

duced plants it is different, for at any rate some fifteen possess degrees of palatability from the very highest—*e.g.*, meadow-grass (*Poa pratensis*) and cocksfoot (*Dactylis glomerata*)—to that of rather poor feeding-value limited to one season of the year—*e.g.*, sweet vernal (*Anthoxanthum ororum*).

(2.) *Causes of Depletion and Deterioration.*

In the order of reference the very necessary distinction between “deterioration” and “depletion” is made—the former a most subtle thing, only to be estimated accurately by one having a wide knowledge of the species present and of their relative feeding-value; and the latter self-evident through the more or less complete destruction of all the members of the grassland, so that, in the worst cases of depletion, actual bare ground is the leading feature of the country. Depletion, then, needs no special definition. On the other hand, deterioration may be defined as reduction in palatability through the destruction of palatable species; and there may be increase of the unpalatable element either through increase in amount of the unpalatable species present, or through the incoming of unpalatable plants absent in the original grassland.

That such deterioration is greatly in evidence in all the land districts visited by your Commission is not only proved by the evidence, but from our personal experience and observations. Further, the sheep returns distinctly show that a more or less gradual deterioration of the grassland has been in progress for many years. But these returns need not receive much attention, since, in order to attain to accuracy, a full history of each run is necessary, and details of this kind are impossible to procure. We will cite only the extreme case of Vincent County, with its 511,188 sheep in the year 1880 and its 315,757 sheep in 1919. Even supposing there had been no deterioration of the pastures, the estimated carrying-capacity of only one sheep to three or four acres of the primitive pastures, as a whole, would show the need for great improvement. Indeed, although lowland farming in New Zealand has made great strides forward, that of the mountain sheep-stations has not merely shown no advance, but has gone backward. This is a state of affairs not at all creditable to the Dominion. Certainly every endeavour should be made to raise the carrying-capacity of the pastures, and to put them on as near an equality with the permanent pasture of the lower country as their disadvantageous circumstances will allow.

In primitive New Zealand the tussock-grassland would undergo no other changes than those brought about by the plants themselves under the action of the environment to which they were subject. There is no need here to go into the life-history of the tussock-grassland as suggested by scientific research. Suffice it to say that the tussock form eventually became the plant form *par excellence*, and through that form occupying nearly all the ground there was little room for any other species to increase its area of occupation. In other words, the tussock-grassland had attained its climax, and was fitted to endure so long as its environment remained constant.

With the exploitation of the tussock-grassland for sheep-grazing, the grazing-animal—a factor unknown in primitive New Zealand—came into play. Unaided the sheep would probably not have made much difference in the composition of the pasture except by eating out the few specially palatable species, and so allowing those particularly aggressive—perhaps the tussocks themselves—to occupy the small amount of ground provided. But the sheep-farmer early found out that none of the tussocks except the blue-grass (*Agropyron scabrum*) were palatable, but that if burned they, in their young leaves, would provide abundance of palatable feed. Consequently, throughout the grasslands year by year the tussocks were set ablaze, and year by year they were exposed to an increasing multitude of sheep. Nor was the burning confined to that season of the year when the tussocks could best recover, but even during hot, dry weather was the tussock burned. Needless to say this indiscriminate burning and, in many cases, extreme stocking led to great changes in the grassland. Of these changes the most momentous were the following: (1) The increase of unpalatable plants on the ground laid bare by burning; (2) the exposure of actual bare