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Wild Spaniard (*Aciphylla*) dominates the foreground of this line drawing of a section of the St James Range near the Clarence River.



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Diversification in the high country

B. Pinney

In the course of an address to the high country field day held at Mount Pisa Station in January 1978, Mr Bernard Pinney, Dunrobin Station, said the real advantages of diversification come from a broadening of the trading base which lessens the effects that violent fluctuations in income have on traditional farming economics. The following is an edited version of his address.

Introduction

Diversification could be defined as a variation or modification of existing practices. It is a fashionable topic today, and like fashion, changes very fast. Often the new ideas are really old ones in a new wrap; often they are out of date in no time, but just occasionally an original idea turns up which becomes permanent.

In the early gold-mining days, the larger part of the population which came into the Mount Pisa district were miners and those who supplied them. Almost all had horses and cows, and resented any restriction on their grazing. This form of diversification existed for many years. "Why should all the Crown land be solely for the use of the run-holders" they reasoned.

Today's high country gold is produced in the form of farm production, electricity, fruit and tourism. Like the true gold, these are harvested with the help of water, but unlike gold are (with good husbandary) a renewable resource.

Conventional livestock production

I believe the conventional sheep and beef systems, evolved so carefully over the last century, are unlikely to be superseded in the back country for a long time. They provide the most obvious potential for expansion that exists on most properties.

The greatest opportunity of all is to diversify towards better management and improved stock performances.

It is very worth while to calculate the economic impact of an extra half kilo of wool, and an extra five per cent lambing, bearing in mind that these can often be achieved without any more capital stock, or extra labour.

The pitfalls in the expansion of the livestock enterprise are numerous. Getting stock killed is one. Depressed stock performance levels generally seem to be one of the less expected but very real costs of development programmes in the early stages. The reason lies in management spending too much time thinking about the development and spending too little time concentrating on the stock which makes the money.

Development or expansion of any new venture generally seems to take longer and cost more than originally planned, particularly in the case of something new or unfamiliar.

Controlled crossbreeding should be considered. It need not over-complicate the pure breeding of the base flock or herd. Healthy premiums may be obtained by producing say Booroola crosses, Border Merino, or Border Romney first cross lambs for total disposal in the autumn. Angus or Hereford cows could be mated to Charolais or Simmental sires. Such a move has the capacity to produce much more beef from the same number of cows and saves having to run more cows to produce the same end result under a pure or straight breeding programme.

When moves in simple cross-breeding like these can also be linked to better marketing

strategies such as the marketing or pooling of one's prime stock, (instead of giving them away on schedule), then considerable advantages are likely as the result of diversifying one's management.

There are however less conventional livestock possibilities which bear examination.

Deer farming

The old proverb that "necessity is the mother of invention" can be applied particularly well to the start of deer farming. Deer can be captured from the wild; managed, yarded, sorted, weaned, put through gates, transported and velveted. They can be trained to eat hay, nuts and grain, and have excellent pasture grazing characteristics, contrary to the early views of many ill-informed individuals. Add to this list

profitability, longevity, easy care, and the fascination which these interesting animals arouse, and you can understand why there is so much enthusiasm for this misnamed noxious animal.

There can be no question that deer farming provides one of the best opportunities for back country farmers to diversify today.

This does not mean that they should rush in without doing their homework and sums very carefully indeed. The capital inputs are considerable at present costings.

Contrary to popular belief the fencing costs are not exorbitant. Deer fences are easier to erect than a good sheep fence, but there can be problems in getting a supply of posts, strainers, and wire. Relative to the profitability of the deer, fences are much cheaper than sheep fences.

The heaviest cost by far is the capital to buy



These two stags would yield about two kilograms of velvet each, to gross about \$300 a head annually.

the livestock and the cost of debt servicing. Hence it is crucial for any intending deer farmer to make firm arrangements for the supply of initial live deer before outlaying a lot of capital for fencing and yards.

There are several options open for the management of deer:

- breeding for live sale.
- venison production.
- velvet production.
- live capture.

Another obvious option not yet fully explored is "put and take" deer farming. For this system, the farmer would rear stags to maturity and then release a few at a time, onto a fenced block. There are indications of a good market with international trophy hunters, whose stalking skills do not always match their story-telling or money-spending abilities.

At the present time there appears to be a sound market for both venison and velvet at

rates far higher than returns for beef or sheep. No farmed venison is being slaughtered at present due to the demand for live hinds and stags. It is the policy of the New Zealand Deerfarmers' Association to send farmed venison to West Germany, where the demand is for feral venison.

Deer farming requires new skills which should not be confused with those needed for sheep or beef. Success is very dependent on stockmanship and intensification, because intensification is the key to civilising and controlling the deer, besides greatly reducing the overhead costs.

Other options

1. Angora goats are currently commanding high premiums for their wool and for breeding-up programmes. Goat meat has a ready market overseas. The world consumption of goat meat is greater than that of sheep meat.



Opossum farming – Is an opportunity to diversity being missed?

2. *Slink skins.* Have we looked at specialist Slink Skin production along the lines of the Astrakhan and Karakul sheep-producing regions of the Soviet Union, where it is an intense specialised industry in regions very like the South Island high country? What about superovulation of the ewe to aid production of slinks?

3. *Opossum breeding.* Let us have a look at selective breeding schemes for specialist pelt production, and practical methods for containing the opossum in a farmed situation. What about the meat-producing potential of the opossum?

4. *Fish farming.* We have in our unpolluted waters an abundance of one of the world's great raw materials. The food-conversion efficiency of fish is considerably superior to that of the ruminants we chase around our hills. The markets for farmed fish are there, the technology has been thoroughly worked out overseas and it is only a well-organised vocal minority of emotional individuals who are holding back an industry, the development of which is inevitable.

High country farmers should be doing their homework now in anticipation of the day when the politicians rectify their very foolish decision of a few years ago when they banned trout farming. In the meantime, there are no political obstructions stopping them from moving into other forms of fish farming such as crayfish, eels or salmon.

5. *Rabbits.* There is great irony in the fact that the large New Zealand White is one of the most favoured rabbit breeds for overseas rabbit farmers. It is also interesting to note that in certain parts of Otago, rabbits skinned and ready for the pot are being traded for three dollars to five dollars a pair. Ever since the 1870's, there has been a diversification problem: whether to farm sheep or rabbits. The export potential of rabbit and hare meat is obvious. There is little reason why licenced factory farming should not be permitted right now. I am not suggesting exporting the droves of rabbits still running round the South Island.

Cropping

There are significant areas of arable land on many back country runs, where usually there are climatic limitations of short growing seasons, where the altitude brings frosts or snows at any time, and where high winds can remove weakly-structured topsoils. These pockets of good arable land could grow very profitable specialist crops.

What we should be actively seeking out are high-value — low-volume crops, such as herbs, the production of which is enhanced by the environment. The remoteness of their surroundings may suit the production of pathogen-free crops in some instances. One classic example of a specialist crop, a few years ago, was Northern Southland's Chewing's fescue which sowed out the world's early airports, and playing fields at Wimbledon and Lords.

M.A.F. and the Crop Research Division of the DSIR should be set to work on high-altitude specialist crops.

There is room for a dynamic farmer-owned cropping co-operative now, which would act as the marketing link and arrange and supervise production contracts. Who knows what crops it may market? Maybe parsley, thyme, sage, peppermint, tetraploid lotus, browntop, Yorkshire fog, elderberries, rosehips, tussocks, matagouri, or even spinifex.

Engineering skills are freely available for farmers to study the possibilities of new and traditional forms of irrigation. Winter water-storage systems, low-pressure side-roll irrigation, and trickle irrigation are all feasible today. It is irresponsible not to check out whether they have high country application for specialist crops or livestock. Water is one of the most likely keys to diversification.

A fresh look at traditional problems should be encouraged. After all, a problem is only a problem as long as we are unable to see the solution.

Sweet briar is one example. Whilst many of us would welcome its addition to the noxious weeds list, how many of us have considered selecting productive strains, line planting, pruning, trickle irrigating the sweet

briar, and automating the collection of the rose hips by the modification of the black currant harvester? Furthermore I understand there is a specialist market for pipe stems from the briar root which would be well worth-while checking out.

Substitution

The real answer to bad briar on weed infestation or the hills is substitution with something more vigorous like a high producing pasture or trees. Any eradication practice which does not do this, leaves us with a situation of good money chasing bad. It should concern us nonetheless that the money happens to come from the Government instead of our own pocket. Some will see the money spent as an insurance policy, whereas the opportunist would view its spending on 'substitution' forestry as both insurance and investment in the future of the region.

Without wishing to over-labour the point or to be too controversial, we may well find that the briar, like the deer, was a blessing in disguise, and a catalyst to diversification.

Forestry

Let us not forget that vast areas of our so-called run country were once clad in forests. By the use of introduced species of hardy conifers it is possible that much of our back country will be reclad. There are a number of regions where this is happening already. The run country from Arrowtown towards Glenorchy will probably be lost to 'automatic' forestry soon after the turn of the century if the present seeding rate continues. Likewise, Mount Cook Station, some of Molesworth, and northern Southland.

Forestry will become the big emotional issue before long among runholders. I believe that with skilled management, forestry has the potential to revitalise many of our back country communities. It will provide more job opportunities in the region, though I hasten to add that these will more likely be provided to mobile skilled teams of men based in local towns than to scattered individuals from the runs. The work will be

seasonal and cyclical depending on the age and rate of the planting of the forest. Continuous planting and forest management is preferable to "stop-go" forestry.

The easily afforested lands of the North Island and in the Nelson area are now planted, and the obvious next step is for the foresters to look hard at the rest of the South Island's understocked run country, and especially that in Southland and Otago.

These developments will bring considerable opportunities for the back country men to diversify. If they sell their land for forestry, they will free up capital for investment either on the remainder of their properties or off the farm. They will benefit greatly from the new roads, protection fences, and grazing rights to the forests if they hold on to them. On the other hand they may decide to set up partnership deals in which they provide the land in exchange for a share in the final crop. If they have the inclination, and more importantly the resources, they may decide to plant and finance the forest themselves. The variations are considerable.

As the energy shortage increases we may see a reversal from the present situation of moving the forest to the processing, to one of moving the processing to the forest. I visualise too a trend away from the huge processing complexes with their related industrial problems and a return to smaller enterprises bonded by a larger co-operative marketing organisation serving primarily the forest growers and those doing the job.

Hardwood production and nut growing also warrant consideration as a means of diversification, as is planting for honey production. A wide variety of native and introduced plants found in the back country produce nectar and pollen. Many farmers could profitably learn the bee-keeping art.

Tourism

Leisure has become democratic and urban. The liking for mountain scenery, like the other good things of life, has spread from the once privileged few to the now privileged many. Ideally, mountains would be inhabited by local people, and though easily

reached would still be undiscovered by anyone other than runholders.

Tourism in our back country will continue to increase. Whilst the prospect may not please us, the increasing number of tourists opens up new possibilities for diversification into a profitable cash crop.

A few radical changes in attitude will be needed if a bountiful harvest is to be reaped.

Tourists will have to be wooed and treated as visitors. There is a subtle difference between a visitor and a tourist. Their wishes will need to be understood and catered for. One could divide these visitors broadly into two groups: those who want to 'go places', and those who want to 'do things'.

Tourism in the high country must be handled with sensitivity. It is a business requiring a high level of personal skill and effort as well as capital. Farming and tourism are complementary and can flourish side by side, but tourism must never be allowed to overtake farming. It should supplement income rather than supplant jobs. By making farms more profitable, tourism can help in checking depopulation and preserve the tradition of the rural community.

There many ways in which the farmer can act. He can provide *residential facilities*, such as bed and breakfast, caravan and camping sites, chalets or second homes from his redundant houses; *sporting facilities* such as fishing, shooting, hunting; *recreational facilities* such as pony trekking, nature trails, sailing, hang gliding, rock climbing, or helicopter skiing. The farmer will have to put a cost on these new services provided, though one hopes we will never see him charging for friendliness.

I have noticed overseas that the impetus for farms going in for tourism often comes from the farmer's wife and not the farmer whose pride is wounded somewhat by the thought of such change. Contact with visitors broadens the interests of back country people, and relieves the tedium of the life for some of the farmers' wives.

Generally tourism creates more jobs for women than men. This alone should encourage serious consideration since there is a

great shortage of job opportunities for women in our country communities with the result that many farmers' daughters have no option but reluctantly to seek jobs in the cities. I suspect that the presence of women has a stabilising and even attracting effect on the male population of the country areas where women are present.

We now live in a society where two-income families are becoming normal. There must be a beneficial attraction for more farm labour in areas where tourism and other forms of diversification are practised.

Broadening the base

The real advantages of diversification come from a broadening of the trading base which lessens the effects that violent fluctuations in income have on traditional farming economics.

Subtle fits can flow too from the stimulus of doing something a little unusual, thereby meeting a different range of people and hearing their ideas.

I believe diversification stimulates thought, and encourages adaptability which is so essential in our changing world. Indeed it can revitalise a dying community.

Any efforts to increase existing production or to diversify must be based on sound market information. New Zealand farmers have been far too production orientated to date, and have neglected the question of marketing until they find that their produce is hard or impossible to sell. All new ventures should start as the result of forward market predictions.

In conclusion there are as many opportunities to diversify as there are runholders in the back country. Diversification requires considerable investment. It also requires attention to detailed planning and execution.

If it is the wish of the runholder to go into the hills and live in 'splendid isolation', that is his choice. As the world does not owe us a living, our future prosperity is in our own hands and no-one else's. The opportunities for diversification are certainly there.

Geological history and erosion

P. Ackroyd

By comparing the geologic history of the New Zealand alpine region with that of North America and Australia, Mr Ackroyd highlights both the relative youthfulness of the rocks that make up our alpine region and the extremely short time interval since the last mountain-building episode in New Zealand. The possible effects that facets of geological history have for erosion potential in the South Island high country are also discussed.

Introduction

In any geological discussion an understanding of the geologic time scale is essential in order for the reader to comprehend the immensity of time available for geologic processes to operate as well as providing a standard to which reference can be made during the course of the discussion. A time scale as set out in Figure 1 is divided up according to 'systems' or 'periods', a system being a rock assemblage with a characteristic fossil content laid down over a period of time.

The problem with a time scale, such as that depicted in Figure 1, is that it belittles the great bulk of time that belongs to the Precambrian about which we know very little. On the left of the time scale is a column depicting the relative durations of the major time intervals. The dominance of the Precambrian immediately becomes obvious, as does the insignificance of the Cenozoic. One way of looking at this scale problem is to treat all of the time of the geologic record as though it were one 24 hour day (24 hours equals 4500 million years). If this was the case then the Precambrian would take up 21 hours, the Paleozoic just under two hours, the Mesozoic nearly one hour, and the Cenozoic under half an hour. Incidentally, under this model man would have been around only for the last half minute of our 24 hour day. Appreciating this immensity of time, we can now look at just how mountain ranges are formed during the major earth building events known as orogenies.

The mountain-building process

The majority of the world's significant mountain ranges, including the Southern Alps, are young fold mountain belts. The rocks that make these mountains were originally sedimentary layers comprised of material eroded from an earlier landmass and deposited in a marine environment. Earlier theories postulated the existence of continually subsiding troughs (or geosynclines), of tremendous extent, in which the great thicknesses of sediment necessary to form a mountain range accumulated. Although a convenient model, this concept is now regarded as being unrealistic.

The sediments are now thought to have been dumped as large deltas on the continental shelf and slope, forming a thick wedge-shaped apron of sediment along the edge of the ancestral landmass. Figure 2a depicts how these features might have appeared.

Over the length of time that the sediments accumulated to build up this wedge (and which in the New Zealand situation appears to have been in the order of 200 million years) they became compressed into rock layers. When later uplifted, with consequent folding, faulting and fracturing, these rock layers formed fold mountain ranges.

In recent years there has been a rapid advance in the field of earth sciences, particularly so with regard to the Plate Tectonic Theory, incorporating the older idea of 'Continental Drift'. The occurrence of

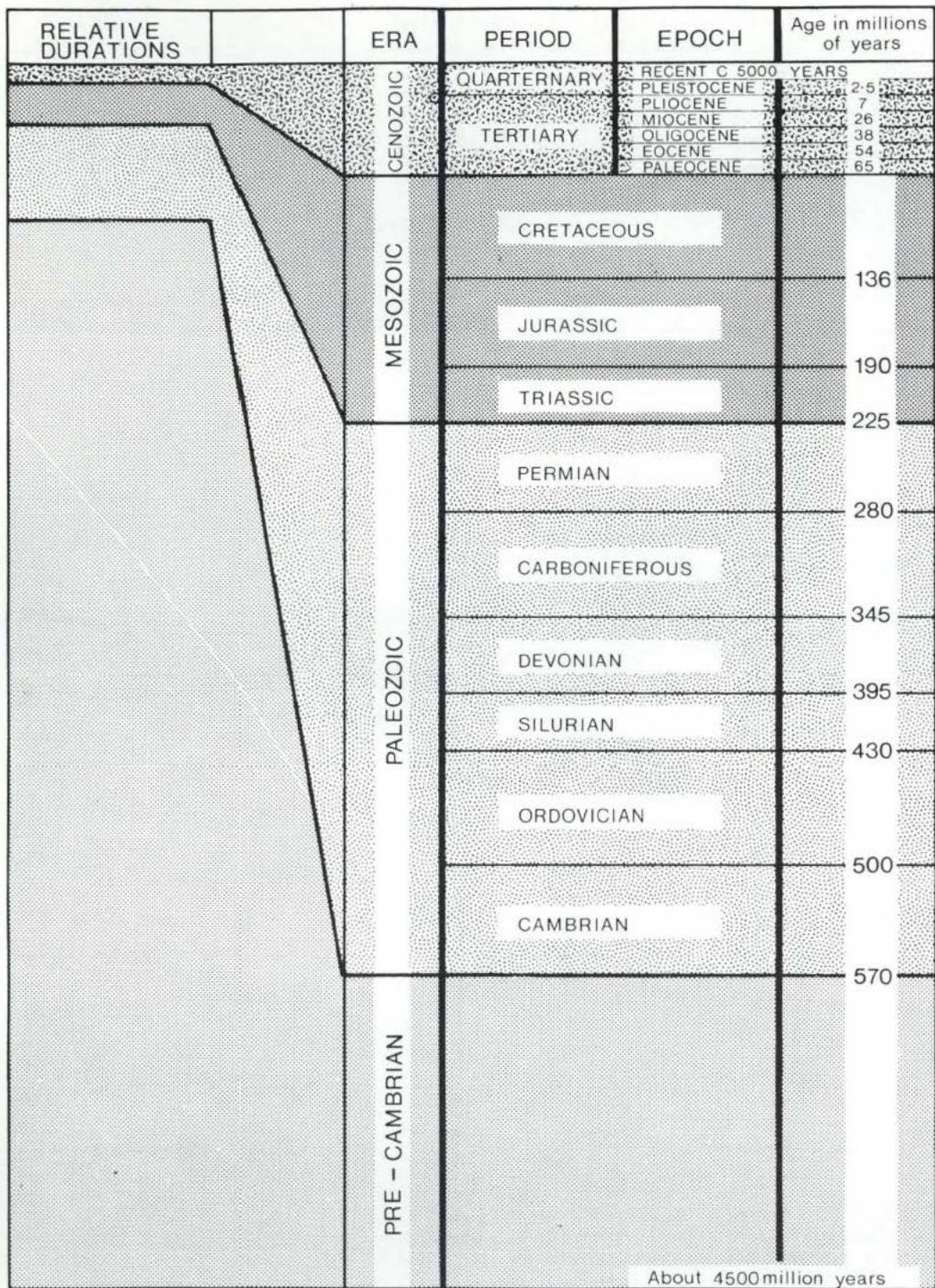


Figure 1 – The Geologic time scale.

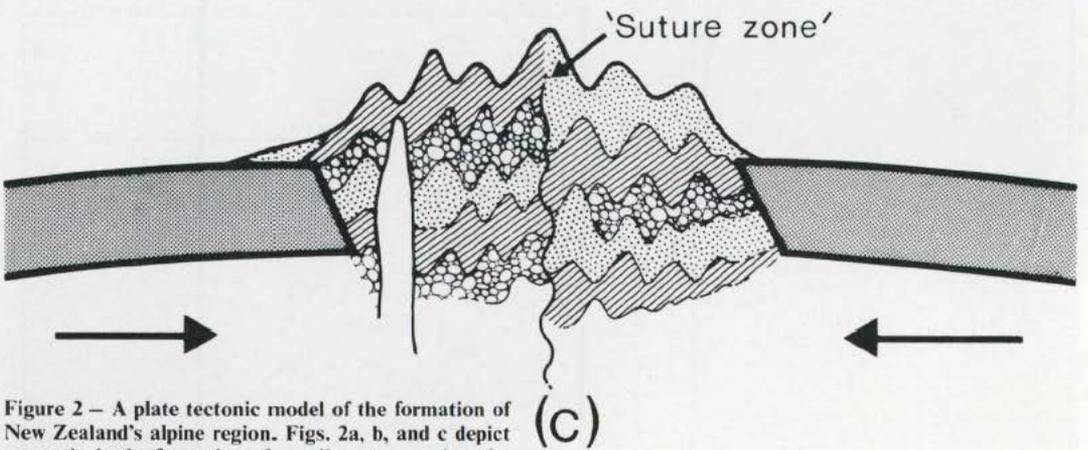
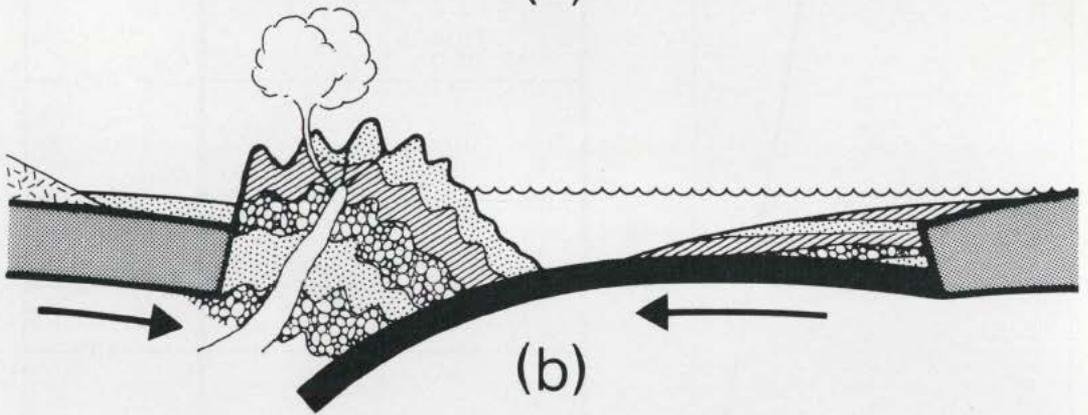
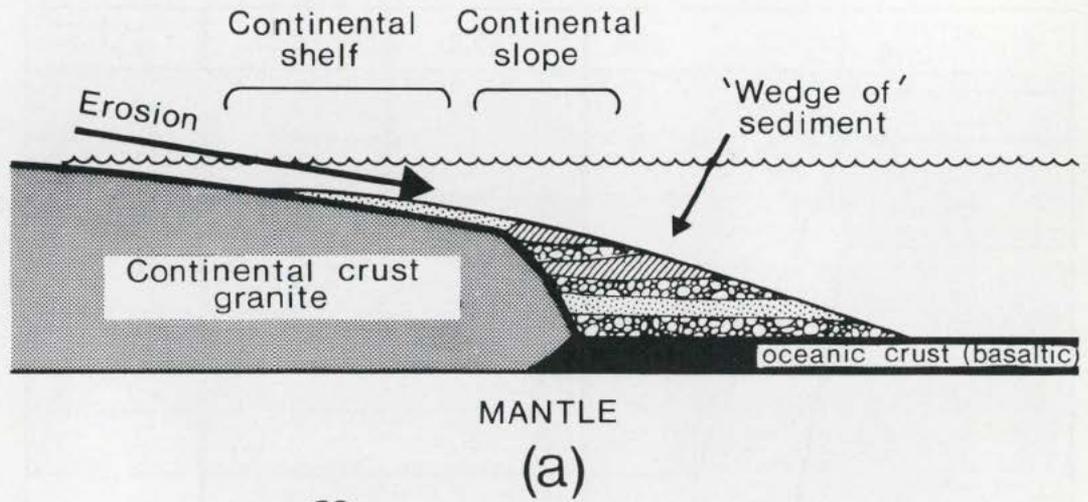


Figure 2 – A plate tectonic model of the formation of New Zealand's alpine region. Figs. 2a, b, and c depict respectively the formation of a sedimentary wedge, the impending collision between two such systems, and the complete development of the fold mountain belt.

earth-building processes is an indicator of the tremendous forces at work in the interior of the earth, and current theories relate such activity to relative movement between portions of the earth's crust ('plates'). Very crudely the basis of the Plate Tectonic Theory is that the outer crust of the earth is divided into several "rigid undeformable spherical caps in relative motion . . . The boundaries of these caps are . . . belts of earthquakes . . ." (McKenzie 1972). The mechanism responsible for the movement is not well understood but is probably some sort of convection current, or a deep-seated upwelling, in the earth's mantle.

Orogenies, or mountain-building events, are thought to occur where a sediment wedge lies in a zone between the opposing movements of two plates. The compressive forces developed in such a situation would force the rock layers upwards, with an amount of folding and fracturing dependent on the degree of compression. Once above sea level the newly created land area becomes subject to erosive forces and may be part of the source area for a new sediment wedge. Figure 2a, b, and c depict development of a young fold mountain belt. Processes such as this are thought to have been operating cyclically over the length of the geologic record.

Early history of the alpine sediments

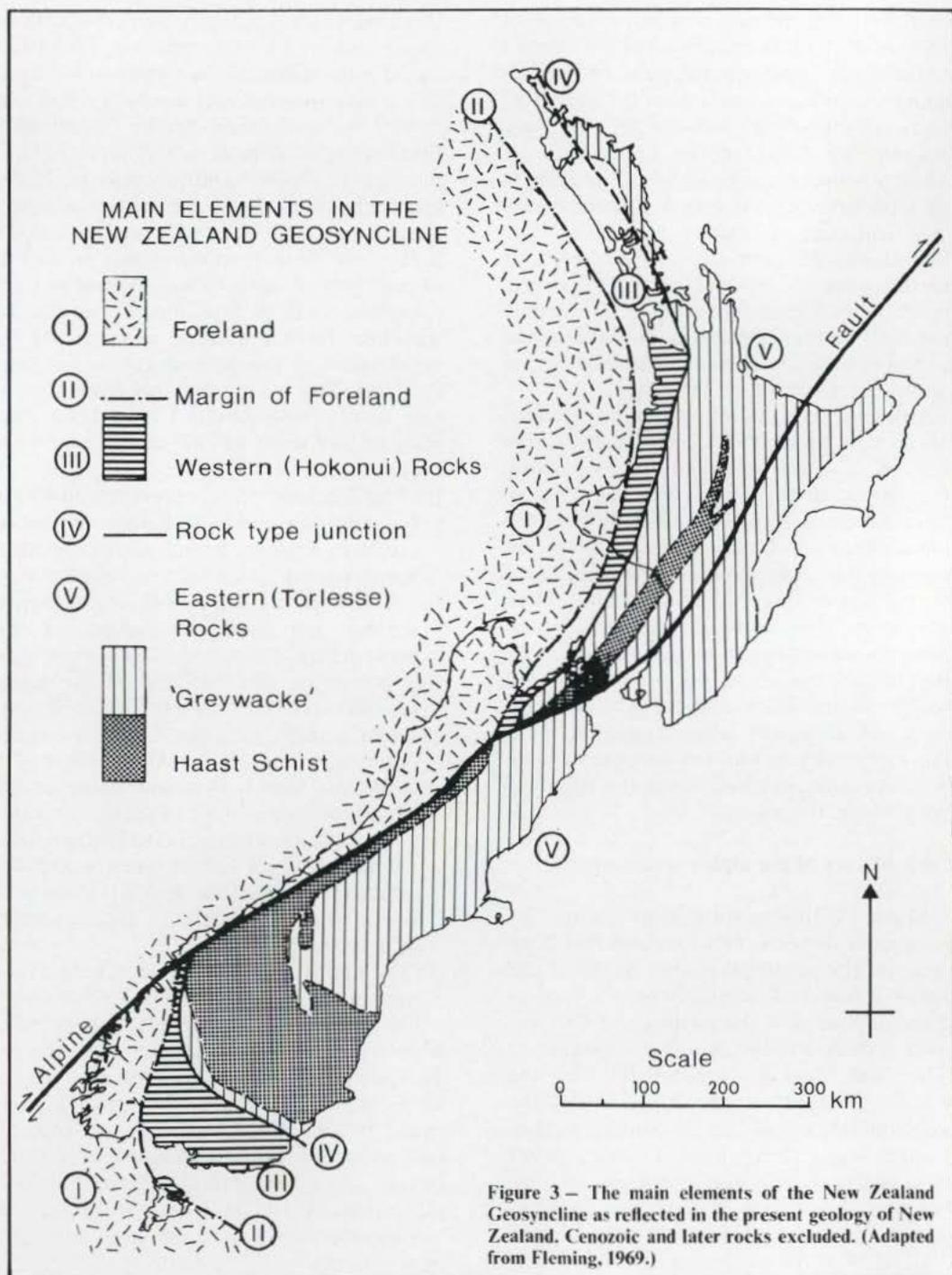
Much of the existing research on the geologic history of New Zealand had been done on the assumption that much of our alpine region had originally been a geosynclinal deposit. For the purposes of this discussion there will be continued reference to 'The New Zealand Geosyncline' as the trough thought to have received the sediments that make up the Southern Alps. As mentioned above, however, the concept of a geosyncline is too simplistic and we should rather think of these sediments as being laid down in huge coalescing deltas.

Deposition of sediments in the 'New Zealand Geosyncline' began somewhere around 350 million years ago when New

Zealand was more closely connected with the supercontinent Gondwanaland. Gondwanaland is the name given to the southern part of a great continent that was believed to exist before being broken up by 'Continental Drift' thought to have begun some 200 million years ago. Being closely associated with Gondwanaland would ensure an adequate source area, or foreland, for the alpine sediments. Bearing in mind that the history of the 'New Zealand Geosyncline' is more complicated than first appears several researchers have identified elements of the geosyncline in the present geology of New Zealand. The main elements from west to east across New Zealand have been summarized by Fleming (1969) and are shown in Figure 3:

- (i) The foreland region represented by the Precambrian and early Paleozoic rocks of southern Stewart Island and the western South Island.
- (ii) A line, partly defined by faults, representing the western margin of the geosyncline.
- (iii) Bordering the foreland on the east a succession of thick sediments folded into a broad trough, (the Southland Syncline), but now broken by the Alpine Fault. The sediments of this belt now make up the 'Hokonui' assemblage of rocks.
- (iv) The Pacific margins of the Hokonui rocks are marked by a belt of igneous and volcanic-type rocks (the Red Mountains of South Westland and the Dun complex near Nelson).
- (v) The final element of the geosyncline is an eastern or 'Torlesse' assemblage of rocks.

From this point on we become concerned with the last of these major elements, the Torlesse group of rocks comprising: (1) the sandstones, (commonly but misleadingly called 'greywackes') that make up the great bulk of the mountainous regions in the South Island; and (2) the Otago schists. Although the schist rocks of Otago and the Canterbury 'greywackes' appear to be quite different, they both belong to the Torlesse assemblage, the schists having undergone alteration through a process of metamorphism.



Metamorphic rocks occur as a result of increased temperature and/or pressure causing a recrystallization of the minerals that made up the original rock and can be accompanied by the growth of new mineral forms. The flaky or micaceous minerals evident in the Otago schists are the product of such a recrystallization process, and characterize many other areas of metamorphic rock. A possible reason for the occurrence of the metamorphism which affected the Otago schists will be mentioned later.

The sediments that make the Torlesse group of rocks have long posed a problem to geologists because the rarity of fossils and the monotonous appearance have provided few clues as to their age or origin. Indeed accounting for the lack of fossils is in itself a matter for debate. Recent fossil discoveries however suggest that deposition of the Torlesse sediments began as far back as the Carboniferous (340 million years ago) and continued, at least in part, until the early Cretaceous (say 120 million years ago), with the major period of deposition being from 225-135 million years ago.

Until recently all the theories regarding the deposition of these sediments have rested on the assumption that they were derived from a foreland which lay to the west, but this is no longer thought possible, the reasons being outlined by Bradshaw and Andrews, 1973. Their two main objections are presented in summary form below:-

- (i) The 'Hokonui' group of rocks, mentioned above, which lies to the west of the Torlesse rocks, were evolved over a period of 130 million years in a region of island arc-type volcanism while the Torlesse rocks, on their supposed seaward side, show little or no evidence of volcanic activity and were derived from a purely granitic source area.
- (ii) If the Torlesse rocks were derived from a western source area then it can be expected that they would have been deposited in shallow water towards the west and deeper water towards the east. Recent field work has shown the opposite to be the case and some eastern parts may in fact be of non-marine origin.

Although the evidence suggests an eastern source area for the Torlesse rocks there is no suitable foreland to the east of New Zealand, indeed the traditional argument for a western source rests not so much on the character of the rocks but rather on the absence of this eastern source area. In order to overcome this problem, one theory now has it that 'the Torlesse rocks were derived from another active continental margin and were subsequently "rafted" into their present position by sea-floor spreading' accompanying continental drift. One source area that has been suggested is the Marie Byrd Land area of Antarctica, an area that has 'appropriate basement geology and inferred pre-drift position'. (Blake *et al.* 1974). Bradshaw and Andrews suggest that there was considerable erosion and re-deposition within the geosyncline, and this could indicate that the Torlesse basin itself acted as a secondary sediment source. If this was the case then it is likely that the sediments would have been considerably disrupted and fractured even before any major uplift took place.

Later history of the alpine sediments

In the geologic history of New Zealand there occurred at the close of the Jurassic, 135 million years ago, the Rangitata Orogeny, which was the first major earth-building event to affect the Torlesse rocks. Deposition of the Hokonui and Torlesse groups of sediments continued, probably as two discrete sediment wedges, up until the early Cretaceous by which time the collision between the two systems had already begun the process of uplift and deformation. The Plate Tectonic Theory thus provides a plausible explanation for the onset of this orogeny. The metamorphism that created the Otago schists may have developed in a 'suture' zone as the two discrete wedges of sediment collided. (See Figure 2).

The Rangitata Orogeny was also thought by Fleming to be responsible for some of the structural trends evident in New Zealand today. Apparently it was not responsible for the 450 km of movement along the Alpine

Fault which is now thought to be post-Miocene in age.

Once out of its marine environment the new land was subjected to the forces of erosion so that by the end of the Cretaceous the land had been reduced to one of low relief over which the sea was gradually advancing or transgressing. This 'levelling-off' of the landscape is known as peneplanation, the process resulting in a flat even land surface which decreases gently in altitude towards the sea. A few of these relict land surfaces can still be seen throughout inland Otago.

Cenozoic history

The marine advance continued for about 30 million years until the Oligocene Epoch (38 million years ago) reducing New Zealand to a rather restricted archipelago over which were laid down shallow water marine deposits. This pattern of sedimentation along with the gradual marine advance was interrupted towards the end of the Oligocene by the forerunners of a second major earth-building event, the Kaikoura Orogeny, which was eventually to result in the uplift of the present alpine belt replacing the late Cretaceous-early Tertiary marine transgression with a marine retreat (or regression).

During this event the basement Torlesse rocks and their covering of later Tertiary sediments were buckled so that they were both placed in the zone of active erosion above sea level. The overlying Tertiary sediments were, because of their relative youthfulness, rapidly eroded and removed, especially in axial regions where the uplift was greatest. Although the Kaikoura Orogeny has resulted in the removal of most of the Tertiary sediments they are still to be seen in certain areas, mainly on the flanks of the main ranges or in isolated depressions such as Castle Hill Basin. It was some time in the Miocene (seven to 26 million years ago) that uplift was sufficient to raise some of the basement Torlesse rocks into the zone of active erosion. Although the strongest movements ceased before the late Pleistocene glaciations the orogeny is, to some extent, continuing

with maximum uplift being centred along the Alpine Fault zone.

One line of scientific evidence (Sheppard *et al.*, 1975) suggests that for at least part of the New Zealand alpine region there has been a total uplift of about 15 km over the last 120 million years with about five km of that total taking place in the Cenozoic, the last 65 million years. Other research (Adams 1978) has suggested even greater rates of uplift, up to 20 mm per year adjacent to the Alpine Fault, enough to raise the Southern Alps 3 km from sea level in 140,000 years or a total uplift of about 50 km over the 2.5 million years since the peak of the Kaikoura Orogeny. Although these latter figures may be inflated they do indicate that the uplift that formed the Southern Alps could have occurred over a very short time interval.

Although initial uplift rates must have exceeded the rate of erosion, in order to produce significant relief, lately the mountains have been reduced at least as fast as they have been uplifted. Hence their final altitude is considerably less than the total amount of uplift.

As well as causing this vertical displacement most of the 450 km of movement along the Alpine Fault is thought to have taken place since the advent of the Kaikoura Orogeny. The result of this movement was to separate north-west Nelson on the Northern side of the fault from south-east Southland on the southern side. As may be seen from Figure 3 these areas have similar geologic settings that can be matched up if the displacement caused by the Alpine Fault is removed, thereby providing a measure of the amount of offset.

Erosion in the New Zealand alpine region

One feature which sets the New Zealand alpine region apart from others of similar material overseas is the presence of large 'running scree' slopes and the susceptibility of the exposed Greywacke rocks to rapid erosion and disintegration. To understand

the unique erosion characteristics of the New Zealand high country we can both look at the history of the Torlesse sediments and draw comparisons with some well-known mountain ranges on other continents.

In part it is the complex geologic history of the Torlesse sediments that has contributed to their instability. The reworking of sediments within the geosyncline, as well as the two major orogenies, has caused considerable folding and fracturing of the rock layers. We can consider the Rangitata Orogeny as making the Torlesse rocks mechanically brittle and then, during the Kaikoura Orogeny, deforming them with much fracturing. The net result has been numerous joint and fracture patterns which today act as zones of weakness along which erosive processes can operate. These fractures are especially prominent in thin-bedded sequences of sandstone and argillite as opposed to the more massive thick sandstone units. The latter, proving more resistant, tend to form upstanding features in today's high country.

As shown by their respective landscapes the 'greywacke' and schist country both have differing responses to erosion processes. Rivers draining the schist country carry a relatively greater volume of eroded material than the rivers further north. This difference can be explained in terms of lithology (rock type), as the schist, both softer and weaker than 'greywacke', is more easily eroded, perhaps up to three times as fast for the same precipitation. The susceptibility of the schist to erosive processes is shown in the rapidity with which schist rock is reduced to very fine sands and clay.

In comparison with mountain ranges overseas the Torlesse rocks of the Southern Alps are remarkably homogeneous, probably as a result of the 'mixing' they received during the Rangitata Orogeny. The Southern Alps as a whole lack the great variety of lithology seen overseas. The Rockies for example, are in part composed of considerable thicknesses of limestone along with areas of intrusive igneous (granitic) rock. Limestone tends to respond plastically to

stress and can be deformed without necessarily becoming closely fractured, and, as is well known, limestone erodes largely as a result of solution, not disintegration. Granites also have a characteristic response to erosive processes and tend to decompose into the component grains producing a very fine grained sand-like erosion product.

As mountain ranges overseas have this variation in lithology, extensive areas of fractured disintegrating rock are not as well developed as they are in the Southern Alps. On the other hand, not having this variation in lithology, and being homogeneous in composition, has meant that the Southern Alps lack the 'castellated-bluff and ledge topography' that typifies the mountain ranges overseas.

A significant difference between New Zealand's alpine orogenies and those that took place in most other parts of the world, lies in the timing of the earth-building episodes, which is evident from a comparison between New Zealand's events and, for example, those that created the North American and Australian alpine regions.

The last major earth-building episode for Western North America was sometime in the late Mesozoic-early Cenozoic (50 to 100 million years ago) and consequently at least 50 million years before New Zealand's Kaikoura Orogeny. The Appalachians on the Eastern Coast of North America have an even earlier history and were in their final stages of orogeny in the Permian, about 250 million years ago, and perhaps only 50 million years after deposition in the New Zealand geosyncline began. Several episodes of uplift have affected the Appalachians since that time but without major deformation occurring.

The only activity during the Tertiary to affect the Rockies was a relatively gentle arching, some volcanic outbreaks, and disruption of the mountain ranges by block faulting. Uplifted, dropped and tilted blocks resulted, each one of which can be taken as defining a modern range of mountains. All this activity took place in the mid-Tertiary, about 35 million years ago, which still places

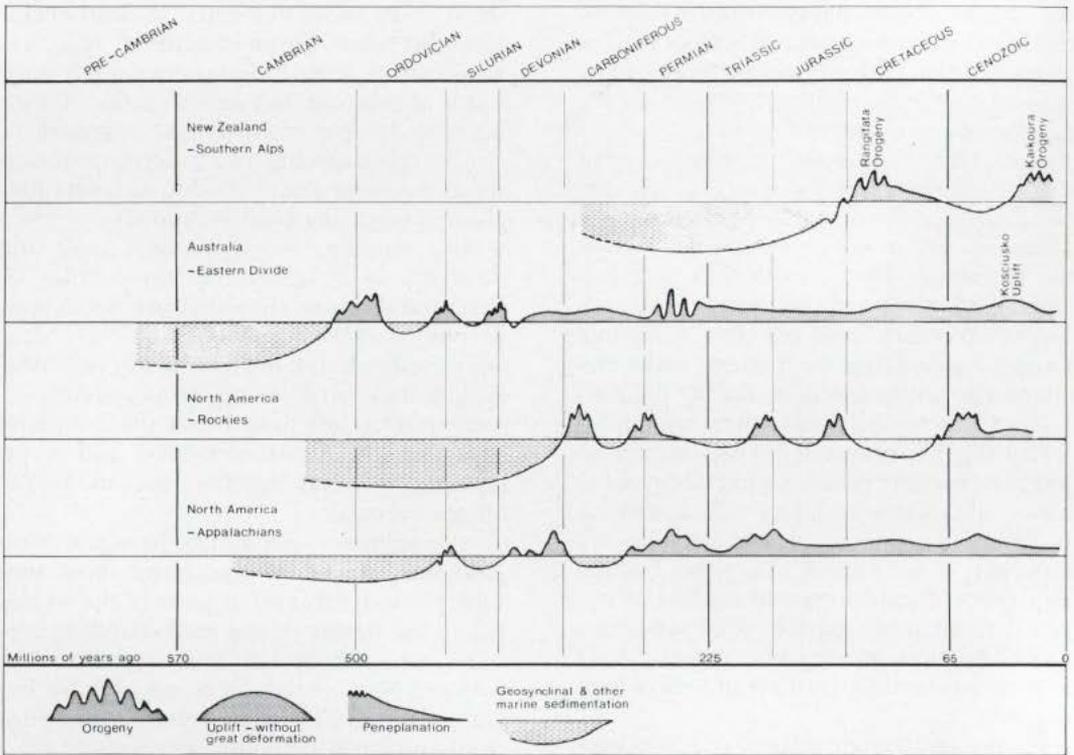


Figure 4 — A comparison between mountain-building episodes affecting New Zealand, Australia, and North America.

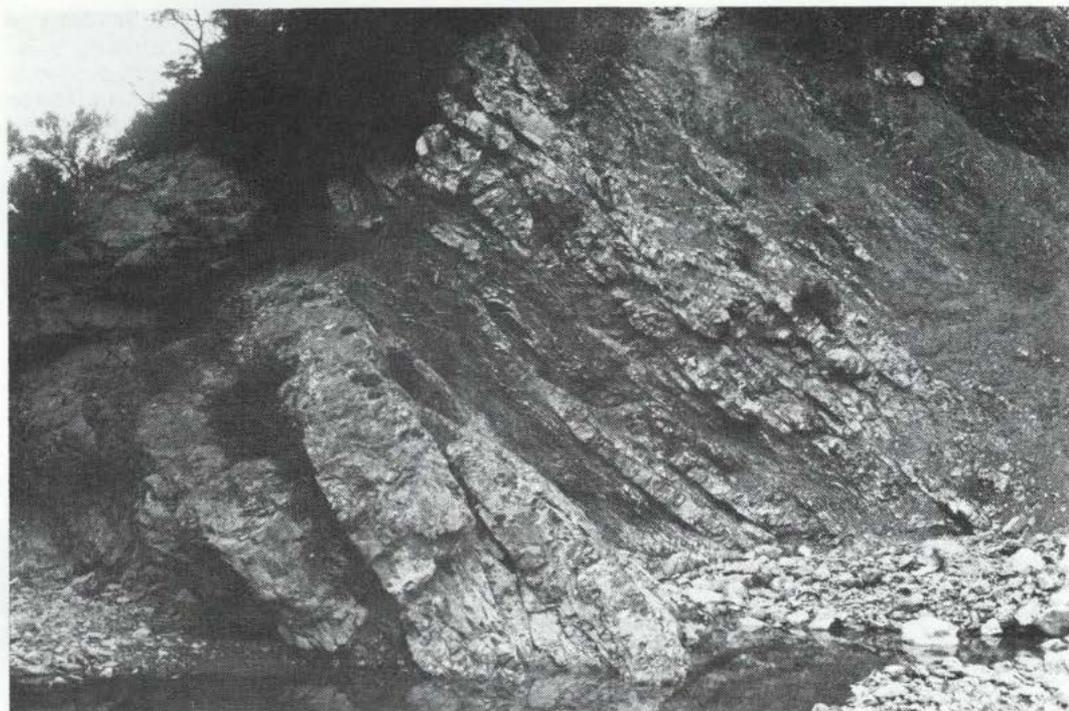
it long before the Kaikoura Orogeny in New Zealand.

During the late Cenozoic a narrow belt of deformation took place along the coastal margins of the continent resulting in the Coastal Ranges to the west of the Rockies proper. These mountains have a folding and faulting pattern and similar erosion potential to those found in New Zealand.

Another interesting comparison may be drawn with the situation in Australia. Just as the history of the New Zealand alpine region had been closely linked with the 'New Zealand Geosyncline', so the history of the Australian alpine region is linked with a 'Tasman Geosyncline'. This sedimentary basin began life in the mid-Cambrian and marine sedimentation continued through to the late Devonian-early Carboniferous (350 million years ago). Although it was not a

stable trough, sedimentation being interrupted by several orogenies and volcanic activity, it was only in the Carboniferous that land-derived sediments came to dominate. The degree of stability since then is reflected by the divide between east and west flowing rivers in eastern Australia which has probably been in its present position since the mid to late Permian (250 million years ago).

The Mesozoic in Australia was time of stability, at least as far as the alpine region is concerned, though locally thick non-marine deposits may have accumulated. The Kosciusko uplift in the late Tertiary led to the stripping of much of the sedimentary cover that accumulated in that interval, but this uplift cannot really be compared with the orogeny that was taking place in New Zealand at the same time. The Kosciusko event produced about 800 metres of uplift,



Typical Torlesse group lithologies. Thinly bedded sandstone (light) and argillite (dark) overlying a more massive sandstone unit. The thinly bedded sequence is heavily shattered and actively eroding whilst the massive sandstone unit appears relatively undeformed and erosion resistant.

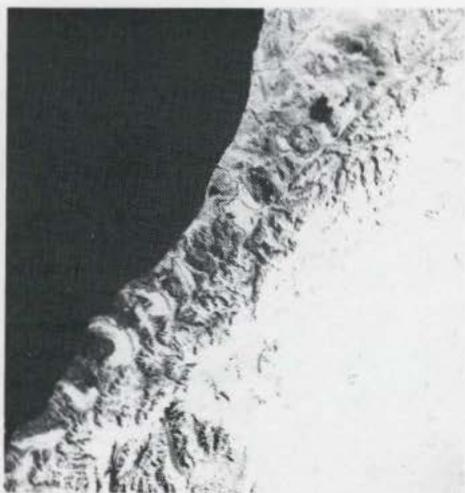
most movement taking place in the Miocene and probably continuing through to the Pleistocene. In New Zealand, for the same time interval, the uplift would have been at least five times as great, as well as being accompanied by major internal deformation of the sedimentary layers rather than a relatively gentle 'uplifting'.

Figure 4 is an attempt to diagrammatically relate the regions of mountain building described above highlighting the differences in age of the respective events.

Regardless of the intensity of the deformation and the nature of the rocks involved, it does appear that timing of orogeny would of itself be an important factor in determining the susceptibility of a mountain range to erosion. As the orogenies that gave rise to the Rockies and Australian Alps were both earlier than the Kaikoura Orogeny

there has been in these cases a longer time interval for these mountains to reach a state of equilibrium. The 'Stable-State Theory' has it that the degree of erosion from a mountain range is directly proportional to the amount of uplift — the greater the amount of uplift, the greater the amount of erosion and vice versa. If this is the case, and realising the rapid uplift affecting the Southern Alps, then the highly erodible nature of the Southern Alps can be seen as a response to try and maintain a 'Stable State'.

For the South Island high country rapid and continuing uplift suggests that the relatively high erosion rates will continue. The extent to which erosion occurs in any area will be dependent on lithology (rock type), whether schist or 'greywacke', and the extent to which faulting, folding and their associated deformational features are



A satellite photograph of the West Coast from north of Greymouth to Bruce Bay in the south. The lineation inland from the coast is the trace of the Alpine Fault, thought to be a post-Kaikoura Orogeny feature. (Image produced by the Remote Sensing Section of the Physics and Engineering Laboratory, D.S.I.R., from original data supplied by N.A.S.A.)

developed. The maximum uplift for the Southern Alps was probably just before the onset of the Pleistocene glaciations and it is hardly surprising that once the oversteepened alpine region lost the measure of support given to it by the ice, severe erosion began.

Acknowledgement

I wish to acknowledge the advice of Professor Kevin O'Connor who suggested the theme for this article. Special thanks are due to Mrs J. K. Campbell of the Geology Department, University of Canterbury, for her constructive criticisms and for clarifying recent geological theories regarding the origin of New Zealand's alpine region.

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Changing trends in mountain lands administration

A. P. Thomson

This paper was read to the Canterbury Mountaineering Club as the Kennedy Memorial Lecture for 1978. In it Mr Priestley Thomson draws on his experience as a former Director-General of Forests and as a member of the National Parks Authority to review the changes in emphasis and in direction that have been taking place in mountain land administration in recent decades.

Introduction

I am very much honoured to have been invited to give this, the 1978 Kennedy Memorial Lecture sponsored by the Canterbury Mountaineering Club. It gives me all the more pleasure since though no longer a member I am one of the older 'old boys' of C.M.C. having joined in 1932. Though I did have a year in 1931 tramping with the Victoria University Tramping Club, the Canterbury Mountaineering Club was my first real climbing club. It was among its then ranks that I met and became friends with such legendary figures as John Pascoe, Andy Anderson, Nui Robbins, Stan Conway, Evan Wilson, Rod Hewitt and a host of others. It was John Pascoe who picked me up and with Win Barnett and Gavin Malcolmson led me on to the mountain fastnesses and the unclimbed peaks of the Rakaia and Rangitata; it was Tom Newth who hauled me up to Mount Cook behind him a few years later; and it was Rod Hewitt who was to be my constant climbing companion in the 1950's two decades later. I owe a great debt of gratitude to the Canterbury Mountaineering Club and its early members and I have a great affection for it.

There was one other spin-off from my C.M.C. membership during these early years. In 1933, John Steeds and I were the prime movers in forming the Canterbury University Mountaineering Club. From memory, our prime motivation was that we were forced to make this move by the fact

that we both liked female company in the mountains as well as elsewhere, and C.M.C. did not. So it could be said that it was your long-standing tradition of exclusive masculinity which led to the genesis of the Canterbury University Mountaineering Club, or at least to its formation earlier than would have otherwise happened. I understand that quite recently Women's Lib. has achieved a quite major victory

There is little I can say about W. A. Kennedy himself and probably nothing that has not already been said. When I first came to Christchurch, although I met him I cannot say that I knew him, except by repute. The repute was a man of stature in all ways other than physical, a pioneering climber and explorer, a skilled photographer and the amasser of a still famous collection of slides, a tower of strength to the young and struggling Canterbury Mountaineering Club and a friend and counsellor to climbers over a period scanning two generations.

The title first suggested to me for this talk was 'The Mountaineering Club in a Modern Bureaucracy'. Now the word 'bureaucracy' has a precise dictionary meaning but it also has a somewhat uncomplimentary emotive one. As a retired bureaucrat myself I was not very happy with it and suggested the alternative 'Changing Trends in Mountain land Administration', by implication as they affect climbers and climbing clubs. I have to admit, however, that the subject matter has turned out to be very much the same.

Then and now in mountain administration

There were not many bureaucracies administering mountain land in the days when Kennedy climbed, and few bureaucrats to say what you could do or could not do. There was the Department of Lands and Survey, the State Forest Service, Acclimatisation Societies, and there were local bodies in the form of county councils and all with their empowering legislation. But there were no National Park Boards or a National Parks Authority; there was no Soil Conservation Council, no Catchment Boards, no Regional Planning Authorities, no Nature Conservation Council, no Commission for the Environment, no Mountain Safety Council, no formal Search and Rescue Organisation, no Council for Recreation and Sport, no Queen Elizabeth Trust, and no Federation of Mountain Clubs. There was no National Park legislation covering the whole country, no Town and Country Planning Act, no Noxious Animals Act, nor any of the other Acts giving powers to this massive array of bureaucracy.

What there was, apart from the mountains themselves, (and we should be eternally grateful for it), was a Lands Act and a series of strategically-placed mountain land reserves created under its provisions. We should be grateful not just for the legislation but for the vision and a farsightedness of generations of land and forest administrators who left us a legacy of scenic reserves, climatic reserves, reserves for national parks, reserves for the prevention of fauna and flora, forest reserves, permanent and provisional State forests, and a host of other different types of reservation. Between them, by reserving the essential nuclei, they made possible the network of national parks which are now correctly a matter of so much pride to all New Zealanders.

On the debit side it must be recorded that although so much of our mountain lands were Crown-owned and permanently-reserved, there were still several unsatisfactory legal features in Kennedy's era. Some of them have persisted to a greater or lesser degree to the present day. First, there were very considerable areas of non-grazable truly alpine mountain lands held under long



looking up the Avoca River to Black Range.

term pastoral leases. Though technically lands of the Crown, they were in effect privately owned and thus not available, except through kindness, for recreational use. Furthermore the old and regrettable practice of grid-ironing meant that there were enclaves of freehold land scattered throughout the main mountain valleys. For both of these reasons legal access to the mountains was sometimes difficult and in a few cases impossible. In addition, permits in law, though admittedly rarely in practice, were required to enter State forests in mountain country. On the debit side, also, there were many unfortunate land use implications of the pastoral run system as it was then administered. By far the main one was that large areas of high alpine country, today classified as Class VII and VIII land, were continually burnt and grazed with little restriction or control and with virtually no regard to the soil and water conservation values of the land concerned.

Before directing my attention to the main theme of the title, changing trends, I would like to highlight some of the major differences in mountain land administration between the 1920's and the late 1970's. I have already made some mention of legislative changes and of the growth of bureaucracies whether they be government departments, local bodies, statutory authorities or ad hoc councils or committees. I will now discuss the growth of national parks, the problems of club huts, hunting, skiing, guides and guideless climbing, roading, and the development of forest parks.

National Parks

There were only two national parks in existence in Kennedy's day, Tongariro and Egmont. Today there are ten, totalling over five million acres or over seven per cent of the land area of New Zealand. I do not propose to say a great deal about them because so much has already been written of the history, philosophy and operation of the national park movement of New Zealand. There are a few points on which I would like to dwell.

The first concerns their genesis. The hard core of New Zealand's first national park, Tongariro, was of course the 6,500 acres gifted to the Crown by the paramount chief of the Tuwharetoa Heuheu Tukino in 1887; the rest of the original 62,000 acres was Crown Land.

New Zealand's second national park, Egmont, set up by special legislation in 1900, consisted originally of 72,000 acres being all the land within a six mile radius of the summit of Mount Egmont. Maori land became Crown Land. This was set aside in 1881 as a reserve 'for the growth and preservation of timber'. In parenthesis, I have often wondered what trees could grow on the snow and ice slopes between, say, Fanthams Peak and the top of the mountain. Although Arthurs Pass was not gazetted until 1929, 73,000 acres of its original 117,000 acres had been set aside as a 'national park reserve' in 1901, the remaining 46,000 acres being provisional State forest or forest reserve. Subsequent major additions included 70,000 acres of public reserve and a further 30,000 acres of State forest land.

By far the largest national park, Fiordland, not formally gazetted as such until after the passing of the National Parks Act in 1953, was created from an enormous base — 2,326,000 acres which was reserved firstly in the early 1890s as 'reserves for the preservation of native fauna and flora' and again in 1905 as a public reserve 'for a national park'.

The nucleus of the main alpine park, Mount Cook, was a recreation reserve subject to the Tourist and Health Resorts Control Act. The point to note is that although there was no National Park Act, no formally gazetted national parks in the South Island and no park boards, the land involved had not only been set aside as one or other kind of reserve but often specifically reserved for national park purposes. In effect national parks in New Zealand well pre-dated the passing of the 1953 Act and the 1928 Public Reserves Domains and National Parks Act. They were in the minds of those few far-sighted land administrators well before the turn of the century. The national park ethic

came early to New Zealand; indeed we must have been one of the first countries to import it from the United States shortly after the famous and historic occasion when the world's first national park, Yellowstone, was established.

A more detailed analysis of what types of land contributed to national parks, shows that nearly half came from the very large original Fiordland reserve and that of the rest approximately 24 percent was Crown Land, 15 percent came from scenic and other reserves, 10 percent from State forests, four percent from pastoral leases, one percent from Maori land and only 0.2 per cent from land under private ownership. Since as always Fiordland National Park distorts all national park figures it is worthwhile looking at the position excluding Fiordland. Of the other nine national parks, 47 percent of their land area was derived from Crown Land, 32 per cent from scenic and other reserves, 16 percent from State forests, two percent from Maori land and two percent from privately owned land. The significance of these figures is first, that very little Maori land had gone into the national park system; second, that very little mountain land of national park quality, indeed only 44,000 acres, has been taken out of pastoral runs and added to national parks; and third, that even less privately-owned land, only 12,000 acres has been acquired. The last statistic may suggest to you that whereas previous generations were prepared to set aside permanently very large parts of New Zealand for the benefit of future generations, more recently New Zealand as a country has not been prepared to add to the national park estate unless it could be done for free. Apparently this generation is not altruistic enough to make relatively small financial sacrifices in order to ensure an even better national park system for the benefit of our children and grandchildren.

Apart from the creation of new national parks and the boards and authority to administer them, by far the most important event in the years since Kennedy was the passing of the National Parks Act 1953. This

has been described, and I concur with the description, as one of the noblest pieces of legislation on the New Zealand statute books. I believe we are very fortunate to have an Act which so carefully protects our national parks and so clearly gives the guidelines for their administration. It is an Act which rightly is the envy of many other countries. We are fortunate also in the calibre of our park boards and in the calibre and dedication of our park ranging staff. But again let us ponder; there were no park boards at all in Kennedy's day and no park rangers – today there are ten boards and between 60 and 70 park rangers plus an undetermined number of Lands and other departmental officers servicing the boards in a number of ways.

Club huts

If Kennedy's club had wanted to build a hut in the mountains it would have had few hassles. A permit from the land owner would doubtless have been required and in the case of huts on Crown Land the club would have had to accept that, although the hut was in effect theirs, in law it was the property of the Crown. It would also have been required to leave at least part of the hut unlocked for use by others in emergencies. But there would have been complete freedom to build any size, to any standard, of any type and with any materials; nobody would have worried, except the occupiers themselves, about rubbish or sewerage disposal, and there would have been no departmentally-imposed restrictions about minimum space for occupants or about fire exits or other health and safety measures.

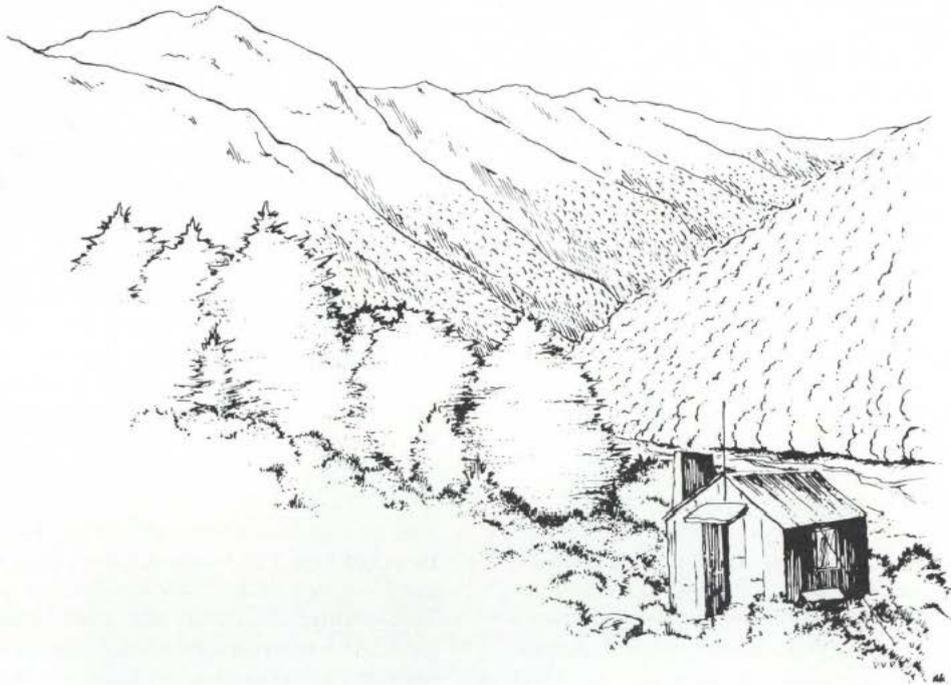
Today the situation is far more complicated. In a National Park, and to much the same degree in a Forest Park, the administering authority would expect and would make it a condition of the permit that the club or lodge would comply with the minimum building standards as laid down by New Zealand Standard Specification 1900, and with any other local body requirements in respect to fire safety and public health.

Further, the Park Board or other controlling body would exercise its right to approve the siting, design and materials used and, if it so wished, to enforce even higher standards than the minimum ones under building codes and local body requirements. Whether or not club huts and lodges on Crown Land, being in law the property of the Crown, are exempt from local body statutory and regulatory responsibilities is still currently a matter of legal debate, although the most recent legal opinion tends to consider that county councils are not absolved from building by-law responsibilities, on the grounds that the National Parks Act takes precedence over a council's statutory responsibilities. If this opinion is confirmed, it implies that local-body health inspectors must issue permits for plumbing and drainage work just as the local-body building inspector must issue a permit for the building itself. Further it could be considered, and it is so held by one local body, that club huts and lodges should be licensed as boarding houses, thus creating even further complications.

Local bodies have a genuine concern about this matter, not because they wish to take on more work or to exercise more power, but because they are not sure where they stand legally in respect to responsibilities and liability. The lawyers have yet to sort this out. I have gone into this matter in some detail merely to illustrate how complex are the problems of clubs in this area compared with the simple situation in Kennedy's day.

Hunting

If Kennedy had wanted to shoot a deer for a trophy head on one of his expeditions, or indeed if he had wanted to hunt at all, he would have been subject to far more red tape than exists today. In his era, deer, chamois and thar were all protected animals, and it was not until many years later that they were deemed to be noxious and included in the appropriate schedule of the Wildlife Act. Kennedy would still have been able to shoot red deer stags, but in carefully specified areas only, at prescribed times of the year, and by a licence granted for a sizeable fee by an acclimatisation society. He would have been



forbidden to use traps, decoys, silencers, heavy guns or metal-case bullets. Further he would have been issued with a prescribed number of numbered metal tags indicating how many trophies he could take. And if he was caught with an untagged trophy, he, as well as the stag, was likely to be 'shot down' with a heavy fine. Today Kennedy's successor on foot, and this is an important caveat, would have no such restriction at all except in respect to other legislation prohibiting firing on to other people's property, or across a public road. On privately-owned land he would of course need a permit from the owner of the land not only to enter but to shoot. On publicly-owned land such as National Parks and State Forests, the permit normally would be to carry a firearm and would be designed not to prohibit shooting but to regulate it. This regulation could take the form of restricting the permit to a given area. Nevertheless the practice of allocating shooting blocks on publicly-owned land, a practice developed in the interest of safety, to ensure the complete coverage of an area, and to obtain accurate information as to where animals were shot, is now very much on the way out.

The point is that, for what seemed to be, and maybe were completely valid reasons at the time, bureaucracy severely constrained the ability of New Zealanders to hunt deer or other introduced wild animals; today, for what seem to be, and we hope are equally valid reasons of our time, there are far fewer and indeed almost no bureaucratic restrictions on the hunter.

Skiing

If Kennedy had skied he would have had to walk for his skiing; there were no rope tows, no T-bars, no Pomas, no chairlifts, no aeroplanes, no helicopters. But since almost certainly he would have skied on the Ball Glacier he would not have had to walk as far as he would today. The phenomenon responsible for this, the extraordinarily rapid retreat of glaciers, is having other repercussions on the pattern of mountain land use

and its administration. Among these are the inability of clubs or the park board to maintain mountain huts on moraine walls, the decline in guided glacier parties and hence in professional guides, and the much greater difficulty of physical access for both climbers and sightseers, leading inevitably to the greater use by both groups of aeroplanes or other forms of air transport. The implications of this latter trend are far-reaching, particularly in respect to the setting aside of wilderness areas and the maintenance in them of wilderness values.

Guides and guideless climbing

Kennedy was one of the small band of mainly guideless climbers who climbed in the 1920's and earlier. No doubt occasionally he climbed with guides and perhaps had the experience of being on mountains with some of the great guides of that era. We know he had Jack Lipp with him in the Godley, but in his day, generally, more climbers were guided than guideless. Because the generations of guides which are so famous in New Zealand's mountain history were concentrated largely at Mount Cook and at the Fox and Franz Josef Glaciers, there was relatively little climbing done elsewhere. Thus it could be that we have two debts of gratitude to the guides of a former era. First, they did so much for climbing in New Zealand, introducing to New Zealanders what we all consider one of the finest and most adventurous of sports, teaching the techniques of snow and ice climbing, of route finding, of reading weather. They climbed safely, and they made New Zealand mountains famous to climbers the world over. But because they were concentrated in the few localities mentioned, they left for us luckier ones, a generation or two later, the great excitement and thrills and the great privilege of being able to explore hitherto unexplored valleys, to make new trans-alpine crossings, and to climb a host of hitherto unclimbed peaks. The transition from the predominantly guided to the predominantly guideless era came in the last decades of Kennedy's life. As

one of the pioneers of guideless climbing it must have given him the very greatest satisfaction.

Roading

The only roads which went into the high mountains proper in Kennedy's day were the Hermitage Road and its continuation to the Ball Hut, the Arthurs Pass trans-alpine crossing plus the road onto the glaciers and South Westland. The first of these was built for tourism, the second for gold. Both of them are monuments to the skill and determination of the early roading engineers and to the enormous courage, energy and perseverance of the men who wielded the picks and shovels. There were also of course the back country roads to the homesteads of those famous runs on the edge of the mountain country, runs through which climbers had to pass and which for many reasons are as much a part of the mountain legend in New

Zealand as are the mountains themselves. I refer to Manuka Point and Double Hill in the Rakaia, Lake Heron, Erewhon and Mesopotamia in the Rangitata, Lilybank in the Godley, Glen Lyon near Lake Ohau giving access to the Hopkins and Dobson Valleys, Mount Albert in the Makarora, and Mount Aspiring in the Matukituki. From these famous hospitable outposts, access to the mountains was entirely on foot; generally on two feet but sometimes on four.

Today, including Hope Saddle and Lewis Pass, we have six trans-divide roads: these two plus Arthurs Pass, Haast Pass, the Homer Tunnel, and Wilmot Pass. Further, the advent of tractors to build them and four-wheel drive vehicles to travel on them has meant the extension of some sort of negotiable roads well up most, if not all of the alpine valleys of the South Island. Very fortunately the nature of the country prohibits any further trans-alpine road crossings between Arthurs Pass and Haast Pass; we are safe from further



incursions of roading into the heart of the central South Island mountain chain. But by the very nature of our heritage, a roadless land which had to be roaded if we were to live in it and develop it, we are a nation of compulsive road builders. The need for living is still there, the need for development should no longer be so compulsive. Nevertheless there are pressures, well-known to most of you, to road the Heaphy Track, the Greenstone with its high mountain pass to the Hollyford River, the Hollyford itself down to Big Bay and thence north to the Cascade. I hope that we can resist these pressures; we have enough tourist roads in New Zealand for the next few decades and the mountains are quite accessible for all who wish to tramp and climb in them even without the other newer means of access now available, aeroplanes and helicopters. Some elements in the National Roads Board and district roading councils are naturally keen to see these roading developments take place. They are aided and abetted by county councils and progress leagues and are strongly supported by the tourist industry. Fortunately on the other hand, there are today strong counterpressures exerted by such bodies as Federated Mountain Clubs, the Royal Forest and Bird Protection Society and the Nature Conservation Council. There is also the machinery by which these counter pressures, if the public so wishes, can be made effective. I refer to environmental impact reporting and auditing procedures, and also to the procedures for public participation in and public objection to district and regional schemes under town and country planning legislation. In these fields some people would say that we have examples of bureaucracy gone mad; whether or not it is so, we now have the opportunity to use these new apparatuses of bureaucracy to decide how much or how little further roading we want in our mountain country.

Forest parks

In Kennedy's days there were State forests but no forest parks. As already stated, in law

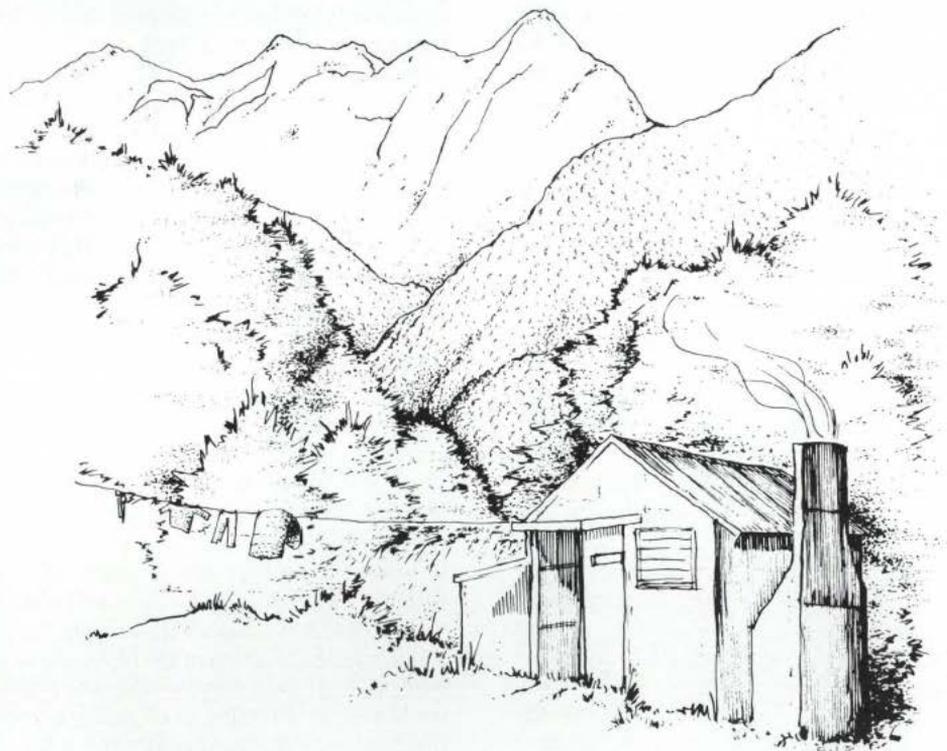
permits were required to enter any State forest but as far as indigenous forests were concerned this law was rarely, if ever, enforced. But since the forests belonged to the people of New Zealand who normally should have every right to use them, the law was an anomaly. A change was needed. In the 1950's foresters were realising that more formal expression should be given to their long-held principle of multiple use of forests, and that State forests which were primarily protective in nature but with an important recreational use or potential, should be accorded more formal management rather than be administered in an almost completely laissez-faire fashion. This combination of circumstances, the need to change the law in respect to entry, and the need to recognise the multitude of uses of hill and mountain State forests, led to the genesis of the Forest Park concept. It was a concept evolved by A. R. Entrican and myself. The catalyst perhaps was the strong pressure being exerted in the early 1950's to have Tararua State Forest proclaimed a National Park. First, we did not then think nor do I now that the Tararua ranges conform to the very high criteria set for national park designation. Second, the importance of the Tararuas as a playground for Wellington trampers, though very considerable, was overshadowed by their importance as protection forests, vital to the well-being of the lowlands around them. Because of this over-riding importance some restorative measures could prove to be necessary for reasons of soil and water conservation. Third, the Tararuas had a small exotic plantation potential on some burnt marginal areas which had reverted to gorse, fern and second growth. Finally, they included several domestic water supply catchments, implying some restriction on human usage, and they had as they still have, a small but controversial hydro-electric potential. In other words multiple-use forest management rather than national park management, seemed to be more appropriate. This viewpoint won the day in F.M.C. as well as national park circles and as a result the Tararua Forest Park was set up, without empowering

legislation but, importantly, with an advisory committee. It was to operate for a trial period of ten years. Soon afterwards, (perhaps because of its close connection with my skiing club, the Canterbury Winter Sports Club, when I was Conservator of Forests in Canterbury), the Craigieburn Forest Park was established, again without legal status. The Tararua and Craigieburn experiments were deemed to be a success and the forest park concept was justified. As a result forest parks were given legal recognition in the Forest Amendment Act of 1965 and the Tararua and Craigieburn Parks were formally gazetted. These were followed soon afterwards by other areas which had in effect been administered as forest parks, notably North-West Nelson and the Kaimanawa Ranges. In the last seven years a further 11 forest parks have been created, totalling in all nearly 1.2 million hectares. They are Piron-gia, Rimutaka, Kaweka, Lake Sumner, Haurangi, Catlins, Kaimai-Mamaku, Wha-

karewarewa (the first exotic forest one) Ruahine and Mount Richmond. As you will see, most if not all of these consist of hill and mountain country which is used by trampers, climbers, skiers and hunters. The administration was, and I believe still is, designed to give these users no less opportunity and encouragement than exists in national parks to practice and enjoy their chosen sport.

Trends for the future

My comments to this point have been so far mainly about the contrasts in mountain land administration between Kennedy's day and ours, with a few diversions en route. These contrasts of course reflect historical trends. I now turn my attention to what is implied in the title of the address, i.e. to present trends and hence to what the future may offer us. I have identified a number of important trends, some of them implicit in what has been said before. I could mention



many others but these are the ones which I think are most significant. No doubt other people would identify other trends and assess their importance in different ways.

Preservation rather than development in National Parks

The first and I think the most important trend has been towards preservation rather than use, or perhaps more correctly rather than development for use. Good though the National Parks Act is, it gave park administrators a virtually impossible task. They had to reconcile preservation and I quote 'in perpetuity for the benefit and enjoyment of the public', and at the same time to keep the parks 'as far as possible in their natural state'. It has been these basic irreconcilables which have bedevilled park boards and the Authority for the last 25 years. I have been directly involved with park administration at the board or the Authority level for nearly all of these 25 years, and I have noted the growing and I think snowballing change towards the preservation rather than the development ethic; towards a more purist approach to the administration of the Act, and towards decision-making on a basis of principle rather than expediency. And I might say here that nobody has played a greater part in instituting this change and in continually reminding the National Parks Authority exactly what the National Parks Act says than one Dr Lance W. McCaskill. There are many manifestations of this change and I will mention a few.

1. Construction in National Parks. Tongariro illustrates an important one; a few years ago nobody worried much about the fact that there was a large skiing village along the Whakapapa slopes as well as all the facilities necessary for the sport of skiing. It could scarcely be said that this sector of Mount Ruapehu was being maintained in a natural state. Today it is generally agreed that if we could put the clock back and start again the Whakapapa village would have been located outside and not inside the national park. Indeed, this is exactly what is

being planned for the new Ruapehu ski field, Turoa. Overnight residents will be at Ohakune or otherwise down country, the only buildings and structures on the mountain being those necessary for the maintenance of up-hill ski lift facilities. No matter how carefully designed and planned these are, they are still basically incompatible with the concept of unspoiled scenery. We have not resolved the conflict because in this instance, as long as North Islanders are to be allowed the opportunity to ski on their own island (and there is a pretty undeniable case that they should be given this opportunity), then the conflict is indeed incapable of resolution. Let us not forget that only a few years ago the Board and the Authority were both positively encouraging more club lodges at Turoa and on the eastern side at Tukino; all we are doing in the now changed policy is attempting to minimise the conflict.

In other parks and for other purposes there is the same tendency to keep buildings other than park board buildings and in some cases high level club huts out of national parks. No longer are clusters of huts and lodges welcome, as for instance at Aniwaniwa in Urewera National Park even for such worthy institutions as the Royal Forest and Bird Protection Society. Lodges and hostels for school, university and other educational uses create a problem, but generally they are being encouraged far less than they were.

2. Grazing in National Parks. Policy towards grazing in national parks in the past has been liberal and even permissive. There were several reasons for this. First the instinctive belief of most New Zealanders, understandable for historic and economic reasons, that any land which can produce meat and wool should be allowed to do so. Second, the argument that grazing river flats reduces high fire hazards. Third, and most important, the fact that grazing rights were often in existence at the time when the land was gazetted as a national park and there was a general desire, even in the cases where there was no legal necessity, to help the economic wellbeing and to secure or maintain the co-operation of the adjacent runholder. Now

sheep and cattle can look very fine in national parks but their presence is entirely contrary to the provisions of the National Parks Act. Sheep introduce an alien and hence legally inadmissible fauna into the park, inhibit some regeneration around the forest edge, and ensure that exotic grasses continue to displace indigenous tussocks. Cattle do all these things but unlike sheep, they also penetrate forests destroying the understory, prevent the regeneration of canopy as well as lower-tier species and play havoc with forest soils. For these reasons the policy now is to phase out all grazing, although there is still a need for sympathetic consideration of individual cases. This means there still must be some compromise of principles. The tougher policy towards grazing will have repercussions when we consider, as is now being done, major additions to national parks and the creation of new parks. In many cases these areas are now subject to grazing. Either the principles must go by the wall, or we will be severely curtailed in what would otherwise be considered desirable additions to the national parks estate.

3. *Roading in National Parks.* This is another area in which attitudes have hardened. There is little support today from the National Parks Authority for a continuation of the Mount Robert road in Nelson Lakes National Park to the Mount Robert ski field, or for a road right up to Temple Basin in Arthurs Pass National Park. Forest parks are being administered with much the same philosophy, i.e. the encouragement of good roads up to forest park boundaries and sometimes within forest parks for short distances to reach approved facilities, but gen-

erally the tendency for forest parks, as for national parks, is to have them as little-roaded as possible. The Heaphy Track proposal, already mentioned, is a good case in point. The policy towards existing roads is also undergoing changes. Roads of course must be safe and economic to maintain but except in the case of nationally important through-routes, there is little sympathy for the aspiration of some roading engineers to realign and widen roads within national parks and turn them into speed highways. The thinking not only is that roading should make the minimum impact on vegetation and scenery but also that in any case roads in national parks where possible should be corridors of enjoyment rather than routes to move people as quickly as possible from point A to point B. When roading proposals would have significantly adverse effects on areas of particular scientific or environmental quality, then all hell can break loose as was demonstrated so forcibly by the same Lance McCaskill in the famous case of the Arthurs Pass tarns.

In this discussion on the trends towards preservation rather than development and towards a more purist approach I have dealt with three major matters only; buildings, roading and grazing. There are very many others. A few that come to mind are (1), the growing consciousness of noise pollution, as witness the recent controversial decision of the Tongariro National Park Board to ban helicopter ski lifts on Mount Ruapehu; (2), the more universal recognition that game management and national park values are basically irreconcilable, as witness the shift of policy emphasis within the Fiordland Park



Board away from being prepared to consider the Wapiti area as a special game management area, towards treating Wapiti as just one more legally-unwanted introduced animal, and the Wapiti area as being no different from any other in the park in its need for wild animal control; and (3), the realisation that natural waters and the indigenous fauna therein are as much part of our national park heritage as are forests and birds, as witness the recent refusal to allow the Wildlife Service to remove native eels from Lake Gunn in order to protect an introduced species of fish, Atlantic salmon. One could list many other examples illustrating this current trend. I must, however, concede that in some other respects there are trends away from a purist approach to National Park principles and their implementation. I will mention these later.

Management of tourism

The second major trend I have identified leads on from the first; it is the unfortunately inevitable increasing conflict with the tourist industry and this despite the fact that the industry is evidently in a state of zero growth. We must of course remember and recognise the great importance of tourists, both indigenous and exotic, to New Zealand's economy; we must remember particularly the contribution of overseas tourism to New Zealand's balance-of-payments problems; we must never forget the fact that tourist hotels were in some of New Zealand's national parks before the national parks were created, and have done a very great deal to make the whole national parks system possible; neither must we forget that people, and particularly older people, should not be denied the right to 'tour' and certainly to view our mountain land. But having remembered all these points and taken them into account in our policymaking and in our planning we must then also remember the sad and wise words of Oscar Wilde in the *Ballad of Reading Gaol* where he said and kept on saying 'Each man kills the things he loves'. The preservation versus development

conflict is nowhere more acute than in the case of the tourist industry. Of course we want as many people as possible to enjoy our national parks; and of course as long as it is policy to encourage overseas visitors to New Zealand as tourists we want the boost that tourism can give to our economy. But if we are to prevent national park values being diminished and in some local areas destroyed by severe over-use, then we must most carefully do our very best to reconcile the conflicting claims of tourist development and of national parks preservation. This I think must mean that we must set upper limits both to the number of tourist beds that can be built within a national park such as Mount Cook, Milford Sound and Tongariro, but also to the number of tourists that can be brought in from outside as day visitors. For the latter alternative, whereas it means that the objective of keeping hotels and motels and all the other buildings necessary to serve them out of national parks, it also implies the construction, contrary to another objective, of more and faster access roads to bring more people in for the day. It also necessarily implies the provision of massive facilities for day visitors, i.e. car and bus parks, restaurants, conveniences, souvenir shops and the rest. So our planning for the tourist industry in my mind must recognise now the upper limits of what the national park environment can safely accommodate without destroying the very values which are responsible for bringing the tourists there. It is not going to be easy so to plan nor is it going to be easy for the tourist industry to accept what may be termed the 'Ballad of Reading Gaol' syndrome. Let us hope that we can reach the best possible solution amicably rather than with confrontation.

Public participation in park management.

A major and important trend is towards greater public participation in mountain land activities. There has always been a certain amount. Thus national parks are administered by boards which contain only one public servant as of right, the Commis-

sioner of Crown Lands who is the chairman; all the rest are private citizens. Similarly forest parks have advisory committees consisting predominantly of private individuals. The National Parks Authority is an almost equal mixture of government and private members, with public participation being ensured by the representation of Forest and Bird, the Royal Society, Federated Mountain Clubs and two representatives of park boards. (The words 'public' and 'private' here seem to be inter-changeable, just as in England they call private schools public schools).

Previously park board members have been appointed by the Minister on the recommendation of the Authority, the Authority in turn getting its recommendations from board chairmen, not from boards themselves. The big recent event has been the innovation of publicly inviting nominations for appointments to boards. The response to this was large and most gratifying. It uncovered a wealth of new talent which obviously board chairmen had not previously known about. There are now further suggestions that commissioners should not automatically be chairmen of boards and that instead private members should be elected as chairmen by the boards themselves. Similarly the question has been raised as to whether the chairman of the Authority should not be a private citizen as in the case with many other statutory authorities, rather than as is the case now by legislation, the Director-General of Lands.

Another recent important change is the move towards involving the public in planning processes. National park policy is now for public notification to be given by boards, through the news media and by other means,



of their intention to prepare or review park management plans and inviting written proposals for consideration. The resultant draft plans will then again be publicly notified as being available for inspection and further written submissions will be invited. Boards will be required to give full consideration to all submissions received. A similar system of public notification and invitation of written submission is already in operation for forest park management plans. The national park movement has yet to implement its new policy. The public also has the opportunity to influence mountain land planning through its right to make both submissions and objections to district and regional plans under Town and Country Planning procedures. Finally, it is also national park policy to inform the public of any proposal to create new national parks or to make additions to or deletions from existing ones. Some sections of the public are certainly not slow in coming forward with their own views as to what additions should be made and to where new national parks could be set up.

Moves for more National and Forest Parks

This identifies the next trend I will discuss, the move for more and more varied parks and reserves and particularly for more national parks. The revised criteria for new national parks recently adopted by the National Parks Authority recognises the desirability of permanently reserving particular types of land forms and landscape and also of important ecological systems, in both cases not already represented in existing national parks. In line with these criteria there is currently an exercise under way to identify areas possibly suitable for new national parks or for additions to existing ones. The areas to be examined and reported on as possible new parks include Te Pahi-Motupia, Tarawera and Rotorua Lakes, Whareorino (South Auckland), the Upper Wanganui River, Cape Palliser, the Inland and Seaward Kaikouras, the Central Alps, the head of the Landsborough, Punakaiki, the

Hopkins and Dobson Valleys, the Paparoa Range, South East Otago, and the Old Man and Remarkable Ranges. The major additions being considered will probably be well-known to you, the Lewis Pass, Maruia-Glenroy-Matakitaki area, the Okarito and Waikukupa State Forests and the Red Hills. The Lands Department and the Forest Service are currently jointly investigating the potential of Stewart Island. Other people have suggested Great Barrier Island, the Chatham Islands, the northern tip of the Coromandel Peninsula, and some other areas in the North Island. The Forest Service has plans to give forest park status in the North Island to areas including Puketi, Hauhangaroa, Ruakumara, Whareorino, and in the South Island to the Paparoas, the Brunner and Victoria Ranges, the Cascade-Big Bay region, the Matakitaki and adjacent State Forests, the Snowdon-Upukoro district and the Takitimu Mountains.

In considering this list you will doubtless notice several things — a trend away from high mountain scenery as the major criterion for national park status, a recognition that adequate examples of fast disappearing lowland forest should be reserved, evidence of the desire to reserve vegetation types other than forests, evidence of the comparable desire to reserve arid land forms such as in Central Otago and North Island sand dunes, and finally a strong indication of the desire that formal designation should be accorded, and positive management given, to all major areas of mountainous unoccupied Crown Land.

You will doubtless also have noticed that several names crop up twice in the list. Let us hope that decisions on the type of reservation accorded a given area are made on the basis of what is best for the land and for the people who use it. Others have pointed out the opportunities for complementarity between national parks and forest parks and have stressed that forest parks could be used to take pressures off national parks. Let us hope that these opportunities are accepted.

Now of course national parks and forest parks are not the only type of reservation

available. Some of you may well by now be querying whether all the areas in my first list meet the very high criteria of national parks. The answer is that they do not. The recently revised criteria lower the original high standards in one respect only; it is by accepting the possibility of some relatively small modified areas where the chances of restoration are good and where there are no similar unmodified areas available. There are those who are now advocating a quite serious dilution of national park standards; they are unconcerned about including irreversibly modified landscapes and vegetation or even about the inclusion of human settlements. They quote as one of their justifications, the English system of national parks, quite forgetting that England and other older European countries had no alternative if they were to have national parks at all. They forget also how lucky New Zealand is to be able to have the sort of natural and unmodified national parks which it has.

There are also pressures to have new national parks created closer to centres of population. In particular some Aucklanders want what they describe as *their* own national parks, as if Fiordland was not in fact theirs, as if almost they did not consider themselves as being part of the New Zealand nation. I think that these people, few in number but vociferous, must wear regional blinkers and must suffer from another syndrome which could be described as a conviction that the Antarctic begins south of Hamilton. The answer surely, and the Auckland Regional Authority is magnificently already providing it, is a system of regional parks. Nevertheless it must be conceded that because of escalating energy costs and hence escalating transport costs, in future years North Islanders will not so easily be able to visit the southern South Island national parks. Already for the same reason there are signs of a resurgence of tramping and climbing in the Nelson region and in the Waimakariri, Rakaia and Rangitata, in other words in areas closer to home.

This is one example of a counter trend

away from the purist approach to which I referred earlier. Another stems from the arguments being proposed, strangely by scientists, that the vegetation was not 'natural' when Europeans came to New Zealand because it had previously been profoundly modified by Maori burning and Maori moa hunting. The implication is that if it was then already modified it does not matter so much if we modify it further, say by tolerating populations of introduced animals in national parks. These arguments to me are both specious and dangerous.

I find this trend deeply disturbing. Our network of national parks is as good as any in the world as is our national park legislation. If we are to keep it so, we must refuse to lower standards on the insistence of some pressure groups and for reasons which in my view do not stand up to logical examination. New Zealand now has the opportunity to create a large and comprehensive reserve system, from the North Cape to Stewart Island, of National Parks, Maritime Parks, Scenic Reserves, Forest Parks, Recreational Reserves and New Zealand Reserves. If properly planned this system should be capable of meeting all present and future mountain land recreational needs ranging through a wide spectrum from busy ski fields to wilderness. It also should be able to ensure that every important type of ecosystem is fully represented and permanently reserved.

Let us not, however, forget the great importance of the several million hectares of pastoral run country. I am indebted to Professor Kevin O'Connor for the results of some interesting research. Of the three-hundred-plus pastoral runs, 26 are close to the Main Divide, 38 contain land in excess of 2100 metres, 73 contain land over 1800 metres, and no less than 176 are known to be visited by trampers and climbers. Further, of the 16 ski fields in the South Island, only five are in National Parks or Forest Parks; the rest are on pastoral or special leases or otherwise alienated land. Certainly there is a large area of high country still in pastoral runs which should be retired and brought into Crown ownership, and certainly there are unfor-

tunately a few distressing access problems. But from the figures I have given, you will see that even as at present administered, pastoral run country is of key importance for mountain land recreation.

Time does not permit a discussion of some other trends I would like to mention. I had in mind such matters as the growing desire to set aside in national parks, forest parks and unoccupied Crown Land more wilderness areas, the greater emphasis being placed locally on recreational hunting as a major tool of noxious animal control, and the refinement in management planning of the techniques of zoning as a means of reconciling conflicting uses of mountain lands. There are doubtless many others.

In considering the title of this talk, 'Changing Trends in Mountain Land Administration', it was obvious that I could not do justice to it completely without getting into the very wide field of pastoral mountain land administration. If there have been changing trends of great importance to New Zealand over the last two decades they are in the fields of run plans, of retiring class VII and class VIII high country, of more careful control of animal stocking, of retirement fences, of improving lower country by top dressing, of noxious weed and noxious animal control; indeed of the whole gamut of trying to achieve more conscientiously than has ever been done before the joint end of soil and water conservation and the optimum justifiable production of meat and wool from the land. But this is a most vast and difficult subject which deserves a lecture in its own right. It impinges directly on the interests of this audience in many ways. First, the trend to retire from pastoral runs the open tops and high country land above the bush line (which is basically unsuited for grazing and for reasons of water and soil conservation should not be grazed by either domestic or introduced animals), should in theory make more land available for mountain land recreation. Second, there is the trend in the use of mountain land by a few occupiers to manage deer as well as sheep and cattle. This development must have some effect on the

legitimate interests and aspirations of recreational hunters; it also could create some more difficult problems with access through pastoral runs to the mountain lands. Third, and similarly, the trend towards pastoral runs to be managed not only for animal production but also for safari hunting could once again reduce the area of land available for recreational shooting and could also exacerbate what already are some difficult access problems.

It will be a challenge to mountain lands administrators to ensure that in governing and directing these trends towards deer farming and safari hunting both that the land is protected, and this is of primary importance, but also that the reasonable interest of other mountain land users, (whether they be climbers, trampers, deer stalkers, skiers,

botanists, photographers or, just what in other countries are often termed, hill-walkers), are reasonably protected. To my mind the heartening feature is that there are strong pressures now to move towards planned and integrated land use management, with pastoralism, soil and water conservation, forestry, nature protection and recreation all being taken into account and all being accommodated. It will be an even bigger challenge for the country as a whole to use the mechanism of government administration, town and country planning, national park and forest park planning and of the public participation in all these activities to ensure that the desired end of integrated land use management is achieved. I identify this pressure as another and perhaps the most important trend of all.



First Director honoured

One of the highlights of the celebrations marking the centenary of Lincoln College in May 1978, was the conferment of the Degree, Doctor of Science, honoris causa, on the first director of the Tussock Grasslands and Mountain Lands Institute, Lance McCaskill.

The Public Orator on this auspicious occasion was Professor R. H. M. Langer. We publish, with his permission, the oration he made in presenting the candidate for conferment of the degree.

Lance William McCaskill

Mr Chancellor, most men count themselves fortunate if they can look back with satisfaction on one career. Lance William McCaskill has had at least four careers, and I am beginning to suspect that he may have embarked upon his fifth. At the beginning of his professional life he was a teacher of agriculture and biology at schools and Teachers' Training Colleges, and then secondly he became a lecturer and later Associate Professor of Rural Education at Lincoln College. Ordinary mortals would have been quite content to seek well-earned retirement at this stage; instead there followed his third career when he was appointed foundation Director of the Tussock Grasslands and Mountain Lands Institute. Contemporary records indicate that he retired officially after five years of service, only to re-emerge in his fourth reincarnation as a writer of books on conservation and natural history, and now there is just a suggestion that he has entered his fifth phase as an observer and chronicler of centennial celebrations.

What a wealth of experience, events and achievements is there to choose from! A crowded life devoted to so many activities and causes, untiring physical and mental energy, fearless challenge of authority for the sake of protecting the environment, these are but a few of the hallmarks of his character. Everything, apart from his sta-

ture, was big — his enthusiasm, his energy, his courage, his heart, his voice, his loves and his hates. To quote a tribute paid to him some 13 years ago, 'like a true fighter he revelled in being at the centre of controversy. In fact, he would no doubt agree that often his most effective work came from storms caused by his singleminded and fearless advocacy of some chosen cause'. But, let us go back to the beginning and examine some highlights of his successive careers.

Lance McCaskill has always been an original thinker and innovator. As a young teacher at Training College he devised novel systems of lectures and field trips, backed by discussion and library work. Effective teaching methods were one of his great concerns, and many of his students learnt to fear and respect his candid comments when he criticised their performance, as no doubt the Public Orator will discover for himself later this evening. Such was his success and reputation that he was awarded the Bledisloe Medal in 1944. Soon after this he joined the staff of Lincoln College where later he became the Head of the Department of Rural Education. Far from resting on his oars he was spurred to even greater activity by his new appointment, and before long he acquired a new reputation as the energetic organiser of the Farmers' Conference, the director of short



courses and general extension work, the editor of reviews, bulletins and other publications, and a frequent broadcaster and speaker at conferences and on field days. This list of achievements is impressive enough, but it omits one essential element in Lance McCaskill's life, his unceasing dedication and energy, for in his fight for just causes he spared neither himself nor his opponents. One could best describe him as the living contradiction of Parkinson's Law, for with him time always expanded to accommodate the work he set himself to do.

It has been asserted by some cynics that 'there aren't any good brave causes left'. Nothing could be farther from the truth as we watch the ceaseless and enthusiastic activities of those who have become the guardians of our environment. We have become accustomed to these well-organised groups and movements seeking and gaining general support, and we now expect authorities to prepare environmental impact reports and to avoid damage to our native flora and fauna. This was the cause for which Lance McCaskill fought almost single-handed at a time when the public needed to be made aware of its own priceless natural heritage and of the supreme importance of preserving it for posterity. He was his own Nature Conservation Council or Environmental Vanguard Movement, and he used all his skills as a teacher, broadcaster, writer and expert in extension methods to gather support. As he himself was to say later: 'you do not have to have a big organisation to get somewhere if your facts are right'. However, it was as a member of the National Parks Authority and other public bodies that he made his greatest impact and through which he acquired the support of concerned people

everywhere. He needed all the help he could muster when soon after his retirement from the Authority he fought his great battle for the preservation of the tarns at Arthur's Pass, a unique feature botanically which was threatened by the construction of the West Coast Road.

This area now remains intact as a lasting memorial to his energy and perseverance. Not that this is the only visible monument of his achievements. There are many more, among them the colony of the rare buttercup *Ranunculus paucifolius* at Castle Hill which he personally preserved from extinction and which he has nurtured ever since. Lance McCaskill remains an honorary ranger for all scenic reserves and State forests in the country and for three major National Parks. Only a man who loves nature deeply and unselfishly could have achieved all this. He can without fear of contradiction be described as one of New Zealand's great naturalists, and in these days of specialisation he may well be one of the last generalists in a distinguished line of tradition. But what is equally significant is that he has always wanted to share this love and his knowledge with others, and this is why so many have been inspired by him, and why he is remembered not just as a devoted teacher but as a concerned and warm-hearted friend. Mr Chancellor, the University is proud to add the name of Lance William McCaskill to the distinguished list of recipients of the degree of Doctor of Science *honoris causa*.

Other recipients of Honorary degrees were Professor I. E. Coop, (D.Sc), H. M. Caselberg (LL.D), L. T. Evans (LL.D) and C. Hilgendorf (LL.D).

Permanent photographic points for following vegetation changes

A. F. Mark

Vegetation changes were recorded in a photographic survey of Mount Aspiring National Park over a seven-year period of substantial deer reduction.

Lower-altitude tussock grasslands and shrublands showed an improvement in vigour and a resurgence of the more palatable species over the period.

At higher altitudes changes were not obvious. Forest improvement also occurred but did not show on photographs.

Introduction

A vegetation survey of Mount Aspiring National Park (287,200 ha as presently gazetted) was made during the summers of 1967-68 and 1968-69 in response to a request from the Park Board for a reconnaissance-type survey to provide it with an inventory of the flora and vegetation types. Information on the condition of the vegetation in terms of the influence of introduced wild animals, within the park, was also requested. The survey was to provide a basis for a management plan to be formulated for the park as well as for use in park interpretation.

Results of the survey were reported to the Board in 1972 and recently published by the National Parks Authority (Mark, 1977). Relatively broad vegetation types were recognised quite subjectively since any objective method requiring a sampling programme would have extended the field work well beyond the two summers allocated to it. This may be considered a severe limitation of the survey but in view of the general remoteness of much of the region, together with difficulties of access and weather, it may be a long time before we know how much the survey lost through a subjective approach.

Species and communities

In classifying the vegetation of the park, six major types were recognised on the basis of differences in growth form of the plant cover — forest, woodland, shrubland, tussock grassland, fellfield and bare. Among these, twenty plant communities (minor vegetation types) were recognised, mostly on the basis of differences in the dominant species. Upper and lower altitudinal limits of certain species and communities were used as a basis for recognising six altitudinal zones. These tended to be somewhat higher at the northern end of the park and east of the main divide, but generally were as follows: lowland to 300-450 m; montane to 550-750 m; sub-alpine to 1050-1200 m; low-alpine to 1500-1700 m; high-alpine to about 2000 m; nival beyond about 2000 m.

Descriptions of vegetation and animal use were made mostly along altitudinal traverses throughout the park, and from these, more general descriptions and assessments were compiled. Boundaries between communities were plotted on aerial photographs from which a vegetation map was prepared (Mark, 1977). It was obvious that the survey was being carried out at a particularly interesting

and informative period. The vegetation was showing the full impact of deer as well as early but clear signs of recovery, caused by the recent drastic reduction in deer numbers. Although hares and chamois were also throughout the park in moderate numbers and goats were locally important in the upper Dart-Rees catchments, their effects on vegetation were not separated from those of deer. Only hares have so far not been hunted.

Grazing and browsing effects were highly variable, and sometimes quite difficult to assess, since there were no unmodified areas remaining within the park except for numerous precipitous bluffs. These are probably not representative of the accessible sites, although they provide valuable refuges and hence seed sources for the many palatable species. In some areas where red deer numbers had apparently been very high, the cover provided by the various snow tussock species in the alpine or valley grasslands was relatively sparse and in some areas virtually absent. They had been displaced by unpalatable or tolerant species such as the blue tussock (*Poa colensoi*) or one or more species of mountain daisy (*Celmisia armstrongii*, *C. walkeri*), but remarkably few areas showed bare soil or serious erosion.

Less modified areas of tussock grassland were often obviously tracked, while areas of sub-alpine scrub were also either tracked or occasionally more severely damaged, with numerous dead or weakened shrubs over a short turf. Many forest interiors were opened up, with shrub, herb and ground layers highly depleted and with bare soil and roots exposed. Regeneration was sparse.

With the re-establishment in many areas of the more palatable members of most plant communities, it seemed likely that an improving trend would continue provided commercial venison recovery with helicopters (began in 1965), remained economically viable.

Of the several methods available for following such trends in a wide range of vegetation types (Atkinson, 1975) the only one which appeared feasible to operate was the establishment of permanent photographic

points in representative areas. While this method is perhaps the least satisfactory of those available, (in terms of its inability to quantify changes in either the vegetation or flora), it nevertheless is capable of providing certain qualitative information.

Photographic points

On completion of the vegetation survey the Park Board accepted a recommendation to install up to 100 representative points in a range of vegetation types and regions of the park. The New Zealand Forest Service offered to assist with the installation and monitoring of the points. A total of 68 photographic points were installed early in February 1970 and a further 20 were added three years later, distributed among 11 vegetation types as follows: forest (13), sub-alpine scrub (6), valley grassland (6), alpine snow tussock grassland (55), high-alpine fellfield (6), and open successional communities (2): (*note, where photographs included more than one type of vegetation only the predominant one is given here*).

A small blackboard with relevant details was included in the mid-ground of each photograph. At 13 sites, second photographs were taken to provide either a contrasting or close-up view of vegetation, or a distant view of a special feature, e.g. glacier, erosion scar, landslide, or moraine with developing vegetation. A brief description of the vegetation and its use by animals was compiled at each site, with plants being listed on a one to five scale of cover. These details, required to retake and assess the photographs, were transferred to special data sheets which, together with the initial photographs, are held jointly by the Park Board, the New Zealand Forest Service, as well as with the Botany Department, University of Otago. The Park Board holds copies of aerial photographs showing field locations of the sites as well as the photo-point negatives.

The re-survey was completed in 1977, 43 in late January with the author assisting New Zealand Forest Service staff, and 35 in mid-April by Forest Service staff alone (*note* 10 points could not be found).

Vegetation changes

At many sites, particularly in the tussock grasslands and sub-alpine shrublands, there has been obvious improvement in the condition of the vegetation during the four or seven year interval between photography. This improvement was most obvious in terms of increased height and cover of snow tussocks, particularly mid-ribbed snow tussock (*Chionochloa pallens*), indicated either by a reduction in visible areas of bare or sparsely covered ground (Fig. 1) or by the submergence of previously conspicuous unpalatable species such as *Astelia nervosa* (Fig. 2) or *Celmisia armstrongii* and *C. walkeri* (Fig. 3), or by the height of tussocks against the standard metre scale (Fig. 4) or by the increased overhang of disused animal tracks (Fig. 5).

In some areas young plants of highly palatable species (*Ranunculus lyallii*, *Ourisia macrocarpa*, *Anisotome haastii*) which had been listed but were not obvious initially, had reached maturity. Some of these species were not very conspicuous among the snow tussock cover (*Ourisia*, *Anisotome*), but others were and where a photograph did not include these plants, some additional ones were taken in 1977.



The rate at which one of the largest speargrasses (*Aciphylla horrida*) became widely established in the upper Dart Valley (Fig. 6) suggests that its previous suppression was caused by grazing pressure. Tussock and shrub recovery in valley grasslands (Fig. 7) and shrub regrowth in areas of sub-alpine scrub (Fig. 8) could be similarly followed. But among the higher altitude alpine grasslands (Fig. 9) and fellfield (Fig. 10) there were no obvious changes in the interval. Changes within the forests, while obvious in terms of the descriptions of seedling numbers, were not readily apparent in most photographs (Fig. 11).

Points to note

While the photography was timed to avoid the complications of irregular flowering years in the snow tussocks, results of the retake have served to stress the importance of other aspects if the maximum amount of information is to be obtained. These include the constant use of the scaled marker and its exact relocation, of similar size and location of the blackboard, use of the same camera or a similar one of equal quality (*note*, camera malfunction in 1977 resulted in substitution with a similar but inferior model and this is

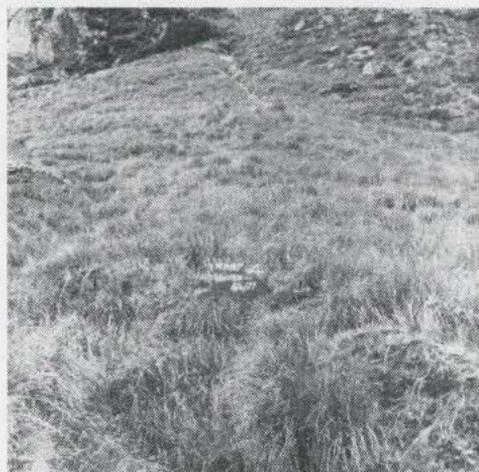


Fig. 1. Photo point No. 4 in broadleaved snow tussock (*Chionochloa flavescens*), low-alpine grassland near the floor of the upper south branch Wilkin Valley at 1150 m (3780 ft) photographed February 1970 (left) and April 1977 (right) showing some improvement in cover of snow tussock over this period. Litter has increased in abundance and "seedling" *Ranunculus lyallii* (1970) have increased to "some large leaved plants" but not shown. *Note*, metre scale and photo centre marker both missing and blackboard somewhat larger and slightly misplaced in the 1977 retake.



Fig. 2. Photo point No. 32 in midribbed snow tussock (*Chionochloa pallens*), low-alpine grassland overlooking Liverpool Stream in the West Matukituki catchment at 1270 m (4180 ft) photographed February 1970 (left) in a highly depleted condition with many small, weakened, snow tussocks and abundant blue tussock (*Poa colensoi*) throughout, *Astelia nervosa* (large silvery plant), and everlasting daisy (*Helichrysum bellidioides* – right foreground), and isolated broadleaved snow tussock (skyline). By January 1977 (right) snow tussock had regained co-dominance (c. 50 percent cover) while other species are now less conspicuous.



Fig. 3. Photo point No. 16a, a close-up view of midribbed snow tussock (*C. pallens*), low-alpine grassland in the upper Beans Burn, Dart catchment at 1250 m (4100 ft) showing, in February 1970 (left), weakened snow tussocks and a conspicuous cover of celmisias, the larger erect *C. armstrongii* and the trailing *C. walkeri* that by January 1977 (right) were becoming submerged by recovering snow tussocks. Occasional semi-mature plants of *Anisotome haastii* and *Ranunculus lyallii* do not show. Blackboard has been slightly misplaced. See Figure 4 for a more general view of this site.

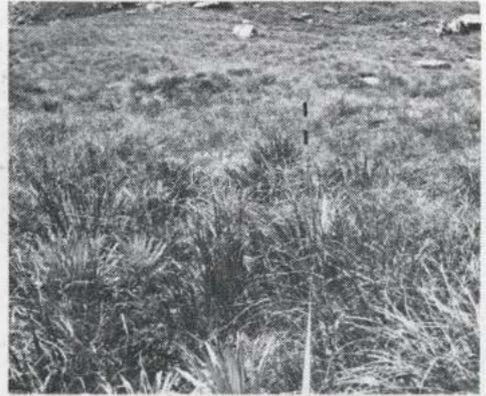
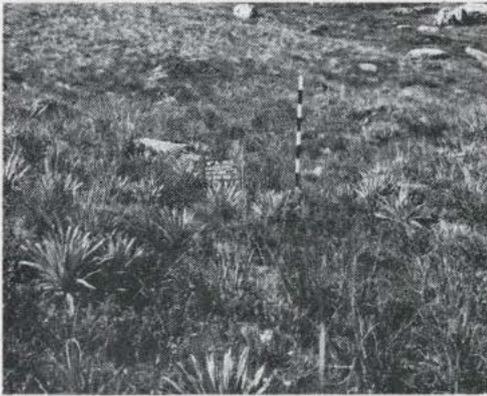


Fig. 4. Photo point No. 16, a general view upslope from site 16a (Fig. 3) showing the increase in cover and height (indicated by the metre scale) of midribbed snow tussock between 1970 (left) and 1977 (right).



Fig. 5. Photo point No. 6 in broadleaved snow tussock (*C. flavescens*), low-alpine grassland in the upper Waitatoto Valley at 1260 m (4120 ft) with a view along a disused deer trail that has become much less obvious due to increased tussock size, over the 7 years from February 1970 (left) to April 1977 (right).



Fig. 6. Photo point No. 21 in depleted, mixed, broadleaved snow tussock – scrub near the floor of the upper Dart Valley at 870 m (2850 ft) in which blue wheat grass (*Agropyron scabrum*) was already abundant in response to a reduction in grazing pressure, along with blue tussock (*Poa colensoi*) and silver tussock (*P. laevis*) by February 1970 (left). Seven years later large speargrass plants (*Aciphylla horrida*) had become numerous (centre mid-ground and background above stake), shrubs of *Hebe subalpina* were established (white flowering bushes on left) and blue wheat grass was less important (right photograph). The metre scale and blackboard are both misplaced and the photo-centre marker is missing in the retake photo.



Fig. 7. Photo point No. 7 on an open flat in the Rock Burn Valley at Theatre Flat, 800 m (2630 ft), showing the herbaceous cover of small tussocks (blue tussock – *Poa colensoi* and alpine fescue tussock – *Festuca matthewsii*) and little change between February 1970 (left) and January 1977 (right) but shrubs, chiefly of *Coprosma propinqua*, are obviously larger (permalap marker wired to bush in centre has been almost concealed) and the isolated broad-leaved snow tussock (left mid-ground) is now conspicuous, reaching 45 cm, though still being lightly grazed. Blackboard slightly larger in retake photograph.



Fig. 8. Photo point No. 15a in mixed subalpine scrub near the floor of the upper Beans Burn Valley at 880 m (2900 ft), showing increased height and cover of shrubs, particularly *Coprosma propinqua* (right foreground), and to a lesser extent of prickly shield fern (*Polystichum vestitum*) (left foreground) between February 1970 (left) and January 1977 (right). Large bushes in background are of Inaka (*Dracophyllum longifolium*). Note permalap marker in left foreground in both photographs, blackboard is slightly larger and permalap marker on shrub in centre is missing in the retake photograph.



Fig. 9. Photo point No. 3 in curled snow tussock (*C. crassiuscula*) low-alpine grassland in the upper east Matukituki Valley at 1340 m (4400 ft), showing a complete plant cover composed of short open tussock with abundant trailing *Celmisia walkeri*, erect and narrow-leaved *C. lyallii* (left foreground) and blue tussock among several species, which has remained essentially unchanged between February 1970 (left) and April 1977 (right).



Fig. 10. Photo point No. 67 in a mosaic of snowbank vegetation (centre) and fellfield at 1840 m (6050 ft) on the McKerrow Range in the upper Makarora Valley. The snowbank depression is dominated by a closed turf of snow patch grass (*Chionochloa oreophila*) while the rocky fellfield surrounding it is characterised by blue tussock and *Celmisia hectori*, all of which have remained apparently unchanged between February 1970 (left) and April 1977 (right). The metre scale and tape are missing and the blackboard is slightly larger and misplaced in the retake photograph.



Fig. 11. Photo point No. 8 in montane mountain beech forest at 800 m (2630 ft) adjacent to Theatre Flat in the Rock Burn Valley, Dart catchment, showing the severely depleted forest interior typical of this area. Apart from abundant beech litter on the forest floor there was a substantial cover (c. 50 percent) of filmy ferns in February 1970 (left) which remained almost unchanged in January 1977 (right) except that many small beech seedlings (5 - 10 cm tall) in 1970 have now reached 25 - 30 cm although they still remain inconspicuous. The white permalap on the photo-centre peg has been lost and the blackboard is slightly larger in the retake photograph.

reflected in the poorer quality of most re-photographs), careful attention to tripod height and field of view to ensure these are identical (*note*, despite copies of the original photographs being taken into the field some small variations occurred). Other problems are more difficult to avoid: sunflecks within

forest and shadows in other vegetation types affected 18 comparisons – even retaking at the same time of day would not avoid this – obtaining comparable close-up views when plants are recovering rapidly (more frequent retakes might have assisted here). Adequacy and comparability in supplementary note-

taking on each occasion, particularly if different personnel are involved, during the brief period available at a site, is also a problem. In addition, security and availability of the negatives and other records is an important aspect (unfortunately some negatives were lost in processing and a few others have subsequently been mislaid).

Nevertheless, despite this range of difficulties and shortcomings with the permanent photographic point method of assessing vegetation changes, I believe the limited record completed to date is already a valuable one and moreover its value should increase with time since changes are obviously still occurring in many areas.

Application

With its wider coverage, the record should offer a valuable complement to the more detailed vegetation studies in limited parts of the park by staff of the Protection Forestry Division, New Zealand Forest Service (Wardle, Hayward and Herbert, 1973), initiated following the establishment of the photo points. The photographic record also provides valuable confirmation of the patterns of deer reduction in relation to vegetation types revealed by the detailed results of monitoring deer numbers on the slopes of the Arawata Valley near the park's western boundary (Challis, 1977).

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'Lympho' ...its epidemiology and control

A. JOPP

Many sheep farmers in New Zealand will be familiar with a condition met with in sheep more commonly in Merinos and Halfbreds known as Caseous Lymphadenitis and characterised by lesions simulating abscess formation found in various lymphatic glands of the body. These glands are round or oval bodies varying in size, interposed in the course of the lymphatic vessels and through which the lymph passes in its course to be discharged into the blood vessels.

In the early stage of the disease the enlarged glands are filled with a greenish pus and sheep thus affected are commonly said to have 'lympho'. In the later stages of infection the abscess contents become dried and cheesy and the disease is then sometimes referred to as 'cheesy glands'. The disease may lead to heavy rejection of lines of sheep killed at freezing works. Any breed can be affected. Mr Jopp reviews the scientific literature to date concerning the cause, mode of infection and methods of controlling the disease.

Cause and economic importance

Ovine Caseous Lymphadenitis (CLA) is a chronic disease of sheep characterised by the formation of abscesses in the lymphatic glands, particularly the superficial ones (Belchner, 1971). The disease is caused by a bacterium, *Corynebacterium ovis* described by Carne in 1932. The organism was first discovered by Preisz (1891) and Nocard (1885) who named it *Corynebacterium pseudotuberculosis* hence its previous alternative names, Bacillus of Preisz-Nocard and *Bacillus pseudotuberculosis*.

The disease is of 'considerable economic importance' according to Hughes and Barton (1969). They estimated the loss occurring in the South Island high country of New Zealand in 1969 to be approximately \$100,000. This stems from the necessary trimming of carcasses which are intended for human consumption. There is no evidence that the consumption of mutton which has been infected with CLA is detrimental to human health, nevertheless, as Belchner (1971) says, 'from an aesthetic point of view, the presence of the disease is undesirable as

nobody likes to carve through an abscess in a leg of mutton.'

Incidence

CLA is widespread in Australia and New Zealand (Hungerford 1967). Although rarely encountered in Great Britain it is common in other European countries and in North and South America.

Ensor (1964) states that in the South Island of New Zealand 60,000 adult carcasses (two per cent) and 11,000 lamb carcasses (0.1 per cent) were rejected in 1962. Further to this, Hughes and Barton (1960) give evidence (see Table 1) of rejection rates of adult sheep from the South Island high country stations. From this it can be concluded that:-

1. Merinos appear more susceptible to *Corynebacterium ovis* infections than Halfbred or Corriedales and they, more than Romneys. This appears to be related to the wrinkled skin of the Merinos being more susceptible to shearing cuts.
2. Sheep shorn with machines appear to be more susceptible than those shorn with blades. This appears to be related to the

closeness of the 'blow' to the skin, i.e. machine shearing removes more wool in comparison to blades. Also blades are routinely disinfected in water pots after shearing; generally, machine handpieces are not.

3. Dry climates predispose to a higher in-

cidence of the disease than do areas which receive a high annual rainfall.

4. Lines of wethers almost always have a higher incidence than lines of ewes from the same property. This could be due to the greater age at which wethers are usually culled.

Table 1

Percentage of rejections for CLA from adult sheep killed at South Island freezing works. Hughes and Barton (1969).

Breed	Shorn	DRY		MOIST				WET		
		Marlborough	Otago	Marlborough	Otago	Southland	Canterbury	Otago	Canterbury	Southland
Merino	Machines	30-40	37	31	26		15	23	12	12
	Blades		30		14					
Halfbred	Machines		12		20	16	3	5		3
	Blades				15	10				
Corriedale	Machines		11		13					
	Blades				5					
Romney and Similar	Machines				2	10				3
	Blades									

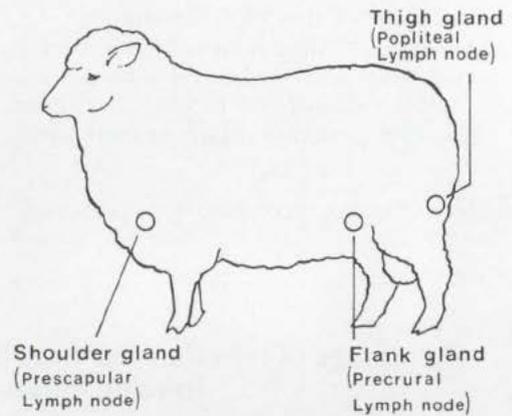
Habitat of *Corynebacterium ovis*

The necessity for preventive measures based on a sound knowledge of the habitat of the organism and means of infection led Australian workers to study these aspects in the years 1929-35. Woodruff and Gregory (1929) considered possible environment contamination via suppurating wounds.

They showed that after manual examination approximately 10 per cent of affected sheep showed suppurating lesions. Seddon (1953) stated that the liability of abscesses in the superficial lymphatic glands to 'point' and rupture by rough handling had often been underestimated. This has led to the view that discharging lesions could widely contamin-

ate the environment and hence provide a source for further infection.

Carne in 1932 considered whether faecal contamination of the environment could act as a possible source of infection. He showed that the growth of *Corynebacterium ovis* occurred readily in certain types of sterilised faeces and concluded that it was possible for the bacillus to lead an external saprophytic existence. Carne (1933) failed to demonstrate the presence of the organism in faecal samples from counting out pens. Bull and Dickenson (1932) recovered the organism from faeces of sheep not showing lesions of the disease. However, organisms could not be recovered from sheep camps after they had been subject to the heat of a South Australian summer or after a severe winter. Furthermore, they could not recover the organism from the soil of open paddocks, from sheep yards or counting-out pens. Seddon (1953) concluded from these results that it was reasonable to suggest that after being voided from sheep, either from discharging lesions, or in faeces, organisms may be present in the soil provided it was sufficiently moist and was protected from desiccation by sun or drying winds. He further concluded that it was not capable of surviving in sufficient numbers to infect dried faeces under sheds, in dust of yards, or in the soil of paddocks or camps under dry conditions.



Sketch of sheep showing lymphatic glands most commonly affected with Caseous Lymphadenitis.

Mode of infection

The natural method or methods of infection by which sheep contract infection by *Corynebacterium ovis* has attracted special attention in the investigation of CLA. This is largely due to the distribution of lesions which are situated in the lymphatic gland draining the superficial parts of the body. Hopkirk and Dayus (1932) stated that in both lamb and adult sheep the most common lymphatic gland affected with the CLA was the superficial cervical, the next being the popliteal (see Table 2 and Figure 1). Carne (1932) considered the preponderance of lesions in the superficial lymphatic glands together with clinical evidence, strongly

Table 2

Caseous lymphadenitis in sheep. Body lymph nodes affected in animal showing only a single lesion. Homebush, 1937 (Seddon, 1953).

LESIONS	WETHERS	EWES
Total infected	685	198
Percentage:		
In prescapular lymph node	61.8	69.7
In precurral lymph node	20.0	24.2
In ext. inguinal (mammary)	11.2	3.5
In ischiatic	3.8	1.0
In popliteal	2.0	1.5
In sternal	0.87	-
In iliac	0.3	-

supported the view that the natural mode of infection was by the causal bacillus gaining entry to the superficial parts of the body via wounds to the skin.

Seddon (1953) quoted figures (see Table 2) describing the distribution of lesions from the Homebush abattoirs, New South Wales in 1937. These investigations not only confirmed the common mode of infection was through a skin wound, but provided much evidence that shear cuts were the most common route of infection; that castration wounds were much less important and that infection occurred after, and not during the actual act of shearing. Evidence for this is as follows:-

- (i) Seddon (1928), Carne (1933) and Bull and Dickenson (1934) described the development of lesions of the type seen in natural cases in sheep in which shear cuts were deliberately infected.
- (ii) The finding of *Cornybacterium ovis* in the pus in shear cuts that had become infected naturally (McGrath 1929).
- (iii) The rarity of the disease in young born lambs. Woodruff and Gregory (1929) quoted figures showing one out of 190 unshorn lambs examined in 1929 at Ballerat meat works was found to be infected with the disease. Subsequently, Gilruth (1931) found at post mortem examination only one out of 48 showed lesions of CLA and that was in the scrotal region. The very low prevalence in young lambs was also shown in Western Australian figures from Fewster in 1947, which showed that unshorn spring lambs had a much lower incidence than shorn summer lambs.
- (iv) The increased incidence with age. Kellaway et al (1929) and Woodruff and Gregory (1929) showed that as sheep were shorn annually, an increased incidence with age was also

related to the number of times animals were shorn.

- (v) The greater incidence in sheep wounded more extensively at shearing. Work by Bull and Dickenson (1934) supported this. Some 45 male lambs (Lot 1) were castrated with the Burdizzo (their tails were not docked) and were shorn carefully each year with blades, any animal wounded by accident being removed from the group. These were run with another group (Lot 2) of the same age, tailed and castrated in the usual way and blade shorn for the first two years and by machines during the third year. When slaughtered at three years old, the following were found infected:-
Lot 1 (38 animals) — 1 infected — 2.6 per cent
Lot 2 (23 animals) — 7 infected — 30.4 per cent
Further evidence by Seddon (1933) confirmed the importance of wounding at shearing.
Lot A — Blade shorn and not, or only slightly, wounded — none infected
Lot B — Blade shorn and moderately wounded — two per cent infected.
Lot C — Machine shorn, more severely wounded — 18 per cent infected.
- (vi) The somewhat greater incidence in Merinos than in sheep not, or not wholly, of Merino blood, (Hughes and Barton 1969). This is thought to be due to the greater degree of wrinkleness of the pure Merino rendering it more prone to accidental wounding during shearing.
- (vii) Evidence of infection occurring in counting out pens. It seems likely that infection occurs commonly in counting-out pens. The results of an experiment by Pearse (1951) at Nyngan Experimental Farm verify

this. Four lots of wethers were shorn as follows:-

- Blade shorn, utmost care, no cuts - none affected.
- Blade shorn, less care, some cuts - two per cent affected.
- Machine shorn, no special care - 18 per cent affected.
- Machine shorn, no special care,, but sheep were not collected in counting-out pens. Instead they were allowed to go straight out to paddocks - none affected.

Descazeux (1929) investigated the possibility of infection occurring at 'marking' time. He experimented with sheep in Patagonia and concluded that 'a considerable infection occurred at marking time', particularly through the castration operation. This does not appear to be the case in Australia and New Zealand (Special Committee, 1930). Comparing sheep owners' method in the two countries the reason for the marked difference would seem to be fairly clear. Whereas in Australia and New Zealand, marking of lambs is almost invariably carried out in temporary yards, in Patagonia the operations are evidently conducted at the shearing shed or homestead; clearly one is under highly favourable conditions for the contamination of fresh wounds, the other unfavourable.

Dust

Research workers also considered the possible contamination of shear cuts by dust during shearing or before the sheep left the yards. Experiments by Seddon and Belchner (1932) verify this. Here two lots of sheep were shorn together by machines for three consecutive years, wounded to approximately the same extent and run together throughout the period. The only difference in handling was that whereas Lot A passed from the shearing boards through the counting-out pens and yards, Lot B was taken out by the wool door; both lots were joined at the exit to the yards. On slaughter, 18 per cent of Lot A were found to be affected with CLA but none in Lot B.

Infection of shear cuts by pus from ruptured abscesses during or following the operation of shearing was also considered as a possible mode of infection. It had been noted that frequently abscesses burst externally and soil the wool with pus. The more sheep that are driven and penned close together, the more likely is rupture to occur. Rough handling on the board may also bring this about, (Special Committee, 1930).

Shearing cutters

The role that shearing cutters have in passing on infection is not clear. It appears possible that cutters may become infected as they pass through the contaminated wound. McGrath (1929) and Murnane (1931) consider this so. However, work by Bull and Dickenson (1934) and Anon (1931) did not support this conclusion and Seddon (1953) stated that 'the cutters become rapidly cleansed as they pass through the wool', although he did consider that for all practical purposes, the handpiece offered a very significant source of infection.

Gilruth (1930) considered that transmission of the microbe per medium of the shearer's clothing, particularly the trousers, was a possibility. Evidence he cites for this is that the prescapular lymph node is the commonest site of infection and as the shoulder and neck of the sheep rest on the left thigh of the machine shearer during shearing wounds about the shoulder might become infected from shearers' contaminated trousers.

Nairn and Robertson (1974) investigated the possibility of transmission of CLA occurring via plunge dipping off shears. The conclusion from their work was that *Corynebacterium ovis* was able to survive in most sheep dipping fluids for 24 hours and that transmission of CLA could occur if sheep were exposed to *Corynebacterium ovis* within two weeks of shearing. Also CLA could be produced quite easily in sheep by placing *Corynebacterium ovis* on unbroken, recently shorn skin after treatment with a defatting agent or skin scalding.

Other sources of infection have been

considered, but in the main, are not important. Consideration was given to soil contamination of wounds, not necessarily shear cuts, as sheep rested in camps in the paddock. Whilst it has been shown that the *Cornybacterium ovis* organism may grow on sheep camps (Bull and Dickenson, 1934) it appears an unlikely source of infection unless the camps are protected by trees and have not been subject to desiccating conditions immediately prior to their use by newly shorn sheep (Seddon, 1953). There is no evidence that bowel injuries by *Oesophagostomum Columbianum* facilitate infection by ingested *Cornybacterium ovis* (Carne and Clunies Ross, 1931). Similarly, transmission of CLA by the sheep ked, *Melophagus ovinus*, has been investigated by Hopkirk (1930). No such infection occurred. Armstrong (1968) considered that dog bites in and around yards could be significant as a source of infection in a flock in which the disease occurred.

Control

From the foregoing account of the disease it is apparent that it may be coped with or its incidence materially reduced by certain measures. Some are comparatively easy to apply, some difficult, yet others may be considered impractical and too costly. Nevertheless they merit consideration by all who desire to prevent the spread and assist in the eradication of the disease.

Armstrong (1968) considered three measures for control:-

- Prevention of unnecessary wounds
- Prevention of wound infection
- Reduction of the source of wound contamination.

Prevention of unnecessary wounds

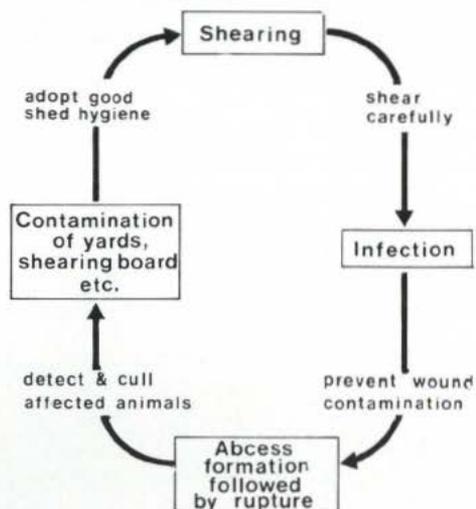
Every effort should be made to reduce the wounding of sheep to a minimum by encouraging 'clean, smooth shearing rather than rough, fast shearing' (Belchner, 1968). Ensor (1964) considered the selection of 'plain bodied' sheep before wrinkly strains would reduce the chance of wounding animals at shearing. Hughes and Barton (1967)

considered dog bites a possible factor in providing the opportunity for infection to occur around sheep yards. They also provided data (1969) which showed that blade shearing as opposed to machine shearing may significantly reduce infection by decreased wounding.

Prevention of wound infection

One of the most important areas to consider in a 'Lympho' control scheme is shed and yard construction. It has been shown that the important yards as a source of infection are all those from the shearing porthole out to the paddock where sheep will be standing with fresh wounds (Pearse, 1951). As such, Ensor (1964) recommends that counting-out pens should be concrete to facilitate washing and that if concrete is not available watering yards to keep dust down may help. Metal piping instead of wooden rails in counting out pens makes for easier cleaning. Also, driveways should be grassed or sprayed with disinfectant, if possible.

Construction of sheds should allow the shearing board to be cleaned and dried at breaks during the day. Tongue and grooved wood offers too many crevices as sources of infection in spite of repeated floor washing (Ensor, 1968). Smooth impervious floors such as provided by linoleum or varnished



Break the "Lympho" cycle.

hardboard, laid in as large a sheet as possible, and walls lined with linoleum or the new plastic floor coverings are easiest to clean and dry. These coverings should be secured with the new adhesives instead of nails. It is important to dry a floor quickly at 'smokos' or when a floor needs disinfecting after it has been accidentally contaminated with pus through the cutting of an abscess during shearing. A rubber 'squeegee' or mop will help to dry any floor quickly.

Hughes and Barton (1969) considered that daily or more frequent spraying of floors and rails of counting-out pens was best. They also stated that the frequent daily washing, broom scrubbing and disinfection of the board was desirable. Belchner (1968) recommended the use of hot water and washing soda ($\frac{1}{2}$ kg washing soda to $2\frac{1}{2}$ litres water) and a hard broom in the shearing shed and counting-out pens before disinfecting as it 'removes the wool grease on the floor and gives the disinfectant full scope'. For disinfecting the following rates are recommended:-

– Shearing board and counting-out pens require a suitable disinfectant mixed 1

part to 40 parts water.

– Ensor (1968) recommended that 'hand shears can be kept in a pot of disinfectant which must be changed daily, and which must completely cover the blades of the shears'. Two pairs of shears can be used so that one pair is always soaking in the disinfectant.

– For machine shears, Tripp (1970) described a water pot which would disinfect machine shears between each sheep being shorn. It consists of a galvanised pot which holds one gallon of disinfectant and 'has an electric element to keep the liquid well above sterilization temperature'. The disinfectant mixture used for the pot was:

2 parts soluble oil

$1\frac{1}{2}$ parts commercial disinfectant

$2\frac{1}{2}$ parts water

(Personal communication)

Attention should be drawn to the importance of good personal hygiene of the shearers. The shearer should be made well aware of the possibility of rupturing an abscess during the process of shearing. He should, therefore, be on the lookout for such an occurrence and the possible risk of soiling



'Lympho' pots in position on a shearing board.

clothing with discharging material. Shearers vary greatly in their co-operation with owners in keeping infection to a minimum. Armstrong (1969) records how some farmers pay an extra bonus per hundred sheep shorn to 'encourage' co-operation. An adequate number of washing machines and hot water availability make it easier for shearers to keep their clothing clean.

The order of shearing is also an important consideration in the prevention of CLA. Anon (1931) stated that 'lambs should be shorn before the older sheep. Next year after the lambs have been shorn the one year old sheep should be shorn and in succeeding years they should be shorn in order of age'. This will materially minimise the risk of infection from shearing appliances.

Hughes and Barton (1969) reported that the off shears spraying of sheep with a commercial disinfectant (e.g. 'Syvel') was a possible method of reducing infection. Hercus (1968) stated that 'Syvel' disinfectant could be mixed at the rate of one part disinfectant to 150 parts water and off-shears sheep run through a misting machine. Hughes and Barton (1969) further considered it possible to fit an automatically-operated spray plant in a race leading from shed to paddock.

Ensor (1964) described some measures which could be taken after shearing to minimise the risk of infection. These are summarised as follows:-

- Do not overcrowd sheep in counting-out pens; fewer sheep will reduce the risk of sheep to sheep contamination.
- Release sheep as soon as possible to clean pasture.
- Do not draft until wounds have dried.
- Do not plunge dip off shears.

Lamb-marking has been considered a time when possible infection could take place. Its role in the spread of CLA appears to be minimal, nevertheless Armstrong (1968) considered a high degree of hygiene and regular disinfection of instruments was necessary. This should be done in temporary yards in clean spelled

paddocks and the lambs dropped onto grassy areas.

The crutching of sheep also provides an opportunity for infection to occur (Anon, 1934). The practice of crutching sheep in the paddock rather than permanent yards has much to commend it.

The reducing of the source of wound contamination relies on the identification and culling of diseased animals and the maintenance of a high hygiene standard when handling sheep.

Prevention programmes

A number of areas should be considered in prevention programmes:-

- Sheep with burst discharging abscesses should be culled before and after shearing.
- Ensor (1964) considered that as an abscess took about two weeks to develop after shearing, then 'the majority of flocks should be manually examined three to four weeks after shearing'.
- The importance of shearing shed hygiene has already been discussed. Its importance in the prevention of CLA cannot be overstressed.
- Armstrong (1968), considered it may be advantageous to clean up sheep camps by either fencing and spelling the concentrated area for two years, or by cultivation and seeding. Anon (1934) considered that as acid conditions restrict the growth of *Corynebacterium ovis* in soil, yards and pens then sheep camps should be treated with about 0.5 tonnes of sulphur a hectare every two or three years.
- Plunge-dipping must also be considered in view of Nairn and Robertson's findings in 1974. They considered that sheep should not be plunge-dipped off shears or within two to three weeks of shearing.

A serology test (Anty-haemolysin inhibition test) described by Zaki (1968) offers considerable promise as a diagnostic tool to determine whether or not an animal is infected with CLA. A false positive reaction has not been so far encountered in any of the experimental sheep tested (Nairn and

Robertson, 1974). The main disadvantage of the test is failure to detect all infected sheep, especially in the early stages of the disease. It is not available in New Zealand.

Vaccination

Cameron (1972) eloped a formalinized vaccine containing Alumum phosphate adjuvant, which, although increased sheep resistance to infection, did not confer solid immunity. However it may prove to be effective when used under field conditions. This can be assessed only by very extensive trials.

Cameron considered that the vaccine be administered shortly before expected exposure to infection (e.g. shearing) so that the animals were maximally protected at that time. The vacine is not available in New Zealand.

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ESTABLISHING TREES FOR SHELTER UNDER IRRIGATION

C. C. Boswell, D. J. Musgrave and A. R. McCord

The removal of competing pasture plants and the provision of a good hole are two important factors in achieving good tree establishment for both dry and well-watered environments in the high country.

Introduction

Wide expanses of continuous high country grassland, with homesteads nestling among their small groups of trees, bring into focus the difficulty of tree establishment in that environment. Indeed, it is mainly about homesteads, where the benefits of shelter are obvious and where regular attention (especially irrigation) is given to trees, that establishment has been successful.

As the area under irrigation in the high country expands, a better understanding of the factors involved in tree establishment would be advantageous. The questions raised by those interested in providing shelter belts or parkland type shelter on border-dyke irrigation are:-

1. How are the trees to be established?
2. Which species will grow in this environment?

Trials at Tara Hills

In an effort to answer these questions, a series of trials was set up at Tara Hills Research Station. Here the rainfall is 520 mm and about 160 days of ground frost are recorded annually.

The trials were conducted on a border-dyke irrigated area of Mackenzie soils sown to a mixed pasture and cut as required for hay. Irrigation was applied on average 10 times from November to April each year so that water was not limiting at the base of the dykes during the growing season.

A range of methods of establishment was compared in one trial using *Pinus radiata* as the indicator tree. Trees were planted either into a post-hole or a machine-ripped opening (Figure 1), both at the base of dykes in the irrigated zone, and on top of the dykes in what was virtually a dryland situation over the establishment year. Strip spraying two weeks before planting (using Permazol) at 12 kg per sprayed ha) and a newspaper mulch (2 cm thick; 25 cm radius) were compared as methods of weed suppression. Trees were planted into the post-hole 2-5 cm below the lip of the hole which provided a small catchment area.

Important factors

Tree survival and height were recorded 6, 12 and 20 months after planting. The most important factors affecting survival were the pre-planting spray to control competition from pasture species and the type of hole (Figure 2). Mulching did not suppress competition and had no effect on survival (mean survival to 20 months: mulched 52 per cent; not mulched 45 per cent).

The position of planting on the dyke was only important in the absence of spray. The rates of survival on top of the dykes were 76 per cent and 5 per cent with and without spray respectively, 20 months after planting. At the base of the dyke 77 per cent and 27 per cent of the trees survived to 20 months on sprayed and non-sprayed areas respectively.

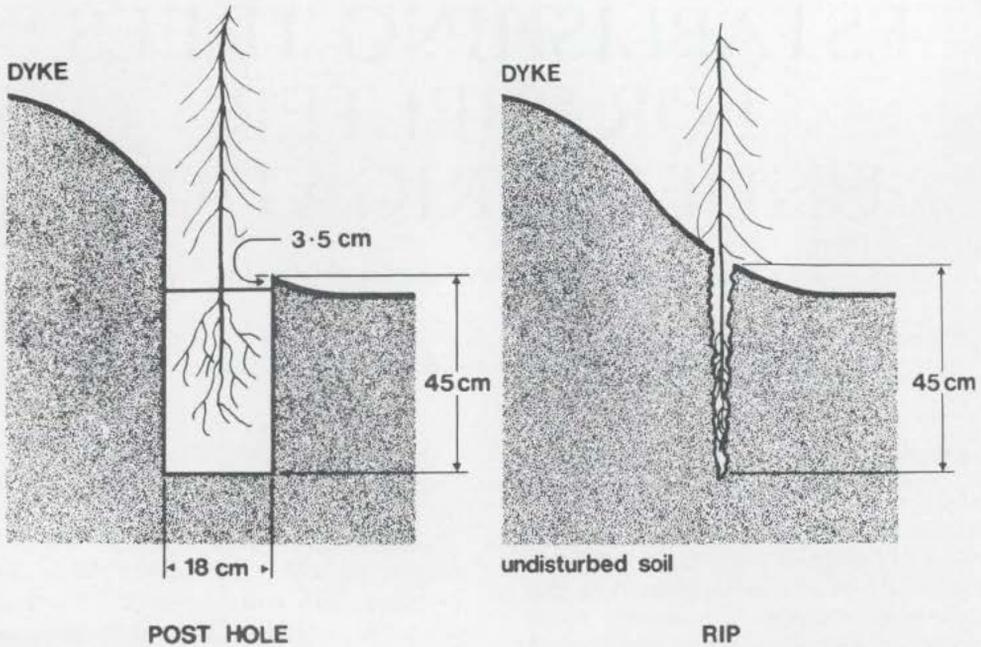


Figure 1.
Tree planting methods

Where spray was applied competition effects were negligible for the first 12 months and survival rates were very good, but on the non-sprayed areas the survival was poor during the first summer (37 per cent) and declined steadily to 20 per cent about 20 months after planting. Growth was reduced also on non-sprayed areas. Trees surviving after 20 months were only 67 per cent of the height of trees planted on sprayed areas.

In an earlier pilot trial trees planted into a post-hole had established far better than those planted into slits dug with a spade to a depth of about 20 cm (mean survival 12 months after planting: post hole 56 per cent; spade slits 27 per cent). Similarly in this trial trees planted into post-holes generally survived better than those planted into a rip. Initially the difference was not large when a pre-planting spray was applied. However the difference increased with time after planting (Figure 2). The advantage of the post-hole seemed to be mainly in providing an improved physical environment for the tree roots as there was little indication of any

marked effect on competition or water availability from the catchment provided by the post-hole.

Tree species

In the spring of 1975 eighteen tree species were planted on an adjacent area to the above trial, to compare establishment and growth under irrigated conditions (Table 1). Trees were planted into machine ripped openings at the base of dykes which had been sprayed with Permazol (12 kg/sprayed ha) two weeks before planting.

After three growing seasons high survival rates were shown by *Pinus Mugo*, *P. sylvestris*, *P. ponderosa* and *Cupressus nootkatensis* *x macrocarpa* (Leyton Green); while *C. arizonica*, *Sequoia gigantea*, *P. nigra*, and *Eucalyptus gunnii* survived moderately well. The other three *Eucalyptus* species planted were disappointing with *E. fraxinoides* not surviving the first year after planting.

In the first year winter mortality was high in *E. delegatensis*, *E. nitens*, *E. fraxinoides*, *P.*

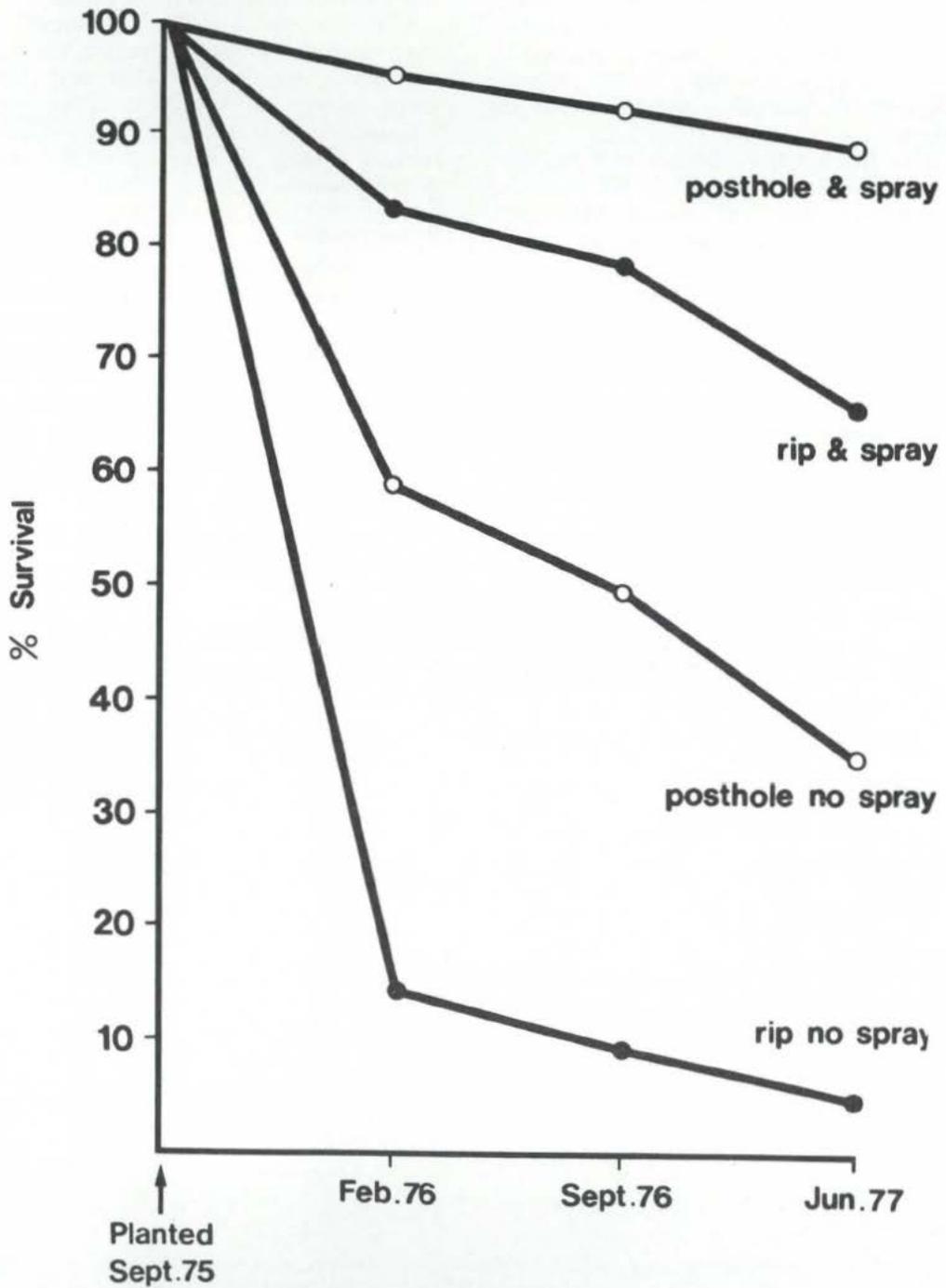


Figure 2
Effects of methods of planting on tree survival

radiata and *P. muricata*; while high summer mortalities were recorded among *E. delegatensis*, *E. fraxinoides*, *P. radiata*, *P. muricata*, *Alnus viridis*, (green alder) *Betula pendula* (silver birch) and *Cedrus atlantica* (Atlantic cedar).

Mean tree heights at March 1978 and the rate of tree growth over the third growing season (November 1977-March 1978) are shown in Table 1. The outstanding species in terms of mean height and actual height gain was *E. gunnii*. Most of the better establishing species grew more rapidly in the third year than in previous years. Of the other species the surviving silver birch, *P. radiata*, *P. muricata*, *E. nitens* and *E. delegatensis* grew well.

The growth (and possibly survival) of some of the deciduous trees was affected by browse damage by hares especially in winter. Silver birch, lime (*Tilia vulgaris*) and green alder were especially affected by browsing, while larch (*Larix decidua*) and Atlantic

cedar were affected to a lesser extent.

Improved growth in silver birch during the third year was probably because the trees were above browse height. Many of the lime, green alder and Atlantic cedar trees remained stunted and susceptible to further browse damage at the end of the third growing season.

Requirements

The main requirements for tree establishment is adequate control of all competing vegetation over the establishment season. This applied in the experiment reported where the vegetation present on the dyke was only a moderate cover of sorrel. Planting using a post-hole digger combined with a pre-planting spray was the most successful combination tested, though the most expensive (Appendix 1).

If achieving maximum growth and survival over the first season is not so critical, the

TABLE 1
ESTABLISHMENT OF DIFFERENT
TREE SPECIES AT TARA HILLS

Species	Percentage Survival (30 months after planting)	Mean tree heights at March 1978 (cm)	Percentage change in height during 3rd growing season
<i>Pinus mugo</i>	100	67	32
<i>P. sylvestris</i> (Scots pine)	95	78	45
<i>P. ponderosa</i>	95	75	50
<i>Cupressus nootkatensis</i> x <i>macrocarpa</i> (Leyton Green)	95	79	49
<i>C. arizonica</i>	85	117	35
<i>Sequoia gigantea</i>	85	72	56
<i>P. nigra</i>	78	62	79
<i>Eucalyptus gunnii</i> (cider gum)	72	289	51
<i>Betula pendula</i> (silver birch)	60	96	101
<i>Larix decidua</i> (larch)	55	72	74
<i>P. muricata</i>	48	117	68
<i>Tilia vulgaris</i> (lime)	45	23	68
<i>Cedrus atlantica</i> (atlantic cedar)	42	23	27
<i>Alnus viridis</i> (green alder)	40	38	61
<i>E. nitens</i>	40	169	67
<i>P. radiata</i>	17	114	73
<i>E. delegatensis</i>	13	157	80
<i>E. fraxinoides</i>	-	-	-

**C. nootkatensis* x *macrocarpa* was not available for planting until 12 months after the other species (i.e. September 1976). 40 *P. radiata* trees were also planted in September 1976 to act as a standard with which to compare the hybrid cypress. Details of survival and growth of this *P. radiata* to March 1978: survival 87 percent; height 73 cm; change in height 74 percent.

cheaper ripping-spray combination may be a more suitable alternative. However, observation suggests that a post-planting spray after the first growing season would improve subsequent survival. This could be expected to limit the relatively high mortality (Figure 2) during the second growing season (September 1976-June 1977) in the rip and spray treatment.

Most of the species which survived well were unfortunately relatively slow growing, especially in the first two years. With these species some form of protection from stock appears necessary. Fencing the trees is the safest, but most expensive, protection. A single wire electric fence each side of the tree row which produces a 'grassfence' effect offers the cheapest form of fencing (\$234/ha).

Chemical repellents may offer an alternative to fencing. Those tested at the N.Z. Forest Research Institute at Rotorua by Knowles and colleagues have reduced browsing damage on *P. radiata* seedlings for three to four months.

The cost of the material excluding application was \$6.20 per 1,000 trees. It would appear that with slower growing species suited to the high country environment, spray would be required at least three or four times in a period of four years.

The ability of *Eucalyptus gunnii* to survive and grow relatively rapidly, to above browsing height, suggests that there will be other eucalypts equally suited to the environment. Provided such species do not suffer

"The main requirement for tree establishment is adequate control of all competing vegetation over the establishment season. This applied in the experiment reported where the vegetation present on the dyke was only a moderate cover of sorrel. Planting using a post-hole digger combined with a pre-planting spray was the most successful combination tested, although the most expensive."

from damage by bark biting, they may be used for plantings in blocks which can be de-stocked for at least two years. In subsequent years the blocks could be grazed normally without concern for damage to trees by grazing animals. A range of different *Eucalyptus* and other species were planted at Tara Hills in 1977 with the object of finding trees with uses other than shelter, i.e. timber, nectar and pollen, or energy production.

It is not intended that these results are the final words on the likely success or failure of a species in this environment. The season, the source of seedling trees, the age of trees, and particularly the stage of development of both the root system and the stem, are all likely to affect the survival of a species.

Some idea of the variability of the survival of one species (*P. radiata*) from four separate spring plantings on pre-sprayed irrigated pasture at Tara Hills is shown in Table 2. There was no obvious explanation for the difference recorded from similarly planted trees in the two trials in 1975. The high sur-

TABLE 2
EFFECT OF ESTABLISHMENT YEAR ON THE SURVIVAL
OF *P. RADIATA* AT TARA HILLS

Year of Planting	Type of hole	Position on dyke	Number of trees planted	Mean tree height at planting (cm)	Percentage Survival (12 months)
1974	post-hole	top	60	18.6	35
1975	rip	base	80	14.0	86
1975	rip	base	40	17.6	37
1976	rip	base	40	28.5	93

vival of trees planted in 1976 (see footnote Table 1) may have been associated with a more vigorous (taller) tree stock. Their survival in 1974 can be attributed to the planting on top of the dyke, combined with a delay in the supply of irrigation water to the trial in this first year while the irrigation scheme was being developed.

The actual survival values recorded in Table 1 should be considered in the light of such possible variations. They could also be expected to be increased by a factor of approximately 1.20 had the trees been planted into post-holes rather than a machine-ripped opening.

Conclusions

1. The removal of competing pasture plants by a pre-planting spray is the single

most important factor in achieving good establishment of trees, for both dry and well-watered situations.

2. Provision of a good hole by either a post-hole or machine ripping an opening is also necessary for establishment.

3. *Cupressus arizonica*, *Cupressus* (Leyton Green), *Pinus mugo*, *P. sylvestris* and *P. ponderosa* survived very well, but in general grew slowly.

4. A moderately good survivor *Eucalyptus gunnii* grew most rapidly. A combination of *E. gunnii* for tall shelter and one of the above species for slower growing shelter offer a good choice for shelter belt plantings in the irrigated high country environment.



Species (from Left to Right) *Cupressus arizonica*, *Pinus mugo*, *Eucalyptus delegatensis* (note this is the best *E. delegatensis* plot on the trial), *Larix decidua*.

Appendix 1

Costs of tree establishment under border dyke irrigation using post holes or ripping methods

1. Summary of Costs	\$/hour
Tractor (50-60 HP) fixed costs (800 hours/annum)	2.44
Tractor variable costs	2.63
Spray equipment fixed costs (100 hours/annum)	0.99
Post hole machine fixed costs (400 hours/annum)	0.28
Ripper fixed costs (100 hours/annum)	0.57
Labour	2.50

2. Assumptions

- 1.5 m wide strip sprayed for tree planting;
- 12.2 m between centres of tree rows;
- 800 m of tree rows/ha (trees 2 m apart within rows). Spray material Permazol at 12 kg/ha (i.e. per sprayed ha).
- Time for attaching equipment to tractor: Sprayer 1 hour; post hole digger 20 minutes; ripper 20 minutes.
- Optimum speed for spraying 107 m/minute (6.4 km/hour). Optimum speed for ripping (stony soil) 54 m/minute (3.2 km/hour).
- Rate of post hole digging 120/hour.
- Costs based on 10 ha planting.

3. Comparison of costs

Post hole	Cost/ha	Ripping	Cost/ha
Pre planting spray – tractor 0.125 hrs at 5.07 = 0.63. equipment 0.125 hrs at 0.99 = 0.12. labour 0.225 hrs at 2.50 = 0.56. materials 11.75	13.06	Pre planting spray –	
Digging – tractor 1.33 hrs at 5.07 = 6.74. equipment 1.33 hrs at 0.28 = 0.37.		Ripping – tractor 0.25 hrs at 5.07 = 1.27.	13.06
labour 1.37 hrs at 2.50 = 3.43	10.54	equipment 0.25 hrs at 0.57 = 0.14. labour 0.283 hrs at 2.50 = 0.71 Post planting spray	2.12 13.06
Total cost/ha.	\$23.60	Total cost/ha.	\$28.24

4. Fencing costs

Two wire "grass fence" either side of tree rows (assuming no labour costs for erection) = \$234.00/ha

Town and country planning

M. K. Edwards

In July 1978, Mr Edwards, District Planning Officer, Ministry of Works and Development, Christchurch, addressed the annual conference of the South Island High Country Conference of Federated Farmers. The following is an edited version of his address.

Introduction

I understand the term 'planning' to mean 'the process for defining an objective and then allowing a way of achieving that objective to be worked out'. Another way of looking at this is to regard 'planning' as a problem-solving exercise. Characteristics common to all planning are:

- i definition of an objective
- ii survey of resources
- iii analysis of survey
- iv preparation of a programme
- v a review process.

Until the late 1960s-early 1970s the term town and country planning was something of a misnomer. The amount of effort that has gone into 'country planning' as opposed to 'town planning' has, until recently, been minimal. The statutory town and country planning process was introduced as a response to problems that were occurring in urban areas. The mechanism and techniques to cater for these problems have therefore been evolved by persons who possess what might be termed 'urban mentalities'. This immediately raises the question of whether the mechanism and techniques are appropriate to a non-urban situation.

Problems

The types of problem that resulted in the establishment of a statutory town and country planning process can be divided into two general categories. The first I shall call 'the nuisance category' and the second 'the public cost' category.

The 'nuisance category' contains those problems that arise from incompatible land

use. An example would be the setting up of a heavy industrial complex in a residential area. The characteristics of heavy industry — noise, traffic, pollution, etc. — will have an adverse effect on the general wellbeing of the neighbouring residents, and this will be reflected in a decrease in their property values.

This category also contains those problems arising from the bad siting and design of similar land uses. For example the construction of a large residential apartment block in a hitherto low density, detached dwellinghouse area could result in loss of view, loss of privacy or shading. Once a nuisance had been established it was difficult to get rid of it and usually involved court action.

As far as the 'public cost' category is concerned, closely settled areas give rise to problems, particularly in the areas of health and roading. Local authorities were established by central Government to provide solutions to the problems. The solutions took the form of public services, such as community sewage disposal and treatment schemes, reticulated water supplies, sealed roads, street lighting and so on.

To meet the cost of the installation and maintenance of these services, money had to be raised in the form of rates and it was not surprising that after a little while the ratepayers began wondering whether they were getting value for money. It became apparent that the cost of providing services to unco-ordinated development or sprawl was much greater than the cost of providing services to co-ordinated or planned

development.

In relation to both the 'nuisance' and 'public cost' problems, the general public began to appreciate that if only they had known that a certain type of development was going to cause a certain type of problem, something could have been done to prevent the particular problem arising. A control system was needed and it was provided through the medium of the Town and Country Planning Acts.

It was a recognition of the fact that the development of an individual's land may either have adverse effects on another person's wellbeing or result in public monies having to be spent needlessly. It further recognised that both of these problem situations could be avoided by using a mixture of experience, foresight and commonsense.

The first Town and Country Planning Act for New Zealand was passed in 1926. Since it was the urban-related problems of nuisance and public cost that had caused the Act to be passed in the first place, it was to these areas that 'town and country planners' were first required to direct their attention.

Zoning

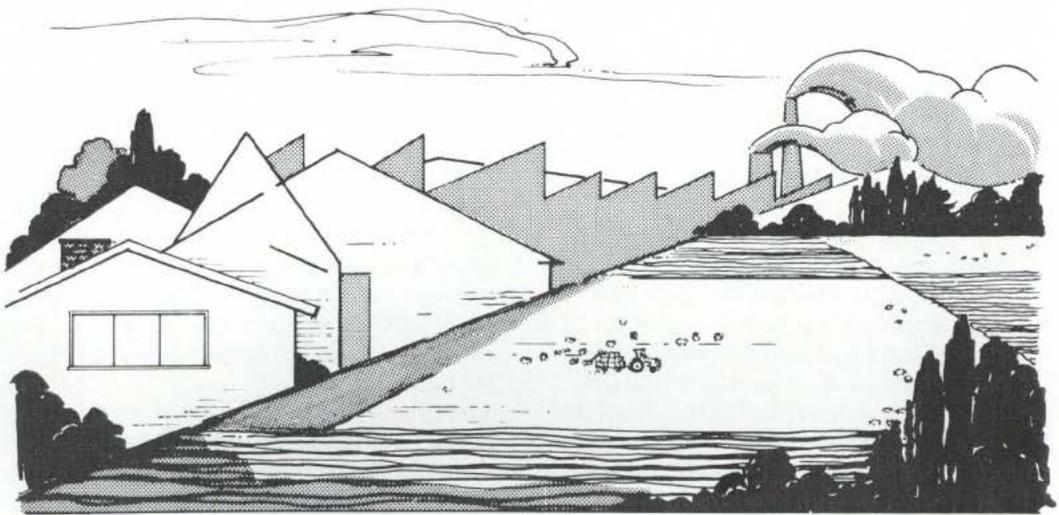
The basic technique evolved for the urban situation was that of *zoning*. Within zones certain uses are listed as being allowed as of

right as long as some standard conditions, relating to bulk and location etc. can be met. These are called predominant uses. Certain other uses are listed as being probably all right within that area. These are called conditional uses but require special application to be made to the council. It may be that under certain conditions the proposed use will not cause any problem within the area.

The lists are drawn up on the basis that the uses selected are compatible with one another or can be made to be if certain precautions are taken. It is this selection that has given rise to the four broad types of zone. Three are urban (residential, commercial and industrial) in character, while the fourth, rural, is in effect the container for the others.

Zoning of existing urban development does nothing to solve existing problems. For example, zoning an area for residential purposes does not automatically remove an existing industrial activity that might be causing problems. In fact that activity's existing use rights are protected by statute.

What zoning does is to indicate that some time in the future the industrial use will phase out. The phasing out is done by prohibiting extension of the industry and by prohibiting any redevelopment in the event of buildings becoming too old or being destroyed. The purpose of zoning an existing area of



development is to ensure that, some time in the future, all non-compatible uses disappear.

Zoning is also used to show those areas where future urban development is permitted. The zone boundaries and the type of zone are determined following studies to find those areas that would give best value for public money. In this instance the general planning objective is to ensure that urban development is directed to those areas which have minimum impact on the public purse.

A town and country planning authority has very limited means at its disposal to ensure the plan it draws up is implemented. It can zone an existing area of development but this does not get rid of the problem of non-conforming uses. It can zone an area for future urban development but it cannot force the landowner to develop the land when it is considered necessary. All it can do in fact is to sit tight and hope that all will come right in due course.

I believe that it is this lack of control over the implementation of a plan that causes town and country planning to be regarded as a very negative exercise. The planning authority can tell you what you cannot do but it has little control over what should be done.

To return to a question I raised earlier: 'Is a process that has been evolved for urban areas applicable in non-urban areas?' My answer is yes. Nuisance and public cost problems can arise in rural areas as in urban areas. There should, however, be less of them and in a less concentrated form. What this means is that the control mechanism for rural areas should manifest itself in a much simpler form than that for urban areas.

The elements of town and country planning

I want to describe the three traditional elements of town and country planning in New Zealand.

Firstly, planning is the responsibility of the local territorial authorities, i.e. the city, borough and county councils. These authorities are supposed to be closest to the day-to-day events that result in planning problems. They are also supposed to be closely in touch with

public feelings and thinking about the district, since they are the elected representatives of that public.

Secondly, there is a high degree of public involvement in the planning process. Individual rights have long been respected in New Zealand and it has been characteristic of the New Zealand town and country planning system that the individual is allowed to voice his concerns.

Finally, in order to protect the interests of the various participants in the planning process, any dispute may be taken before an independent tribunal for adjudication. This tribunal is part of the Justice Department and has resulted in the planning process becoming somewhat legalistic.

The 1953 Town and Country Planning Act required every local territorial authority in New Zealand to produce a document to be known as a district scheme. Its purpose is to show how development occurring within the district is to be controlled so that it occurs in such a way, and I quote from the Act '... as will most effectively tend to promote and safeguard the health, safety and convenience, and the economic and general welfare of its inhabitants, and the amenities of every part of the area.'

District Schemes

Three distinct but inter-related sections (the scheme statement, the code of ordinances and the district planning maps) together make up a district scheme.

In the *scheme statement*, a council is supposed to set out the particular planning objectives it hopes to achieve, or the particular planning problems it hopes to avoid, in the various parts of its district. *The code of ordinances* detail the particular zones, the various lists of predominant and conditional uses and certain standard conditions relating to the various uses. *The district planning map* defines on a map where the various zones are situated.

Any person with an interest in a piece of land should be able to locate that property on the district planning map, determine the particular zone in which the land is situated

and then turn to the code of ordinances to see what he can or cannot do with that piece of land. If what he intends to do is allowed by the ordinances, all is well. If, however, he is not allowed then he can turn to the scheme statement and find in a general way the council's reasons for denying him what he wants to do.

Everything, therefore, should flow from the scheme statement since this is the section that justifies why a local authority is denying certain individuals certain rights in relation to land. It is also necessary that the 'objectives to be achieved' or the 'problems to be avoided' be clearly spelt out in the scheme statement.

When producing a district scheme the council has to follow a procedure set out in the Town and Country Planning Act and its attendant Regulations.

Public involvement

Before a council prepares a district scheme it has to publicly notify its intentions of doing so and call for submissions and comments on what individuals and organisations consider the scheme should include. Theoretically this is the first opportunity for you to become involved. As far as I know, all councils completed this stage long ago.

Once all submissions have been received the council produces a district scheme which is publicly notified. In the public notice the council calls for objections to all or any of the provisions of the scheme. A period for lodging objections is specified. The Town and Country Planning Act also requires that every person or body whose name appears on the valuation roll for the district, be advised individually. On receipt of the advice or on seeing the public notice you should check the district scheme and see if your interests have not been prejudiced. If they have you should lodge an objection with the council against the relevant part of the scheme. This is the second opportunity for you to become involved.

Once the period for lodging objections has passed the council collates all the objections

and puts them into a summary form which is also publicly notified. The public notice lists the objections that have been received, calls for cross-objections by a certain date, and states when and where the council will hear the objections and cross-objections. This is your third opportunity to become involved because you should check the objections so as to ensure that none of them, if allowed by the council, would adversely affect your interests. If so you should cross-object in opposition. On the other hand it may be that you are in strong agreement with a particular objection. In this case you should cross-object in support.

If you have lodged an objection or a cross-objection you are entitled to make your views known to the council at the hearing of objections. Your views may be supported by technical evidence presented on your behalf by experts. This is your fourth opportunity to be involved but is of course dependent upon you lodging either an objection or a cross-objection.

After hearing all the various objections and cross-objections the council has to make a decision on every one of them. Each individual objector or cross-objector receives a copy of the decision relating to his particular concern. If the decision is unfavourable, the matter can be taken to the Town and Country Planning Tribunal. Appeals must be lodged within one month of receiving the council's decision. If you opt to do this then this is your fifth opportunity to be involved.

A date is set for the Tribunal's hearing of the appeal. The appellant, the respondent council and any people who claim to have an interest, must appear before the board and state their case. This particular procedure is a very formal one. Appellants and the council are usually represented by legal counsel. Evidence is presented under oath and this is open to cross-examination.

After hearing all the evidence the Tribunal makes its decision. This normally takes a few weeks to prepare, but all parties are notified. On town and country planning matters the decision of the Tribunal is final. Only questions of law can be taken to the Supreme

Court and then, if necessary, to the Privy Council.

After all appeals have been decided the council makes its district scheme operative. Once this happens the Town and Country Planning Act states, and I quote: '... it shall be the duty of the council, and of every other public body and local authority having jurisdiction within the district in respect of any of the subject matters of the scheme, to observe, and (to the extent of its authority) to enforce the observance of, the requirements and provisions of the scheme: and neither the council nor any other public body or local authority nor any person shall thereafter depart or permit or suffer any departure from the requirements and provisions of the scheme.' (s. 62(3) 1977 TCP Act).

Once a district scheme becomes operative there is a clear obligation for all parties to observe its provisions even though they do not necessarily agree with them. A council may in fact end up administering a district scheme that it does not fully support.

Although in many ways, lengthy and cumbersome, the process is considered essential so that all affected parties get a fair go at a document that has potential to severely restrict individual property rights.

Variations and changes

When a district scheme is publicly notified it may take a long time to complete the objection and appeal procedure. Circumstances may arise that cause part of the scheme to become less relevant. There is, therefore, provision for a council to *vary* its scheme. If it does this, however, the variation has to be publicly notified and there are the attendant rights of affected parties to object and if necessary appeal against it. Once a district scheme becomes operative the variation procedure is known as a *change* to the district scheme. This is your sixth opportunity to be involved in the planning process.

When a district scheme has been operative for five years the council must review it in total, notwithstanding the fact that in the intervening years numerous changes may have been made to it. To review the scheme

the council starts at the publicly notified stage and proceeds from there. This is your seventh opportunity.

One year before a district scheme becomes due for review, that is four years after it has become operative, the council has to prepare and publicly notify a statement of the planning issues as the council sees them. You are entitled to examine this 'issues statement' and see if it covers all the matters you consider relevant. If you consider it necessary, you have a right to make your views known to the council either in writing or in discussion. As a result of these discussions the council produces its review. This is your eighth opportunity.

The particular provision for what is called 'pre-review discussions' was introduced into the Town and Country Planning Act some seven years ago. It was done in response to a public demand for more public participation in the preparation of a district scheme, this participation to be as early as possible and to be less formal than the objection and appeal procedure. Councils now find this procedure to be of particular value since it is an opportunity for widespread public discussion. You should therefore take as much advantage of the pre-review discussion stage as you can, so any views you have are communicated to the council before it prepares a new scheme.

Applications

Apart from the district scheme process there is a ninth opportunity for you to become involved in the planning process. This is when planning applications are made. As discussed above the code of ordinances of a district scheme contains two lists, predominant and conditional uses. Before a person can undertake a conditional use he has to make an application to the council for approval. This application has to be publicly notified, and affected persons or organisations can object and appeal if necessary. If a particular use is not contained in either of the two lists, a person has to make application to the council for a specified departure. Again this has to be publicly notified and there are

objection and appeal rights. When there is no operative district scheme there is a third type of application, known as a change of use, that a council can require a person to make. These are also open to objection and appeal. It should be appreciated that because this is an interim control procedure, applicable only until such time as there is an operative district scheme, this type of application will gradually disappear.

It is easier to obtain approval for a conditional use than for a specified departure. By implication a conditional use is included in a zone on the understanding that subject to conditions it will probably be compatible with the other uses in the zone. A specified departure on the other hand, is a use that has been specifically excluded from the zone on the grounds that only in exceptional circumstances can it be made to be compatible.

Example

As an example of the sort of rural problem that a local authority considers to be of planning significance, we can use some of the provisions of the Ashburton County district scheme. The scheme contains a Rural A zone which covers land retired from grazing, unoccupied Crown land, State forests and scenic reserves. The objectives of the zone are:

- a To conserve soil and vegetation cover, mitigate erosion and ensure regulated water run-off
- b To conserve native flora and fauna
- c To reserve a region for possible future use as a national park or other recreational area, provided that where there is any conflict, objective 'a' shall predominate.

It can be seen that this zone covers land in some form of Crown ownership. The council has recognised that erosion is a problem in the area and will support measures aimed at water and soil conservation. It also has indicated that it would like to see a national park be established. These matters illustrate the weakness in the planning process that I pointed out earlier i.e. the town and country planning authority cannot implement its plan. It cannot ensure that erosion will not

occur. This task has in fact been given to another body working under a different act of Parliament. Similarly just because it would like to see a national park in the area it cannot ensure that one will in fact come into being.

The limited means at the council's disposal for achieving its objectives are related to the control of *future* land uses. The lists of predominant and conditional uses should reflect what the council would like to see happen in the area. Predominant uses are:

- a Use of land in accordance with approved management plans for soil conservation and water management purposes
- b Forestry for protection and recreation purposes only.

The conditional uses are:

- a Hut sites and walking tracks, provided that in the context of this zone "hut" means an overnight shelter for the public and not a privately owned permanently or temporarily occupied dwellings, and
- b Other recreation facilities, provided that to ensure visual integration with the local environment, the design and materials used in such facilities shall be to the council's approval.
- c Use of land not in accordance with an approved management plan.

In my opinion the ordinances are a good reflection of the council's objectives. The limited number of uses that are probably appropriate to the area but might cause erosion problems or detract from the visual amenities if not sited properly are made conditional. The council thus has an opportunity to vet each development proposal and if necessary impose conditions to prevent problems arising. One criticism I do have is that although recreation is a feature of the conditional uses, reference to it does not appear in the objectives. For completeness I feel the council should have included a fourth objective; something along these lines:

- "d To allow for limited recreational development but only as long as it is compatible with the other objectives of this zone, i.e. soil and vegetation conservation, etc."

I must re-emphasise at this point that the coming into operation of this district scheme does not have any immediate bearing on uses already existing in the area. Dwelling houses are not provided for in either the predominant or the conditional uses, but that in itself does not mean that all existing ones must be removed forthwith. Only in the event of them being destroyed does the council have any say over their replacement. Similarly with the general use of land. A person already using land without having an approved management plan for soil conservation and water management purposes, does not have to go to the council and obtain approval for a conditional use. I find it a little difficult in this instance to see when, in fact, such an application will be necessary. I presume, however, that if someone wanted to convert an area of forest land to farm land then a conditional use application would have to be made.

Regional planning

A form of planning that you will probably be hearing more about in the future is regional planning. It is essential that you appreciate the difference between regional and district planning.

District planning is done by one local territorial authority and is confined to that authority's administrative area.

Regional planning is done by two or more councils acting in concert. Councils agree to join forces so as to resolve planning problems that any one council cannot solve on its own. It is this agreement of councils which is the distinguishing mark of regional planning. It has nothing to do with the size of the area planned. If the whole of the South Island was administered by one council, there would be no regional planning within the South Island.

In 1929, New Zealand realised the need for statutory recognition of regional planning. Until now this type of planning has only been of any significance in the larger metropolitan areas — Auckland, Wellington, Christchurch, Dunedin and, more recently, Hamilton. Note once again the urban as-

sociation of this type of planning.

Regional planning has had the following characteristics:

- i It is a product of the local territorial authorities. A regional planning authority could only be established following local initiative;
- ii Public involvement was almost nil;
- iii Central Government involvement was minimal, and
- iv Any disputes between councils were sorted out by the Town and Country Planning Appeal Board.

The significance of regional planning has been altered by the passing of the Local Government Act 1974 and the Town and Country Planning Act 1977. Under the Local Government Act each region, as to be defined by the Local Government Commission, is to have a regional authority in the form of either a regional or united council. Each council, when established, must prepare a regional planning scheme under the Town and Country Planning Act. This means that in time the whole of New Zealand should be covered by regional planning schemes just as it is with district schemes.

The initiative to undertake regional planning has been removed from the local territorial authorities and made a mandatory function of the as yet to be established united or regional councils. It should be noted that under the 1977 Act district schemes must give effect to the provisions of approved regional planning schemes. In the event of any conflict the regional scheme prevails.

Partnership

Rather than being a mechanism to solve the planning problems of two or more councils, regional planning is now conceived of as being a partnership between local and central Government. As such, its aim is to reach agreement for the better use and management of resources, both local and central, as they are applied to each region.

The 'agreement' aspect that is a distinguishing feature of regional planning is still there but it is now agreement between a form of regional Government and central

Government rather than between local territorial authorities. To give weight to this, the 1977 Town and Country Planning Act has taken the dramatic step of requiring the Crown to adhere to the provisions of an approved scheme. What is given with one hand, however, is taken away with the other. The final settling of disputes between participants is no longer the function of the Appeal Tribunal. Before a regional scheme can come into operation it must be approved by the Governor-General by Order in Council.

Public involvement is still fairly limited in the regional planning process but opportunities do exist.

The *first* might be termed the institutional approach. A united or regional council must establish a regional planning committee to help it prepare a regional planning scheme. Although there is no specific provision for Federated Farmers to be represented on the planning committee, the 1977 Act does allow up to three additional people to be appointed to the committee if they have special knowledge that would assist the committee in its work. In addition, there is an opportunity to gain appointment to one of the sub-committees that may be set up by the planning committee. One that is given special mention in the 1977 Act and looks potentially promising for Federated Farmers is the Land Resource Advisory Committee.

I term the *second* method the procedural approach. When a regional plan is being prepared there are two occasions when the

general public has a statutory right to participate. Before preparing a regional planning scheme a united or regional council has to publicly notify its intention of doing so and call for submissions on matters the general public considers relevant. Once the submissions have been received the united or regional council may hold hearings or discussions to clarify matters. This is your *first* opportunity to participate.

The council proceeds to produce a draft regional scheme which it then publicly notifies for comment. If you have commented at the earlier stage you should check the draft scheme to see how the council has dealt with your concerns. If they have been ignored or misinterpreted you will have to try and persuade the council to take them into account by presenting a stronger case. This is your *second* and last opportunity to participate. From now on and until the scheme is approved by the Governor-General, the general public is effectively excluded from the formal regional planning process. It is now limited to the local authorities, the united or regional councils and the Crown.

The *third* way Federated Farmers could influence the regional planning process is by what I term the political approach. All I mean by this is the pressure group-cum-lobby on politicians that is a recognised part of the New Zealand political scene. Central Government should be more sensitive to this type of approach than it was in the past because it now has to take an active role in regional planning.

Wild Plants of Mount Cook National Park

by Hugh D. Wilson

(Reviewed by P. Wardle)

Mountain recreation and nature conservation in New Zealand are becoming ever more centred on the national parks, and in recognition of this, the National Parks Authority and individual park boards are publishing a good deal of literature about them. Most of this is at a popular level, and is of necessity either very general, or restricted to limited aspects, such as a particular nature walk. The Authority has also commenced a Scientific Series, and the first volume, entitled *The Vegetation of Mount Cook National Park*, by Hugh D. Wilson (reviewed in No. 33 of this journal), was definitely technical in content. By writing "Wild Plants of Mount Cook National Park", the author has recognised the need to make his botanical knowledge available to the many users of the Park who are not qualified botanists.

In New Zealand we have access to the standard floras, and to excellent books of more popular appeal which deal with selected species, or the plants of a particular class of habitats, or particular groups of plants (native trees, for example). Hugh Wilson's book is a completely new departure, in that it describes and illustrates *all* the vascular plants in one region, and it does this most successfully in a way that is easy to follow. By the same token, one would invite considerable frustration by attempting to use the book any great distance beyond the boundaries of Mount Cook National Park.

The book commences with instructions for use, which are followed by a brief outline of the habitats of the Park. Next, there is a dichotomous key with 141 end-points. This is clearly insufficient to pinpoint all 526 native and introduced vascular species, let alone the 19 selected mosses and lichens illustrated; but at each end-point, the user is directed to consult the descriptions and illustrations in

the main body of the book. Usually, this involves comparing only up to half a dozen species that are similar enough to key out together, but at point 28 in the key there are two groups each containing 28 and 40 species of mat or cushion plants; here the user will need patience, at least until some familiarity with the flora is gained. However, I found that testing the key with a number of species gave correct results, and the user should not have any real difficulty.

The descriptions are succinct yet clear, and unavoidable botanical terms are defined in a glossary. It is difficult for a botanist to know how much to take for granted, as far as non-botanists' understanding of such terms is concerned, but 'th' seems to be the only one used which is not in the glossary and perhaps should have been.

The illustrations, executed in pencil, are unpretentious but effective, and a credit to the author. There is an adequate index, and 10 blank pages for notes. And, clinching the fact that Hugh Wilson is a thoroughly competent botanical artist, simple and attractive coloured illustrations on the covers. The book seems sturdily bound, and in measuring 11.5 × 19 × 2 cm and weighing 380 gm, meets every requirement for a field guide.

A reviewer's task is also to find faults, and these are few. In my copy two pages have been displaced upwards, so that the top of the heading has been cropped, and it is a pity that in the first entry in the main part of the book — *Clematis marata* — it is not clear in the explanation of the botanical name whether 'a vine branch' refers to the generic or specific part. But these are small blemishes in such an excellent and reasonably priced volume.

(Published by Field Guide Publications. Printed by Whitcoulls Ltd. Christchurch. Price \$9.50).

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A. P. (PRIESTLEY) THOMSON, Q.S.O., B.For.Sc. (N.Z.) M.N.Z.I.F. is qualified by both nature and nurture to write about mountains and their management. Grandson of the illustrious G. M. Thomson, he had a notable mountaineering career and several years as Conservator of Forests in Canterbury before becoming Director-General of Forests. He has been president of the Federated Mountain Clubs of New Zealand, member of the National Parks Authority, National Research Advisory Council and the N.Z. Energy Research Development Committee.



A. F. MARK is Professor of Botany at the University of Otago and a past Fellow, presently Adviser on Studies to the Miss E. L. Hellaby Indigenous Grasslands Research Trust. His plant ecology studies have concentrated on mountain vegetation, particularly the snow tussock grasslands of Otago. He is a Fellow of the Royal Society of New Zealand, and serving his second term as an elected member of the Otago Catchment Board (currently Chairman of its Regional Water Committee) and is also Chairman of the Guardians of Lakes Manapouri and Te Anau.



A. J. JOPP is a veterinary surgeon at Waipukurau, Central Hawke's Bay. He attended Massey University where he graduated B.V.Sc. (With Distinction) in 1978.



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P. WARDLE is a leader of the Ecology Section at Botany Division, DSIR, and like Hugh Wilson is very interested in New Zealand mountain plants. As he too has been studying the vegetation of a National Park, namely Westland, he has closely observed the progress of the author's survey in Mount Cook National Park, and the means used to present the results to both scientists and the public.



M. K. EDWARDS is District Planning Officer, Ministry of Works and Development, Christchurch. A holder of a B.A.(Hons) degree from the University of Newcastle-upon-Tyne and a Diploma of Town and Regional Planning from the University of Glasgow, Mr Edwards joined the Ministry in 1970.

ANNUAL REPORT OF THE TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE FOR THE YEAR 1977/78

Committee of management

During the year, Mr W. V. Hadfield and Mr A. L. Poole retired from their respective positions in the Ministry of Agriculture and Fisheries and Soil Conservation and Rivers Control Council. Mr N. A. Cullen, now at Ruakura, was nominated to succeed Mr Hadfield. Following the retirement of Sir John McAlpine from the Council of Lincoln College, Council appointed one of its members, Mr Bernard Pinney, of Mossburn, Southland, to the Committee. The New Zealand Wool Board has since nominated Mr R. H. M. Johnston of Ashley Gorge, Oxford, replacing Mr J. D. McIlraith of Hakataramea.

In February 1978, Committee of Management re-elected Mr J. M. Wardell Chairman and Mr A. A. Innes Deputy Chairman.

Staff developments

The Institute has been generously well served by its core of professional staff who have been in turn assisted by a competent and dedicated technical and clerical staff. During the year it was decided to translate the position of statistician from a technical to a professional appointment. Likewise following the resignation of Mr W. G. Kreger as Journalist it was decided to appoint in his stead a Scientific Information Officer. Arrangements have since been made for Mr

Brian Robertson to take up this position later in 1978. With the growth in volume and range of work required of professional staff, Management Committee re-affirmed its intention to appoint an additional Management Officer when sufficient funds became available. Miss Lynda Budgeon has replaced Miss Susan Rogerson on the technical staff.

During the year the Institute was host to two full-time fellows who worked on contract-supported Institute co-operative programmes. Dr Robert Aukerman of Colorado State University was a Lincoln College post-doctoral fellow for 1977/78 and was engaged in the work to establish criteria for the recreational use of mountain lands. Mr Martin Whitby of the University of Newcastle-upon-Tyne as Drapers Fellow for 1977/78 led the study on the economic assessment of pastoral development alternatives in the Upper Waitaki. In addition, Mr Gordon Dryden of Queensland Agricultural College, Lawes, spent several months at the Institute experimentally evaluating the effect of mineral supplements on the use by sheep of fescue tussock. All of these visiting scholars were assisted by both permanent and temporary staff of the Institute.

Major features of the Institute's year

In March 1977, the Cabinet of government reaffirmed the establishment of the Institute at Lincoln College, decided that the funding

of the Institute's capital and administration grant be through the Department of Lands and Survey and directed that a review of the role of the Institute and its terms of reference be undertaken by the funding department and the National Research Advisory Council. Submissions to this review were invited from and made by the Council of Lincoln College, the Committee of Management, and by the Director and Staff of the Institute.

The Committee of Management was enabled by the improved level of funding for 1977/78 to authorise resumption of the full work programme of the Institute. The generous supplementation of its regular grant by the New Zealand Wool Board allowed the Institute to carry out a full survey of high country pastoral production for the year 1976/77. This survey is to be repeated in the coming year.

The Institute, especially through its Director and with excellent support from staff, made substantial contributions to the 1977 Conference on the Conservation of High Mountain Resources which was sponsored by the Department of Lands and Survey at Lincoln College in November. Management Committee looks forward to the fuller development of the work of this Conference in improvements in public understanding and administration.

Immediately prior to this meeting the Director participated in a small UNESCO regional workshop on techniques for the selection of Biosphere Reserves for the Asian and Oceania region. This programme was conducted in South Australia, Queensland and New Zealand with the New Zealand high mountains component being based on Lincoln College. Management Committee welcomes this step towards improved nature conservation in the New Zealand mountains.

A major exhibit on the multiple objective national use of high mountain resources was constructed by Mr Kreger, Mr Fryer and Miss Prendergast and featured in the Canterbury Court A. & P. Association exhibition for the Royal Show and at Lincoln College for the celebration of its centennial.

The Institute has taken special pride in the

decision of the Lincoln College Council to re-name the former laboratory building, now housing the Institute, the McCaskill Building, in commemoration of the service to the College of L. W. McCaskill, the Institute's Foundation Director. Management Committee notes the continuing contributions that Lance McCaskill makes to the cause of nature conservation and public education in rational use of mountain resources, and records its special pleasure at the decision to award him the degree of Doctor of Science *Honoris Causa* of the University of Canterbury on the occasion of the Lincoln College Centennial.

Progress in Work Programme

The work programme of the Institute has been carried on in the same sectors as it has previously been reported. Greater emphasis has been given in some projects to inter-sectoral aspects. A decision has been made by Management Committee to have all major projects of the Institute subject to periodic 'peer group review' and arrangements have been begun to have up to four of these reviews carried out under the supervision of the Director during 1978. On a less formal basis, all the projects led by visiting fellows were subject to peer group preview before the research programmes were begun and will be the subject of similar review when the project reports are complete. Major features of the work programme activities follow.

Erosion and Hydrology Sector

Torlesse co-operative study

Between 1972 and 1977, 86 storms have produced a measured yield of 564 tonnes of sediment. This is equivalent to 30 tonnes per square kilometre of catchment per year and represents a surprisingly low rate of erosion, by both local and international standards. A long-term (or geologic) rate of erosion has been estimated at 800 tonnes per square kilometre of catchment and although this estimate is crude, it serves to reinforce the view that erosion rates in the Torlesse stream catchment are much less than are popularly

believed.

Theoretical and laboratory studies have proceeded into aspects of the dissipation of stream energy under a research contract with the Department of Lands and Survey. After critical review the concept of entropy has been rejected for its application to river systems.

Liaison with Catchment Authorities

Manawatu Catchment Board

The programme of investigation leading to a management scheme for the South-Eastern Ruahines has been completed, to the satisfaction of the Board.

Taranaki Catchment Commission

During the year, a request for assistance was received from the Taranaki Catchment Commission. Mr Ackroyd and Mr Hayward are advising that authority on a plan to manage the stream-bed gravel resources of the Taranaki.

South Canterbury Catchment Board

The Institute continues to develop and maintain computer programmes for the South Canterbury Catchment Board's Upper Orari Catchment Study. This study aims to identify primary factors which contribute to erosion. Data were collected from 1276 erosion sites in 1976 and have been cross-linked to such regional map data as soil types, rainfall, vegetation, etc. Data can be retrieved and processed according to point data characteristics, regional data values and location.

Resources Sector

High Country Pastoral Production Survey

The Institute carried out a survey of high country production from all 306 runs for the year 1976/77. This 1977 work was done principally by Mr E. J. Costello with assistance from Mr I. G. C. Kerr and from temporary staff recruited for the purpose. Mr Kerr will resume major responsibility for this project in its 1978 survey year. Continued

increases are evident in most aspects of pastoral production in the interval since the 1972/73 survey.

Recreational Resources

Dr Robert Aukerman with special assistance from Miss Jenny Davison and the co-operation of other staff has carried out a major status and trend review of mountain land recreation in New Zealand. This study has received excellent co-operation from New Zealand Forest Service and the Department of Lands and Survey whose officers were especially involved. Work on preparation for publication of a series of reports on these matters is continuing and it is expected that these publications will become available from early in 1979.

In association with this work the Director, with post-graduate assistants, carried out a mail-questionnaire of runholders to establish the facilities for and recreational purposes of high country run visitors. This was followed up with a study through the Joint Centre for Environmental Sciences on the significance of recreational involvement on high country runs where developments for such purposes had been revealed by the primary survey.

Revegetation Sector

Studies of the ecology and improvement of montane and sub-alpine plant communities which began in 1976-77 in the Grampian Mountains, were continued. A new area of about two hectares in extent was enclosed on an east-facing slope at 1460 metres altitude. The dominant *Chionochloa* species here is *C. macra* and contrasts with *C. rigida* as the dominant species on the west-facing site established at the same altitude in the previous season.

Direct planting of fresh tillers of *C. rigida* in open ground on the west face, in a pilot trial in November 1976, gave a survival rate of 16 per cent after 12 months. Further plantings were made in October 1977 to compare the effectiveness of plantings with several types of tiller and seedling material. These compared —

- (a) rooted tillers and fresh tillers, for both *C. rigida* and *C. macra*;
- (b) rooted tillers (two ages), fresh tillers and seedlings (two ages) for *C. rigida* alone;
- (c) the effect of fertiliser on tillers of both species, and on seedlings of *C. rigida* alone.

The survival rate for rooted tillers of *C. rigida* at six months after planting was twice the rate achieved with fresh tiller plantings of the same species, and about 20 per cent better than the rate achieved by rooted tillers of *C. macra* of the same age. However, fresh tillers of *C. rigida* were much less successful than the fresh tillers of *C. macra* which in turn were only marginally less successful than the rooted tillers of *C. macra*. Superphosphate at planting has had no observable effect on the survival rate of either species after six months. In the comparison of different kinds of *C. rigida* material, the rooted tillers gave the best results followed by eight months old seedlings, then fresh tillers and last, the five months seedlings.

To further examine the effectiveness of transplanting as a revegetative technique, some additional autumn transplants were carried out at both lower and high altitudes. The natives, *Chionochloa macra* and *Deyeuxia youngii*, together with the introduced sweet vernal (*Anthoxanthemum odoratum*) have been planted in the lower sites on both aspects. Plantings of each of these species have been made in each of the three months of February, March and April. Similarly, on the summit site at 1760 metres altitude, the effectiveness of autumn planting is being studied in the three, monthly-spaced plantings of each of *Poa colensoi*, *Trisetum spicatum* and *Chionochloa macra*.

In the widely separated high altitude enclosures between Marlborough and Southland a biennial assessment of clover shows a slow but satisfactory trend in native recovery. Moderate maintenance dressings of superphosphate which have been applied this autumn will help to maintain this trend, largely through a boost to the dwindling clover content.

Collaboration with the N. Z. Agricultural

Engineering Institute at Lincoln College and the Grasslands Division of the Department of Scientific and Industrial Research has facilitated the comparison of some methods of establishing grasses and legumes into uncultivated sites. Preliminary trials at several locations have re-emphasised that for grass establishment in particular, disturbance of the seed bed is important. A method of cultivation of narrow strips of 6-8cm width, and seeding into these shows promise for grass establishment compared with broadcasting or sowing into narrow disc-openings. Further development is being planned in collaboration with the Engineering Institute.

Management Sector

Grazing management

The first, untopdressed, phase of the Glenthorne grazing behaviour study of sheep on free range has been completed by Mr P. S. Harris. The results of three years' observations and of intensive study over one year have been incorporated into his thesis for M.Agr.Sc degree, with which he was awarded first class honours. Mr Harris has prepared a detailed programme for the second phase involving partial area top-dressing. After review this programme will be initiated as funds permit.

The results of biochemical evaluations of herbage brought about by grazing management treatments in the Mesopotamia study have been incorporated into the successful Ph.D. thesis of Dr D. G. Clarke of the Biochemistry Department of Lincoln College. This work revealed the high digestibility of clover throughout, of sweet vernal and browntop in the spring before flowering and of sweet vernal again in the autumn. In contrast fescue tussock remained at low digestibility throughout. Cocksfoot was the only component clearly adversely affected by *not* deferring grazing from early summer until the following spring. The benefit to cocksfoot of this long deferment was in early spring growth. Otherwise there was no benefit in terms of available digestible herbage in early spring as a consequence of

foregoing late summer and autumn use. Over the several years of this experiment late closing (or non-deferment) involved more grazings than the early closing (or deferred) treatment. The effect of this more frequent grazing was seen at virtually all times of the year and in all grass species in high digestibility and lower cell wall constituents. The application of superphosphate had little effect on any herbage yield except clover and this was small in this experiment. The effect of superphosphate was however to raise the digestibility of yorkshire fog throughout the year and of fescue tussock through spring and summer.

Mr Gordon Dryden's studies are still awaiting final chemical and statistical analyses. Provisional results indicate a marked increase in intake of fescue tussock in stall-fed sheep as a result of supplementation with sulphur.

Glasshouse studies on the influence of nitrogen and phosphorus nutrition on the yield of herbage and distribution of sclerenchyma in the leaves of fescue tussock are being completed.

Economic management

With the co-operation of the Department of Lands and Survey and Valuation Department, Mr Kerr collated all the information on physical resources and valuation of pastoral leases. He has continued this work into a useful review of the assessment of rents for such leases. This work is expected to be available in 1978.

Mr Martin Whitby with the co-operation of Mr Chris Kerr, Mr Errol Costello, Mr Ken Lefever, Mr Ray Ward-Smith and Mr Peter Harris, together with the help of several Lincoln College economists and engineers and staff of the Waitaki Catchment Commission and Ministry of Works and Development, has developed a series of analyses of the economics of the public sector and the private operator for existing and possible future pastoral planning and development in the Upper Waitaki. The results of his work will be available later in 1978.

Systems Sector

Systems modelling

The systems modelling project, begun in 1976 when Dr White visited the Natural Resource Ecology Laboratory, Colorado State University, Colorado, has advanced towards the final development. Its objective is to examine the interactive effects of insects and livestock on tussock grassland herbage production, especially in relation to pastoral management. The model is now essentially complete and extensively tested in its overall structure, but some refinements and a little further development in some compartments are required before satisfactory simulations of insect and stock grazing effects can be expected.

The scope for using the completed model should include the following possibilities:-

(a) computer studies of the joint feeding effects of invertebrates and vertebrates on the availability and 'condition' of grassland vegetation through time (e.g. different insect complexes competing with different livestock management options);

(b) computer feeding trials to test the effects of livestock or insects on selected vegetation components under a range of 'experimental' conditions, all computed in a single exercise (e.g. a simulated vegetation or stocking 'experiment' with different 'treatments');

(c) extension of the model (if desired) to include further compartments (e.g. a decomposer sub-model) or a sophistication of existing compartments (e.g. animal production).

It is hoped that the model will become a useful means of inter-agency co-operation in the use of existing data, in the examination of promising field research directions and in the continuing evaluation of grassland management. In its present design it is especially suited to assess the 'problem status' of insects on grasslands of a tussock character. It would be also suited to assess 'problem status' of grazing insects on other kinds of grasslands.

Biogeochemical Systems

Dr P. A. Williams, now of Botany Divi-

sion, DSIR, continues the publication of the primary set of studies in tall tussock grasslands carried out at the Institute. Studies of nitrogen transformations under tall tussock grasslands have been continued by Mr G. D. McSweeney, Hellaby Fellow at the Institute. His studies are revealing a winter or early spring surge of mineralisation to ammonium nitrogen even at high altitudes, apparently associated with the freezing and thawing of soil. Nitrification to nitrate occurs apparently rapidly in the spring even in these acid soils. These phenomena which are found in tall tussock grasslands in good condition may help to explain the background level of nitrate nitrogen which may be evident in drainage waters of mountain lands even in good condition. Severe depletion of tall tussocks or destruction of tall tussocks and cultivation lead to a temporary further increase in nitrate production at lower altitudes.

General Extension

Mr Kerr, Mr Hayward and Mr Dunbar have maintained liaison with Catchment authorities and Mr Kerr in particular has continued working relations with a wide range of agencies involved in the tussock grasslands and mountain lands. Formal liaison by the Director has been maintained with the Protection Forest Advisory Committee of the New Zealand Forest Service. Formal representation through the Mountain Catchment Committee and its Technical Group has now lapsed with the disbanding of that Committee. Dr White and Mr Hayward continue to play important roles with professional societies in entomology and ecology and in hydrology respectively. These contacts, and the regular involvement of Mr Dunbar with the N. Z. Grasslands Association and Mr Kerr with Farm Management groups as well, are important ways of keeping in touch with and sharing information on developments in the tussock grasslands and mountain lands.

The major formal extension efforts for 1977/78 were associated with the Canterbury A. & P. Show as noted before, with the

production of two issues of Review, and with addresses to field days by Mr Hayward and Mr Dunbar in Otago, Canterbury and Marlborough.

As part of its established role, the Management Committee commissioned the preparation of a review of hydrologic research in the tussock grasslands and mountain lands. This was an objective-oriented review rather than one concerned merely with the state of science. It was carried out by Mr John Hayward with Dr R. Dils and Professor Burton, who had spent some months visiting New Zealand, as reported last year. In carrying out this review the authors received considerable co-operation and encouragement from personnel in a wide range of agencies involved. The published report from this review attracted considerable attention. Management Committee is confident that such periodic reviews of the state of research activity and of its application to clarifying and solving problems will be generally welcome.

The work of preparing for publication and publishing the findings of Institute co-operative research and investigative projects has become a major commitment for the Institute. Senior staff of the Institute have an important role in preparing reviews of major topics on mountain resources, resource uses and mountain research in various fields. Only a portion of this work is for publication in Review or in other Institute publications. The Management Committee recognizes the importance of this role of the staff of the Institute in a University institution and welcomes the participation in this role of visiting scholars. It emphasises the responsibility which Director and staff have to the truth as they as scholars can find it and asserts their freedom to publish it with that responsibility. The Management Committee is confident that such principles would be endorsed by all those interested in information about the tussock grasslands and mountain lands and their uses.

J. M. Wardell
for the Committee of Management.

High country land use planning

K. F. O'CONNOR

The political science of land use planning

Power and reason in land use decisions

The central issue affecting the future use of the high country is whether political power or political reason will dominate in determining which land is used for what purposes. Political power and political reason ideally should be conjunctive, not disjunctive. They may not always be so.

Past uses of the high country were, for the greater part, not dictated by public planning. As recently as 1948 the political perceptions of principal land use opportunity in the high country were limited to the general pattern of earlier experience of use that, like Topsy, just grew. The high country was the frontier of pastoral New Zealand. What was beyond that frontier was already judged useless for pastoralism. Much of it was already reserved for National Parks, much of it for State Forest. Accordingly, the 1948 Land Act empowered the Land Settlement Board to classify all Crown land available for disposal under this Act into four classes: farm land, urban land, commercial or industrial land and pastoral land. It should be noted that Crown land in this Act means land vested in Her Majesty which is *not* for the time being set aside for any public purpose or held by

any person in fee simple.

Land may be set aside for public purpose under a range of political powers. Such public purpose may be preservation of nature, recreation, protection or production forestry, electricity generation, roading, water supply, among many. The responsibility for such public purposes is vested as a power in a range of public agencies. While such power, as a right to command, derives from law and is subject to what we recognize as the rule of law, its expression as an effective power depends on the strength, energy and competence of the people in the agencies involved.

In the physical world, power is *the rate of flow of useful energy*. As Odum (1971) has pointed out, there is close analogy between the energetics of physics and the energetics of social groups and political bodies: 'The energetic laws are as much first principles of political science as they are first principles of any other process on earth'. By such an analogy we can recognize the building up of statutory law and regulation as the storing of potential energy. This work is *storing work*. It is an essential part of the maintenance of a workable social network. From this potential energy storage comes the second kind of

work, *processing work*, accomplishing the useful ends for society. It is like having a storage water tank on a farm into which water is pumped and from which water is then usefully reticulated. In this process as in any real process, some useful potential energy becomes lost. That is the cost of government. It can never be eliminated. All we can work for is to have it energetically efficient.

Human reason contributes to the design of law, including in it the values, criteria and perceptions of society. The values and criteria of any time have always to be confronted with the facts of the real world. When the social network of building up law and regulation is complex and especially if it is not full co-ordinated, reason is essential as the switching gear that determines down which channels the useful energy will flow to achieve desirable ends.

The New Zealand constitution, being unwritten, does not resolve in advance the various conflicts of power that arise when different agencies try to have each their own way. In effect, these conflicts may often be resolved in the executive of the government by political discretion. In many cases of course, the enunciated general policy of the elected government party may be used as a guide to such discretion. In some situations, a legal assessment of the cogency of a particular cause may be sought. Comparatively seldom are these issues arising from law resolved by referral to the Courts. Indeed, laws may be administered for many years without any judicial interpretation of the intention of the law.

Land use conflict and the public interest

In the last decade, there has been a rapid increase in the volume and vexatiousness of land use conflict in New Zealand. In this conflict, different agencies of central and local government are often involved on different sides. Public interest is identified as a dominant concern in all such issues. People are often left wondering which of their interests is really more important: foreign ex-



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Social research and planning

The situation which now exists in New

Zealand society in the matter of land use would repay intense, competent social scientific study. Indeed, it is more complex, more dynamic than any natural ecosystem which receives scientific attention today. If one were to describe the public administrative sector as a jungle, it would be considered by many to be a pejorative. In truth, however, we should recognize that the study of human ecology and behaviour in such a situation would be in every way as valuable as the study of plant ecology and animal behaviour in a high energy rain forest or grassland. Nor should we think that the pastoral or silvicultural behaviour of man is any less important to understand than the dynamics of tree growth on the foraging behaviour of sheep.

There have been substantial initiatives and developments in social science research in New Zealand in recent years. More public attention has been recently directed, however, to the need for planning – national social and economic planning, economic sector planning, energy planning, town and country planning, farm planning, home planning, education planning and family planning. The emphasis on the need for planning, rather than merely on social research, arises from the crises which are now perceived and is justified by the very nature of man as a reasoning, goal-seeking and goal-changing organism. We would be foolish, however, to neglect the understanding of ourselves and our behaviour in our attempt to plan a way out of our current conflicts.

People practise planning because they have goals or ambitions. When they are single-purposed, their planning is straightforward. As their goals increase and multiply, their planning becomes complex. Goals increase and multiply, not just because of more people of different ambitions but because of growing appetites and emergent needs. As frontiers no longer recede into the distance but press upon us, we become more conscious of our competition. These facets are illustrated in the high country.

Changes in competition for high country land

A hundred and twenty years ago prospective runholders competed with one another to select runs and stock them with sheep and cattle. There was little other appetite for the high country. This situation has now greatly changed.

Recreation and tourism

The inroads of recreation and tourism into a pastoral scene have been traced in an historical study of the Ohau region by Davison (1978). From her analysis we can see how the complementary features of recreation and pastoralism dominated the first half of this century to the virtual exclusion of their mutually competitive elements. The outcome was that recreation and pastoralism were then highly compatible. Only in recent decades has the surge of interest in mountain recreation in New Zealand brought pastoral and recreational interests into apparent conflict. However, as a recent study demonstrates (Gresham, 1978) recreational use has been commercially integrated with pastoral management in a growing number of high country runs. On a still greater number of runs recreational visitors have come for a wide variety of pursuits, in keeping with the resource endowment of these properties (O'Connor, Smith and Tan, 1978).

The establishment and development of National Parks and of Forest Parks in mountainous areas of both islands, and improved access to them and to other areas including land no longer grazed and unalienated Crown land, have contributed to substantial increases in mountain recreation. The recent growth of international tourism in New Zealand has had its influences in the mountains, in bus and air tours, greater sophistication of facilities, increased provision and use of accommodation both in 'resorts' such as Te Anau, Mount Cook and Queenstown and in high country village centres

such as Omarama. As Faulls (1978) suggests, such changes may have a substantial influence on the social life of pastoral communities.

Intensive agriculture

Perhaps more sustained and powerful than recreation and tourism have been the inroads of intensive agriculture on extensive pastoralism in both North and South Islands. O'Connor and Kerr (1978) in reviewing the history of pastoral occupation of South Island open country and O'Connor (1978) in tracing the evolution of the Upper Waitaki pastoral community, identify the impact of closer land settlement from 1890 onwards. The coastal plains and downs of Canterbury, Otago and Southland and much of the intermountain basins of Otago had been converted from extensive pastoral holdings to semi-intensive or intensive mixed farming in less than a generation from the advent of the Liberal government. The high country areas were generally spared from serious partition. Some pastoral areas, notably Benmore in North Otago, were subjected to the painful trial and error of close settlement at the time of World War I. The failure of intensive farming in the Omarama district was in part the outcome of inadequate planning and in part the outcome of a temporary downturn in economic and physical climate (Mains, 1976). The widespread collapse of 'soldier settlements' in the 1920s, of which this high country example was but one, served as a reminder for the more thorough planning of land settlement in the late 1940s and 1950s. The review of the Southern Pastoral Lands Commission in 1920 seemed to settle the future of much of the high country as essentially pastoral land to be managed extensively, a view not greatly altered by the Sheep Industry Commission of the 1940s.

Extensive pastoralism gave way after World War II to pastoral development in central North Island and in northern and western Southland. As McGregor (1957) reminded us, private farmer as well as State participated in these transformations of landscape. Such development of a cultural

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landscape in north-western Southland was well described by Dunbar and Hughes (1974). It is noteworthy that it recapitulates many of the same features they had cited in the intensification of land use on the eastern fringes of the high country approximately four generations before. Thus, as its northern and southern outposts, extensive pastoralism has yielded to the competitive inroad of semi-intensive farming. The technology of grassland development altered dramatically in the 1950s. Most pastoral holdings in the hill and high country have since joined in sometimes uneasy compromise on their own ground with the invading technology and economics of intensive farming.

Water management

Water management in high country environments was for many decades considered impossible except for the regulation of river flow or lake level by the installation of dams. In more recent years, the emphasis of soil conservation programmes has been heavy towards water regulation through soil conservation and vegetation management. In some circumstances Catchment Authorities have recommended the retirement from pastoral use of land classified by them as suitable in some degree for pastoral use. Regardless of the outcome of lay and technical debate on the likely hydrologic consequences of such retirement from grazing, the fact remains that there is now competition between extensive pastoralism and advocates of water management.

Forestry

Forestry in the high country generally has been co-existent with extensive pastoralism rather than competitive. That situation is now changing at least in some areas. For many decades the pastoralists' inroads by fire and stock into mountain forests have ceased, except for relatively minor incidents. The patient work of foresters in establishing the boundaries of State Forests, developing working plans for them and regularising their use accordingly, has earned the respect and co-operation of pastoralists and of personnel of other agencies. Most of these high country forests have been regarded as 'protection forests' and the chief attention that they have received is in control of wild animals by hunting and in scientific study of their ecology and watershed condition. Plantation forests established in the high country or in adjacent hill country such as at Karioi, Hanmer, Kakahu, Tapanui, Naseby and Waipori have been considered as of regional production significance.

For many years runholders in the high country have graced their homesteads with exotic plantings for shelter. At one period, they were enjoined to plant a minimum area of a few hectares as a condition of their lease. Many of them heeded the exhortation of T. D. Burnett inscribed in stone in Burke's Memorial at the gateway to the Mackenzie Basin and planted 'trees for their lives'. In Mackenzie County and some other localities, the local authority took an initiative in exotic planting.

Where tussock country conifer plantations have been bordered by unimproved grassland or shrubland under low grazing pressure, the spread of conifers has alarmed many pastoralists as well as those concerned with conservation of 'natural condition' in areas such as Tongariro National Park or Waiouru in Central Plateau. A similar reaction has emerged in response to exotic conifer planting for soil conservation purposes in many localities. Deliberate or accidental plantings of conifers have been used for timber supplies as they have matured.

Some accidental establishments have been subjected to control or eradication programmes. Meanwhile substantial afforestation schemes are being developed, especially in Marlborough, on land once used for extensive pastoralism. In the tussock country of Southland, greater emphasis is being given to farm forestry programmes (Pinney, 1978). The prospect of pastoral afforestation or plantation forestry in high country for energy production purposes is currently being examined (Nordmeyer, 1978).

Nature conservation

Nature conservation has not manifested major competition with established extensive pastoralism in the recent past except in the valley floors of National Parks. Here cattle, damaging forest margins and interiors, and sheep, often maintaining an exotic grasslands sward, on terrain which would otherwise revert to native forest, scrub or tussock grasslands, are both considered balefully by many nature conservationists. Present National Park Authority policy is towards elimination of such grazing.

There is a growing awareness of the need to reserve large representative examples of our varied tussock grasslands and shrublands for scientific, aesthetic and other purposes, generally in localities where few reserves exist. This kind of land use must be recognized as at least locally competitive with extensive pastoralism. In some areas it is also recognized as competitive with land development for intensive pastoralism and arable agriculture. Likewise there are zones of high country which are being considered for possible reservation as new National Parks or as extensions to National Parks. Some of these areas have been zoned for such possible nature conservation and public recreation purposes in District Planning Schemes. Such areas would especially affect extensive pastoralism in the gorge runs of the interior high country. Their competitive effect would probably be most strongly demonstrated in the mountain valley floors and on the lower fans. Such a situation has

been illustrated from the Arrowsmith district in central Canterbury (Dickson, 1978); further examples could no doubt be found.

Extensive pastoralism in the defensive

At first sight it may not be easy now to see intensive farming as a competitor with extensive pastoralism in the same way as tourism and recreation, water management, forestry and nature conservation have been represented. I can well recall the indignation with which twenty years ago many traditional high country runholders resisted what they recognized as the meaning of my message for them – to become 'farmers'! Yet Hughes (1974) demonstrated the growth of farming technology in the high country. It is the same kind of indignation with which some of them a decade ago greeted my suggestion that they become involved in recreation management – touching their forelock to a camera-sporranned tourist, indeed! Yet Gresham (1978) demonstrates the growth of commercial involvement of runholders in tourism and recreation. Although some tussock hill and high country runholders have now become deer-farmers, there would still be widespread but not universal rejection of any suggestion now that they be gamekeepers or wildlife managers. To suggest that they become foresters or forestry farmers would probably divide them into two or more camps.

This situation indicates that runholders are as varied as are runs. Especially are they varied in their ambitions and aspirations and in their readiness to adopt new goals and adjust old ones. This feature they have in common with people of all other occupations. It is very glib to represent them as a conservative class of people. It is also misleading and counter-productive to the resolution of the competition for land among different land uses that already exists and will surely grow in the future.

Even though runholders are by no means universally conservative or resistant to innovation, Graham Hughes (1966) has pointed out that runholders do have a na-

turally defensive attitude. An important reason for defensiveness in the present situation is that it is extensive pastoralism which is under attack from all of these potentially competitive uses. It is extensive pastoralism which is expected to yield ground. If it is to give ground, is it to be to the strongest power of the moment or is it to be by the greatest input of effective reason? If strength of power is not to be the determinant then planning becomes imperative as a vehicle for making use of reason.

The planning response

The responses to planning imperatives in any human society are almost as varied as the members of that society. We vary in our human attitudes from those who are advocates of the big stick to those who swear by the carrot, from those who prefer draconian solutions to those who believe in public education, from those who rush to the law drafting office to those who research for the old statute book and pick up the regulatory pen, from those who put their trust in resource inventory and evaluation to those who emphasise the function of pricing policy. There is some wisdom and justification in each of these approaches. While each approach can be set in contradistinction with another, a reasonable assessment of the situation would see each of these approaches as a potential means to an end in an integrated and balanced statement of general policy for our mountain lands. All of these approaches assume that we have an agreed and co-ordinated set of goals for the national use of high country resources. I suggest that this is still far from being the case. I claim that this *normative* sense of planning requires our attention far more urgently than the *techniques* of planning. We have to agree as a nation on what we want as uses of our mountains!

As was emphasised to the 1977 Conference on the Conservation of High Mountain Resources (O'Connor, 1978), our goals have to be clearly enunciated in keeping with a general policy as a primary step in a planning

programme. Objectives, recognized as instrumental means for the attainment of such goals, must likewise be identified and must earn assent. Otherwise, appropriate alternative objectives for the attainment of the same goals must be proposed and supported.

The progress towards the enunciation and acceptance of such a statement of general policy, goals and objectives at the 1977 High Mountain Conference, was substantial. The general policy statement agreed to at that Conference in plenary session, and the use sector goals and objectives derived from the deliberations of several working groups, are set out in the Appendix to this essay. This represents the beginning of a potentially valuable process in high country planning.

Let me emphasise the standing of these enunciated goals and objectives. They are the collective fruit of the efforts of a hundred or more people engaged in a series of workshops. These people had come from public agencies involved in mountain land administration and use with a sprinkling from particular interest groups. In that sense they represented national and regional interests rather than local or residential interests. They had been exposed to a wealth of international and New Zealand thinking about all aspects of the rational use of high mountain resources. They were assigned to individual workshops to achieve the most effective mix of interests relevant to the use which was the theme of each workshop. They were not organized to represent sectional interests. They enjoyed skilled leadership and reporting services in their workshops. They were able to propose, draft, debate and redraft their ideas. Their interim sector goals were fused into a common statement of general policy which was debated, amended and eventually adopted unanimously in plenary session. Their final sector goals were presented also to plenary session, discussed and endorsed. The schedules of goals and instrumental objectives were edited and refined to achieve a uniform style and were submitted later to the work group leaders for their comment. No attempt has yet been made to reconcile one set of objectives with

another. No attempt has been made to establish priority between one use and another. This statement of policy, goals and objectives represents then a serious effort at public service by skilled and interested people acting in a way in which sectional interest was probably effectively counteracted if it emerged at all.

At the time of writing, these goals and objectives are being considered by some agencies of government and other bodies will no doubt study them and assess them. Apart from their endorsement by the Conference which prepared them, no approval has been stamped upon them. The Institute welcomes the opportunity to put them before people of all kinds who are interested in some way in the mountains, whether for livelihood or relaxation, for water or wool, or simply because they are our mountains and we have them in our care.

It is my earnest hope that every mountain neighbourhood, every interest group, every community of any sort will consider and critically assess these propositions and publicly make known their attitudes to them. In that way we shall have some possibility of participative planning in this highly significant area of our national environment.

What is especially important for run-holders is to assess these social goals and objectives in relation to the extensive pastoralism which has been their tradition, which is still their image, but which may not be such an important part of their future.

What is especially important for public agencies and other special interest groups to do is to examine, not merely how their own interests are served, but how their use objectives can be related to the objectives of other uses. It must be the special concern of our legislators and administrators to confront our values with the facts of our environment and to examine whether the current instruments that we employ are appropriate to the goals and objectives which we formulate and support. Is it appropriate, for example, to classify land as pastoral land, meaning that it is suitable or adaptable only for pastoral purposes? Are our national and

regional water policies appropriate to the hydrologic characteristics of the different hydrologic regions and the various hydrologic purposes which must be served both in the mountains, in the water bodies themselves and in the downstream zones? Are our emerging land use policies at a national, regional or local level designed to secure a balanced relationship between natural landscape character and all forms of land and water use? Are our administrative arrangements for pastoral land and forest land appropriate to ensure a desirable local as well as regional and national balance of agricultural, pastoral and forest uses? Are our recreational and tourist developments appropriate to the fulfilment of the human needs of recreationists? Are our measures for nature conservation consistent with the facts of mountain nature?

When we as a society can confidently see such doubts resolved, we will be assured that political reason is conjoined with political power and that the flow of useful energy in our island mountain habitat is tolerably efficient.

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Conference on Conservation of High Mountain Resources — Lincoln College 1977

General Policy Statement

Having regard to the mountainous character of New Zealand and to the need to improve and maintain the condition of the mountains for the full and proper benefits to mankind, this conference recommends —

(a) the sustained production in the high mountains of forest, pastoral, agricultural, mineral and other products and water of high quality and usefulness;

(b) the provision of opportunities for work, recreation, relaxation, and learning in the high mountains;

(c) the safeguarding therein of natural history, of representative examples of all indigenous mountain biota, and of major ecosystems in natural condition;

(d) the preserving of natural landscapes of outstanding scenic quality and the creation and preserving of cultural landscapes of high quality;

(e) the retention of unallocated land, managed towards a healthy and viable state, for the maximisation of choice by present and future generations.

Pastoral and agricultural use

Goals

1. to intensify and increase use of the high mountain regions for sustained and diverse pastoral and agricultural production on land

suitable for such purposes, consistent with economic viability and with balanced land use and protection of natural resources to ensure enhancement of social, cultural, and environmental values;

2. to promote the adoption of alternative primary uses, where conditions warrant it, in response to local, regional, or national priorities;

3. to seek the integration of secondary uses compatible with pastoral or agricultural uses.

Objectives

1. To encourage intensive land development and management where necessary for the primary goals.

2. To provide opportunities for closer settlement and increased permanent rural population with amenities to contribute to social stability.

3. To ensure land tenure which encourages and provides other incentives for achievement of primary goals.

4. To develop opportunities for alternative animal and plant production systems and combinations.

5. To ensure adequate allocation of water for irrigation where consistent with the primary goals.

6. To identify, develop, and apply practices

necessary for maintenance of landforms, soil, vegetative cover, satisfactory water quality and water regimes, and landscape quality.

7. To develop feasible procedures for control of weeds, plant and animal diseases and animal pests.

8. To retire from pastoral or agricultural use land not suited to such uses and to restore and maintain such land with purely protective vegetation if necessary or with the development of suitable productive vegetation and uses.

9. Where biologic, economic, or social conditions indicate, to develop other primary uses (e.g., biological conservation forestry, recreation) as alternatives to or associates with pastoral and agricultural use.

10. To provide integrated research and extension services and other necessary infrastructures to achieve these objectives.

Water Management

Goals

To provide sufficient high-quality water in the right place for —

1. the growth, development, and conservation of mountain biota and preservation of soil systems;

2. the maintenance of rivers, lakes, and ground water systems;

3. the basic needs of New Zealanders and where possible meeting their aspirations and ambitions.

Objectives

1. To identify hydrologic regions through quantification of hydrologic characteristics by recording of snow, ice, rainfall, river flow, vegetation, geomorphic characters, and dominant hydrologic processes.

2. To identify hydrologic systems that will lead to proper use, appropriate engineering developments, and correct land use by recording, analysing, and defining flow patterns, run-off generation processes, points of egress of water on mountain slopes, and the

role of screes, bogs, tarns, and of snow and ice storage in determining river flow patterns.

3. To identify land management working policies and practices for each hydrologic region so that the quantity and quality of water will be compatible with general goals, by determining the effect of land management practices in different circumstances on water quantity and quality, and by classifying practices accordingly.

4. To retain soil *in situ* for what it is, for what it does in biota conservation, and for its role in terrestrial systems, by recognition of infiltration and stream flow generation processes, of soil stability and of soil erosion potential, and by identifying land uses that effect irreversibly the potentiality of land.

5. To maintain water bodies in satisfactory condition for their intrinsic worth, for the life systems they support, the aesthetic qualities they possess, and the varied uses to which they may be put.

6. To maintain ground water systems for areas known to possess artesian, sub-artesian, and unconfined ground water by identifying such areas, and by preventing activities that would cause non-recharge or risks of damage to such systems.

7. To maintain (or enhance if possible and otherwise desirable) the quantity and quality of water from catchment areas required for urban and rural water supply.

8. To determine and ensure compatibility of tourism, recreation, electrification and telecommunication, and their ancillary services (roading, ski-fields, repeater stations, water supply, and sewage disposal) with above goals.

9. To reconcile water quality or yield with other objectives in general and in specific terms where prospecting, mining, or timber extraction is an objective.

Forest uses

Goals

To grow and manage healthy and viable forests to provide economic and environ-

mental benefits consistent with balanced land use and conservation of soil.

Objectives

1. To conserve and improve soil —

- (i) by evaluating physical resources and identifying those areas in order of priority where significant social and economic benefits are dependent upon maintenance or improvement of the soil; and
- (ii) in such identified areas (a) by maintaining and improving the soil protection capacity of existing forests through animal, disease, and fire control operations and suitable forestry management, and (b) by establishing suitable tree species in localities where such action is necessary to maintain or improve the soil resource;
- (iii) by formulating and implementing adequate controls to ensure minimal soil loss or degradation in areas where tree extraction is or may be undertaken;
- (iv) by permitting other forest uses only where these are compatible with the above objective of conserving and improving soil.

2. To maintain and improve water quality —

- (i) by evaluating physical resources and identifying those water systems in order of priority where significant social and economic benefits will accrue from the maintenance or improvement of water quality; and
- (ii) in such systems by controlling detritus/sediment input (a) through suitable management practices in existing forests, and (b) by establishment of suitable tree species, in association with structures where necessary, where this action is required to maintain or improve water quality;
- (iii) by establishing, maintaining, and managing forested riparian zones where these are required as buffers against water contamination.

3. To supply forest produce —

- (i) by satisfying local demand for all uses

(a) through wood production as a by-product of management practice designed to perpetuate and maintain existing forests in a healthy and satisfactory condition to fulfill other values and uses such as soil conservation and habitat provisions, and (b) through establishment and management of suitable local afforestations;

- (ii) by investigation of the development of substantial resources for industrial processing, taking account of technical developments and future demand prospects for wood-based products, including fuel.

4. To maintain and improve landscape quality —

- (i) by ensuring that landscape evaluation is a component of all forestry planning and development;
- (ii) by managing forests as components of the landscape;
- (iii) by integrating forests, shelter belts, wood lots and specimen planting with other functions of resource management, e.g., control of wind erosion of soil, provision of screening and shelter and aesthetic improvement of homesteads, buildings and fields, provision of fuel for local requirements, provision of recreation resources.

5. To provide and maintain recreation opportunities —

- (i) by allowing public entry where it is consistent with soil conservation and water quality objectives and with safety, fire prevention, silvicultural practices and biological considerations;
- (ii) by providing appropriate facilities for recreation where this is desirable;
- (iii) by encouraging private hunting to assist the adequate control of animals which degrade forest communities;
- (iv) by zoning and managing accordingly areas of forest of high recreational value.

6. To provide and maintain habitat for biological conservation of communities —

- (i) by identifying biological communities worthy of protection;
 - (ii) by classifying each identified community into rare, endangered, and representative communities which need protection for future survival;
 - (iii) by undertaking specific management required to maintain each biological community so assessed;
 - (iv) by encouraging public involvement in the preservation and management of biological communities.
7. To provide habitats for biota for sustained yield —
- (i) by maintaining and enhancing habitats for biota preservation and harvesting, where consistent, in indigenous forests and related lands, with the primary objective of the survival and ecologic stability of the indigenous species;
 - (ii) by identifying the biota by resource surveys, and by identifying species and environments in need of management and protection;
 - (iii) by assessing existing biota before any change is made to the forest or planned forest habitat;
 - (iv) by studying the whole forest habitat conditions required for the survival and stability of balanced biologic systems;
 - (v) by establishing specific management to improve and maintain habitat for desirable species;
 - (vi) by controlling strictly or eradicating harmful biota when and where required;
 - (vii) by encouraging public participation in harvesting biota, consistent with the aforesaid goals and objectives.
8. To provide shelter —
- (i) by use of forests, shelter belts, woodlots, shade trees, and whole farm shelter systems for control of wind erosion, reduction of crop and animal losses, and improvement of human amenity;
 - (ii) by use of appropriate forestry and related measures against snow drift-

ing, avalanching, and other climatic accidents.

9. To prepare for the possible integration of forestry with agriculture and pastoralism —
- (i) by investigating and evaluating possible interrelations of animal use including forest and plantation grazing, deer farming, fur and skin production, and honey production;
 - (ii) by investigating and evaluating social effects of such integration on employment, recreation, human settlement, economic stability, and population.

Recreation and tourism

Goals

1. To seek fulfilment of human needs and aspirations for a wide variety of types of mountain-based recreation, passive as well as active.
2. To provide for a continued but carefully-controlled development of a tourist industry oriented to the mountains and contributing to the national economy.

Objectives

1. To assess mountain resources for recreation by carrying out resource inventory and capability surveys for recreation in the high mountain zone within the framework of wider land use and land capability surveys, preferably on a catchment or regional approach;
2. To identify and quantify recreational demand of different types and assess compatibility of these recreational uses with different kinds of terrain and with one another.
3. To classify all unalienated high mountain lands of the Crown in a way similar to the existing national parks classification as special areas, wilderness areas, natural environment areas, and facilities areas, and to assign recreational activities which are inappropriate or incompatible with the above classification, or each other, to specially de-

signed areas with due consideration to environmental impact.

4. To provide opportunities to meet recreation demands —

- (i) by ensuring public right to use and enter, without payment or permit, all unalienated high mountain lands of the Crown, of which the main categories are national parks, forest parks, other state forests, scenic reserves and unoccupied Crown land, provided that such entry and use is consistent with the capability and designation of such lands;
- (ii) by providing reasonable, practical, safe, and legal access to the above lands where such access does not already exist, taking into proper account the other users of lands involved in such access;
- (iii) where practicable under Town and Country Planning legislation and where not contrary to the interests of the occupier, by zoning of occupied land adjacent to Crown land to be compatible with the recreational use classification of that Crown land;
- (iv) by providing facilities for recreation, planned so that they do not encourage or allow more visitors than the area served can accommodate or the land can carry without harm;
- (v) by applying special control in planning for the development of both the tourist industry and recreation generally in high mountain areas, especially those of great natural beauty or significance for nature conservation.

5. To ensure the compatibility of tourist industry development with scenery and habitat preservation and with the recreational, social, and cultural needs of New Zealanders —

- (i) by subjecting all major tourist industry development within the high mountains to environmental impact reporting procedures;
- (ii) by planning access and transport from facility centres to areas with

highest scenic values, protecting the latter from further intrusion of facilities;

- (iii) by avoiding the multiplication and extension of roads in high mountain areas (e.g., proposed Heaphy and Greenstone roads).
- (iv) by using natural materials and colouring in tourist facility construction to harmonise with the high mountain surroundings, working through statutory and local body ordinances;
- (v) by providing a greater variety of tourist facilities on the margin of high mountain areas, tending to simplicity of style and less cost, contrasting with the more expensive traditional "one night" organised tour system;
- (vi) by improving liaison among the tourist industry, other recreational users, and administering government agencies to maintain the overall well-being of mountain lands subject to proposals for tourist development;
- (vii) by excluding commercial tourist safari hunting operations from public land (including Crown leasehold) in mountainous areas under free range conditions;
- (viii) by taking into proper account the community character and functions of villages and other centres for high mountain residents, both village and countryside.

6. To maintain and enhance habitats for sustained recreation use, recognising that the greatest threat to the well-being of habitat, over the whole of the New Zealand mountain lands is the presence of wild animals —

- (i) by controlling introduced animals in the high mountains sufficiently to achieve and maintain the well-being of ecosystems with local eradication where necessary and practicable;
- (ii) by identifying the future recreational value of controlled populations of introduced animals at levels compatible with the well-being of high mountain ecosystems not otherwise

- designated for protection;
- (iii) by identifying the social values of recreational hunting in planning the management of the high mountains;
 - (iv) by continuing monitoring and interpreting the inter-relationships between populations of introduced animals, vegetation conditions, soil erosion, water quality, and sediment supply in waterways in mountainous areas;
 - (v) by controlling fire in high mountain lands by preventive, educational, and fire-fighting means, and by limiting its use as a management tool to where it is necessary for protecting the environment, for public safety or maintaining specific plant communities;
 - (vi) by using zoning to avoid conflict between commercial (game recovery) hunting, which is accepted as a valuable control measure, and recreational hunting;
 - (vii) by eliminating or abating noise pollution by power vehicles and machinery, e.g., by zoning, height, and landing restrictions for tourist flights;
 - (viii) by controlling or abating the undesirable invasion or extension of certain plants on land or in water bodies;
 - (ix) by controlling the influence of off-road vehicles on terrain, power boats on water margins, domestic or feral animals especially on native fauna, and poisons or unlawful taking of native birds and recreational fisheries.
7. To maintain and enhance scenery for sustained recreation use, recognising that the scenic value of mountain lands is intrinsic to mountain land recreation and tourism –
- (i) by preserving the unique or outstanding visual qualities of high mountain landscapes by appropriate zoning, development controls and protection from any development that would detract from or degrade these qualities;
 - (ii) by carrying out essential develop-

- ment in other areas whether roading, other communications, building or mining, or other activities, in harmony with the qualities of the natural scene or by applying appropriately-designed screening or correctives;
- (iii) by designing new cultural landscapes in keeping with the natural landscape;
- (iv) by identifying and conserving for the benefit and enjoyment of the public, cultural features of high scenic quality in areas of agricultural or historic development in mountain lands.

8. To enlarge and improve the utilisation of mountains for public education –

- (i) by educating the public to appreciate and use mountain lands for their own personal improvement as well as for strictly recreational value;
- (ii) by educating the public to respect the mountains and other users of them;
- (iii) by educating management and staff connected with the tourist industry for similar objectives and for the transfer of information to tourists;
- (iv) by restricting education *in* the mountains to those phases for which physical and active presence is essential and to circumstances in which the values taught are not violated by example.

Nature conservation

Goals

1. To promote understanding of nature and natural evolutionary processes and preserve their integrity as far as possible in planning land and water use, recognising the spiritual, emotional, intellectual and long-term material value of man working in harmony with nature to the best of his ability.
2. To fulfil national and international obligation to conserve representative examples of high mountain natural history for its intrinsic worth and for man's understanding and enjoyment.

3. To fulfil the obligation to preserve environmental diversity in examples of major ecosystems in natural condition and, especially because of its unusually high degree of endemism, to preserve the indigenous mountain biota.

Objectives

1. To identify clearly the categories of protection available for different kinds of high mountain resources and the categories of resources in need of protection or other means of conservation –

(i) by reviewing the reserves and related legislation as it applies to biological conservation and the whole field of nature conservation;

(ii) by reviewing and identifying the areas and biota in high mountains which are at risk, especially through conflicting resource use;

(iii) by identifying appropriate procedures and status of protection or conservation for different kinds of areas and biota.

2. To identify and secure the actual items for conservation –

(i) by establishing or designating an appropriate independent body with responsibility and power to co-ordinate and implement the comprehensive inventory and documentation of natural resources in the high mountains;

(ii) by ensuring the completion of inventory and documentation of mountain natural resources, identifying, and ranking areas or resources according to priority for nature conservation;

(iii) by providing technical, administrative, and consultative procedures for the expeditious designation of adequate protected areas or resources and the reconciliation of conflicting goals and objectives with other uses;

(iv) by emphasizing the indigenous biota of all classes in biological conservation programmes without neglect of the special features belonging to exotic elements in some situations.

3. To ensure appropriate management for nature reservations –

(i) by preparing and applying management plans including guidelines, prescriptions, and administrative procedures, and providing for appropriate scientific input and review;

(ii) by ensuring monitoring, continuing research, public education, and interaction between national nature conservation authorities and administrative bodies.

Integration of uses

Goals

To promote and maintain a balanced relationship between natural landscape character and all forms of land and water use, expressed in visual quality of the landscape and in a harmonious relationship between all present and possible future mountain users.

Objectives

1. To identify and preserve typical natural landscapes and those of outstanding scenic quality.

2. To conserve examples of cultural landscapes of high quality and interest and with full regard to natural and cultural history.

3. To create and develop cultural landscapes of high quality by the design and management of land and water use and with full regard to their future evolution.

4. To contribute to maximisation of choice by present and future generations –

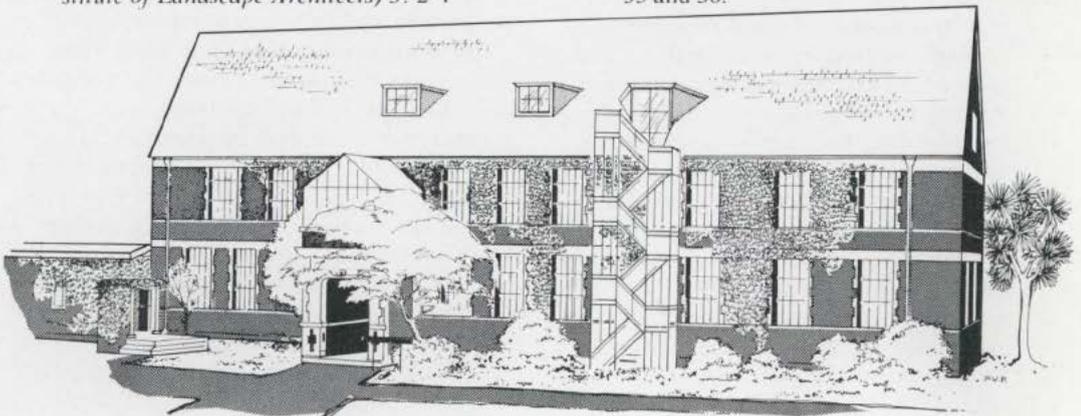
(i) by retaining some land unallocated to particular uses but managed towards a healthy and viable state;

(ii) by ensuring that all resources are preserved from irreversible degradation;

(iii) by applying the principles and practices of sound resource management in appropriate procedures of multi-disciplinary and multi-objective resource evaluation, impact assessment, and community consultation prior to resource allocation, and in appropriate procedures of monitoring and assessment subsequent to allocation.

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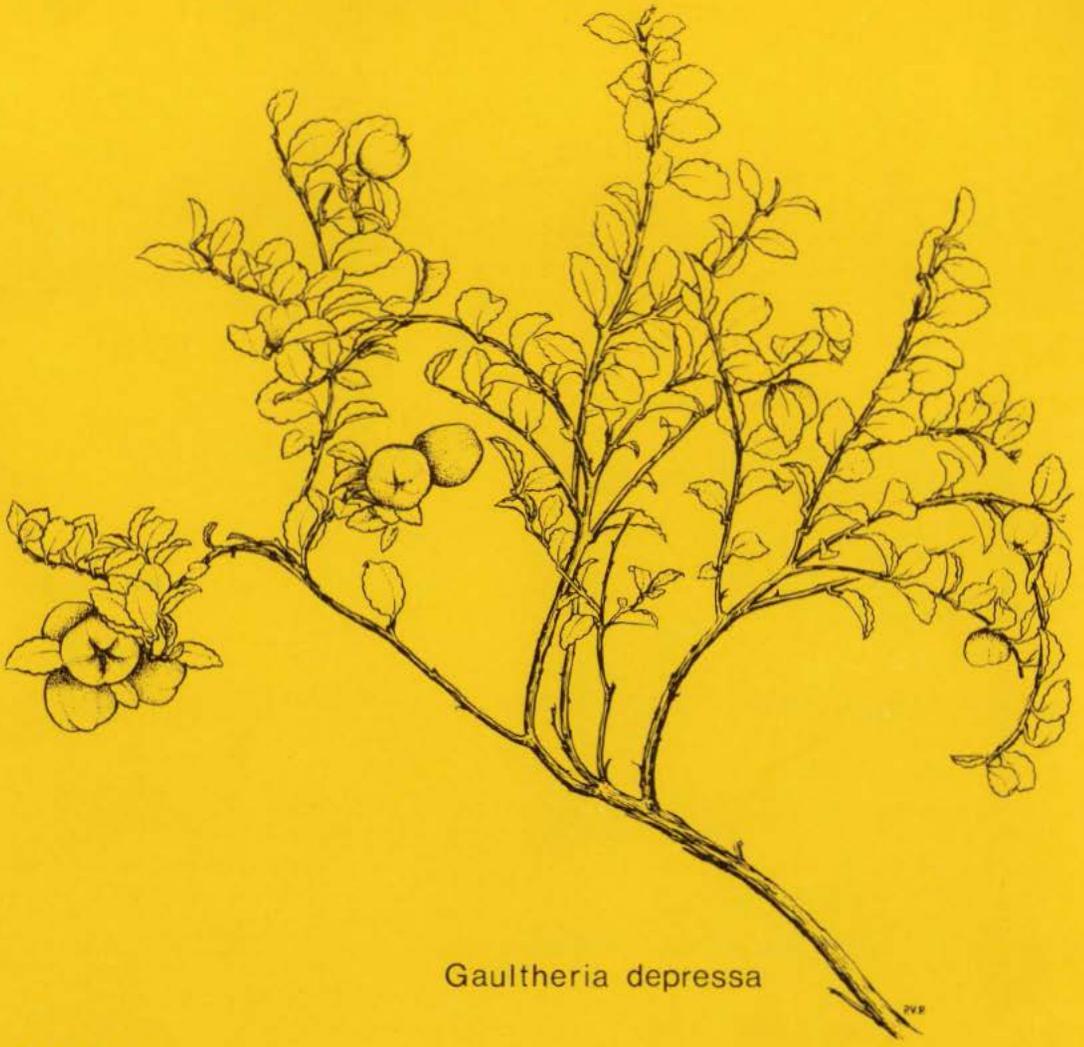
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In this issue:

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