 60 km ² . As many of these subpopulations have not been observed in the last 20 years, and some for the last 100 years, it is unknown whether they are extant in those areas. The species occurs in remote areas. Therefore, additional subpopulations may exist, which would increase the AOO.
AOO is a standardised spatial measure of the risk of extinction, that represents the area of suitable habitat known, inferred or projected to be currently occupied by the taxon. It is estimated using a 2 x 2 km grid to enable comparison with the criteria thresholds. The resolution (grid size) that maximizes the correlation between AOO and extinction risk is determined more by the spatial scale of threats than by the spatial scale at which AOO is estimated or shape of the taxon's distribution. It is not a fine-scale estimate of the actual area occupied. In some cases, AOO is the smallest area essential at any stage to the survival of existing populations of a taxon (e.g. breeding sites for migratory species).				

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Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
Trend	Declining			As stated above, <i>B. mollissima</i> has been observed in at least eight subpopulations historically. However, only four have been observed within the last 20 years, although survey effort may have been low in some remote areas. Whether the historically observed subpopulations are extant is unknown. However, given the historical observation data, AOO is inferred to be declining.
Number of subpopulations	4	3	>8	<p>Historically the species was known from at least eight subpopulations (Bionet 2021). However, within the last 20 years it has only been found in four subpopulations. Two of these subpopulations were burnt in the 2019-20 bushfires, with post-fire recruitment being observed at one (Table 1). As the species is an obligate seeder it can be assumed that the second subpopulation has also achieved post-fire recruitment. Based on spatial analysis it appears that the other two known subpopulations were not burnt in the 2019-20 bushfires (DPIE 2021). These subpopulations are assumed extant for the purposes of this assessment.</p> <p>The Mount Kaputar summit subpopulation and the Waa Gorge subpopulation are c. 25 km apart. The species is wind pollinated, therefore, there is a chance that genetic material is being shared between these subpopulations. Little is known about dispersal of the species pollen and whether or not these subpopulations are genetically distinct.</p> <p>The species is known to occur in remote locations on steep hillsides and rocky summits. Therefore, undiscovered subpopulations may exist in unsearched habitat, particularly in the Warrumbungle NP where it was previously observed in 1974 (Halford & Henderson, 2002).</p>
Trend	Declining			<p>Historically at least eight subpopulations have been recorded. However, within the last 20 years only four have been observed. The mechanisms behind this apparent decline in subpopulations is unknown and may be due to lack of sampling effort as the species occurs in remote locations.</p> <p>However, given only four subpopulations have been confirmed to be extant the number of subpopulations is inferred to be declining.</p>
Basis of assessment of subpopulation number	Subpopulations were identified through occurrence records (Bionet 2021). <i>B. mollissima</i> has been recorded from four sites within the last 20 years, the closest two being c. 25 km apart. Although the species is wind pollinated, seed dispersal across this distance is unlikely. Sites with recordings older than 20 years were not included in the estimate.			

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Metric	Estimate used in the assessment	Minimum plausible value	Maximum plausible value	Justification
No. locations	2	1	4	The number of locations is estimated at two. Half of the known subpopulations were impacted by the 2019-20 bushfires, evidence that even distant subpopulations can be affected by a single threat. The minimum plausible value is estimated at one, as the extent of the 2019-20 bushfires has shown that a single threat can cover an area large enough to threaten all known subpopulations.
Trend	Declining			There has been an annual increase in forest area burned in Australia which has been attributed to climate change (Canadell et al. 2021). This increasing trend is projected to continue, putting even distant subpopulations at threat from single bushfire events.
Basis of assessment of location number	The number of locations is estimated at two. Half of the known subpopulations were burnt in the 2019-20 bushfires, evidence that even distant subpopulations can be affected by a singular threat event. With an increasing fire threat due to climate change (Canadell et al. 2021), another event similar to this one occurring within the minimum fire tolerable interval for the species could deplete the seedbank and threaten local extinction at two of the four subpopulations.			
Fragmentation	The population is likely severely fragmented. Each subpopulation is isolated, and although population data are unavailable for the majority of sites it is unlikely that more than 50% of the AOO is in habitat patches that are supporting minimum viable population. The species may be wind pollinated like other members of the genus (Fatemi & Gross 2009), which means that genetic material can more easily flow between subpopulations; however, the closest subpopulations are c. 25 km apart, and pollen movement across this distance is unlikely.			
Fluctuations	It is unknown whether <i>B. mollissima</i> experiences extreme fluctuations.			

Criterion 1 Population size reduction

Reduction in total numbers (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) <i>cannot be used for A3</i>]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>Based on any of the following</p> <ul style="list-style-type: none"> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites 			

Criterion 1 evidence

Insufficient data to determine eligibility

Generation time

The juvenile period of the species is estimated to be approximately 3 years (based on similar *Bertya* species) (OEH 2020). The age structure of senescing individuals is unknown. Generation length is inferred to be between 10 and 50 years, based on the generation length of other *Bertya* species (DELWP 2021a, b, c). This gives an estimated three generation period of between 30 and 150 years.

Population decline

Of the four known subpopulations, only one has current population data available. Post-fire, the Mount Kaputar subpopulation comprised of two mature individuals and over 100 seedlings. The exact number of mature individuals lost during the 2019-20 fires is unknown; however, it is estimated that there was a loss of 95 percent of mature plants (RBGDT 2020). Therefore, it is estimated that the subpopulation contained roughly 40 mature individuals prior to the 2019-20 fires. Pre-fire population data are unavailable for any of the subpopulations, making it impossible to estimate any decline in population over a three-generation period.

Conclusion

There are no robust estimates of population size for any of the subpopulations and it is not possible to determine any population reduction. Therefore, the Committee considers that there

is insufficient information to determine the eligibility of the *B. mollissima* for listing in any category under this criterion.

However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 2 Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy

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

Criterion 2 evidence

Eligible under Criterion 2 B2ab(i,ii,iii,iv) for listing as Endangered

EOO and AOO

Bertya mollissima is known from only four subpopulations. The EOO of the known sites is estimated at 7672 km² and the AOO of known sites is 20 km². The figures for EOO and AOO are based on mapping of point records from 2000 to 2021.

The species' EOO appears to meet the requirements for listing as Vulnerable under B1 (<20,000 km²). The species' AOO appears to meet the requirements for listing as Endangered under B2 (<500 km²).

Severely fragmented and number of locations

Bertya mollissima is likely severely fragmented, as it occurs at isolated sites with specialised habitat and has limited dispersal ability. To be considered severely fragmented, over 50 percent of the AOO must be in small and isolated patches that cannot support a minimum viable population (IUCN 2019). The species may be wind pollinated like other members of the genus (Fatemi & Gross 2009); however, genetic exchange is unlikely as the nearest known subpopulations are c. 25 km apart. Frankham et al. (2014) estimates that 1000 individuals are required as general minimum viable population size for resilience to genetic threats associated

with small populations. There are population data for only one of the four known subpopulations, although it is unlikely that any one subpopulation contains more than 1000 individuals as the site the species is best known from has been recorded with only two mature plants, with over one hundred seedlings after the 2019-20 fires. Although it is possible that other subpopulations contain more individuals than the Mount Kaputar summit subpopulation, it is unlikely that they exceed 1000 individuals. It is therefore likely that the majority (>50 percent) of the AOO of the species is in habitat patches supporting small subpopulations less than a rudimentary estimate of minimum viable population size.

Bertya mollissima is considered to occur at two locations, based on the most plausible serious threat (fire) as per the IUCN Guidelines (IUCN 2019) (Table 3). The 2019-20 bushfires burnt half of the known subpopulations. If a similar fire was to occur (Canadell et al. 2021)), within the minimum tolerable fire interval for the species subpopulations could be subject to local extinction dependent on the size and quality of the seedbank. Therefore, the species meets the threshold for listing as Endangered under sub-criterion (a).

Continuing decline

Extent of Occurrence, Area of Occupancy, number of locations and habitat quality are all inferred to be declining, thereby meeting sub-criterion (b) (i,ii,iii,iv). Habitat quality is likely declining due to grazing and trampling by feral goats, and threatens to decline further due to change to precipitation regimes and the potential for erosion caused by extreme weather events under climate change (Table 2). Continuing decline may also result from interactions between fire and feral goat herbivory, leading to a further loss of seedlings..

Fluctuations

There are no known extreme fluctuations in EOO, AOO, number of subpopulations, locations or mature individuals.

Conclusion

The data presented above appear to demonstrate that the species is eligible for listing as Endangered under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 3 Population size and decline

	Critically Endangered Very low	Endangered Low	Vulnerable Limited
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a) (i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Criterion 3 evidence

Eligible under Criterion C2a(i) as Endangered

There is no current estimate for number of mature individuals. Post-fire observations have only been carried out at one of the four known subpopulations, where only two mature individuals were found. However, *B. mollissima* survives fire by seedling recruitment, and there were >100 seedlings found at the Mount Kaputar subpopulation after the 2019-20 fires. It is estimated that the pre-fire subpopulation contained c. 40 mature individuals (see Criterion 1). The Mount Kaputar summit subpopulation is the most frequently observed, and the only subpopulation to have more than one observation record within the last 20 years. This may be because it is the most accessible of all the subpopulations, or that a significant number of individual plants occur at the site. Although subpopulation numbers at the remaining sites are unknown, it is unlikely that they significantly exceed that of the pre-fire population estimated at Mount Kaputar summit. Therefore, while there are insufficient data available at this time to precisely estimate population size, it is reasonable to infer that it is less than 2500 mature individuals.

There is insufficient evidence available to determine a trend in the number of mature individuals across the population. However, due to the continuing decline in location and habitat quality (see criterion 2), it is plausible to assume that a decline in mature individuals is occurring. Although three of the subpopulations lack population data, it is unlikely that they

significantly exceed that of the estimated pre-fire population at Mount Kaputar summit of 40 mature individuals. It is likely that all of the known subpopulations contain less than 250 mature individuals. Therefore, the species appears eligible for the Endangered category under criterion C2(a)(i). However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4 Number of mature individuals

	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
D. Number of mature individuals	< 50	< 250	< 1,000
D2.¹ Only applies to the Vulnerable category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time			D2. Typically: area of occupancy < 20 km ² or number of locations ≤ 5

¹ The IUCN Red List Criterion D allows for species to be listed as Vulnerable under Criterion D2. The corresponding Criterion 4 in the EPBC Regulations does not currently include the provision for listing a species under D2. As such, a species cannot currently be listed under the EPBC Act under Criterion D2 only. However, assessments may include information relevant to D2. This information will not be considered by the Committee in making its recommendation of the species' eligibility for listing under the EPBC Act, but may assist other jurisdictions to adopt the assessment outcome under the [common assessment method](#).

Criterion 4 evidence

Eligible under Criterion D as Vulnerable

Population data are available for only one of the known subpopulations. However, as the only surveyed population contained 40 mature individuals pre-fire, it is unlikely that the total population contains more than 1000 mature individuals. Therefore, the species appears eligible for listing as Vulnerable under criterion 4. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 5 Quantitative analysis

	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

Criterion 5 evidence

Insufficient data to determine eligibility

Population viability analysis has not been undertaken.

There are insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Adequacy of survey

The survey effort has been considered adequate and there is sufficient scientific evidence to support the assessment.

Public consultation

Notice of the proposed amendment and a consultation document is made available for public comment for a minimum of 30 business days. Any comments received relevant to the survival of the species are considered by the Committee as part of the assessment process.

Listing and Recovery Plan Recommendations

A decision about whether there should be a Recovery Plan for this species has not yet been made. The purpose of this consultation document is to elicit additional information to help inform the decision.

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