What makes rare plants rare?
By Kelvin Lloyd, Bill Lee and Bastow Wilson.

Although many rare plant species are intensively studied, one aspect that is not generally studied is the comparative ecology of rare and common species. Often there are both rare and common species within the same genus and it would be helpful for conservation managers to know why the rare species are rare. Do rare species form a distinct group, with traits that differ consistently from those of common species, or must causes and consequences of rarity be assessed on a case-by-case basis? We have tried to answer this question by growing both rare and common species under the same conditions and measuring their growth and reproduction. We used two New Zealand genera, *Acaena* (Rosaceae) and *Chionochloa* (Poaceae), both with several rare and common species.

The experiments used ten species of *Acaena* and nine of *Chionochloa.* We examined aspects of the species competitive ability, vegetative and reproductive growth, and their responses to a range of stress factors such as, nutrient limitation, drought stress, waterlogging and frost.

Acaena (bidibid) species are generally renowned for their tendency to attach hooked seeds to socks and clothing, however, it is less well known that the New Zealand species fall into three different taxonomic sections, and only one of these sections (sect. Ancistrum) contains species with hooked seeds. Some *Acaena* species are extremely common throughout New Zealand (*e.g. A. anserinifolia*) while others are common on one island only (*e.g. A. caesiiglauca* in the South Island) and others very local endemics (*e.g. A. rorida* in the central North Island). *Chionochloa* species, popularly known as snow tussocks, frequently form extensive grasslands over large geographical areas (*e.g. C. crassiuscula, C. rigida* and *C. rubra*), particularly in the montane and alpine zones, but some species are far more local

(*e.g. C. ovata* and *C. spiralis*, two Fiordland endemics with patchy distributions).

We defined rarity and commonness according to the geographic range sizes of the species, measured as the number of 10 km grid squares occupied by each species in New Zealand. Distribution information was gleaned from herbarium specimen labels at the AKL, CHR, OTA and WELT herbaria, the National Vegetation Survey database administered by Landcare Research, lists compiled by the late A.P. Druce, the scientific literature and personal observations.

We looked for differences between rare and common species using correlations between a species' geographic range size (the rarity scale) and its traits (competitive ability, growth and reproductive ability) and responses to stress. The association of species traits with different types of rarity was also examined, although small sample size hampered interpretation.

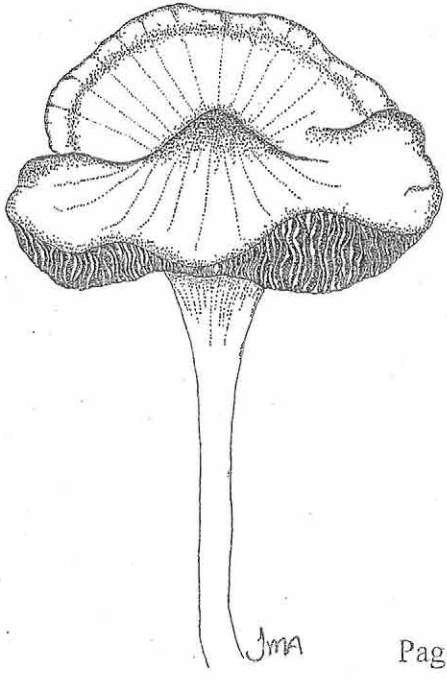
In *Acaena*, very few significant differences were found between rare and common species. However the power of these tests was reduced because the *Acaena* species comprised two groups of closely related species, and these groups had to be considered separately to avoid confounding differences between groups with differences in phylogenetic relatedness. Regardless, some of the *Acaena* species appeared to be rare on account of recent speciation or colonisation, and there need not be any expectation that the biological attributes of such species should be related to their rarity.

In *Chionochloa*, common species differed significantly from rare species in several respects. Common species possessed attributes promoting wider dispersal, had faster growth rates and showed higher competitive ability. Additionally, there was a tendency for the common species to tolerate a greater range of abiotic stresses. Thus common *Chionochloa* species appear to achieve their large range sizes through the ability to disperse widely, grow fast and

be competitive in a range of habitats. The rare *Chionochloa* species appeared to be specialised to habitats that are themselves relatively rare (*e.g. C. defracta* on ultramafic areas in the Nelson region, and *C. spiralis* on calcareous outcrops in Fiordland).

Across both genera, there were few strong associations between species' attributes and types of rarity, apart from significantly higher relative growth rate (RGR) in common species (species with a large geographical range).

Rarity appears to be a complex phenomenon. This study showed that in some groups, there may be consistent differences between rare and common species, but in others, explanations for a species rarity may have to be sought on a case-by-case basis. More studies comparing the ecology of rare and common species in other groups are needed, to assess whether the patterns revealed in *Chionochloa* prevail, or whether rarity is an idiosyncratic phenomenon as appeared to be the case for *Acaena*.



Field Notes

Mushroom Cap = Mid brown
Gills = Lighter brown almost copper colour
Stem = Lighter brown again almost grey in parallel stripes
Location = growing on soil / leaves / bank under trees
-Sullivans Dam, Dn.