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**ECOLOGY OF THE
OLEARIA COLENSOI DOMINATED
SUB-ALPINE SCRUB IN THE
SOUTHERN RUAHINE RANGE,
NEW ZEALAND.**

A thesis presented in partial fulfilment of the requirements for the degree of

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Peter Ronald van Essen

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Olearia colensoi in flower.

Reproduced from a lithograph by Walter Fitch in *Flora Novae-Zelandiae* (J.D. Hooker 1852). Source: Alexander Turnbull Library in New Zealand Heritage, Paul Hamlyn Ltd

ABSTRACT

The *Olearia colensoi* (leatherwood or tupari) dominated southern Ruahine sub-alpine scrub is the largest continuous area of sub-alpine asteraceous scrub in New Zealand - the result of a lowered treeline due to climatic conditions characterised by high cloud cover, high rainfall, and high winds and the absence of high altitude *Nothofagus* species.

Meteorological investigation of seven sites in the southern Ruahine found that altitude alone was the main environmental determinant of climatic variation, particularly temperature regime. Temperatures varied between sites at a lapse rate of $0.61^{\circ}\text{C } 100\text{m}^{-1}$ while daily fluctuation patterns were uniform for all sites. Rainfall increased with altitude over the Range at a rate of 3.8mm m^{-1} . Cloud interception, unrecorded by standard rain-gauges, adds significantly to total 'rainfall'.

Vegetative phenology of *Olearia colensoi* is highly seasonal and regular with an annual growth flush from mid November to January. Leaf litter production in *Olearia colensoi* formations is high ($4.864 \text{ t ha}^{-1} \text{ yr}^{-1}$), in comparison with world averages for cool temperate forest conditions ($2.5 \text{ t ha}^{-1} \text{ yr}^{-1}$), and is higher than some lowland forest systems in New Zealand. The high rate of litter production is the main contributor to the build up of the Takapari Peaty Loam on the southern Ruahine plateau regions (accumulating at up to 0.33mm yr^{-1}).

Olearia colensoi is an irregularly heavy (mast) flowering plant. Floral primordia are initiated in the summer / autumn preceding anthesis and the degree of flowering is correlated with the temperature regime at that time. Flowering in individual plants can occur in successive years. *Olearia colensoi* mast flowering / seeding appears to be a consequence of synchronised floral initiation during favourable (above average temperature) summers when adequate carbohydrate reserves are available. The evolutionary basis for this synchronisation may involve predator satiation, as a selective pressure, in combination with other 'efficiencies of scale' such as pollination success.

Phytosociological investigation of vegetation data from 34 plots in the southern Ruahine, Mt Taranaki, Westland and western Taranaki Range, analysed using multivariate classification and ordination techniques, demonstrated that the southern Ruahine is significantly different from other leatherwood areas in New Zealand. Regional differences in species composition were apparent but the main differentiation was a high (91% mean) cover of *Olearia colensoi* in the southern Ruahine. Ordination analysis indicates that the southern Ruahine leatherwood communities are particularly homogeneous.

Southern Ruahine *Olearia colensoi* formations are continuously regenerating. Areas of canopy opened by disturbance or die-back are replaced by *Olearia colensoi* without any intermediate successional vegetation. There are currently no impediments to *Olearia colensoi* regeneration and no indications that *Olearia colensoi* will not continue as the dominant vegetation cover, regardless of possible climate change and animal population fluctuations.

Natural forest decline accelerated by introduced browsing animals has allowed a down-slope range expansion of *Olearia colensoi* to occur during the last forty years. Much of the higher altitude *Libocedrus* forest in the southern Ruahine has been replaced by *Olearia colensoi*. The *Olearia colensoi* formation now appears to have reached its maximum range and apart from localised increase is likely to remain relatively constant in extent in the foreseeable future.

The extent of dominance over such a large area of sub-alpine scrub by a single habitat-specific (wetter-cloudier sub-alpine) species is an ecological feature unmatched elsewhere in New Zealand and renders the southern Ruahine a nationally significant ecological area.

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