RE-ESTABLISHMENT OF *LEPTINELLA FILIFORMIS* INTO SUITABLE REMNANT HABITATS IN CANTERBURY: A PROGRESS REPORT

NICHOLAS HEAD*, BRIAN MOLLOY AND ANITA SPENCER
*Department of Conservation, Private bag 4715, Christchurch

INTRODUCTION

Leptinella filiformis (Hook.f) D.G. Lloyd & C. J. Webb, is a small rhizomatous daisy presumed extinct until it was rediscovered growing in the Hanmer Lodge (now known as Heritage Hanmer Springs) grounds in 1998 by one of us (BM). It is currently ranked as Nationally Critical by New Zealand's threat classification system (de Lange et al. 2004). Habitat loss and competition from exotic plant species are considered the major reasons for the near extinction of *L. filiformis* in the wild.

Its rediscovery was timely as it coincided with large scale development plans for the Hanmer Lodge and grounds, which would have destroyed this relict population. It was lost during this development, despite an assurance by the developer to protect the site! Luckily plants had been collected beforehand and propagated in cultivation for its re-establishment back into the wild. Although some plants have been returned to the new grounds of the Hanmer Lodge, re-establishing *L. filiformis* into reserves of suitable habitat throughout its historical range is a major focus of the recovery of this species.

WHAT DO WE KNOW ABOUT ITS PREFERRED HABITAT?

L. filiformis is known only from the eastern South Island plains and basins. The first collection was made by von Haast in 1862 from the Canterbury Plains, followed by Cockayne in the Upper Awatere basin in 1911, Christensen in the Hanmer Basin in 1912 (where it was considered to be relatively common), and Wall among scrub in the Culverden basin in 1917. It was not seen again in Canterbury until Arthur Healy found it on the paths at the Hanmer Lodge in 1975, and then by BM at the same site in 1998 growing under exotic trees. It was last collected in the Awatere valley in 1968 (Molloy 1999).

These early collections provide us with a general picture of the potential habitat for this species. Historically the indigenous vegetation of these landforms is thought to have comprised a mosaic of grassland and seral woody vegetation in response to regular disturbance, such as fire and flooding (McGlone 1989, 2001; Meurk et al 1995; Walker et al 2003).

This dynamic landscape would have provided and maintained open 'habitats' considered necessary for *L. filiformis* (Molloy 1999). The Hanmer Lodge habitat, sparse exotic grassland under exotic trees, is regarded as atypical.

A preference for open ground is supported by information from herbarium sheets and field evidence, which suggests that *L. filiformis* is a poor competitor with taller and/or dense sward-forming exotic species. For example, records highlight the importance, somewhat paradoxically, of rabbits in maintaining open habitat for this species by keeping exotic grasses and herbs suppressed, and Healy described it as a troublesome weed on gravel (Cockayne 1915; Molloy 1999). In addition, there is evidence suggesting that it is shade tolerant, firstly from Wall who refers to the plant he collected in 1917 as growing among "Balmoral scrub", and secondly from the Hanmer Lodge site where it was growing under a canopy of evergreen exotic conifers and deciduous hardwoods.

REMNANT HABITATS SUITABLE FOR *LEPTINELLA FILIFORMIS*

The Canterbury Plains and Culverden Basin are some of the most modified landscapes in New Zealand, with less than 1% of their indigenous vegetation remaining (Thompson et al. 2003). Therefore potential indigenous habitat for *L. filiformis* is now scarce. What remains usually comprises small modified fragments of open kanuka (*Kunzea ericoides*) woodland and associated grassland and herbfield, which are poorly buffered and vulnerable to edge effects. This is compounded by aggressive sward-forming exotic grasses and herbs, such as browntop (*Agrostis capillaris)* and mouse-ear hawkweed (*Hieracium pilosella*), which have often invaded and smothered much potential open space habitat for this species. Competition with exotic species seems particularly pertinent in the case of the historic Marlborough sites, where despite large areas of potential short tussock grassland habitat remaining, numerous surveys have failed to relocate the species in this area (Cathy Jones pers com.).

Nevertheless, there are four reserves in the Canterbury Conservancy that contain dry alluvial terrace plant communities considered to be suitable habitat for re-establishing *L filiformis*. These are the Medbury Scientific Reserve (55 ha) and Culverden Scientific Reserve (10 ha) in the Culverden Basin, and the Bankside Scientific Reserve (2.6 ha) and Eyrewell Scientific Reserve (2.3 ha) on the Canterbury Plains (Department of Conservation 2002).

The Medbury Reserve provides the best opportunity to trial the re-establishment of *L. filiformis,* being the largest and arguable most intact area of basin floor habitat remaining in Canterbury (Meurk 1988). Its vegetation is dominated by mature kanuka up to 3.5 m tall which forms patches throughout the reserve. Seedling kanuka on the edges of these patches are frequent. Extensive moss (*Hypnum cupressiforme, Polytrichum juniperinum, Racomitrium lanuginosum, Triquetrella papillata*), herbfield and native grassland occur between the kanuka stands. Shrubs of matagouri (*Discaria toumatou*), porcupine shrub (*Melicytus alpinus*), native broom (*Carmichaelia australis*) and *Coprosma propinqua* occur sporadically throughout. Exotic species are well established, in particular sweet vernal (*Anthoxanthum odoratum*), browntop, hairgrass (*Vulpia bromoides*) and mouse-ear hawkweed, which are an obvious component of the open grassland areas. With perhaps the exception of the exotic species, this vegetation is probably not too dissimilar to that present when Wall made his collection from "Balmoral scrub" in the Culverden Basin in 1917.

RE-ESTABLISHMENT TRIALS

To assess plant response to the different habitats we set up two transects, each four meters long, through open grassland, kanuka stand edge, and under kanuka canopy. The three different conditions associated with these sites are as follows: under kanuka canopy (shady and much bare ground); kanuka stand edge (mixed light and ground cover); moss-field/grassland away from the kanuka canopy and edge (high light and dense ground cover). At half-meter points along each transect, two paired pots (one each side of transect) of nursery-raised *L. filiformis* were planted (32 pots). Plants were monitored for survival and growth (measured as diameter of patches along two axes), initially undertaken bi-annually and then biennially. Site descriptions of each planted site were also recorded (canopy cover, % bare ground, % species cover etc).

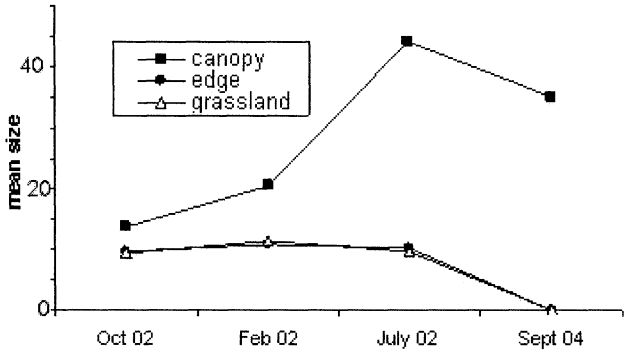
SUMMARY OF RESULTS

Preliminary results indicate that *L filiformis* clearly prefers the kanuka canopy habitat to the kanuka edge and open grassland (graphs 1 and 2). Plants under canopy have greater vigour than those not under kanuka which barely spread at all, declined in mean area, and eventually died out in Transect 1. Plant response in the kanuka edge habitat is mixed, probably due to varied light and ground cover conditions of these sites.

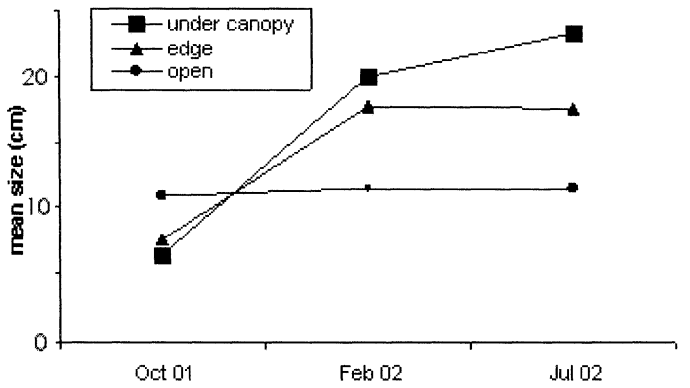
Although *L. filiformis* has performed better in a shaded environment, this is possibly the result of shade suppressing competitive exotic species,

which are abundant in high light, rather than a genuine reflection of habitat preference for shade *per se*. It is worth noting, however, that the high light sites are typically dominated by native mosses, which form thick carpets with very little bare ground available for species to colonise. The lack of spread generally of *L. filiformis* in high light sites suggests that inter- specific competition and available 'space' is more limiting than shade alone (although light levels and ground cover are correlated in the Medbury Reserve!).

The relatively poor response of plants in edge habitats is interesting because it is reasonable to assume that these habitats should provide the most favourable conditions for growth given the availability of both light and space (bare ground), compared to the greater extremes of shade and ground cover of the other two habitats. The results at edge sites are, however, complicated by the lack of uniformity of site conditions.



Graph 1. Mean growth rates of *Leptinella filiformis* on Transect 1 (n=16 plots)



Graph 2: Mean growth rates of *Leptinella filiformis* on Transect 2 (n=16 plots)

DISCUSSION

There are many nationally threatened species that occupy semi-shaded habitats where exotic species are suppressed by low light levels, and similar questions arise regarding their true habitat preference in the absence of exotic species. It has been suggested that many of these species may have been forced from their preferred high light habitats by aggressive exotic species, such as browntop and mouse-ear hawkweed. Consequently semi-shaded habitats may be sub-optimal refugia (Given 1981; Wilson and Given 1989), where a degree of shade tolerance allows threatened species to survive but not thrive.

The nationally endangered *Carex inopinata* is one such species. In Canterbury *C. inopinata* occupies a narrow habitat of 'semi shade' under limestone bluffs and associated shrublands, between high light areas dominated by exotic species, and low light areas with plentiful bare ground. This habitat was considered to be sub-optimal for *C. inopinata*, which may have been forced from its preferred high light habitat to a semi-shade environment at the edge of its tolerance (Given 1981; Wilson & Given 1989).

However, research on the light preference of this species found it performed best under semi shade (Morgan & Norton 1992), despite its noted vigour when planted in full sunlight in gardens. The planting trials of *L filiformis* reported here also suggest it has a natural preference for shady environments, and this would align with early habitat descriptions by Wall in 1917. Other species of *Leptinella*, e.g., *L. nana* and *L. pusilla*, also grow successfully in semi shaded habitats, and *L. pusilla* occurred with *L. filiformis* at Hanmer and is often found in stands of kanuka.

CONCLUSION

These early results raise a number of questions regarding habitat preference of *L. filiformis*, in particular the relationship between light requirements and inter-specific competition. To tease out these habitat relationships requires more detailed analysis and statistical testing than has been undertaken here. This also requires further trials in a greater range of indigenous habitats, which represent more fully the variety of plant communities that occurred on these landforms prior to extreme modification, such as short tussock grassland, divaricate shrublands, and perhaps hardwood forest. Unfortunately, opportunities to include the full range of indigenous plant communities that occurred on these landforms are limited by their scarcity, and the high degree of modification of those

that still exist. Ongoing monitoring to determine longer term survival trends is also important, as is a replicated study with more stringent controls under laboratory conditions to untangle the subtle interactions of *L filiformis* between light and inter-specific competition.

In the meantime, further planting of *L. filiformis* under kanuka stands in appropriate reserves should be undertaken as this is a successful strategy to re-establish this nationally threatened species. Establishing numerous isolated populations is also desirable as an insurance measure against stochastic loss. This lesson was harshly learned in February 2003 when a catastrophic fire devastated around 70% of the Medbury Reserve, including the loss of Transect 2. The fire resulted in the loss of around 60% of all the remaining alluvial terrace indigenous vegetation combined in reserves on the Canterbury Plains and the Culverden Basin– an area more than twice the size of the Culverden, Eyrewell and Bankside Reserves combined. The intensity was such that it seems unlikely that there will be any immediate recovery of burnt kanuka, and monitoring seems to support this.

ACKNOWLEDGEMENTS

We thank Jorge Santos of Motukarara Conservation Nursery and David Purcell of Landcare Research Nursery for raising plants of *Leptinella filiformis.*

REFERENCES

Cockayne, L. 1915: List of the vascular plants of the Awatere River basin together with remarks on some of the plant-associations. Unpub. MS read before the Wellington Philosophical Society 22nd September 1915. 33 pp.

Department of Conservation 2002: Canterbury Conservation Management Strategy, Volume 2. Department of Conservation, Christchurch, New Zealand.

de Lange, P. J. ; Norton, D. A.; Heenan, P. B.; Courtney, S. P.; Molloy, B. J. P.; Ogle, C. C.; Rance, B. D., Johnson, P. N.; Hitchmough, R. 2004: Threatened and uncommon plants of New Zealand. *New Zealand Journal of Botany 42*: 45-76

Given, D. G. 1981: Rare and endangered plants of New Zealand. *New Zealand Journal of Botany 24*: 425-503.

McGlone, M. S. 1989: The Polynesian settlement of New Zealand in relation to environmental and biotic changes. *New Zealand Journal of Ecology 12 (supplement)*: 115-129.

McGlone, M. S. 2001: The origin of the indigenous grassland of southeastern South Island in relation to pre-human woody ecosystems. *New Zealand Journal of Ecology 25*: 1-15.

Meurk, C. D. 1988: Assessment of kanuka stand, Shimmins Road, Medbury. *Unpublished DSIR report No.638A.*

Meurk, C. D. ; Bellingham, P.; MacMillan, B. 1995: The last kanuka landscape on the Canterbury Plains? *Canterbury Botanical Society Journal 29*: 11-24.

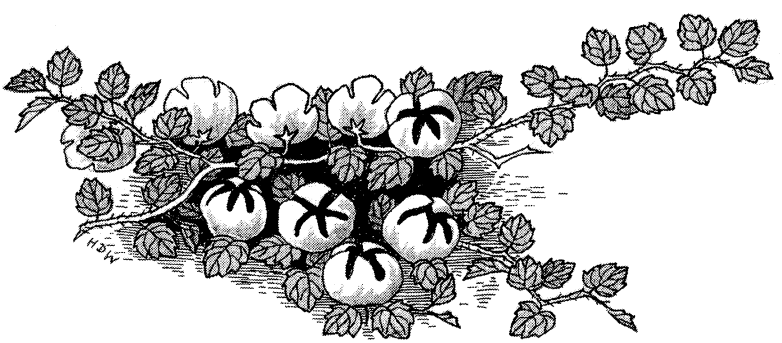
Molloy, B. 1999: Notes on the rare button daisy *Leptinella filiformis* (Hook. f.) D. G. Lloyd & C. J. Webb. *New Zealand Botanical Society Newsletter 55*: 16-20.

Morgan, M. D.; Norton, D. A. 1992: Growth response to light of *Carex inopinata* Cook, an endangered New Zealand sedge. *New Zealand Journal of Botany 30*: 429-433.

Thompson, S.; Gruner, I.; Gapare, N. 2003: New Zealand Land Cover Database Version 2. Illustrated Guide to Target Classes. Ministry for the Environment, Wellington.

Walker, S.; Lee, W. G.; Rogers, G. M. 2003: Post-pastoral succession in inter-montane basins and valleys of eastern South Island, New Zealand. Science for Conservation No 227, Department of Conservation, Wellington.

Wilson, C. M.; Given, D. R. 1989: Threatened plants of New Zealand. Wellington, DSIR Publishing.



Gaultheria depressa var. *novae-zelandiae* snowberry