

THE STATUS OF *CARMICHAELIA CURTA* IN THE WAITAKI RIVER CATCHMENT

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INTRODUCTION

The current status of the native broom *Carmichaelia curta* (Fabaceae), classified as Vulnerable by de Lange *et al.* (1999), is not well known. The species is naturally restricted to dry parts of Central Otago and the Waitaki River catchment in South Canterbury, where it has been recorded from stony hillsides, rocky outcrops and river terraces, as well as sites of human disturbance such as road cuttings. The type locality for the species is the Waitaki Dam roadside, from where it was collected by G.W. Simpson in 1947. This paper provides an overview of an investigation into the current status of *Carmichaelia curta* in the Waitaki catchment. The aim of the project was to revisit sites where the plant had previously been recorded within the Waitaki catchment and to assess the status of these populations, as a precursor to undertaking conservation management of the species.

Within the Waitaki catchment, I was able to find 32 historic records of *C. curta* (mostly from the Lincoln herbarium database), dating from 1893 to 1996. According to these historical records, the range of *C. curta* in the Waitaki Valley extended from a southeastern limit near Duntroon inland as far as the vicinity of Lake Benmore. In addition, several more recent records of *C. curta* in the Waitaki catchment have been made in the last few years (1997–2001). These considerably extend the known range of the species to the north and west as far as Mt John and Sawdon Station near Tekapo (Wardle 2000), as well as to the western foothills of the Rollesby Range and Mackenzie Pass (J. Comrie and I. Grunner pers. comm. 2001).

Description

Carmichaelia curta is a shrub of variable growth form. Some plants have only one or two upright, aerial stems that may reach 1.5 m in height; others show a low-growing suckering and/or sprawling habit, forming patches up to 2 m in diameter, with numerous stems emerging from an underground rootstock. Many plants exhibit a combination of both growth forms. Branches are slender, almost round and grooved, olive-green to brown-green, often brown or bronze in winter. Branchlets are hairy when young and leaves are only present on young plants. The inflorescence has 8–12 flowers, flowers are c. 4 x 3 mm and a creamy yellow colour striped with purple. Pods are 3–5 mm long, 2–3 mm broad, with a short stout beak. Seeds are yellow-green with black spots. Flowering generally occurs from October to February and fruiting from January to August (Allan 1961; Poole and Adams 1994; Heenan 1995).

SUMMARY OF RESULTS OF THE FIELD INVESTIGATION

A total of 1649 *Carmichaelia curta* were counted at sites extending from the Lake Waitaki roadside in the southeast to Mt John in the northwest. The survey was not definitive. The suckering growth habit of many plants meant counts could only be approximate, and particularly at sites with over 100 individuals, there are likely to be more present.

Many of the (mostly older) historic records provided insufficient information to enable precise relocation and/or there was discrepancy between the sites' recorded grid reference and the textual description. Nevertheless, the presence of *C. curta* was confirmed at several of the historic localities: Lake Waitaki roadside, Awahokomo Stream, the south side of Lake Aviemore, Deep Stream on the north side of Lake Aviemore and several of the Lake Benmore islands.

The Lake Aviemore locality is the stronghold for *C. curta*. It is common on the roadside of SH 83 from near Parsons Rock to approximately 2 km upstream of Aviemore Dam. More than 380 plants were counted growing on roadside verges, road cuttings and lakeside reserves. Another 424 were counted growing in adjacent farm paddocks, but there are likely to be hundreds more present. A conservative estimate of the *C. curta* population in the Lake Aviemore locality is at least 1000 plants. The habitat is the dry, northeast-facing colluvial footslopes of the St Marys Range, with a relatively high proportion of bare ground. *Carmichaelia curta* were recorded from 450 m a.s.l. down to Lake Aviemore at 280 m. Vegetation on these footslopes is a mosaic of dry grassland-herbfield, short tussock grassland and shrubland; semi-natural communities with a mixture of native and exotic species. Prominent associated shrub species include *Coprosma propinqua*, porcupine scrub (*Melicytus* aff. *alpinus*), matagouri, prostrate kowhai *Muehlenbeckia complexa*, *Carmichaelia petriei* and adventive sweet brier (*Rosa rubiginosa*). Some European broom (*Cytisus scoparius*) is present here but is being controlled by landowners and local authorities.

At Deep Stream, a District Council administered reserve on the north side of Lake Aviemore, there is also a relatively large population of *C. curta*. A total of 119 plants were counted within c. 5 ha, and there are more known to be present in the surrounding area (280-380 m a.s.l.). This population occupies a steep southeast-facing slope that also has numerous rock bluffs and a high proportion of bare ground. Vegetation is mostly low shrubland (similar range of species as listed above), with scattered wilding pine trees.

The Awahokomo Creek site now has only a tiny remnant population of heavily-browsed plants in modified pasture on a river terrace (360 m). This population is threatened by weed invasion (European broom) and farming activities (stock browse and weed spraying) and is unlikely to survive for long. A remnant population of 71 *C. curta* shrubs persists at a 200 m-long roadside verge site (240 m a.s.l.) at Lake Waitaki, approximately 3 km upstream from the dam, where they grow amongst fescue tussock grassland and on the bare road cutting. However, here *C. curta* is absent from adjacent farmland that has been ploughed and sown in exotic pasture. The Lake Waitaki roadside population was the easternmost recorded in this survey, and may now be the extant population closest to the species' type locality.

No *C. curta* was seen at or downstream of Waitaki Dam although many of the historical records (as recent as 1975) come from the Kurow area, and, as already mentioned, it had been recorded east to Duntroon (by Petrie in 1893). The spread of exotic shrub weeds and willows, combined with a shift to more intensive farming in this part of the Waitaki Valley make it likely that these records have vanished due to loss of habitat. It is possible that *C. curta* may still be present somewhere in the hills near Kurow (where it was collected by A. Wall in 1931), for example on rock bluff refugia, but time did not permit survey of this large, poorly defined area.

Some of the small islands formed by the flooding of Lake Benmore support populations of *C. curta*. These islands have been free of domestic stock, and wild mammal browsers are, for the most part, scarce or absent. Unfortunately however, all these islands have been planted, to a greater or lesser extent, in exotic conifers and wilding conifers have spread into adjacent unplanted areas. The size of the *C. curta* population on each island is thus inversely proportional to the area occupied by exotic conifers. In this survey, a total of 330 *C. curta* were counted on five islands: Turnagain Island (6 plants), Junction Island (33 plants), Blackjack Island (64 plants), Gooseneck Island (186 plants) and Madac Island (41 plants). Where free of encroachment by conifers, the *C. curta* on these islands are, in general, healthy, vigorous specimens. Gooseneck Island, in particular, supports a population density of large *C. curta* not seen on mainland sites. However on islands with greater amounts of conifers, there has undoubtedly been a reduction in numbers of *C. curta* and associated native species.

At Otematata Station, *C. curta* is locally common on old alluvial terraces in several paddocks close to the homestead and other farm buildings (350 m a.s.l.). In this survey, 111 *C. curta* were counted at two sites of c. 1 ha, and others are likely to be present in similar habitat nearby. Most of these plants had, at the time of survey, been browsed down near to ground level during a recent period of heavy stocking.

On the steep northwest face of Mt John, several sparsely-vegetated greywacke rock outcrops (940–980 m) support *C. curta*, with a total of 179 plants counted in this survey. However no *C. curta* were observed on the colluvial hill slopes surrounding the outcrops. Plants in this population were generally smaller than at lower-elevation sites, suggesting Mt John might be near the upper altitudinal limit of the species. Most *C. curta* individuals in this population had been browsed; only plants on the most inaccessible rock bluffs, or growing amongst patches of porcupine scrub, showed little or no evidence of browse. A rabbit-proof enclosure plot, established near these rock outcrops, provides graphic evidence of the high level of rabbit/hare impact on the vegetation of this area.

At a spur crest site on the Benmore Range, overlooking the Ahuriri Arm of Lake Benmore, 48 *C. curta* were counted on four separate rock outcrops (720–800 m a.s.l.). Others may be present on similar outcrops nearby. This population, like the one at Mt John, appears to be relictual, confined by mammalian browsing pressure to the most inaccessible sites. Elsewhere in the Mackenzie Country, small populations of *C. curta* (five or less plants) have been recently recorded by other observers from sites at Sawdon Station near Tekapo (720 m), the foothills of the Rollesby Range (600 m) and near Mackenzie Pass (640 m).

THREATS

The principal threat to *Carmichaelia curta* is habitat loss. In the Waitaki Valley, this has often resulted from the spread of exotic trees and shrubs (in particular willows, wilding pines, European broom and gorse) that can overtop and exclude *C. curta* and other native species. There has also been physical destruction of habitat, usually associated with land development for more intensive agricultural production (e.g. the shift from extensive dryland pastoralism on semi-natural plant communities to heavily-stocked, irrigated ryegrass-clover pasture). Roadside control of gorse and European broom is being carried out at the Lake Aviemore locality, and the adjacent landowners are also attempting to control the spread of these weeds. Such efforts are essential to maintain *C. curta* habitat here, but they do carry the risk of the species being killed by spray drift or applicator misidentification.

Browsing by introduced mammals is the other obvious threat, but its intensity and effects vary from site to site. Mammals appear to browse *C. curta* down from the stem tips, thus browsing does not often (at least in the short term) kill the plants. However, such browsing does preferentially remove flowers and fruits, as these are borne towards the stem tips, and must therefore inhibit regeneration.

At lower-altitude sites (< 500 m), *C. curta* seems able to tolerate low-to-moderate levels of browsing by domestic stock. The plants in farm paddocks generally show a suckering growth habit, vegetatively resprouting from their rootstocks after browse episodes. The *C. curta* in the home paddocks at Otematata Station, for example, have survived more than 100 years of continual stock browse. Nevertheless, plants on sites not grazed by domestic stock (e.g. Lake Aviemore roadside, Deep Stream Scenic Reserve) were, on average, taller and more vigorous than their neighbours on farmland. Rabbits and hares did not seem to browse *C. curta* at these low altitude sites, as most plants on roadsides/reserves appeared unbrowsed, even though rabbits and hares were present. Although the survey took place outside the main flowering/fruitlet period, some flowers and fruits were seen on roadside and reserve plants, but none recorded on individuals in paddocks.

At higher-altitude localities, however, *C. curta* is browsed both by stock and rabbits/hares. The species appears to be much less browse-tolerant at higher altitudes, and is almost always restricted to growing on relatively inaccessible sites on steep stony slopes, rock outcrops and amongst other spiny shrubs. Present populations are therefore probably relictual, and in general, are smaller and more isolated than is the case for populations lower down the Waitaki Valley. For example, at the Mt John sites, which have not been grazed by stock for several years, *C. curta* is present only on rock bluffs, and even at these sites, only the few most inaccessible plants show no evidence of browse.

The effect of introduced herbaceous plant species on *C. curta* is uncertain. At many sites, *C. curta* shrubs grow amongst a ground cover dominated by exotic species (e.g. grasses, Vipers bugloss and *Hieracium pilosella*). Although the adult plants appear able to co-exist with these exotic herbaceous species, they may inhibit *C. curta* seedling establishment and survival, and therefore population regeneration. This question requires further investigation.

CONSERVATION MANAGEMENT

Only one population of *C. curta* is currently within a formally protected area, Deep Stream Reserve, and no populations are administered by the Department of Conservation. The Deep Stream population is healthy at present, but wilding pine and European broom control will be necessary to maintain this habitat. The area is also being invaded by stonecrop (*Sedum acre*); its effect on seedling establishment is uncertain but is unlikely to be helpful.

The southern side of Lake Aviemore supports the largest known population of *Carmichaelia curta* and should therefore be a focus of conservation efforts. It would be worthwhile to explore the possibility of a covenant arrangement with Transit NZ to protect the substantial roadside *C. curta* population with a coordinated program of weed control and general maintenance of the existing habitat. A similar arrangement would also be useful for the much smaller roadside population at Lake Waitaki.

Mt John, administered by the Ministry of Defence, also supports a relatively large population of *C. curta* that is perhaps at its geographic and altitudinal limit. The site is not currently grazed by stock but has lots of rabbits and hares that do browse *C. curta* here. The plants are restricted to relatively inaccessible rock outcrops. Rabbit-proof fencing around some of these outcrop sites should be considered in order to maintain and enhance the Mt John population.

The Lake Benmore islands, in particular Gooseneck Island and Blackjack Island, offer excellent potential for conservation management of *C. curta* and the range of associated native plant species that form these distinctive dry shrubland-grassland communities. The Department of Conservation is hoping to take over the management of these islands in the near future and will then be able to carry out weed and pest control. Gooseneck Island currently has high possum numbers, probably because it is very close to the mainland, that have had some observable impact on *C. curta*, but effective possum control should not be difficult here.

CONCLUSION

Results from this study show there has been a contraction in the historical range of *C. curta* in the Waitaki catchment, but substantial populations remain at a number of sites. Recent surveys have extended the known range of the species, and it is quite possible that some future botanical surveys within the catchment area of the Waitaki River will reveal new populations. In the meantime, it is important to maintain existing populations, particularly at the key sites mentioned. There is a need for further investigation of the effects of mammal browsing (both stock and wild animals) on *C. curta* growth and reproduction; and the effect of competition from herbaceous exotics (e.g. grasses, hawkweed, stonecrop) on seedling establishment and survival to guide the conservation management of this vulnerable species.

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Lepidium oleraceum. Sketched on Stewart Island. (del. Hugh Wilson).