Productivity, decomposition and carbon sequestration of *Chionochloa* species across altitudinal gradients in montane tussock grasslands of New Zealand

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General abstract

Anthropogenic activities are drastically altering Earth's terrestrial, aquatic and atmospheric processes and altering carbon (C) and nutrient cycling. Carbon sequestration, which can be negative feedback to climate change, may help mitigate humanity's impacts on Earth's climate. Carbon sequestration is a natural process occuring when the fixation of C is greater than the release of C back to the atmosphere from a specified system over an annual timeframe, minimally. Investigation of annual plant productivity, decomposition and alterations in relationships between productivity and decomposition across altitudinal and climate gradients will provide insight into C sequestration driven by environmental and plastic responses of species to climate change. This research investigates how alterations in climate influence ecoclinal populations of *Chionochloa* species' in terms of their productivity, decomposition, as well as C and nutrients, across altitudinal gradients on Mounts Tongariro and Mangaweka, Central North Island, New Zealand. Further, impacts on the C sequestration are investigated through alterations in productivity to decomposition ratios (P:D). Reciprocal translocations of living *Chionochloa* plants and litter decomposition bags were performed across plots every 100m in elevation (equivalent to 0.6^{o}C mean annual lapse rate). Trends were analysed based on experimental plots of origin and destination, and were compared with *in situ* plants and home site transplants. Productivity of downslope transplants increased at lower elevation plots (i.e. in warmer climates). Leaf litter experienced greater mass loss based on litter translocation to higher elevations on Mount Tongariro and at lower elevations on Mount Mangaweka likely owing to precipitation and temperature gradients respectively. The chemical and constituent composition of leaves and decomposed litter following translocation indicates strong environmental effects on both the plastic responses of plants in growth and the alterations in mass loss from decomposition. Despite chemical and constituent differences in *Chionochloa* species' tissues and decomposed litter across gradients, the P:D ratios were greater in warmer environments of lower altitudinal plots. The increased productivity observed outweighs the less-climatically responsive decomposition, indicating greater C sequestration in New Zealand's tussock grasslands is likely to occur with warming associated with climate change, providing an environmental and economic imperative for conservation of these indigenous grassland systems.

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