



Conservation Advice for *Zieria citriodora* (Lemon-scented Zieria)

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 29 September 2021.

This document provides a foundation for conservation action and further planning.



Photo of *Zieria citriodora* (Lemon-scented Zieria) at Australian National Botanic Gardens © Copyright, Fagg, M. (2000) (from [Australian National Botanic Gardens](#))

Conservation status

Zieria citriodora (Lemon-scented Zieria) is listed in the Vulnerable category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 16 July 2000. The species is eligible for listing because prior to the EPBC Act, it was listed as Vulnerable under the *Endangered Species Protection Act 1992* (Cwth).

The main factors that make the species eligible for listing in the Vulnerable category are low population size and restricted distribution in both Extent of Occurrence and Area of Occupancy.

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, see the [Species Profile and Threats Database](#).

Species information

Taxonomy

Conventionally accepted as *Zieria citriodora* J.A.Armstr.

Description

The Lemon-scented Zieria is a small, procumbent shrub growing to no more than 15 cm high and proliferates from rhizomes (ANBG 2015). Branches are dotted with oil glands: younger branches are covered with a dense covering simple hairs and older branches are glabrescent. Leaves are small, opposite, petiolate (2–4 mm), palmately trifoliate, and the central leaflet is lanceolate or linear, 4–5 mm long and 1.5–1.9 mm wide. Leaves are dotted with oil glands, and have coarse, stiff, long simple hairs on both surfaces. Leaf apexes are rounded to acute, margins are entire, and slightly recurved. Leaves are highly aromatic, smelling strongly of lemon when crushed due to a high content of volatile oil-rich citronellal (Armstrong 2002; VicFlora 2019; ANBG 2015). Inflorescences are longer than the leaves, and have 1–3 small (8 mm in diameter) pale pink to white flowers with four petals (4–6 mm long). Peduncles are usually 4–5 mm long (range of 2.5–9.1 mm), dotted with oil glands and covered in coarse, stiff, long hairs, and pedicels are 3.5–4.5 mm long. Sepals are triangular, 1.5–2 mm long and hairy. Petals are 3–4 mm long, with overlapping edges and have a cover of short, weak hairs. Fruits are hairy and dotted with oil glands and seeds are 2.5–3 mm long, black and striated (Armstrong 2002; VicFlora 2019; DAWE 2020b; PlantNet n.d.).

Distribution

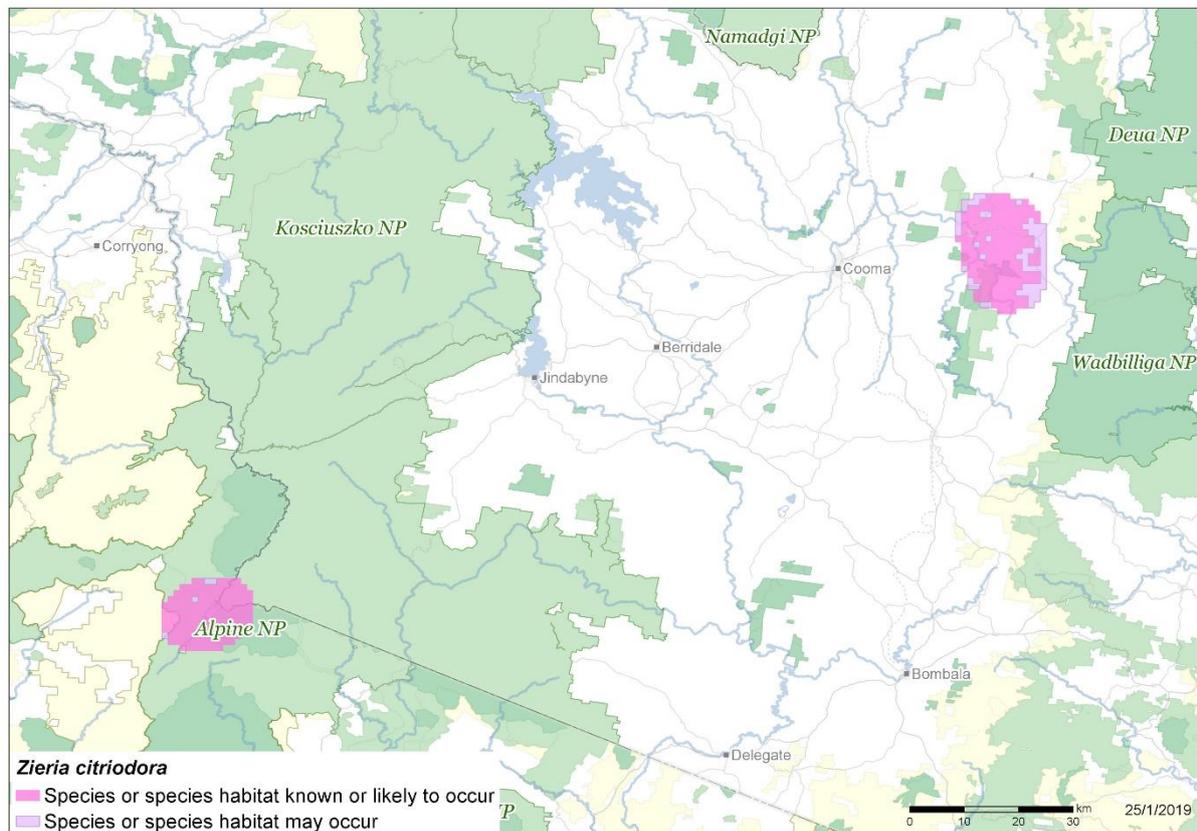
The Lemon-scented Zieria is restricted to a small area of south-eastern Australia where it occurs at three sites. Two subpopulations are located east of Cooma, New South Wales (NSW) in the Kybeyan Range; one near Numeralla (crown land) and the other near Kybean trig (straddling two private properties). A third site, thought to contain four subpopulations, occurs near Omeo in the Alpine National Park, Victoria (Vic) (Briggs & Leigh 1990; DAWE 2020b).

In 1986, the subpopulation near Kybeyan contained 30 plants occupying two ha and the subpopulation near Numeralla contained approximately 150 plants occupying about 15 ha. In 1998, following a wildfire through the area, the NSW National Parks and Wildlife Service monitored the Numeralla subpopulation and recorded 154 mature plants vigorously resprouting from their rootstocks and 109 seedlings (Armstrong 2002). In 2002, the population size within NSW was estimated to be less than 600 individuals (NSW Scientific Committee, 2002a). During the extensive bushfires of 2019/2020, one subpopulation of Lemon-scented Zieria in NSW was impacted. Post-fire monitoring by the Department of Planning, Industry and Environment (DPIE) found 435 resprouting mature plants and 60 seedlings in the fire impacted area which represented approximately 30 percent of the subpopulation at that time (DPIE 2021) population to be approximately 2700 plants in 18 ha of habitat (DPIE 2021).

The four Victorian subpopulations were discovered in 1988 (Briggs & Leigh 1990), totalling about 400 plants in a two ha area about 6 km north-west of Mt Cobberas. In 2000, the population in Vic was reported to consist of 40 plants (DAWE 2020b) and in 2004 contained 260 plants (DSE unpubl. data cited in Sutter 2011). Approximately 50 plants are currently in cultivation at the Australian National Botanic Gardens from cuttings taken from the two known NSW subpopulations and material from the Victorian subpopulation recently sent to the Royal Botanic Gardens in Melbourne (DAWE 2020b; Sutter 2011).

All known subpopulations of the species occur in areas where there has been little land clearing since European settlement and there are no historical records of the species from other sites. It is therefore likely that the Lemon-scented Zieria is naturally rare and appears not to have suffered a major decline since European settlement (Sutter 2011).

Map 1 Modelled distribution of Lemon-scented Zieria



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

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 specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred 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 cultural significance of the Lemon-scented Zieria is not well understood, although eucalypt woodlands, which are habitat for the species, have a long and profound history of occupation and management by Indigenous people.

Relevant biology and ecology

The biology and ecology of the Lemon-scented Zieria is not well understood. Further studies are required to understand its ecological requirements, reproductive strategies, soil seedbank dynamics, longevity, fecundity, recruitment levels, and seed germination requirements.

Habitat ecology

In NSW, the Lemon-scented Zieria grows on moderately steep, generally north to south-west facing slopes near small ephemeral creeks at 800–1000 m altitude. The soils are shallow, gravelly to sandy loams which are highly erodible, overlying decomposed granite or metamorphosed sediments (Briggs & Leigh 1990; Armstrong 2002; ANBG 2015; PlantNet n.d.). The vegetation is low eucalypt woodland with a shrub understorey. The overstorey is dominated by *Eucalyptus mannifera* (Brittle Gum), *E. macrorhyncha* (Red Stringybark) and *E. dives* (Broad-leaved Peppermint). Associated understorey species include *Allocasuarina nana* (Stunted Sheoak), *Banksia canei* (Mountain Banksia), *Brachyloma daphnoides* (Daphne Heath), *Monotoca scoparia* (Prickly Broom-heath), *Leucopogon attenuates* (Grey Beard-heath), *L. fraseri* (Sharp Beard-heath), *L. fletcheri* (Twin-flower Beard-heath), *L. microphyllus* var. *pilibundus* (Hairy Beard-heath), *Platysace lanceolata* (Shrubby Platysace), *Pultenaea procumbens* (Heathy Bush-pea), *Hibbertia obtusifolia* (Hoary guinea flower), *Bossiaea foliosa* (Leafy Bossiaea), *Lomandra longifolia* (Spiny-headed Mat-rush), *Olearia iodochoa* (Violet Daisy-bush), *Poa* spp. and *Acacia* spp. (Briggs & Leigh 1990).

In Vic, the Lemon-scented Zieria grows on open rocky slopes with exposed northern and western aspects with an altitude of 900 m and mean annual rainfall in excess of 1400 mm. The substrates are ignimbrite (Snowy River Volcanics) and Buchan Limestones. Associated flora species consist of an overstorey containing *Eucalyptus rubida* (Candlebark) and an understorey of *Acacia rubida* (Red-stem Wattle), *A. gunnii* (Ploughshare Wattle), *Daviesia latifolia* (Hop Bitter-pea), *Banksia canei* (Mountain Banksia), *Hibbertia obtusifolia* (Hoary Guinea Flower), *Dianella revoluta* (Black-anther Flax-lily) and *Veronica perfoliata* (Digger's Speedwell) (DSE unpubl. data cited in Sutter 2011; Armstrong 2002).

Reproductive biology and ecology

The Lemon-scented Zieria flowers from late winter to summer and fruits in early spring to autumn. Flowers are bisexual, conspicuous and have all floral parts in fours. It possesses functional pollen and is genetically self-compatible and therefore is capable of setting fruit following self-pollination. Dry, dehiscent fruits of Zieria species consist of one to four cocci. At maturity, seeds are ejected forcibly enabling short-range dispersal. Seeds possess an ant-attracting elaiosome, assisting secondary dispersal. Proliferation occurs by rhizomes and stem layering (i.e. layered stems take root when in contact with the soil) as observed in plants at the site near Numeralla (Barrett 2016; Armstrong 2002). The species resprouts following bushfire, as observed at the site near Numeralla in 1998 and 2020 (Armstrong 2002; DPIE 2021).

Habitat critical to the survival

At this point in time there is insufficient information available to describe, with spatial information, areas of habitat that are critical to the survival of the species. Further research is needed to do this (see conservation actions). Until such information is available, all habitat for this species 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 subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation.

At this point in time there is insufficient information available to be able to describe, with spatial information, important populations of this species. Further research is needed to do this, if practicable to do so (see conservation actions). Until such information is available, all populations of this species should be considered important.

Threats

The Lemon-scented Zieria is threatened by fire, browsing by native species, habitat loss, disturbance and modification, climate change, domestic and invasive species as well as the potential for disease introduction. Of particular concern is the increased frequency and intensity of bushfires in south-east Australia. In addition to the potential direct impacts of fire, increased risks of post-fire herbivore impact and weed invasion are likely to further place the species at risk which were observed in post-fire surveys in the Numeralla area (DPIE 2021).

Table 1 Threats impacting Lemon-scented Zieria.

Threat	Status and severity ^a	Evidence
Climate change		
Increased severity and frequency of bushfire	<ul style="list-style-type: none"> • Timing: current • Confidence: inferred • Consequence: major • Trend: increasing • Extent: across the entire range 	<p>Climate change projections show that southern Australia is likely to experience harsher fire weather in the future (CSIRO 2015). While the Lemon-scented Zieria will resprout and germinate following fire, there has been no research to determine the effects of fire on germination or the longevity of the soil seed bank. Fire frequencies are expected to be low at all sites due to the naturally slow accumulation of ground layer biomass, but too frequent fires may exhaust the soil seed bank and the ability of mature plants to resprout after fire (Sutter 2011). Observations of the previously burnt site near Numeralla also suggest that frequent fire may lead to erosion problems, as the plant occurs on relatively erodible sites (OEH 2018).</p> <p>The potential impact of fire on Lemon-scented Zieria is not clear. A bushfire impacted the Numeralla site in early 1998, and subsequent monitoring in August of the same year recorded the species vigorously resprouting from their rootstocks and new seedlings (Armstrong 2002). However, there has been no research to determine the effect of fire on germination from seed (Sutter 2011), or effects of fire severity on mature plants and reproductive success.</p> <p>In 2019-20, following years of drought (DPI 2020), catastrophic bushfire conditions resulted in extensive bushfires across eastern Australia. Initial estimates suggest these bushfires overlapped with approximately 50 percent of the Lemon-scented Zieria distribution (DAWE 2020a). Fire severity varied across the bushfire extent, with many patches burning at extreme severity while others remained unburnt (DPIE 2020). This type of event is increasingly likely to occur as a result of climate change. The Lemon-scented Zieria has been identified as a high priority species, requiring urgent management intervention, following the 2019-20 bushfires (DAWE 2020a). The life-history traits and limited distribution</p>

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		predisposes it to risk of decline or extinction, resulting from high fire severity, post-fire herbivore impacts, weed invasion and cumulative exposure to high risks (DAWE 2020a).
Changes to precipitation and increasing temperatures	<ul style="list-style-type: none"> • Timing: future • Confidence: inferred • Consequence: major • Trend: increasing • Extent: across the entire range 	Climate change projections show that southern Australia's climate will get hotter and drier, with time in drought predicted to increase (CSIRO 2015). Such changes in climate are likely to cause forest decline, with drought stress leading to plant mortality (Choat et al. 2012). While the consequences for the species are currently unknown, they could be severe.
Native species		
Browsing/ grazing	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across part of its range 	Heavy browsing of the Lemon-scented Zieria by native herbivores, particularly wallabies, has been previously observed in both the NSW subpopulations. No browsing in the past had been observed in the Victorian subpopulations (Briggs & Leigh 1990) but current status is unknown. The impacts of grazing are worse in drought conditions for this species (OEH 2018).
Habitat loss, disturbance, and modification		
Habitat clearing and unsuitable land management	<ul style="list-style-type: none"> • Timing: future • Confidence: suspected • Consequence: major • Trend: unknown • Extent: across part of its range 	The NSW subpopulation occurring on private land may be at risk from clearing or management practices in the future. In particular, habitat in the vicinity of the Numeralla subpopulation may be under pressure from rural-residential development (Sutter 2011; OEH 2018). The interest of future landowners in protecting the species is unknown, and there is a risk they would not be sympathetic to the protection of the species (OEH 2018).
Recreational activities such as off-road vehicles and mountain bike riding	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: moderate • Trend: static • Extent: across the entire range 	Off-road vehicles have affected habitat for this species at the Numeralla site (OEH n.d.), with the NSW subpopulations occurring close to vehicle tracks. Soils on which the Lemon-scented Zieria grows are susceptible to damage from vehicles and mountain bike activities which could pose a risk to the long-term viability of wild subpopulations (Sutter 2011; ANBG 2015).
Damage associated with road maintenance	<ul style="list-style-type: none"> • Timing: current • Confidence: suspected • Consequence: moderate • Trend: static • Extent: across part of its range 	The NSW subpopulations occur close to vehicle tracks and there is some risk that grading of tracks may damage nearby plants (Sutter 2011).
Erosion	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: major • Trend: static • Extent: across part of its range 	The NSW sites where the species occur have an inherent high soil erosion risk (DAWE 2020b). There is also an increased risk of soil erosion following bushfires (OEH 2018).
Domestic species		
Browsing/grazing	<ul style="list-style-type: none"> • Timing: historical/ future • Confidence: known/suspected • Consequence: moderate • Trend: unknown 	The subpopulation near Kybeyan has been browsed by domestic stock in the past (Sutter 2011). There is potential that the private land where this subpopulation occurs may be grazed again in the future.

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	<ul style="list-style-type: none"> • Extent: across part of its range 	
Trampling	<ul style="list-style-type: none"> • Timing: historical/future • Confidence: known • Consequence: moderate • Trend: unknown • Extent: across part of its range 	Soils on which the Lemon-scented Zieria grows are susceptible to degradation from trampling by domestic stock. Such activities pose a risk to the long-term viability of wild subpopulations (ANBG 2015). There is potential that the private land where a subpopulation occurs may be grazed again in the future and as such could be subject to impacts of trampling.
Invasive species		
Unmanaged goats (<i>Capra hircus</i>)	<ul style="list-style-type: none"> • Timing: current • Confidence: known • Consequence: moderate • Trend: increasing • Extent: across part of its range 	Unmanaged goats have increased to high numbers in parts of the species' range and are causing degradation of habitat and trampling of plants (ANBG 2015; OEH 2018). Competition and land degradation by unmanaged goats is listed as a Key Threatening Process under the EPBC Act (DEWHA 2008).
Weed invasion	<ul style="list-style-type: none"> • Timing: current • Confidence: suspected • Consequence: major • Trend: unknown • Extent: across the entire range 	<p>Weed invasions of natural ecosystems are among the greatest environmental threats now facing temperate Australia (ANBG n.d.). Particularly invasive weeds have the capacity to alter ecosystems and therefore habitat suitability for native species as well as directly outcompeting native plants. Although there are no known weeds currently threatening subpopulations of Lemon-scented Zieria, weed invasion is an ongoing threat that should be monitored (DPIE 2021).</p> <p>Further, fire may provide opportunities for growth of existing exotic plant species, entry of these species into burnt areas of vegetation (particularly where the weed sources are within or proximal to burnt areas), and incursions of new weed species. This could result in impacts to native species through competition (DAWE 2020a). Preliminary assessment following the 2019-20 bushfires assessed the Lemon-scented Zieria as having low likelihood of significant weed impacts post-fire (DAWE 2020a).</p>
Disease		
Phytophthora dieback caused by root-rot fungus (<i>Phytophthora cinnamomi</i> and other <i>Phytophthora</i> spp.)	<ul style="list-style-type: none"> • Timing: future • Confidence: suspected • Consequence: major • Trend: unknown • Extent: across the entire range 	<p>While not currently impacted by any major diseases (ANBG 2015), it may become susceptible to spreading or new diseases.</p> <p><i>Phytophthora cinnamomi</i> is an introduced soil-borne pathogen, which infects a large range of plant species and may contribute to plant death when other stresses are present, such as waterlogging, drought and bushfire (DEE 2018). <i>Phytophthora cinnamomi</i> can disperse in water flowing from roots of infected plants to roots of healthy plants and mud clinging to vehicles, animals, and walkers (DEE 2018). Dieback caused by <i>P. cinnamomi</i> is listed as a Key Threatening Process under the EPBC Act (DEE 2018).</p> <p>While the disease is currently not in the vicinity of habitat for the Lemon-scented Zieria, there is the potential for future introduction of the disease. Other Zieria species occurring in NSW are at risk of adverse effects from <i>P. cinnamomi</i> through either direct infestation or habitat degradation (NSW Scientific Committee 2002b).</p>

Timing—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

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

Extent—identify its spatial content in terms of the range of the species.

Each threat in Table 1 has been described in terms of the extent that it is operating on the species. The risk matrix (Table 1) 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: the life stage they affect; the duration of the impact; 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 1 Lemon-scented Zieria risk matrix.

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Moderate risk	Very high risk Unmanaged goats	Very high risk Changes to precipitation and increasing temperatures	Very high risk
Likely	Low risk	Moderate risk	High risk	Very high risk Increased severity and frequency of bushfire Browsing/ grazing by native herbivores Erosion Weed invasion	Very high risk
Possible	Low risk	Moderate risk	High risk Recreational activities Road maintenance Browsing/ grazing and trampling by domestic animals	Very high risk Phytophthora dieback	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Very high risk
Unknown	Low risk	Low risk	Moderate risk	High risk Habitat clearing and unsuitable land management	Very high risk

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be 'very high' or 'high'.

Conservation and recovery actions

Primary conservation objective

By 2030, the population of Lemon-scented Zieria will have increased in abundance and viable subpopulations are sustained in habitats which are managed for ongoing threats.

Conservation and management priorities

Climate change and bushfire

- Survey known subpopulations to monitor ongoing impacts from bushfires.
- Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigation measures in bushfire risk management plan/s, risk register and/or operation maps.
- Avoid any use of fire for management or research and other activities that impact upon the persistence of the subpopulation unless there is evidence to show the impact would be positive and without enduring effect on the species persistence.
- Develop and implement a fire management strategy that optimises the survival of the Lemon-scented Zieria during planned burns and bushfires:
 - Fire regimes must be managed so that they do not disrupt the life cycle of the Lemon-scented Zieria, that they support rather than degrade the habitat necessary to the threatened species, that they do not promote invasion of exotic species, and that they do not increase impacts of grazing.
 - Physical damage to the habitat and individual Lemon-scented Zieria plants must be avoided during and after fire operations.
 - Avoid the use of fire retardants, fire-fighting foams during fire operations.
- Ongoing management actions to be informed by outcomes of monitoring and research priorities.

Impacts from native species

- Extent and effects of browsing on Lemon-scented Zieria monitored at all sites and appropriate culling of herbivores or fencing of sites undertaken if necessary (Briggs & Leigh 1990; OEH n.d.). Continue fencing of sites as deemed required (OEH n.d.; DPIE 2021). Fenced areas require monitoring of vegetation biomass to ensure it does not become a fire hazard or reduce diversity of native species by eliminating growth opportunities.

Habitat loss, disturbance, and modifications

- Ensure land managers are aware of the species' occurrence and provide protection measures against known and potential threats.
 - Establish informal agreements with the landholder of the site near Numeralla to protect the Lemon-scented Zieria and to allow the NSW Government to implement the Saving our Species strategy (OEH n.d.).
 - Increase protection for the subpopulation at the site near Numeralla through legislation and/or management avenues, including consideration for a formal reserve if appropriate (Sutter 2011).

- Formally protect the subpopulation near Kybeyan Trig occurring on private land, either by acquisition as a reserve, a Voluntary Conservation Agreement, or an Incentives Property Vegetation Plan (Briggs & Leigh 1990; Sutter 2011).
- Install barriers (logs, rocks, or fence) at unfenced NSW sites to prevent vehicles (and bikes if necessary) accessing the site (OEH n.d.; OEH 2018).
- Install field markers to avoid damage to subpopulations.
- Ensure that local government bodies consider the Lemon-scented Zieria in development proposals in suitable habitat (OEH 2018).

Impacts from domestic animals

- Establish informal agreements with the landholders of the NSW sites regarding management, including elimination of stock from habitat via fencing if necessary (OEH 2018).

Invasive species

- Cull feral goats at NSW sites where they pose a threat (OEH n.d.).
- When undertaking species monitoring, inspect plants for signs of browsing damage likely to be attributable to goats and for goat scats at or near the site (OEH 2020).
- Identify and control problem weeds where required at all sites using appropriate methods. Consider the possible disturbance and off target threats associated with the control method.
- Implement suitable weed hygiene protocols when undertaking survey, monitoring and management activities. Refer to the *Arrive Clean, Leave Clean Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems* (Department of the Environment 2015).

Disease

- Establish susceptibility of the Lemon-scented Zieria to *Phytophthora cinnamomi*.
- Ensure appropriate hygiene protocols are adhered to when entering or exiting sites for survey, monitoring or management such as those outlined in the aforementioned guidelines.
- Implement a *P. cinnamomi* management plan to ensure it is not introduced into known sites of the Lemon-scented Zieria.

Seed collection, propagation, and other ex situ recovery actions

- Collect seed from all natural subpopulations for storage at appropriate seed bank(s) and determine seed viability (OEH n.d.; Sutter 2011). Best practice seed storage guidelines and procedures should be adhered to, to maximise seed viability and germinability.
- Maintain plants in cultivation (at least 30 mature plants from seed/cuttings) to provide a research subpopulation and potentially a source of plants for reintroductions (Sutter 2011).
- Any translocation, either for ex-situ subpopulations or reintroductions, should be conducted in accordance with the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander et al. 2018).

Stakeholder engagement/community engagement

- Liaise with landholder of the site near Kybeyan Trig to increase awareness of the location of the plant and encourage management practices that help protect it (OEH n.d.).
- Update landholders on the progress of recovery actions and address any questions/concerns they may raise (OEH n.d.).
- Identify and implement opportunities for community involvement in the conservation of the Lemon-scented Zieria (Sutter 2011).
- Engage and involve Traditional Owners in conservation actions, including the implementation of Indigenous fire management and other survey, monitoring and management actions.
- Prepare a management strategy with input from local experts.

Survey and monitoring priorities

- Continue to implement the current monitoring program established by DPIE (between October-December when in flower) to understand abundance, extent, and condition on all sites. This should include identification and control of any threats, and response against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data (Sutter 2011; OEH n.d.).
- Survey known subpopulations to understand impacts of the 2019-20 bushfires and continued monitoring to better understand any ongoing impacts of fire.
- Monitor the size, structure and reproductive status of subpopulations at different stages in the fire cycle, taking opportunities to monitor after planned and unplanned fires (where they occur) and improve understanding of the fire response of the Lemon-scented Zieria.
- Identify and survey potential habitat using ecological and bioclimatic information that may indicate habitat preference, including the development and testing of a predictive model for potential habitat (Sutter 2011; OEH n.d.).
- Adapt, add, or remove management actions over time in response to monitoring results.

Information and research priorities

- Investigate the ecological requirements of the Lemon-scented Zieria that are relevant to persistence, including:
 - define habitat requirements and identify habitat critical to the survival of the species
 - evaluate current reproductive status, seed bank status, longevity, fecundity, and recruitment levels for all subpopulations
 - quantify reproductive ecology, regenerative potential, and seed bank potential for all subpopulations
 - identify key stimuli for seed germination requirements
 - identify management strategies to maintain, enhance or restore processes fundamental to reproduction and survival
 - investigate response to fire and prepare and implement fire management prescriptions at all sites

- determine subpopulation growth rates and complete a Population Viability Analysis for all subpopulations
- identify important populations of the species.

Links to relevant implementation documents

[National Recovery Plan for the Lemon-scented Zieria *Zieria citriodora* \(2010\)](#)

[NSW: Lemon Zieria – profile](#)

[NSW: Saving our Species Strategy](#)

[Threat abatement plan for competition and land degradation by unmanaged goats \(2008\)](#)

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