USE AND CONSERVATION OF NEW ZEALAND NATIVE GRASSLANDS IN 2079*

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SUMMARY: The distribution of native grassland types is related to moisture and temperature gradients. Past trends in distribution likely to continue are the advance into the forest zone, the retreat from higher altitudes and further extensive modification by grazing agriculture. Whether these changes are "good" or "bad" is a human viewpoint. Current social issues influencing native grasslands are considered. In particular the conservation movement is seen as a transient phenomenon.

INTRODUCTION

The following is a personal view of the environmental factors and human attitudes that have influenced the New Zealand native grasslands in the past, at present, and their likely consequences a century from now.

PRESENT NATIVE GRASSLANDS AND ENVIRONMENTAL GRADIENTS

Variation within the present native grasslands relates to two environmental gradients. The first is a moisture gradient of rainfall, soil water-holding capacity, etc., and in New Zealand is probably best approximated by a soil moisture or soil type classification. The second is a temperature gradient, which in the native grasslands is largely dictated by the combined effects of altitude and aspect. In particular localities, the temperature gradient also corresponds to a sequence of topographic landforms, e.g., slopes, moraine, flood plains, etc. The relationship between the grasslands and associated vegetation types according to these two gradients is given in Figure 1.

Grasslands are bounded by *Celmisia* herbfields at higher altitudes and where low temperatures prevail; by beech forest, occasionally by podocarp forest and by associated shrubs, on the wettest sites; and by pastures comprising mainly exotics on low-altitude, warm sites. Within the native grasslands there are the tall tussocks at the higher altitudes, ranging from *Chionochloa rigida* types (solid shading in Fig. 1) on the drier sites through to other *Chionochloa* species at the moist sites. In particular, the remnants of *Chionochloa rubra* occur on intermediate .temperature and moisture sites (dotted). At lower altitudes are the short tussock grasslands in which *Festuca novae-zelandiae* is generally the dominant species (light hatching) together with a large area of modified native grassland derived from *Festuca* grasslands, or in which *N otodanthonia* species are prominent (heavy hatching).

This gradient approach has the advantage in showing the pattern in grassland properties such as the pasture yield in response to agricultural development by oversowing and application of fertiliser. The utility of such an approach will depend on identifying simple and unambiguous measures of these moisture and thermal gradients and probably other gradients such as soil fertility.

TRENDS IN NATIVE GRASSLANDS

This description of the gradients provides a basis for discussing the future of the native grasslands. Compared to last century the present native grassland shows (Fig. 2):

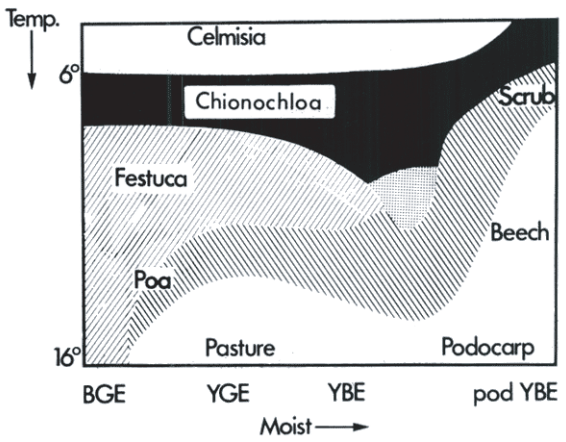

FIGURE 1. *Relationship between the distribution of present native tussock grasslands and temperature and moisture gradients.*

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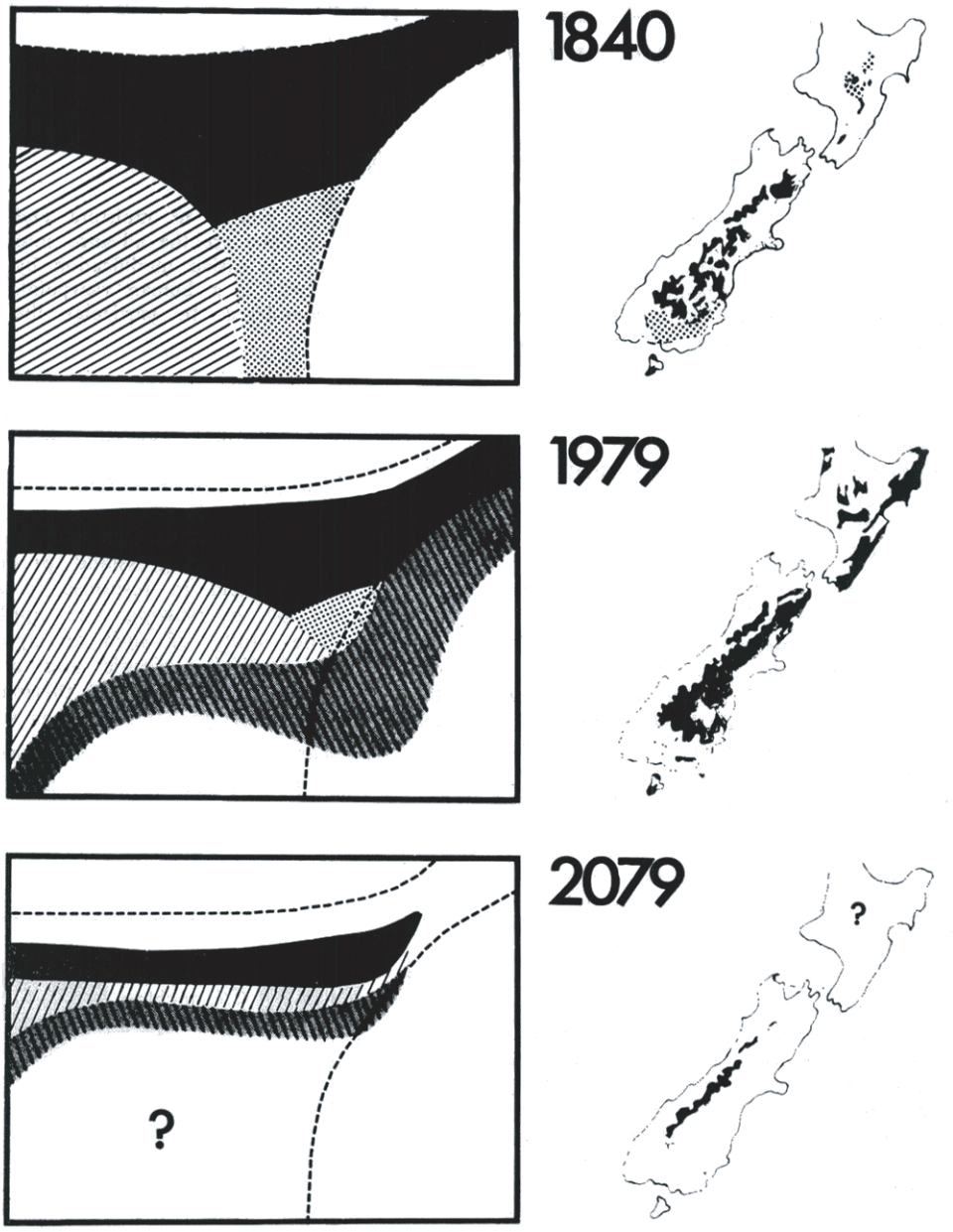

FIGURE 2. *Distribution of native grassland types* in *1840*. 1979 *and 2079*. *Key as in Figure* 1.

1. An advance into the forest zone as a result of forest clearing or climate degradation.
2. Some retreat from the higher altitudes because of the increased erosion and the expansion of herbfields.
3. Increase in the extent of short tussock grassland at the expense of tall tussock grassland.
4. Replacement at the lowest altitudes, particularly of the fescue tussock grasslands of Canterbury and the red tussock grasslands of Southland and central North Island, by arable or pastoral farming based on introduced pasture species.
5. Modification of the remaining native grassland by grazing and burning, which reduced tussock cover but" .increased the frequency of many species, if not the total flora.

The replacement of native grasslands by introduced agricultural species is likely to continue.

SCIENTIFIC VERSUS HUMAN VIEWPOINT

Whether the changes noted above are regarded as "good" or "bad" is a human view referring to a particular point in time. At the Conference on Conservation of High Mountain Resources held at Lincoln College in November 1977 (Anon, 1978, 1979), it was demonstrated that the outlook and policy towards anything, such as the native grasslands, are based on human values and aspirations at a particular point in time, and not on scientific facts. Scientists are taking part in two activities when they consider any matter. As scientists they are endeavouring to isolate the facts of cases. However, at the same time, as human beings, they are developing likes and dislikes, values and aspirations. These two activities may be going on almost independently of each other, though commonly they will interact. Unconsciously, scientists tend to select or interpret only the facts that support their opinions. It must be recognised that they talk with these two voices.

SOCIAL INFLUENCES ON NATIVE GRASSLANDS

My views on the native grasslands in 2079, and some of the facts I use to support these opinions, are given below. In presenting them I probably overstate the case to make a point.

Firstly, I am deeply concerned with the conservation of biota, notably the species *Homo sapiens,* and particularly one member of it. Any other consideration may have to be subservient to this requirement.

Secondly, native grasslands are a resource which can be utilised by humans. They are also a renewable resource if certain precautions are taken. Their value at present is that they are there and can be assessed, but this does not preclude their replacement if an alternative use is considered to be more beneficial.

Thirdly, I am suspicious when native grasslands are described as "fragile ecosystems", or utilisation of them as "upsetting the balance of nature". This is confusing the human value assessment with the scientific assessment. An ecosystem is dynamic and as scientists we are saying that if one factor is changed then the system undergoes readjustment-whether that is "good" or "bad" is a human value judgement. It is strange that the tussock grasslands are described as "fragile" but its human occupants as "rugged individualists".

The human view on native grasslands has changed in the past, and will continue to change. In one sense it is presumptuous of us to predict how our grandchildren will view the native grasslands in 2079, though their options will probably depend on our reactions today. In the distant past, mountains and grasslands were viewed with awe and even dread, with probably only the thought of a moa roast justifying excursions into them. In Samuel Butler's day, grasslands were only to be assessed for their potential for burning and conversion to sheep pasturage.

At present the following considerations influence our view of native grasslands:

1. Extensive grazing agriculture is still the main contemplated use of native grasslands.
2. Control of soil erosion, the movement for which started last century, remains a dominant theme. The political pressure to stop soil erosion reached its maximum in the last ten years, but the bureaucratic inertia of laws and regulations which it created in the form of land retirement and other policies, is just starting to be felt and will continue for decades.
3. Increasing farming productivity by oversowing with legumes and grasses with phosphate and sulphur fertiliser started between the wars, increased after the Second World War, and is still strongly advocated.
4. In recent decades water conservation has been linked with soil conservation. A number of dilemmas arise when soil and water conservation requirements do not correspond, such as in consideration of dry sectors of the native grasslands.

5. Also linked with the water conservation movement is the increased importance given to hydro-electricity development, from which, together with the affluence of the 1960s and recreational demand, arose the current concept of "multiple use".
6. More recently there is the "conservation" or "ecology" movement of the 19608 and 1970s with its "back to nature" aspiration. This will be discussed later.
7. The interplay between human opinion and science is probably best seen in the attitude to introduced animals. Since European settlement sheep have been regarded as an integral part of the native grasslands and probably most people still regard them as continuing to occur there as of right. Deer were regarded as "an essential part of our cultural heritage" when first introduced, a "novelty" during the first few decades of their appearance, a "good source of income for a few" in the 1920s and 1930s, a "pest" to be exterminated by any means possible in the late 19408 and 1950s, and at present everything from a "pest", a "valuable export industry of game meat", a "dwindling natural resource", a "great sports animal" to an "ideal animal for intensive agriculture". Science hasn't changed as much as human attitudes.

Similarly, rabbits were regarded as a "scourge" for many decades, while at present feeling seems to be relatively neutral, apart from a few murmurings of "remember the lessons of the past", and some exponents of "rabbit farming".

The point is that attitudes towards native grasslands are continually changing, and in this science generally follows rather than leads. There is a current emphasis on the revegetation of eroded mountain slopes to prevent erosion and flood damage of the plains. While that view once seemed to have a scientific basis, current work suggests that upper slopes are not the source of flood damage. Similarly, cattle were once thought to be of benefit to native grasslands' agriculture by not grazing the vegetation too closely, or at the higher altitudes. Recent scientific evidence now suggests that cattle cause more damage to waterways which are more generally the origin of erosion and flooding.

CONSERVATION MOVEMENT

It is my opinion that the conservation or ecological movement is a real force influencing the utilisation of the native grasslands at present. However, I have the impression that the forces or pressures do not come from people living in the areas concerned, but rather from the cities and towns. Consequently, I wonder whether the whole ecological movement is not a transient phenomenon related to the agricultural revolution of recent generations. With agricultural technology leading to greater output per farmer, and the consequent movements of surplus people to urban centres, I believe we are seeing the hankering after childhood memories of farming from first and second generation town people. That the phenomenon may be transient is supported by the impression that few of third and later generations have any urge to leave the town environment. It seems that some of the pressure for conservation reserves is to preserve the human cultural heritage of one generation back, rather than of earlier generations, or for biological or scientific reasons as often given. For example, there is the current move to reserve sections of tussock grassland, which are undoubtedly highly modified from a century of grazing, yet there seems to be less pressure to reserVe areas of dense tussock, matagouri, spaniard and the multitude of wekas, which are probably the common form of the original tussock grassland.

RESERVES

While native grasslands are still relatively extensive, it is easy to believe that agricultural development will give the greater good to the greater number. But before the last tussock is in sight we should be selecting our reserves, whether they be for scientific or cultural purposes. In this, use can be made of the moisture and thermal gradient concept developed earlier, for by using it such reserves can be selected to cover the full range of sites available, or with proportionally greater representation of types that occupy greater areas (Fig. 3).

In establishing reserves, undue emphasis has been put on rare flora and fauna and not enough on modal communities. This trend is obvious in some Otago figures (Table 1). From the scientific point of view, there probably should be ten reserves of "normal" tussock grass for anyone which is a "unique" variant. On either basis, more attention needs to be given to reserves in the lower-altitude, dry-grassland regions. It should also be remembered that human preferences have a large influence on selection of reserves. Having been brought up in the tussock grasslands I cannot understand why most people seem to prefer trees to tussocks. It seems strange that there was such an uproar when a few beech trees were drowned in Lake Manapouri and yet not a whimper when thousands of tussocks

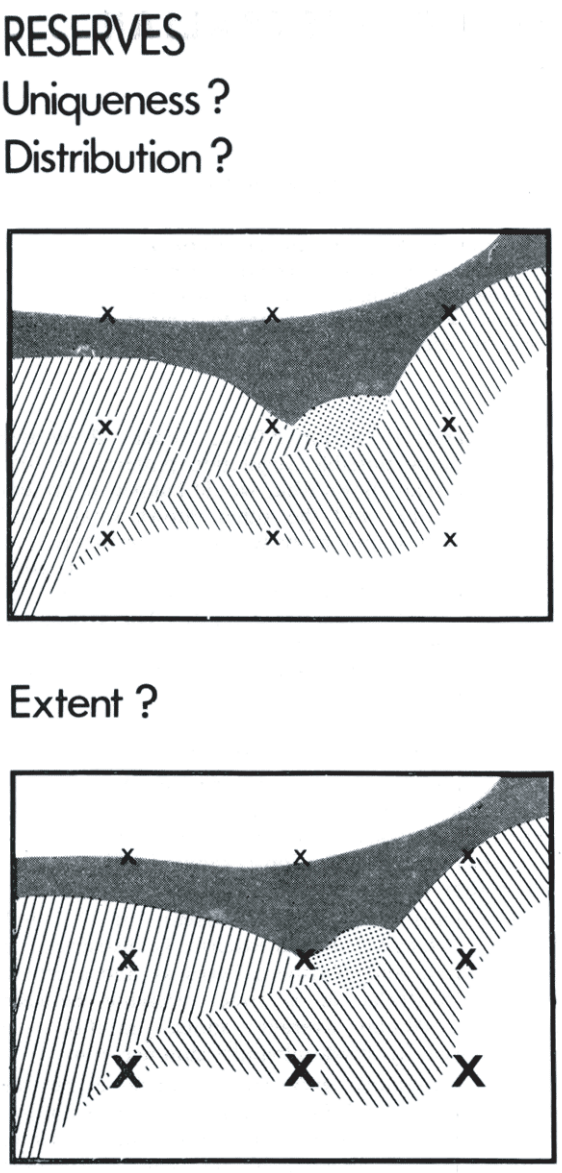

FIGURE 3. *Criteria for distribution of reserves.*

and scabweeds disappeared below the hydro-electric dams of the Waitaki and Clutha rivers. As a scientist, I see very little difference between the two; in responses of others the differences were profound.

Similarly, all species of animals have some value relative to man. Even the rarest must rank below me. Again because of my background I rank humans above sheep. But I have no doubt that one sheep is worth more than one black stilt *(Himantopus himantopus).*

If the reasons for making reserves, national parks, etc., are scientific ones, or as sources of biota, or reference points, then we have to ensure that all classes of biota are represented. This, in practice, will probably mean creating greater political pressure for the preservation of the native grasslands, particularly the lower-altitude, dry sections, since we have to overcome a partial human pre~erence for forest types.

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TABLE 1. *Percentage of types of vegetation in 1840 Otago vegetation and in present reserves (Allan. 1978).*

	Vegetation 1840	Reserves 1976
Short tussock	29	0.1
Tall tussock	21	10
Broadleaf / podocarp	10	64
Beech forest	10	14
Others	30	12