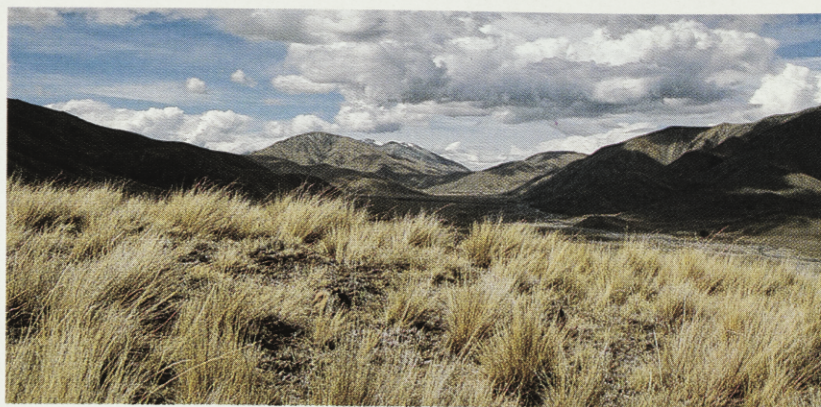




"The exceeding joy of burning", as Lady Barker described firing tussock in the 1860s, continues to have its attractions for some present day runholders. Fire has now been implicated as one of the major causes of degradation in the high country. While tall tussock can withstand occasional fire, the combined effects of burning and grazing will eventually kill the tussock plants.



Much tall tussock grassland has been reduced to short, fescue tussock through repeated burning and grazing. Now the native short tussock, such as this on Molesworth Station, is threatened by continued pastoralism and introduced weeds and pests. Photo: Mike Harding.

to tolerate the combined effects of grazing mammals and repeated burning.

### Complex Ecosystems

Individual tussocks can be decades old. The grassland communities they form can have a complex structure and support a rich diversity of species. They have often been compared with forest. The late DSIR botanist Lucy Moore said of tussock grassland in 1956: "Because its dominants are perennials with very long lives, it has many of the characteristics of a forest and few of those of a short rotation pasture. Like a forest, it is the product of long slow development, and like a forest it is much easier to destroy than rebuild."

Yet when early European graziers entered the high country, little value was placed on intact tussock grasslands. The first act was often to set fire to the dense waist-high grasslands to remove awkward plants like the spiny 'wild irishman' (matagouri) and the sharp pointed 'spaniard' (*Aciphylla* spp.). Standing at their homesteads many miles away, runholders measured workers' progress in exploring new sheep country by the dense plumes of smoke. The "exceeding joy of burning" was described by Lady Barker in her book *Station Life in New Zealand*. "It is a very exciting amusement ...and the effect is beautiful, especially as it grows dusk and the fires are racing up the hills all around us. The immediate results of our expeditions are vast tracts of perfectly black and barren country, looking hideous and desolate to a degree hardly to be imagined."

Because the nutritional value of tall tussock grasses is low, it was common in the early days of high country farming to burn the grasslands regularly. Burning removed the accumulated dead leaves and litter, promoting a flush of fresh growth that was highly palatable to sheep. Professor Kevin O'Connor of Lincoln University estimates that stock units in Central Otago increased by 247 percent between 1861 and 1871, reaching a high of 11.3 million sheep in 1878. These very high stock levels were achieved by effectively mining the native tussock grasslands. O'Connor estimates that by 1950 "unimproved" range-lands of Central Otago supported only 10 percent of the stock carried in 1880.

While tussock burning is less frequent today (about 20,000 ha is burnt annually), visitors to the high country in spring are still greeted by dense palls of smoke as whole hillsides burn from valley floor to snowline,

under Department of Conservation and regional council-approved permits. Scientists have now shown that repeated burning and grazing of unimproved snow tussock grassland depletes nutrient reserves, reduces the height of the tussocks, opens up the tussock sward to invasion by introduced weeds, and can eventually lead to its replacement by short tussock. Tussocks will slowly recover from burning, but repeated burning or burning followed by grazing can be lethal.

It is now acknowledged that there are several advantages in retaining tall tussock on pastoral lands. Tall snow tussock grasslands on the eastern and Central Otago block mountains yield more water, through reduced evaporation and interception from fog, than grazed tussock, or even bare soil. Tussock grasses can act as heat conductors: melting and breaking up snow, thereby freeing the shorter intertussock plants from the cover of winter snow. Tussocks are adapted to exploit seasonal surges in mineral nitrogen, released by the freezing and thawing of the subsoil layers, capturing valuable nitrogen into the grassland system. On many runs snow tussock still provides useful shelter and emergency forage for stock.

Fire, grazing and introduced weeds and

pests have taken their toll. Burgeoning rabbit numbers have forced land out of production in the driest parts of Central Otago and the Mackenzie Basin. Bait shyness is causing major headaches for landholders and regional councils (see box). To complicate the problem, invasive introduced hawkweeds (*Hieracium* spp.) are spreading at an alarming rate through the dry tussock grasslands (see box). Both rabbits and *Hieracium* are having a serious impact on the viability of pastoral farming and the survival of native species.

### Rabbit plague

Large areas of the high country are badly degraded with a loss of soil organic matter, fertility, soil moisture, and soil structure. Degradation has been obvious in the dry tussock grasslands for over 100 years, with earlier crisis periods in the 1890s and 1940s coinciding with periods of high rabbit numbers. Many still remember the rabbit plagues and scabweed of the 1940s and are familiar with the rescue of Molesworth Station by the Government.

A recent review by the Parliamentary Commissioner for the Environment, Helen Hughes, concludes that traditional pastoral-



Otago skinks bask on the open schist of Central Otago. The unique lizard fauna of Central Otago has been decimated by habitat loss and predation. Photo: Ian Southey.