



***Ceratocephala pungens* – a conservation management report for the Plant Species on the Brink programme for the 2023-24 growing season**

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s9(2)(a)

May 2024

Background

Garnock-Jones (1984) named *Ceratocephala* [*Ceratocephalus*] *pungens* (hereafter *Ceratocephala*) as an endemic New Zealand species of “dry sheep-land” of Mackenzie Basin and Central Otago. The first specimen of *Ceratocephala* collected in New Zealand was gathered by D. Petrie at Bald Hill Flat (Flat Top Hill), Central Otago, in 1885. Specimens of Petrie's collection are at AK, CHR, K and WELT. The Bald Hill Flat collection is the holotype: “Bald Hill Flat, 2000 ft., D. Petrie Nov. 1885, CHR 3438”.

Along with other spring annuals, the biogeography, ecology and conservation status of *Ceratocephala* (Threatened – Nationally Critical, de Lange et al. 2018) was a priority research topic in the 1990s and 2000s (Rogers et al. 2002, 2005; Rogers & Overton 2007; Wood & Walker 2008). A major concluding hypothesis from autecological research was the role of sheep and rabbits in habitat mediation, perhaps as surrogates of ground disturbance and nutrient embellishment of the species' habitat by birds in pre-human times. (Appendix 1 contains the Abstract of Rogers & Overton (2007)). Wood & Walker (2008) confirmed that *Ceratocephala* is native to New Zealand by recording subfossil seeds, as was suggested by Garnock-Jones (1984) when he named the species, despite the extremely disjunct distribution of the genus (New Zealand, Australia and Eurasia).

The species' conservation value also aided land protection initiatives by Crown environmental agencies in the late 20th and early 21st centuries using covenanting, tenure review of pastoral leases and purchase of privately-owned land. For instance, the spring annual flora of Flat Top Hill contributed to the case for land purchase by DOC in the 1990s. However, the accompanying land use paradigm following almost all the land protection of dryland reserves has been to exclude or limit grazing by vertebrate herbivores. A meta-population analysis of the species conservation status using Plant Species On The Brink (PSOTB) resources is timely after c. 15–20 years of accumulating

botanical and ecological knowledge of the species, particularly the species’ response to land use changes accompanying land protection.

Scope of work (Contract tasks)

- Out of scope
- Select representative Central Otago sites to revisit this spring for assessing modern population states in relation to historical land use changes. A cautionary caveat for this activity is the species’ highly variable inter-annual presence (Rogers & Overton 2007).
- Compile an inventory of past records for the species’ entire range in Central Otago and . This data will be a combination of qualitative and quantitative, utilising past records and complimented with anecdotal accounts from other botanists and DOC staff with complementary knowledge.
- Compile a summary report, including recommending a draft biogeographic framework for a sustainable future conservation engagement for the species in Central Otago

Methods

1. Firstly, I have tabulated all the CHR and WELT herbarium voucher data available at the commencement in 1996 of my spring annual research project (Table 1).
2. Next, I have collated all the *Ceratocephala* biogeographic data accumulated in the course of my subsequent research into our spring annual flora. I also canvased other botanists familiar with *Ceratocephala*, particularly s9(2)(a), s9(2)(a), John Barkla and s9(2)(a) seeking their knowledge and data of the species. This aggregate knowledge and data, plus that from numerous 2023 site visits undertaken during the present study are arranged under the primary regional division of: Out of scope 2) Central Otago.

Results

Firstly, I tabulated the voucher specimens for *Ceratocephala* before 1996 in both CHR and WELT to gain a biogeographic perspective of its recorded status prior to the last three decades of autecological research and land protection for the species. In Central Otago, the species’ recorded biogeographic stronghold was around Alexandra. Also, there are imprecise records from the Dunstan Mountains and the Carrick Range. Out of scope

CHR #	Location	Habitat	Collector	Altitude	Grid	Date	Remarks
418456	s9(2)(a)	SE-facing gentle slopes, silty soil	s9(2)	1200'	s6(c)	17-10-84	Frost heave on treads of terracettes. Bare patches in depleted grassland with <i>Aphanes</i> , <i>Myosurus nz</i> , common & fruiting; not found in 1999 by GMR
418461	s9(2)(a)	Fine soil beside track	s9(2)	1800'	s6(c)	17-10-84	Common & fruiting

	s9(2)(a)						
480322	Conroys Rd	Flattish ground, seasonally moist	s9(2)(a)	300m		10/92	Flowering early Sept and Oct, the population along with <i>Myosurus</i> covered an area of 1000m squared. Dom <i>Erodium</i> sp., <i>Poa manitoto</i> , <i>Myosurus</i>
48442	Dunstan Mountains		s9(2)(a)	1650'	s6(c)	12-10-44	
418465	Out of scope	Side track in grassland, fine soil	s9(2)(a)	1600'	Out of scope	18-10-84	One plant only and fruiting
418468	Out of scope	Depleted hillside	s9(2)(a)	1500'	Out of scope		One plant only and fruiting
471895	Flat Top Hill, Alexandra		s9(2)(a)		s6(c)	9-9-91	
473243	Flat Top Hill	Gentle hillslopes of partly bare gravel/silty soil in full sun	s9(2)(a)	400m	s6(c)	19-9-91	Small plants with single flowers from the harshest gravelly sites; larger specimens from deeper silt soils seemingly more moist and fertile
510518	NE Alexandra and SE Chatto Creek, Manuherikea		s9(2)(a)	180m	s6(c)	28-9-93	
156575	Fruitlands near Alexandra	Depleted tussockland on scabweed	s9(2)(a)	700-800'	s6(c)	7-10-52	Early collections were as <i>Ran falcatus</i>
474619	Dunstan Gorge, Otago	Cushionfield on terrace bare patches between cushions and other herbs	s9(2)(a)	245m	s6(c)	30-9-91	Past flowering; site to be flooded by Lake Dunstan; dom <i>Raoulia australis</i> , <i>Sedum acre</i> , <i>Myosurus minimus</i> , <i>Aphanes</i> , <i>Eschscholzia californica</i>
79365	Above Shephards Creek, Carrick Range	Dry sunny hillside	s9(2)(a)	2000' approx.	s6(c)		

Out of scope

WELT #	Location	Habitat	Collector	Altitude	Grid	Date	Remarks
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61962	Bald Hill Flat, Clutha River		s9(2)(a)				
78170	s9(2)(a) [REDACTED] [REDACTED] [REDACTED]	10m either side of gate	s9(2)(a) [REDACTED]	800'	s6(c) [REDACTED]	17-10-84	Fine soil beside track

Table 1. Collation of voucher data for *Ceratocephala* before 1996 in both CHR and WELT.

Out of scope

CT

RE

Out of scope



RE

Out of scope



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Out of scope



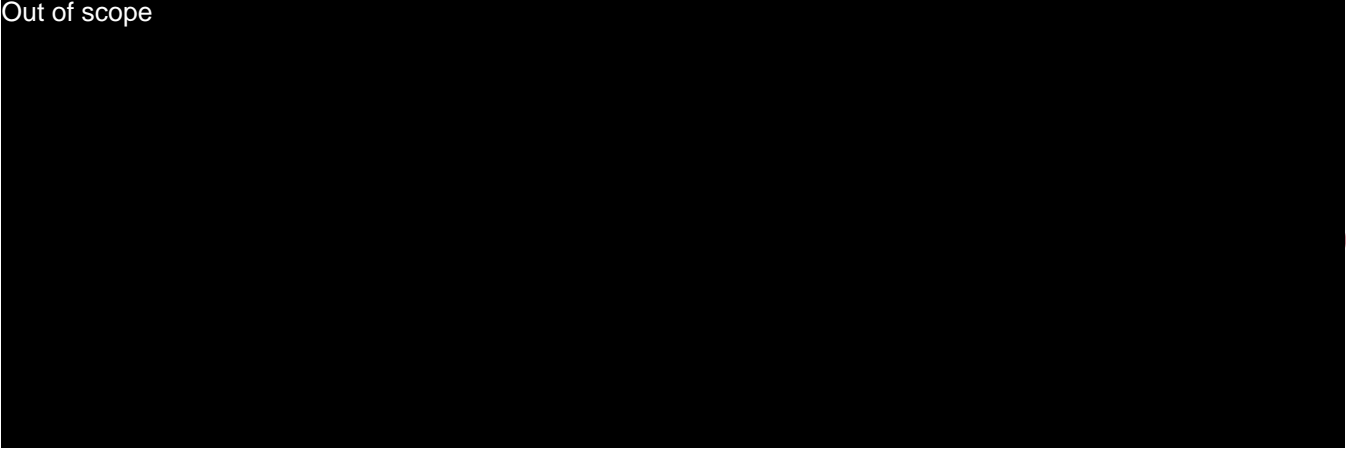
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Central Otago

Blue Butterfly Lane-Tor Hill Drive (ex s9(2)(a) tenure), Conroys Rd, Alexandra

Background: This small near-horizontal terrace subtended by tors on the south margin supported two small populations of *Ceratocephala*, along with the other spring annuals *Myosurus minimus* ssp. *novae-zelandiae* and *Myosotis brevis*. Just this one location was known to support *Ceratocephala* in a thoroughly botanised, rock tor landscape. Rabbits were a major influence in maintaining a close-cropped turf. I monitored this site for six years.

Present status: Given that a dwelling straddles the site, it is presumed the population is extinct (s9(2)(a) pers. comm. 2023).

Co-ordinates: s6(c)

Conroys Rd Reserve (reported by s9(2)(a) and resurveyed by myself)

Background: In early spring, 2023, s9(2)(a) reported about 10 small plants of *Ceratocephala* in a small clearing within thyme shrubland adjacent to and just above Conroys Rd near its intersection with Conroys Dam Rd, south-west of Alexandra. Thyme dominates extensive areas of hill-slope above the road in the vicinity of this record. The *Ceratocephala* clearing was partly created by rabbit scarification and where their faeces accumulated (Fig. 4, 5). Thyme shrubland is an unlikely habitat for *Ceratocephala*. However, there are one or two other records from similar habitat, for instance, I remember two small populations at Flat Top Hill surviving during the early stages of thyme invasion there (pers. obs. 2006).

Present status: s9(2)(a) re-visits this site each year. I re-surveyed the site on October 26, 2023 but failed to detect *Ceratocephala*.

Co-ordinates: s6(c).



Fig. 4. A small clearing within thyme shrubland littered with accumulations of rabbit faeces that was reputed to contain *Ceratocephala* in previous spring seasons (but not 2023 when inspected by the author).



Fig. 5. The general appearance of the hillslope above Conroys Rd, Alexandra within which s9(2)(a) has previously recorded *Ceratocephala*.

Flat Top Hill Conservation Area, Alexandra

Background: Four small populations of *Ceratocephala* on sheep and rabbit mediated bare soil areas were originally known to me from this well-botanised landscape when the site was acquired as Public Conservation Land (PCL). The Butchers Dam population occupied an alluvial fan mantled in the mine-sluicing debris, whereas the other three sites were on rock- or tor-studded downland with intact soils on the toeslope of the main range. Although thyme dominates the present vegetation, at time of land purchase and protection, this species was infrequently encountered in wander-at-will survey. I monitored all four populations for six years in the early 2000s.

Present status: All four sites are now infested with thyme or rank swards of pasture grasses following removal of farm stock and the maintenance of low rabbit densities. My monitoring of all four sites for six years following land protection and herbivore control recorded progressive decline and final population extinction at the four sites. I presume *Ceratocephala* no longer occurs within the Reserve.

Co-ordinates: s6(c)

s9(2)(a), Alexandra

Background: This population was originally uncovered by s9(2)(a) while cycling a mountain bike track within a rockland bike park several years ago (s9(2)(a) pers. comm. 2023). The site occupies degraded pasture with thyme rapidly invading to dominate most dryland soil pavements surrounding rock outcrops and tors. The population is near the junction between bike tracks and a 4WD track (Fig. 6). s9(2) last observed *Ceratocephala* in 2022. She has also observed *Myosurus minimus* there.

Present status: I resurveyed this site on October 10, 2023 but failed to detect any *Ceratocephala* or *Myosurus minimus* (Fig. 7).

Coordinates: s6(c)



Fig. 6. Location and plant community characteristics of the *Ceratocephala* population observed by s9(2)(a) over recent years on the Matangi Bike Park trail. (Image and annotation courtesy s9(2)(a).)



Fig. 7. Present day landscape character of the site on the Matangi Bike Park where *Ceratocephala* was previously observed by s9(2)(a). Comparing this with the image of s9(2)(a) above, thyme has expanded and the cover of grass-dominated turf has increased. *Ceratocephala* was not evident on October 10, 2023.

Chapman Road Scientific Reserve, Alexandra (CRSR)

Background: Sluicing from past gold mining has modified the landforms at the toeslope of this rock-studded hummocky hill-slope. This has inadvertently created habitat for all three spring annuals, including two patches/sites of *Ceratocephala* (Fig. ??) that I monitored for 6-years prior to publishing two papers on spring annuals (Rogers et al. 2002; Rogers & Overton 2007). One site was on an eroding bank at the hill-slope base, the other on an alluvial fan of redistributed sluicing debris; both sites were highly mediated by rabbits.

Present status: I revisited both these sites during the present survey but found no *Ceratocephala*. However, John Barkla reported *Ceratocephala* present in 2022 at two places at CRSR just east and west of a prominent pedestal tor created by sluicing (J. Barkla pers. comm. 2023).

Co-ordinates: John Barkla's site locations need to be GPSed.



Fig. 7. (Left) The present appearance of the eroding bank on a hill-slope at CRSR where I used to monitor *Ceratocephala*. It was not evident in 2023. The habitat is highly sodic or saline. (Right) The present appearance of the alluvial fan of redistributed sluicing debris at CRSR where I used to monitor *Ceratocephala*, but it was not evident in 2023.

Omeo Gully Track, Blackman Rd, Alexandra

Background: This was a small population of < 20 plants in any one season on an eroded knoll used as a camp by merino sheep near the Omeo Gully Track. Rabbits also scarified the site.

Present status: Unknown.

Co-ordinates: s6(c)

Cairnmuir Mountains: 4WD track just above Lake Dunstan

Background: Originally discovered by a s9(2)(a) team monitoring rangeland management of pastoral leases, the two sites supported very small populations of spring annuals. The eastern site on an eroded crest of a ridge overlooking the lake had <10 *Ceratocephala* in any one year, along with a small population of *Myosurus* and *Myosotis brevis*. The western site had a small population of *Myosurus*, only. Each site had moderate frequencies of sheep, goat and rabbit faeces and scattered bare soil patches maintained by the hoof impacts of the two ruminant species. I monitored the eastern site for six years in the early 2000s.

Present status: I inspected both these sites in mid-September 2022 and 2023. I found two plants of *Myosotis brevis* and no *Ceratocephala* or *Myosurus* on each occasion. The area of bare soil and surface disturbance had diminished from my monitoring period in the early 2000s and evidence of sheep, goat and rabbit use was much less than earlier. However, cyclists on the Lake Dunstan Trail walk and ride their bikes to and on the site for lake views. Perhaps, crucially, animal faeces were infrequent.

Co-ordinates: s6(c) [REDACTED].

Cairnmuir Mountains: summit ridge above Lake Dunstan

Background: In spring 2022, s9(2)(a) [REDACTED] encountered a population of about 10 plants in a bare soil site on an upper montane hill-slope at c. 840-m altitude, approximately 140-m below the summit ridge of the Cairnmuir Mountains south of Lake Dunstan.

Present status: not resurveyed in 2023.

Co-ordinates: s6(c) [REDACTED]

Springvale Conservation Area, lower Manuherikia River valley

Background: I understand *Ceratocephala* has been recorded within the dryland reserve created to protect the abundant saline soils and other assets but I have no knowledge of it.

s9(2)(a) [REDACTED], *Lowburn, upper Clutha valley*

Background: This population at s6(c) [REDACTED] was discovered by a local contract botanist a few years ago in an uncharacteristic habitat for the species - beneath a mature stand of pine trees that formed a shelter belt.

Present status: Access in spring 2023 was denied by the s6(c) [REDACTED] operator. A recent aerial photograph suggests the previous stand of mature pines may be reduced in spatial extent.

Co-ordinates: Not available.

s6(c) [REDACTED]

Bannockburn Sluicings Historic Reserve

Background: s9(2)(a) [REDACTED] and Sasha Roselli (DOC, Alexandra) surveyed spring annuals at the Bannockburn Sluicings Historic Reserve in spring 2020 (Pillai 2020). Their report provided a substantial inventory of spring annuals, including *Ceratocephala*. They documented 18 *Ceratocephala* sites, with many populations numbering 50–100 individuals.

Present status: In spring 2023, I revisited four of s9(2)(a) previously inventoried sites during the presumed peak flowering period. Just two of the four sites supported *Ceratocephala* and compared to the previously documented population sizes, the 2023 populations were much smaller. The comparatively dry early and mid-spring season may account for the reduced number and smaller size of populations. The reserve appears to be trending to greater vegetation biomass with, in particular, thyme increasing in spatial extent and biomass. Two micro-habitats of low spatial extent provide the best prospects for medium-term perpetuation of *Ceratocephala*: 1) bare, silty, mildly saline, eroding pavements on knoll crests (Fig. 9a), and 2) damp, moss-covered, east-facing slopes below the sluicing-created escarpments (Fig. 9b and c).

Furthermore, again in spring 2023, Corrie & Curtis (2023) re-surveyed all 18 sites recorded by s9(2) (2020). At five of the 18 sites they found no *Ceratocephala* and three sites had less than five plants. However, they found one new site, where there was 50–100 individuals. Interpretation of these re-monitoring data needs to recognise the documented, variable, inter-annual presence of *Ceratocephala*.

Co-ordinates: s9(2) (2020) provides waypoint coordinates for all 18 recorded populations.



Fig. 9. Two microhabitats offering the best prospects for perpetuation of *Ceratocephala* at the Bannockburn Sluicings Historic Reserve: A, silty, stormwater-erodible, saline pavement on a knoll created from redeposited sluicing debris (*Ceratocephala* plants in red circles); B, damp, moss-covered, moderately fertile seepages on hill-slopes, for instance here at s6(c); C, a large plant of *Ceratocephala* in moss microhabitat.

Bendigo, west of old Welshtown, southern Dunstan Mountains

Background: For six years in the early 2000s, I monitored *Ceratocephala* and *Myosurus minimus* on a spur top and adjacent hill-slope in clearings or light-gaps within kanuka scrub, s6(c). Both sites were heavily mediated by sheep and rabbits. The *Ceratocephala* often numbered in the hundreds over 400m² of habitat.

Present status: unknown.

Co-ordinates: s6(c)

Sites adjoining the Otago Central Rail Trail

Three sites adjoining the Otago Central Rail Trail were uncovered in the late 1990s in the discovery phase of spring annual biogeography. All three locations were in paddocks experiencing grazing by densities of sheep, sometimes with rabbits, immediately adjacent to the Rail Trail. The three sites were:

s [redacted]
s [redacted]
s [redacted]
[redacted]

As part of my spring annual ecology research, I monitored the Kokonga population annually until October 19, 2007 in 73 small plots (Rogers & Overton 2007). Subsequently, John Barkla and Craig Wilson inventoried all three *Ceratocephala* sites in their survey of threatened plants of the Otago Central Rail Trail (Barkla & Wilson 2008). Finally, in September 2023 Jo Corrie and Ross Curtis resurveyed the threatened plant records of the Rail Trail as documented by Barkla & Wilson (2008) (including *Ceratocephala*). Corrie & Curtis (2023) reported:

“We were unsuccessful in re-locating any *Ceratocephala pungens* but these may have been undetected due to their small size. At all sites in Galloway to s9(2) the pasture grasses in adjoining paddocks, where these have been found before, were certainly dense and seemingly not suitable anymore, with the only available bare ground being sheep tracks.

In 2008, *Ceratocephala* was usually found in areas fenced into sheep-holding paddocks adjoining the Rail Trail. *Ceratocephala* often co-occurred with *Myosurus minimus* subsp. *novae-zelandiae*.”

As part of the present project, I revisited all three sites in October 2023.

Galloway: I believe this site was in the fenced paddock containing the historic, blue-coloured shed. s9(2)(a) has periodically observed *Ceratocephala* there but not very recently (pers. comm. October 2023). The site has been planted in exotic trees and with several recent years of apparently no sheep and rabbit grazing, the predominant understorey cover is a rank sward of exotic grasses (Fig. 10). Thus, there is a strong probability the species is lost from there.



Fig. 10. The assumed location of a *Ceratocephala* population s6(c). The present rank sward of exotic grasses and herbs appears inimical to the survival of *Ceratocephala*.

s9(2) I have historic photographs of what was frequently a dense and extensive population, particularly adjacent to the Rail Trail boundary fence (Fig. 11).



Fig. 11. (Left) Heavy grazing by sheep in a holding paddock on s9(2)(a) s6(c) the Otago Central Rail Trail on October 7, 2007. The dominant light green plant adjacent to the fence is *Ceratocephala*. (Right) The same holding paddock on October 11, 2023, s6(c) on distant right), which is now dominated by pasture grasses, with no *Ceratocephala* evident.

Today, there is minor bare ground habitat available on the narrow terrace step and associated batter but there was no *Ceratocephala* evident when I visited on 11/10/23 (Fig. 11 (Right)). Corrie & Curtis (2023) unsuccessfully searched the site in September 2023.

Kokonga: Virtually all the sheep- and rabbit-mediated bare ground matrix surrounding the basalt rock pavement has been smothered by *Bromus diandrus*, *Vulpia myurus* and *Sedum acre*. My wooden 25-mm x 25-mm pegs for marking the 63 permanent monitoring plots remain (Fig. 12). Sheep and rabbit use of this steeply-sloping part of the paddock below the Rail Trail was very light as judged by faeces and hoof impact-induced bare ground. No *Ceratocephala* were sighted and there seems low probability the population remains in the form of a soil seed bank. Corrie & Curtis (2023) also unsuccessfully searched the site in September 2023.



Fig. 12. (Left). A small paddock below the Otago Central Rail Trail at Kokonga used to support a strong population of *Ceratocephala*. Most of the bare ground resulting from sheep disturbance in the early 2000s has now vanished under a grass sward. One of my original plot pegs for monitoring *Ceratocephala* is visible lower right. (Right) Sparse and apparently diminishing bare ground due to little recent farming use of the paddock is evident.

Table 2 below summarises what I know of the original discovery and present status of all the *Ceratocephala* populations covered in the present report.

Population	Origin of record	Date last recorded	Present population/habitat status
Out of scope			
Central Otago			
Blue Butterfly Lane-Tor Hill Drive (ex s9(2)(a) tenure), Conroys Rd, Alexandra	Unknown	?	Probably extinct
Conroys Rd Reserve	s9(2)(a)	?	Present 2022; not present 2023
Flat Top Hill Conservation Area, Alexandra	Pre-purchase inspection?	2007	Probably extinct
s9(2)(a), Alexandra	s9(2)(a)	Several years ago	Not present in 2023
Chapman Road Scientific Reserve, Alexandra	Unknown	2022 (J. Barkla)	Unknown
Omeo Gully Track, Blackman Rd, Alexandra	Unknown	?	Unknown
Cairnmuir Mountains: 4WD track just above Lake Dunstan	s9(2)(a) team	1997	Not present in 2022 and 2023
Cairnmuir Mountains: summit ridge above Lake Dunstan	s9(2)(a)	2021	Unknown
s9(2)(a), Lowburn	s9(2)(a)	2021	Probably extinct
Springvale Conservation Area	Unknown	Unknown	Unknown
Bannockburn Sluicings Historic Reserve	Unknown	?	Several perpetuating populations but likely declining
Bendigo, west of old Welshtown	Unknown	?	Unknown
Galloway; adjacent to Otago Central Rail Trail (OCRT)	Probably s9(2)(a)	?	Probably extinct
s9(2) adjacent to OCRT	Probably s9(2)(a)	?	Habitat available but not present in 2023
Kokonga; adjacent to OCRT	unknown	?	Probably extinct
s9(2)(a)	s9(2)(a)	?	Present 2023 but private tenure

Table 1: Summary table of the historic and present status of *Ceratocephala* populations in Out of scope and Central Otago.

Conclusions

- Ceratocephala* joins several other dryland species in being vicariously-restricted to Central Otago Out of scope. Some of the others are *Carex albula*, *C. decurtata*, *Leptinella conjuncta*, *Lepidium sisymbrioides* and *Carmichaelia curta*.
- Of all the spring annual flora, *Ceratocephala* is the least tolerant of competition from other plants, native or exotic. Thus, it requires bare, moderately well-drained soil. Without ongoing, physical disturbance, its gravel-, sand- or silt-based soils succeed to a vegetated state, inimical to its survival. However, a few present-day populations survive on the

extreme geochemistry of sodic and/or saline soils that constrains the invasion of taller, potentially smothering plants.

- Its present dependence on sheep and lagomorphs as habitat mediators indicates they are crucial surrogates for its pre-human evolutionary link with avian herbivory.
- Seed viability or longevity is unknown. However, wide, annual variation in the frequency of populations evident during monitoring in the early 2000s points to seed viability >1 year.
- I believe the present report incorporating the author's and other botanists' monitoring data and anecdotal perspectives indicates the species has undergone a substantial decline in the number of sites and the population frequency in the era of land protection for the rare dryland native flora.
- Out of scope

Recommendations

My final contractual undertaking was to recommend a draft biogeographic framework for a sustainable future conservation engagement for the species in both Central Otago Out of scope. Intuitively, this should involve selecting the strongest and most biogeographically- and ecologically-representative sites to: 1) foster its persistence if present site and population circumstances seem conducive; 2) where it has a questionable future, undertake documented, experimental, habitat manipulation; 3) where it has apparently become extinct following land protection, attempt reintroduction using artificial habitat-creation techniques.

Out of scope

For **Central Otago**, the challenge of a sustainable conservation framework is much more difficult due to: limits in our biogeographic knowledge; uncertain and potentially challenging land owner and conservation agency politics; my limited understanding of the resource implications of various conservation scenarios. Daunted by those uncertainties, I'd prefer to recommend DOC convene a workshop of knowledgeable botanists and other stakeholders charged with mapping a future conservation pathway for the species.

Acknowledgements

I'm indebted to s9(2)(a) for sharing their biogeographic and ecological knowledge of *Ceratocephala* and for sharing field survey experiences.

Out of scope

I thank Ross Curtis for sharing the results of his 2023 field monitoring of *Ceratocephala* populations around Alexandra District Office and also John Barkla who shared his 2008 report of monitoring rare plants along the Otago Central Rail Trail.

s9(2)(a) provided much appreciated help with field survey.

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Appendix 1

Rogers & Overton (2007) Abstract: We examined trends over six consecutive spring seasons in three "spring annual" herbs, *Myosurus minimus* subsp. *novae-zelandiae* (Ranunculaceae), *Ceratocephala pungens* (Ranunculaceae), and *Myosotis pygmaea* var. *minutiflora* (Boraginaceae), in terms of their habitats and site land uses in several rare, non-forest ecosystems. On dry hillslopes, saline soils, and turfs of ephemeral wetlands (including coastal turfs), *Ceratocephala* and *Myosotis* declined where sites were managed for conservation by removal of mammalian herbivores. Some populations of *Myosurus* declined only marginally or remained stable despite high cover of ruderal and weedy, herbaceous exotic plants. Loss of monitored populations during the study was offset by discoveries of additional populations of all three taxa. Statistical models of population trends suggest that in some instances spring annual populations benefit from farm animal and rabbit (*Oryctolagus cuniculus cuniculus*) disturbance of their habitats perhaps by 1) suppressing transitions to taller vegetation and retarding competition of invasive exotic plants and 2) maintaining nutrient supplementation from faeces lost with the extinction of ground-dwelling birds. Frequent seeds of all three taxa preserved in moa coprolites from several sites in Central Otago point to 1) the herbs' probable non-rarity in pre-human times and 2) dispersal mutualisms and mediation of community ground cover by extinct ratites.