Cover Sketch: The 30 square mile man-made Benmore Lake, the largest totally artificial lake in New Zealand. Further hydro-electric power has been planned for Otago — for both the lower and upper reaches of the Clutha River. Here, for the first time, hydro-electric development faces the very real obstacle of viable present land use. In this issue the human implications of power development on the Clutha is discussed by Mr M. A. Morton, senior lecturer in history, Otago University.
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Editor—J. Runga

Contributing photographer—B. Pinney

July 1972
Looking northwest above Lindis Crossing towards Maori Pt in the Upper Clutha (Lake Hawea in the distance). If a hydro-power supply from this region is necessary the minimum disturbance, maximum irrigation proposal is best.

**HUMAN IMPLICATIONS OF POWER DEVELOPMENT ON THE CLUTHA RIVER**

H. A. Morton  
Senior lecturer in history,  
University of Otago  

An address to the 1971 High Country Field Day gathering, Bendigo Station.

I was asked to speak about the human implications of hydro electric development on the Clutha River. As a historian I was pleased to come because that is what history is: the story of humanity, of human implications, the story of power in all its forms, both the use and the abuse of power. Power in government and the power which resides in water held at a high level should both be used only for good. For the good of human beings.

Dams and turbines and cables are not created for themselves but only as means of extracting and conveying energy to where a human can make use of it. This is what I mean by good/human use. It may be that the electrical energy is used to bake a cake to feed a man already overweight, or used to play mood music to help accomplish a seduction... who knows. But our definition of human good can only go so far as placing the energy where it is available for human use — that is good. The wisdom of its usage, being left to human choice, will vary widely.
Energy then, potential or actual, is a resource belonging to all humans. To get to first principles I think we must accept that the energy which is potential in this area is compounded of the location in the Clutha of water which runs through local water storage areas at a height sufficient to create a powerful force, which we, with our techniques can harness. These are natural phenomena, so this potential energy belongs to all the people of New Zealand, not just to those who live in the Clutha Valley. That, I think, must be accepted; just as we in Dunedin accept fully that Otago Harbour belongs to Otago and to New Zealand, not just to Dunedin.

Having accepted that, we can see that the human implications of power development reach as far as power lines can run. Some importance in the development of sufficient power resources lies in seeing that no future power cuts would endanger anyone's life in a hospital theatre in Dunedin or Christchurch, perhaps a patient from this area. And all over New Zealand now, and for years ahead, a chief beneficiary of power development and distribution has been the farm wife.

Electricity has done more for rural women than has anything else —it truly was Women's Liberation. Perhaps it is electricity which has given liberated women the time to demonstrate — although I have my own views as to what they are demonstrating — about themselves, not about men.

But these main points I repeat — first, that power potential anywhere in New Zealand belongs to all New Zealand just as do harbours, or airwaves, or the coastal sea. Second, that the development of electricity has benefitted farm people all over New Zealand, tremendously.

These points being made I wish to emphasize that the well-being of the people who reside in the immediate vicinity of power development is of tremendous importance. By well-being I mean emotional and social well-being, not simply economic. I know we would all agree that financial compensation should be generous for anyone who is compelled to move. It should be generous, genuine compensation. But this is easily said, less easily computed.

How do you compensate for decisions undecided? What are the costs of uncertainty? Is there a cost to doubt that dollars can't diminish? How can you pay a human being for his
seeing a lifetime of sweat and thought and skill disappear beneath a lake, and seem as if it had never been?

Farmers and orchardists are very much like other human beings — they like, even if they neither express nor realize it, to leave something of themselves behind. Parents can do this with children, a historian with books, an artist with a picture, a musician with a melody. Farmers make their mark with terracing or drainage, orchardists with trees and these things last, if not forever, at least beyond a lifetime. Farming, the modern management men say, is a business, but it is not. It is a way of life which must be business-like but it is not a business. It is not a living but a life; no more a business than is artistry merely because some paintings are sold, than is music merely because some composers are rewarded, than is medicine merely because some doctors are wealthy, than is history merely because some historians are teachers too. All these things are vocations. They are all things you must want to do in order to do at all well. And how can compensation fully compensate in such cases?

You can, perhaps, pay a man the value of his land — a value coldly assessed by some impersonal formula, cold-bloodedly discussed as if the committee were not talking about a substance now part of the man himself; in the same way as he has put part of himself into the land with everything he planned and everything he did.

Fishing on Wanaka the feeder lake of the Clutha River. New dams on the Clutha would increase the area of recreational waterways, but are such gains worth the loss of land of easy contour and landscapes and riversides of natural beauty.  

(Photo: B. Pinney).
"You plant a tree . . . so that a man may seek shade at the end of a day or a woman see beauty at the end of a garden. Money alone will never compensate for the loss of this relationship between men and the land they have worked."

(Photograph: F. D. Boffa).

You plant a tree, not to get a 7 percent return on the value of the seedling, and on the value of the 100 square feet of land from which it feeds. Nor do you calculate the amount of steel that wore off the shovel blade that turned the sod, and how many calories you burned in pushing that blade firmly home, and lifting it, and turning it. That sort of nonsense is for computers at a Ford Motors plant — whence humanity departed when they drove the last Model A away from its doors. No, you don't do these things when you plant a tree and God forbid if you ever should. You plant a tree so that a child may eat freely of its fruit, so that a man may seek shade at the end of a day, or a woman see beauty at the end of a garden.
Among the prices of dammed water are the steep, stark contours and sometimes the difficulty and cost of access. Lake Hawea at its new level. (Photo: B. Pinney).

Money alone will never compensate for the loss of this relationship between men and the land they have worked. We have to find something more, and I think we can if we but try. We can if we use imagination and not calculation.

Farmers are not the only humans involved in power development and not the only humans concerned in it who wish to leave their monument intact behind them. One of the genuine problems in the development of a country is the desire to build, to create something to which you can point and say — that is what I designed, or helped to build, or helped to make possible. Engineers — and there is nothing sinister in this, nothing improper, just something very human — often confuse the question: "Can we build a high dam, or a superjet, or a motorway, or," I suppose, "a pyramid?" with the question "Should we build it?" "Can we build it?" is not the same question at all as "Should we build it?" History is full of instances of things which man was able to build but which he should not have built — that is, if he had examined the human implications first, as I am here to do. Were the pyramids, majestic as they are, symbolic as they are of man’s ability to calculate, to plan, and to complete: were they worth the slavery and suffering entailed? Are there not doubts about whether moon capsules are not modern pyramids, not worth the ignoring of the slums, of the ill-health, of the degradation that cries out for curing?
I said earlier that power resources are national resources. My own view is that they should be developed for the nation's use, but only if for each scheme we examine far more thoroughly the question "Should we do it?" in human terms.

We are told of committees of experts, made up I have no doubt of decent and able men. But experts in what? In engineering, in hydrography, in agriculture? Is there a humanist among them — one whose training is, in other words, in the humanities? Is there a social scientist among them, one trained to examine the human foundations of the district as thoroughly as others no doubt examine the geological foundations of the dam?

Should so many decisions nowadays be taken, or at least examined, only by men whose natural interest is that a thing be done, and not that it be prevented? To ask a committee of engineers from the hydro-electric department whether a scheme should go ahead produces much the same answer as you would expect if you asked a committee of Maniototo fat lamb producers to make the recommendation as to whether a significant scheme of irrigation should go ahead.

It is amazing how quickly a pessimistic cost-benefit-analysis is applied to a farmer's project, and how swiftly optimistic cost-benefit-analyses could be published about Manapouri — long since proved over optimistic. There indeed is a classic case where technique — I have no doubt of its brilliance — as well as the design of men for monuments to their life's work overcame or even overwhelmed the natural doubts of those who believe that human implications are even more important than the Gross National Product. "Can we do it?" in the short-term seemed more important than "Should we do it?" in the long-term.

And I am not even talking about the raising of the lake.

What I am saying is that for a short-term, and very small benefit in foreign exchange we have pledged for a long time an immense New Zealand asset, cheap hydro-power, to a group outside New Zealand. I speak with great feeling — and some little knowledge, as a former Canadian—of the effects of such pledges (called contracts, I think) to foreign groups. And yet after Manapouri we are still told that people won’t go to the power, and that cables under straits are necessary to take power to where
the people are. And I also say that the same amount of capital spent on irrigation schemes and agricultural development in a number of places in New Zealand would have brought us a greater return financially, even in foreign exchange, but most definitely in human terms.

The point is that long term social effects are simply not taken into account early enough in the planning. I am not suggesting for one moment that there was anything sinister in all this. What is there, is something much more old fashioned: the idea that people are still prepared to accept constant increases in the Gross National Product as the only national goal, no matter what it costs in environmental or human terms.

The people are not willing to accept this any more in Europe, in Japan, in the United States, or as Lake Manapouri shows, in New Zealand either. Here I think is something with which to reassure yourselves. No government is going to stir up another Manapouri — not if it is wise. My whole argument is based on the premise that the worst of the alternative schemes will not be put in. The whole Clutha Valley will not be flooded. Manapouri has seen to that.

Here is the strength of your case in the Clutha Valley. If those of you concerned are reasonable and not simply negative if you state your case with eloquence and even emotion but not with malice and venom, you will find the vast bulk of the people of New Zealand behind you in full support.
Mosel Valley, Germany. Here the land resembles parts of the Clutha Valley except that the stony soils and steep valley sides grow vines. Advanced energy dynamics may prove similar use more valid for the Clutha. It would be inconceivable to the Germans to dam such a valley and inundate centuries of toil.

(Photo: B. Pinney)

What must be obtained in everyone's interest is a scheme of development which gives the most power at the least cost, the least cost in human and social terms as well as of money. But we will be being completely unrealistic if we expect the least cost to be no cost at all to anyone. I cannot see — and, of course, perhaps I am wrong — any scheme which is workable and worthwhile from a national point of view which will not entail some sacrifice in both agricultural and human terms. But if we accepted this now, we could plan in such a way that sacrifice could be at least minimized and ameliorated.

A chief sacrifice, from any point of view, will be that of some apricot orchards. I am using apricot orchards only as an example. I know that there is something almost unique about them but I also know that in human terms the effect on a sheep-farmer who loses all his flat land will be much the same.

For apricot men, it is most unfortunate that the conditions of air drainage and sun-capture and soil that make Central Otago apricot orchards so productive of quantity and quality, are the very description of the depth of shelter and the slope of land that makes possible the storage of the same water supply that has been used to grow the fruit. It is, in terms of drama, a tragedy when one is destroyed by one's own best qualities. The Clutha could be a tragedy too, in human terms. But is there not something more we can do than lament?
Could we not, first of all, get the deciding done? Could we not make up our minds? I know that in every third year in New Zealand it is very difficult to get decisions from Wellington. If this were another occasion I would explain how foolish New Zealand is to have elections at fixed three year intervals. It would take all the fun out of a Canadian politician's life if he knew when the next election would be. However, for the moment, we are stuck with the New Zealand electoral cycle which as far as I can see, is one year to do, one year to explain, and the third year to postpone. Even so, as soon as a decision is made (and getting the doubts and uncertainty dispelled is as important in human terms as is anything else) then plans can be made and action begun.

I think, for example, that suitable apricot land should be purchased now — and there is enough available in Central Otago and some in North Otago — as part of the whole power development scheme. The trees could be planted now, not six or seven years from now, so they would begin bearing when the turbines spin, not years afterwards. Above all, I urge that if possible and if he wishes, anyone who is sacrificed to the good of the nation should as far as possible be put back in the equivalent situation to the one he was forced to leave. We simply cannot afford to lose not only some valuable and hard to replace apricot trees but also more valuable and even harder to replace apricot men.

In human terms one of the most abhorrent things about unemployment is not the disuse of labour but the disuse of talent and of skill and of hard-won experience. These things New Zealand always needs and cannot afford to neglect just to save hundreds within a scheme of millions. Compensation should not only be fair and even generous but also should be so planned and directed that the aim of re-location of talent and of tree should be attained, and not their destruction.

Such talent would well repay New Zealand for any fraction of a mill difference in the delivered cost of power.

From what I have seen in Canada, the re-organisation of schools, the re-location of roads, the re-building on higher ground of the low-lying portions of towns have generally worked out to the long-term benefit of the districts concerned. I am talking about the re-location of roads higher up but on the same route as the old roads. In human terms the implications of a completely
new route are difficult to assess but are nonetheless both real and worrisome. Let it be enough to say that if I were in local government I would be very concerned about any proposed rerouting that would take the new road past my borough at any greater distance than half a mile to a mile, or that would seriously disturb long established traffic patterns.

Human implications of development are many and serious. No one, I think, really fears that the government will not be fair in compensation. But at 45 or 50 years of age who wants to start to build again? And if compensation is not enough to retire on, are the skills which helped the nation in growing apricots, for instance, the skills that will win one an interesting and satisfying job in town? Many of the implications go further and are part of the whole pattern of deteriorating rural/urban political and social relationships that are, and will increasingly become, an accompaniment of rural depopulation. Some of the human implications are implicit in the growing concern about regional development in New Zealand, and in Otago in particular.

In the human implications of power schemes, of rural depopulation, of regional development, we need much much more than the sensible, decent, well-intentioned administration of policies that are often forced on us by factors we cannot control. What we need is a leap of the imagination so that we

New Zealand has little ploughable land. Should more be sacrificed for hydro-power and irrigation? Under sound dryland-farming practice this class three land can be improved to class two and with irrigation to class one, at a price.

(Photograph: B. Pinney).
cease repeating ten years later every mistake in centralization, in urbanization, in industrialization, that was made in Europe and America. The United States government has just re-started giving out free land as the re-action grows against the urban loss of living values. We still are somewhat short of this, but can't we see it coming? Can't we think? Can't we plan? Can we understand and accept that there are human implications in every scheme of technological development? Could New Zealand possibly be the leader again as she has been the leader before, in seeing that society never forgets the human price of progress? This leadership itself would be a monument to planning based on principle, to efforts made effective, that should satisfy the engineer, the economist, the historian and the farmer alike.

PRIME POWER QUESTION: ALTERNATIVES

Mr J.F. Henderson, Chairman of the Interdepartmental Committee which studied the effects of electric power development on the resources of the Clutha Valley was reported in the Otago Daily Times (27 July) as saying that the Clutha had been considered as a possible electric power producer as early as 1909, that the need for power had given the proposals more priority. In the same report the district manager of the Electricity Department, Mr G.B. Collie, said the demand for electricity was increasing at the rate of 7½ percent a year that in ten years as much electricity again would have to be produced as had been produced up to the present.

Mr Collie's query, "If we don't develop the Clutha we will have to develop something else. It is all very well to be idealistic, but what are the alternatives?" whether a rhetorical question or not is clearly the question to be settled before concrete is poured. What are the alternatives to hydro-electric power on the Clutha River or anywhere else in New Zealand? Hydro-electric power may have been cheap in 1909, it may be cheap today. Will it be cheap in 1999 when the land it consumes may be twice as productive in dryland form, twice as rare or twice its present value? The figures provided in that part of the official report for the Upper Clutha show that the sale value of power is barely viable on the capital costs of power schemes. True benefits must therefore be in what Industrial New Zealand can earn from that power and what irrigation as a side benefit can also earn. While agricultural production losses have been estimated there is no indication they have been capitalised and while the agricultural potential under each proposal may be a credible figure the full costs of achieving these have not been attempted.

With an Upper Clutha scheme to cost more than $200m cash plus undeterminable hidden and aesthetic costs it would seem prudent to first explore alternatives, whether these are hydro schemes in Fiordland or elsewhere, increased efficiency of existing schemes, or alternative extraction. In closely settled areas that are historically agricultural it is the irrigation potential that should be fully planned and costed and hydro-electric production an ancillary to those plans. Farmer support for any dam construction is most likely to be based on the final criterion of irrigation potential. The Upper Clutha scheme D, favoured by the Minister of Electricity, meets this requirement, but it is not irrigation costed and the cost analyses only distantly relates to irrigation potential.

—Ed.
WINTER FORAGE CROPS
R.S. Scott and Dr T.N. Barry
Invermay Agricultural Research Centre, Mosgiel

Winter forage crops have been grown on both lowland and hill country since the early days of land settlement. According to latest statistics they are as important today as they were ten years ago, in spite of claims that they are being replaced by saved grass and other methods of wintering.

While considerable research effort has gone into the breeding and selection of improved varieties of the various crops, little attention has been directed to the evaluation of which crop rather than which variety to grow for maximum yields of utilisable dry matter. Evaluation of the suitability of the crops by the final arbiter — the animal, has also been given scant attention.

This article reports the results of a programme of research conducted over the past four years which provides some indication of the results obtained in different environments.

Crop Yields

The experiments were conducted on a range of soils and under rainfalls varying from 490 to 890 mm per annum in the year in which the crops were grown. High yielding varieties of all crops were grown. Chou moellier was drilled at 35 cm row spacings and the remaining crops were ridged at 60 cm spacings. Results were as follows:

<table>
<thead>
<tr>
<th>Soil:</th>
<th>Alluvial</th>
<th>YGE₁</th>
<th>YG-YBE</th>
<th>YG-YBE</th>
<th>YBE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Invermay</td>
<td>Palmerston</td>
<td>Invermay</td>
<td>Hindon</td>
<td>Waikare South</td>
</tr>
<tr>
<td>Rainfall*</td>
<td>890</td>
<td>640</td>
<td>890</td>
<td>490</td>
<td>850</td>
</tr>
<tr>
<td>(mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnips</td>
<td>4,420</td>
<td>4,650</td>
<td>3,270</td>
<td>5,350</td>
<td>8,770</td>
</tr>
<tr>
<td>(Green globe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swedes</td>
<td>5,570</td>
<td>8,980</td>
<td>—</td>
<td>7,040</td>
<td>10,380</td>
</tr>
<tr>
<td>(Sensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chou moellier</td>
<td>12,250</td>
<td>12,130</td>
<td>9,730</td>
<td>6,540</td>
<td>10,120</td>
</tr>
<tr>
<td>(Medium stem)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fodder beet</td>
<td>8,740</td>
<td>12,480</td>
<td>5,120</td>
<td>4,180</td>
<td>6,680</td>
</tr>
<tr>
<td>(Yellow Daeno)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangolds</td>
<td>8,990</td>
<td>11,590</td>
<td>4,790</td>
<td>5,110</td>
<td>3,840</td>
</tr>
<tr>
<td>(Yellow globe)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

₁ Yellow grey earths.
₂ Yellow brown earths.
* Rainfall for experimental year.
All trials, with the exception of the Hindon trial, were sown into ground ploughed out of pasture. The Hindon trial was the second crop out of tussock, and had the lowest fertility of all sites.

The most consistent feature of the trials was the high yields obtained from chou mollier. Swedes were only equal to or better than chou moellier at Hindon and Waiwera South but the difference was not great. At these sites turnips gave yields approaching those of swedes.

Of crops belonging to the beet family fodder beet was superior to mangolds in three environments. It was only at Palmerston where summer conditions were drier and warmer, that fodder beet gave yields equal to those obtained from chou moellier.

Crop Utilization

Yields of dry matter alone can give a misleading indication of the worth of a crop. As every farmer knows, different forage crops are consumed to varying degrees. In two experiments the crops were fed to ewes until each crop was utilized as fully as possible. The average utilizations obtained with the crops were:

- Turnips: 88%
- Swedes: 90%
- Chou moellier: 75%
- Fodder beet: 68%
- Mangolds: 83%

These figures show that turnips and swedes were utilized to a high degree whereas chou moellier was utilized to a much lesser extent, and fodder beet was poorly utilized. The same level of utilization of fodder beet was obtained whether the crop was grazed in the ground or following hand pulling.

The amount of utilizable dry matter calculated from the utilization and yield data is shown in Table 2.

<table>
<thead>
<tr>
<th>Soil:</th>
<th>Alluvial</th>
<th>YGE</th>
<th>YG-YBE</th>
<th>YG-YBE</th>
<th>YBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site:</td>
<td>Invermay</td>
<td>Palmerston</td>
<td>Invermay</td>
<td>Hindon</td>
<td>Waiwera South</td>
</tr>
<tr>
<td>Turnips</td>
<td>39</td>
<td>41</td>
<td>29</td>
<td>47</td>
<td>77</td>
</tr>
<tr>
<td>Swedes</td>
<td>50</td>
<td>81</td>
<td>—</td>
<td>63</td>
<td>93</td>
</tr>
<tr>
<td>Chou moellier</td>
<td>92</td>
<td>91</td>
<td>73</td>
<td>49</td>
<td>76</td>
</tr>
<tr>
<td>Fodder beet</td>
<td>59</td>
<td>85</td>
<td>35</td>
<td>28</td>
<td>45</td>
</tr>
<tr>
<td>Mangolds</td>
<td>75</td>
<td>96</td>
<td>40</td>
<td>42</td>
<td>32</td>
</tr>
</tbody>
</table>

(1 kg/ha = 0.892 lb/acre)
Results noted for dry matter yields were altered when utilization was taken into account. Mangolds provided higher yields of utilizable dry matter than fodder beet at four or five sites. Chou moellier remained as good if not better than the other crops for all sites except Hindon and Waiwera South. At these latter two sites swedes provided higher yields of utilizable dry matter and turnips provided yields similar to those from chou moellier.

Methods of Sowing

The precision seeder was examined in several trials as an alternative to the ridger as a method of sowing the crops. Its use did not result in any improvement in yields. Possibly under ideal soil conditions on level sites and where the ideal population (which is not known at present) is sown the precision seeder may offer some advantage.

In one experiment, in which swedes, chou moellier and fodder beet were drilled and had higher plant populations than ridged crops, higher yields were obtained. This indicates that a considerable amount is yet to be known about the desirable spacing of forage crops between and within rows. Also the question of sowing in ridges compared to sowing ‘on-the-flat’ has yet to be resolved.
Time of Sowing

Early sowing (mid November) was compared with late sowing (early December) at all sites excepting Waiwera South. At Invermay yields of fodder beet and chou moellier were better following early sowing. At Palmerston there was no clear difference in any of these crops when sown at either time. At Hindon all crops benefited from early sowing except turnips which gave higher yields from a late sowing.

As a generalization it appears that there is no reason to alter the time of sowing from present district practice — early sowing beet crops, sowing chou moellier and swedes in November and turnips in December early January.

Nitrogen Fertiliser

Requirements of the various crops for fertilizer nitrogen was examined in all experiments. Only on the Hindon site, where the ground was ploughed out of tussock, were responses obtained. When ploughed out of pasture it appears that sufficient nitrogen is available to meet the needs of winter forage crops.

Animal Performance

Sheep — The benefit which animals derive from different foods can be determined from a combination of three measurements. These are the extent to which they digest the foods, the amount of the foods they will eat when offered _ad-libitum_ (referred to as the ‘voluntary intake’) and the liveweight gains on each food. The digestibility and voluntary intake of five winter forage crops, measured with Romney hoggets at Invermay, are shown in Table 3. To measure digestibility the hoggets were kept indoors in pens and the crops were chipped before being fed. Voluntary intake was measured with the hoggets grazing the crops in the field.

<table>
<thead>
<tr>
<th></th>
<th>Digestibility of energy (%)</th>
<th>Voluntary intake of digestible energy (Mcal/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnips</td>
<td>90.1</td>
<td>4.53</td>
</tr>
<tr>
<td>Swedes</td>
<td>90.8</td>
<td>4.42</td>
</tr>
<tr>
<td>Chou moellier</td>
<td>83.0</td>
<td>2.71</td>
</tr>
<tr>
<td>Mangolds</td>
<td>86.4</td>
<td>2.71</td>
</tr>
<tr>
<td>Fodder beet</td>
<td>87.7</td>
<td>2.85</td>
</tr>
</tbody>
</table>
The digestibility of all five crops was very high and, although there were differences between crops, the extent of these differences was not large. The digestibility of winter forage crops (83-90%) is much higher than the digestibility of medium quality hay (50-55%) or of lucerne hay (65-70%).

There were differences between crops in voluntary intake. High intakes were found for turnips and swedes and low intakes for chou moellier, mangolds and fodder beet. The reason for the differences in intake may be the hardness of the bulbs caused by the content of dry matter, which was less than 10% for turnips and swedes and greater than 12% for the other crops. However other factors may also have been involved.

Liveweight gains, measured with both hoggets and pregnant ewes, are given in Table 4. With both types of stock the best gains were recorded on swedes and turnips, due to the greater voluntary intakes. Gains were low on the other three crops, although ewes appeared to gain weight more readily on mangolds than did hoggets. The greater gains obtained with ewes than hoggets can be misleading, — it is due to fluid retention associated with pregnancy.

**TABLE 4:**

**Liveweight gains obtained with hoggets and ewes**

<table>
<thead>
<tr>
<th></th>
<th>(g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hoggets</td>
</tr>
<tr>
<td>Turnips</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>(0.28) +</td>
</tr>
<tr>
<td>Swedes</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>(0.34)</td>
</tr>
<tr>
<td>Chou moellier</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
</tr>
<tr>
<td>Mangolds</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
</tr>
<tr>
<td>Fodder beet</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
</tr>
</tbody>
</table>

Figures in brackets are gains expressed in lb/day.

Collectively, the crop yield and sheep performance data show that the choice of crop to grow will depend on the type of animal performance which is desired. Voluntary intake and liveweight gain were highest on swedes and turnips but, as swedes consistently outyielded turnips in dry matter utilized per hectare, swedes would be the choice where individual animal growth rates are desired.
Demonstrating the high utilization by hoggets of swedes (above) and low utilization of fodder beet (below).
Where it is desired to winter large numbers of animals per hectare and high animal growth rates are not considered important, then the choice of crop will depend only on the yield of utilisable dry matter per hectare. Clearly, this will depend on the location where the crop is to be grown. Chou moellier is recommended for the Invermay region, mangolds or chou mollier for Palmerston and swedes for Hindon and Waiwera South.

Cattle — Work with beef cattle commenced in the winter of 1971, when beef weaners (about 180 kg initial weight) were allocated to three treatments. These were:

(a) hay fed to appetite,

(b) unrestricted grazing on swedes,

(c) unrestricted grazing on chou moellier.

Both forage crops were supplemented with hay fed in racks. The cattle were weighed during the 56 day winter feeding period and also after the groups had been boxed and grazed as one group on spring pasture for 59 days. Hay consumption and liveweight gains are shown in Table 5.

<table>
<thead>
<tr>
<th>Winter treatment</th>
<th>Hay consumption (kg/day)</th>
<th>Winter gain (g/day)</th>
<th>Post-winter gain (g/day)</th>
<th>Main gain (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay</td>
<td>4.8</td>
<td>125</td>
<td>481</td>
<td>308</td>
</tr>
<tr>
<td>Swedes</td>
<td>2.3</td>
<td>(0.28) +</td>
<td>(1.06)</td>
<td>(0.68)</td>
</tr>
<tr>
<td>Chou moellier</td>
<td>1.8</td>
<td>(0.71)</td>
<td>(1.24)</td>
<td>(0.98)</td>
</tr>
</tbody>
</table>

Figures in brackets are gains expressed in lb/day.

Animals on the forage crops consumed about 40% as much hay as those on hay alone. Liveweight gains were similar on swedes and chou moellier, both giving considerably higher gains than were obtained from the ration of hay alone. The effect from forage crops was also apparent in the post-winter period at pasture.
Summary

1. The production of turnips, swedes, chou moellier, fodder beet and mangolds was compared at five sites under rainfalls ranging from 490 to 890 mm.

2. Highest yields of utilizable dry matter were obtained from chou moellier and mangolds at Palmerston, chou moellier at Invermay and swedes at Hindon and Waiwera South.

3. Conventional ridging was as good as precision seeding of all root crops.

4. Early sowing in November gave highest yields of all crops except turnips which were better following later sowing in December.

5. Only at Hindon, where the area had been ploughed out of tussock, were responses obtained to nitrogen fertilizer.

6. Digestibility ranged from 83-90%, with only small differences between crops.

7. Hoggets had higher voluntary intakes on swedes and turnips than on chou moellier, mangolds or fodder beet.

8. Swedes and turnips gave the highest growth rates in both hoggets and pregnant ewes. Where it is desired to winter large numbers of sheep per hectare at maintenance, the choice of crop depends only on the yield of utilizable dry matter (see 2 above).

9. In a trial with weaner beef cattle, swedes or chou moellier with supplementary hay produced greater live weight gains than were obtained from a hay ration.

Acknowledgements

The authors wish to thank the following farmers for making land, machinery, and their time available for this work: Messrs J. Knowles, Glen Park, Palmerston; R.J. Reid, Traquair, Outram; John B. Hurst, Silver Peak, Gore. Mr K.H.C. Lewis is thanked for his permission to use data from his cattle nutrition study as are Messrs A. Kelson, S.J. Duncan and G.J. Greer for assisting with the experiments.

The following article on Sir Malcolm Burns was written for Review by the College’s Information Officer, Mr D. Crabb.
Knighthood for Principal of Lincoln College

The announcement in the last Queen's Birthday Honours conferring a knighthood on Dr M.M. Burns will have come as little surprise to readers of this Journal.

From those who know him well to those who have heard him speak or offer introductory remarks at Conferences and field days Sir Malcolm has brought to the platform an easy informality that has at once attracted his listeners. He has also had that happy knack of talking in terms readily understood by the layman.

There would be few farmers, agricultural scientists or people servicing agriculture to whom the names of Lincoln and Burns are not synonymous.

The attitude Sir Malcolm took when the Honour was announced was typical of the person.

“I am pleased personally of course, but I am even more pleased that this recognition of the tremendous contribution of the College staff, Council and students has been shown.

“I have been singularly fortunate being in the right place at the right time . . .”

These comments may be made by any person when such an Honour is conferred but here, from those who know him, they may be taken as the genuine modesty of a person who was so responsible himself for so many of the changes and innovations.

He has been Principal of Lincoln College during the greatest development period in its 90 years of history; from a student enrolment of just under 100 when he was appointed Director in 1952 to a present day complex of nearly 1,100 students.

Perhaps most important, Sir Malcolm has been a keen advocate of the development of Lincoln as an agricultural research centre.

The Tussock Grasslands and Mountain Lands Institute was established on the campus largely through his untiring work; the Agricultural Economics Research Unit and the New Zealand Agricultural Engineering Institute also owe much of their existence to his efforts.

He campaigned actively for the growth of the Department of Scientific and Industrial Research centre near the College and the establishment of the Wool Research Organisation and the Department of Agriculture's Animal Health Laboratory nearby.

The wisdom of this foresight is seen not only in the bricks and mortar both on and around the campus but more important in the research and development work that comes from such a closely grouped nucleus of agricultural institutions with staff working in close collaboration.

His work has spread far beyond the gates of Lincoln too. Many developing countries, particularly in South East Asia, have reason to be grateful for his farsighted guidance and practical help with Colombo Plan and associated projects. He has also been
prominent on the national scene most recently with his work on the National Development Council and its associated agricultural committees.

A shrewd judge of men, Sir Malcolm has gathered on the Campus a large and closely knit staff and has encouraged and prodded their energies into avenues of teaching and research that have made the College a world renowned institution producing a practical, versatile graduate well equipped to take his place in any of the various aspects of agricultural research or extension.

Through all this growth and development, the College has continued to maintain a contact with the changes and problems not only of the rural community in which it lives but also in the plains of Southland and the Manawatu and the high country of both Islands. Perhaps the link has not been as close or personal over past years but the increasing pressures on staff and the growth of advisory services within and outside the Department of Agriculture have resulted in the decrease in these activities. It is quite fair to say though that Sir Malcolm has always recognised the immense importance of both his staff and students maintaining as close a contact as possible with the farming community and has actively encouraged this ‘grass roots’ contact.

Since he joined the staff in 1937 Sir Malcolm has been away from Lincoln College for only four years when he was for a period director of the Fertilizer Manufacturers’ Research Association. This post he took up in 1948, at which time he was senior lecturer and head of the Department of Soils and Chemistry. He returned to the College in 1952 to succeed Professor E.R. Hudson as Director.

His announced intention to retire on 31 March 1974 is drawing to a close another era in the history of the institution to which he has given so much.
Dear Sirs,

The article by A. Thomas (Review 23) is a good account of what has happened in paddocks alongside homesteads whereas most other kea damage has occurred on hills where more accurate observation has not been possible. You ask for a photo of a kea on a sheep's back. I do not know of any, in fact the Makarora episode is one of the few cases where this has been observed, although most high country men know it goes on from such signs as described in the article.

Apart from those sheep chased over bluffs I myself have seen hundreds that appear to have died from blood poisoning. It is likely that it could be spread by the bird's beak after having fed on rotting carcasses.

Keas do feed on carcasses — goats, deer, sheep and cattle as well as offal. What is likely is that the bird has it fixed in his mind where he is going to get a feed before he gets into a paddock. I have known him to dig through one to two feet of snow to get to a carcass he is used to feeding on.

What I have seen bears with stories of keas tearing up tents, hoods off Ford motor cars, packs, sleeping bags, socks, cameras, rolling billies down hills for fun; how they like meat, jam, honey, fruit, carrots and so on and in fact anything that will rip, tear, jangle, rattle or digest. I have been told of one case of a fatality in the mountains where keas found the body before the rescuers. I have been immobile just to see what would happen and have had my boots and clothes tugged at by keas. The thought of all the dead sheep and of the blood poisoning and kea wounds compelled me to move before more than my clothes had been punctured.

To my knowledge, dating from 1935 or so, the bounty was divided between Government, County, and runholder at a rate of something like 3/-, 2/-, and 5/- per beak, though there was nothing to stop the runholder paying more if he wished. I have heard of some runholders who have paid £5 or £10 a beak in an attempt to get rid of a few very troublesome birds. Last year all forms of bounty were dropped.
In late winter and spring all birds and animals are affected by a lack of natural food and may suffer from starvation. This is born out by my own observations of pigeons and ducks etc. and the fact that for several years I skinned shot keas and noted their condition and stomach contents. The pattern was: April/May—fat and full of berries; June/July—losing condition with few berries but some smelly, meaty muck and sometimes wool in the crop; August—lean with the crop often full of meat and offal.

Of latter years I have not had the same losses as in the 1940s and 1950s and suspect that the reduction of deer has resulted in more berry-bearing shrubs such as *Coprosma serrulata* which is very palatable to deer yet is showing recovery and keeps its berries until August.

In spite of occasional remarks to the contrary most runholders have a deep regard for the mountain lands and what lives there, and quite an affection for the kea. This affection can be very expensive at times when this destruction is going on anywhere from 1,000 to 5,000 ft at night and in the depth of winter.

Many runholders for the last 100 years have learned to read the signs of kea damage but have not been able to record accurate details. Kea killing has occurred all the year round but the most damage has been in winter, at night, and on steep country and often during or after heavy snow falls. This has made recording dangerous to impossible and leaves high country men to form their opinions from their own experience and a high cost in sheep losses.

**Letter 2**

Occasionally on the flats I used to see dead ewes with kea wounds and small, starving, but still alive and untouched lambs with them.

On one occasion, October, I saw signs of what might have happened perhaps one or two months earlier. There was a furrow through the bracken then scattered wool, further down more wool and further again more scattered wool and the remains of a sheep carcass. This showed that a sheep had been chased until it collapsed and when the bird(s) started to pull it apart it struggled ahead over a distance of some 75-100 yards.
A hoget pierced by a killer kea. The bird was shot after several weeks of observation and waiting. Photo: A. Thomas

I have seen keas with a considerable amount of blood and muck on their beaks and face feathers as well as their feet. Like most other animals and birds they do try to keep themselves clean but get dirty scavenging in old carcasses.

It was not until we began inoculating hoggets against blackleg and malignant oedema that large wounds came in. One hogget had a wound about ten inches long and four inches wide. A ewe had a wound full of maggots down to the backbone but recovered after treatment. On the other hand 15-20 hoggets died two months after inoculation. They had the characteristic kea wounds which had become fly blown.

I have included one or two photos which you may personally find interesting. The ones on the album page are over 30 years old and bleakly show the remains of dead sheep and 45 shot keas in cold snowy conditions.

Yours faithfully,
J. C. Aspinall,
Mt Aspiring Station

* Unfortunately these photos are not reproducible. — Ed.
Planning for Recreation among other uses of Mountain Land and Water Resources

K.E. O’CONNOR
A review of planning for recreation in the tussock grasslands and mountain lands by K.F. O'Connor, Professor of Range Management and Director of the Tussock Grasslands and Mountain Lands Institute.

Recreation History in the New Zealand Mountains

Recreation in the tussock grasslands and mountain lands is not new. It is almost surely a very ancient use of a wide range of the resources of the tussock grasslands and mountain lands of New Zealand. Our early Polynesians apparently forsook their coastal settlements to spend long visits in our mountainous hinterland. Their activities, game hunting, mineral fossicking, and tramping have their contemporary counterparts. For some Maori visitors at least these activities were probably truly recreational, just as they have been for early Europeans and for citizens and visitors of present times. To understand the recreational part of our history of human presence in the tussock grasslands and mountain lands requires some attention to the differentiating characteristics of recreation. What makes an activity recreation?

Recreation is a use of discretionary time or leisure, characterised by the seeking of relatively immediate gratification. If our aims in an activity are dominantly to better ourselves for the future rather than to enjoy the activity itself then the recreational element is diminished. If our purpose is some extrinsic gratification such as a reward of money or goods rather than intrinsic gratification, so too does the recreational element diminish. If the pre-European inhabitants of this country did not in fact indulge in hunting, fishing, swimming, boating and walking for intrinsic and immediate gratification, then it is at least likely that, like a peasant leaning on his hoe to enjoy the respite from toil and to admire the scene, the Maori mountain visitor from time to time chose inactivity for the sheer joy of it. Did the moa hunters hunt always for food and feathers, or sometimes for fun? Did the early Polynesians light fires in the tussock for the pleasure of it or to facilitate hunting or access? It is hard to conceive that the extensive fires of the Polynesian era were lit solely by accident.

Whether or not Maoris enjoyed the simple delights of grand arson there is little doubt that our early European settlers did. Lady Barker in “Station Amusements in New Zealand” reveals in her account of “the exceeding joy of burning”, activities in many cases explicitly undertaken by such ladies of society for immediate intrinsic and spectacular gratification. Tussock burning was by no means the only outdoor recreation of these times. Picnicking, riding, hunting, camping, fishing, boating and a range of winter sports are all described with varying enthusiasm by Lady Barker in “Station Amusements in New Zealand” and in “Station Life in New Zealand”. Her story of her discomfiture in a dark night with no eels is an exquisite piece of Victorian honesty.

By the turn of the century, mountaineering and alpine sports were becoming established as recreational goals for mountain visits. The mountain recreation users were from increasingly varied walks of life. The region was becoming occupied by more kinds of people than those immediately associated with pastoralism. The growth of the National Parks movement in New Zealand has demonstrated a close affinity for the mountain regions in both islands. Itself in part a response to recreational needs of society, the National Parks movement has in turn served to nurture and direct to the mountains the recreational activities of New Zealanders and visitors from overseas.

The Necessity of Planning

During the last 20 years in particular, improved access, greater wealth, greater discretionary time and perhaps the growth of genuine psychological need for wilderness contact have resulted in obvious growth and diversification of outdoor recreation in the tussock grasslands and mountain lands. The variety, the numbers, and the increased sophistication of demands for facilities now make planning essential as a means of retaining order or of retrieving it where it has already begun to decline. The need for co-ordinated planning now extends across the whole gamut of administrative designations of tussock grasslands and mountain lands whether these lands be freehold land, pastoral land, National Park, State Forest, or unoccupied Crown land. If resources were not finite, planning would be less necessary. Where numbers of people are small in relation to the abundance of resources, planning seems less necessary. But the mobility, the equipment and accessories, and the volume and variety of residues of modern man’s recreational activity compound the effect of numbers and make planning essential as a means of ensuring the public good.
Recreation and planning are uneasy bedfellows. As Clawson and Knetsch remark in "Economics of Outdoor Recreation"¹, "The distinguishing characteristic of recreation is not the activity itself but the attitude with which it is undertaken. When there is little or no feeling of compulsion or 'ought to', an activity (or inactivity) is almost surely recreation. In the modern, complex world, where so many aspects of life are socially ordered, recreation is often a major opportunity for self expression". Constraints and controls which may be designed for the public good, whether for the preservation of natural resources or for the satisfaction of other resource use objectives, continually frustrate the free self-expression which is the hallmark of recreational activity.

The Essentials of Rational Resource Use Planning

Rational planning process for any kind of resource allocation problem in a society can be logically represented as several stages. The first stage is inventory and characterisation of the resources themselves. Especially, those inherent characteristics of the resources are recorded which are likely to affect significantly their productivity or suitability for use in as wide a range of resource uses as is being considered. This record covers such features as climate, landforms, soils, stream flow and other characters of water bodies, including water quality, vegetation and animal communities. Pattern and abundance or scarcity in the occurrence of these features are recognised.

The second stage is the assessment of the productive capabilities of each of the appropriate resource parcels for each of the various uses considered. Such uses may be generic such as abstraction of water, extraction of minerals, harvesting of plant produce, harvesting of animal consumers, or utilisation of areas for construction purposes. More specific uses may be considered such as the production of pulpwood, cereal crops, wool, game meat, provision for recreational fishing, skiing, cottages or airports or simply looking at landscape.

The assessment of use capability or use suitability is not sufficient ground for recommending use in a freely competitive society nor for planning it in an ordered, co-operative society. There is more than a letter or two difference between "could" and "should". Further evaluation is essential which brings together the assessments of capability, the assessment of need for each kind of production, the alternative means of meeting such needs
and the risks, benefits and costs of different uses or use combinations. In this third stage of planning the assessment of competition, complementarity and compatibility among different uses for the same or related resource parcels is of vital importance. The worth of different allocations of resources, of using resources in particular ways, is assessed relative to one another. Finally by comparison of these several worths or evaluations priorities of resource use can be determined in accordance with the existing or developing goals of the society.

Most of these principles of resource allocation are reflected in our private and public decisions and utterances. Seldom however, are they kept in an orderly perspective, even by many involved in the decision-framing or decision-making process. “That land is good sheep country” may have been too often in the past thought sufficient reason for using it for sheep pasturage. In some cases the quoted assessment of capability has been since found to be erroneous. Even where it is not in error it is not sufficient reason for continuing to use the land for sheep pasturage when it could be of greater social worth if used for forest products, for cattle or as a nature reserve. Worth or value of land or water is not always easily calculated in dollars and cents, whether for growing wool or wood or for producing electricity. Still more difficult is the evaluation of the worth of a tree in a meadow, a homestead settled snugly in a valley, a buttercup growing in a scree. Value such things one must. Sometimes the value is found to be priceless.

Such a formal planning process as that outlined has not been employed for recreational purposes in New Zealand, although some elements of the process are evident in the working programmes of National Parks and of recent Forest Parks. What kinds of problems arise in applying the above planning process to recreation?

**Identifying Recreational Objectives**

One of the most common sources of confusion in planning for recreation, especially in areas of varied natural resources, is the non-specific character of recreation as a term describing resource use. The social objectives sought under the broad banner of recreation are immensely varied in themselves and in their environmental significance. Some recreational uses are localised, others are dispersed. Some, like photography, painting or bird-watching, are appreciative. Others, like hunting or fishing, are consumptive. Such a range of uses shows varying compatibility
of one recreational use with another. For example, jet boating may be in conflict with angling, one form of angling with another.

The social need to conserve wildlife for appreciative or consumptive use is often associated with the social need to conserve the natural environment and its life systems for their own sake. Although these two objectives are often joined they should not be confused. Some conservative uses may completely preclude recreational use. Recreating man is excluded from the Murchison mountain home of the takahē and from the limited and precarious habitat of the Castle Hill buttercup. Some recreational uses may have some conservative value for the natural environment even though they are themselves consumptive in character. Deer stalking and pig hunting in some endangered mountain forests are obvious examples. Such a paradox arises from the ill-advised fostering of new wildlife for recreational purposes in the past.

Recreational uses may conflict with other non-recreational uses. Sometimes this conflict may be one of competition for the same resource. Wildlife are hunted for meat and money as well as for the joy of the hunt. Game meat recovery and packing is at present a substantial and in many ways sophisticated industry. Whether or not it is to suffer the vicissitudes of the cray-fishing industry, the present existence of the game meat packing industry greatly influences policy development and planning for mountain soil and vegetation conservation on the one hand and for certain forms of recreational hunting on the other. Recreational uses may conflict with non-recreational uses from merely incidental use of the same resources. The problems of damage and trespass endured by high country farmers as an incidental consequence of recreational activity are not becoming more bearable as they become more familiar.

Such examples of conflict among recreation uses and between recreation and other uses can be multiplied almost interminably throughout the islands of New Zealand. That such conflicts are not unusual elsewhere is illustrated for the United States by Clawson and Knetsch⁴ and for the United Kingdom by Coppock⁵. Planning is not going to eliminate such conflict but it may assist in reducing it. In order that planning can have such an
effect recreation needs have to be interpreted specifically rather than generically before they can be allocated resources. Recreational uses must be identified in character, volume and location if harmony of people is to be achieved and if the fragile or vulnerable landscape which we have inherited is to be restored, conserved or improved.

Concern for the damage to our tussock grasslands and mountain lands resources occasioned by our pastoral history leads many to the thought that uses of a recreational character would be more conservative. The lesson we should learn from our pastoral experience is that a pattern of resource use untested in our kind of environment led to unforeseen resource destruction. We have little knowledge and little or no research concerning the recreational use capability of many of the resources at present being considered for exploitation to meet recreational goals. Indeed we have little information on the real character and impact of many recreational uses and little more than guesses concerning the volume, direction and points of impact of human traffic that will be generated by the facilities for mountain recreation currently proposed or being developed. What information is available suggests that the load of humanity may be locally even more damaging to soil and vegetation than the equivalent burden of grazing sheep. Our human propensity for discarding waste in undecomposable forms or situations makes us even more hostile one to another than is the sheep of whom it is said that his worst enemy is another of the same species. We might well guard our mountain environment from ourselves.

Multiple Use Management and Recreation

The illustrations of conflict that have been cited reflect the fact that recreation occurs in the midst of multiple use. The traditional occupiers of tussock grasslands and mountain lands have been albeit imperfect practitioners of multiple use long before the term entered our semi-technical jargon. Their present problems are also their opportunities, applying the principles of multiple use to integrate recreation into their resource use pattern. New Zealand may prosper from the analysis of experi-
ence in the forest and range lands of the United States as outlined by Clawson and Knetsch.

"Multiple use management is an important idea, with many possibilities for increasing the output of given areas of land and water; but there has also been some exaggeration and fuzziness of discussion. "Multiple use is partly a matter of the size of the area under consideration. The national forests, some other federal lands, many state forests, and much private forest and grazing land can be said to produce more than one product or service or to be used for several purposes, when the whole of each tract or body of land is considered as a unit. But often the recreation activity is largely confined to one smaller area within the larger whole, the forest harvest takes place on localised areas, the grazing is restricted to other areas, and so on. This interweaving of different uses calls for the most careful planning and management of the whole area; this is multiple use management, on this scale and in this sense.

In other cases, the same acreage or tract of land is used for two or more purposes either at different times during the year or simultaneously; this, too, is multiple use management. This latter system will become, undoubtedly, the more common practice as the demands for the various uses of the resources increase. Accomplishing this will require a thorough study and analysis of the resources and their potential and of the demand. The result will be the establishment of levels of use of the resources on various areas that represent optimum combinations of uses and not maximum production of any single use. "The economic rationale of multiple use is that the sum total of the values thus created is greater than the value from any single use — and enough greater to more than offset the added costs. Under many circumstances, this is probably true. Under any multiple use programme each user group must accept the fact that other users have an interest in the area also; and that the area is not being managed for his interest only".

It seems highly unlikely that recreational use of tussock grassland and mountain lands in New Zealand will ever be a single purpose use except on very small tracts. On pastoral land recreational uses will have to be accommodated where compatible with pastoral uses and with the conservation of the land. In forest parks and in National Parks recreational uses will have to be accommodated with the particular roles of watershed protection and the preservation of the native flora and fauna appropriate to each area. Agencies of government, particularly the Lands
and Survey Department and the New Zealand Forest Service have not been inactive in developing appropriate working plans both for land managed by public bodies and for land leased to private individuals. Such agencies face many problems in formulating such working plans. Not least among these are a shortage of highly skilled and experienced personnel in the broad field of Park and Recreation Management and Administration, and a deficiency of reliable information on the likely demand for recreational facilities and opportunities of one kind or another. In such conditions it may be very appropriate to put the introductory planning emphasis on the environment itself, its limitations to supply recreation consistent with preservation of environmental quality in a general sense. This last has so many delicate facets in the New Zealand mountains that there are serious limitations to providing safe recreational opportunities.

A further problem faces recreation planning in the New Zealand mountains, a problem of dimension or scale. New Zealand has much variety to attract various recreation uses, often in very small space. A National Park Board, for example, has a planning responsibility that extends to the Park boundaries. The effectiveness of its planning may be greatly affected by what occurs in planned or unplanned fashion on pastoral land or forest beyond the Park boundaries. Recreational planning might often be best conceived at the scale of a major river basin or broad geographic region. It is unlikely that such planning dimensions can ever be financially supported to an effective stage except as part of a multiple use programme.

Resource Use Planning for Multiple Use Basin Programmes

As it seems that recreation planning for mountain resources may have to be done in the context of multiple use planning and that such planning might be best done in the dimensions of major river basins or like areas, it would be well to review some of our recent experience in evaluating resources and planning their allocation for different uses in large mountain land areas, especially in so far as recreation planning is concerned.

Taupo

The Taupo basin has recently been reviewed as a study in environmental management7. This review traced the growth of planning, integration and co-ordination from the first concerned
action in 1954 of the local authority to preserve Lake Taupo as a national asset of great recreational significance among other values. Complex environmental problems arose not only because of the special character of the land tenure, geology, soils, vegetation and water resources of the basin, but also because of the rapid changes in resource use associated with intensification of pastoral farming, indigenous forest exploitation, exotic forest development, recreation in many forms, and hydro-electric power generation. The character of these problems was clarified only with the progress of time. Initially concerned with ways of maintaining the lake, its fishing and its immediate surroundings in natural state, planning has subsequently had to be extended to comprehend the whole basin, both for the future of the lake proper and of the basin itself. Because of the pressures for development of one kind or another and because of the pace at which developments were in fact occurring, planning often had to be pragmatic rather than truly rational in comprehensive fashion. In the assessment of the report:

"The overriding lesson from the case study is the need to obtain the basic data on which land use decisions are to be made, and then to plan in a comprehensive scale before commissioning developing work. Planning and data collection must precede development if environmental problems are to be avoided.

"Initially this formula was not followed in the Taupo basin, but because of the Taupo County Council's foresight and initiative in awakening official recognition of the existing and potential environmental problems of the basin, there is every chance now that the well-being of the basin will be safeguarded".

Waiau

Of a perhaps different character from the Taupo basin is the resource allocation debate that has waxed over the Waiau river system in western Southland. There planning had been carried out for a dominant single purpose, the generation of electricity for use in a new industrial development. The intertwined considerations of conservation of natural environment and safeguarding of resource-based recreational opportunity were prominent in opposition to the dominantly single purpose planning, initially in a campaign to "save Manapouri". The resulting debate, the hearing, enquiries and reports have served to clarify some of the early issues but new dimensions have been introduced, expanding the scope of concern and debate to include Te Anau as well as Manapouri, without as yet approaching the scale of the entire Waiau basin. Perhaps planning for recreation and conservation of natural environment has been more easily
accommodated in the Taupo basin where the major interests of central government were represented not in one departmental purpose as at Manapouri but in several objectives: land development for farming, forest development, power generation, and the administration of Maori affairs.

Waitaki

Two other major river basins in the tussock grasslands and mountain lands have been the subject of Interdepartmental Committee reports, the Waitaki and the Clutha, each arising from the projected utilization of major water resources for electricity generation. In the case of the upper Waitaki system, no formal attention was given in the report to recreational planning but noteworthy volume and quality of work was carried out to increase and improve recreational facilities and opportunities, especially at lakes created for power generation purposes in the middle sector of the Waitaki. In summary it can be inferred that recreational use capabilities have not greatly influenced the power planning decisions in the Waitaki but opportunity has been taken to exploit the often improved recreational use capabilities that have resulted from dam construction. Where existing recreational values have been adversely affected by the power generation programme some efforts have been made to mitigate such effects.

Clutha

The report on hydro-electric development effects on the Clutha valley goes much further along the lines of rational resource planning than any of the earlier electricity generation proposals. The report illustrates some features of the orderly process of resource use planning that have been outlined earlier, although these principles and stages are not clearly defined in the easily read presentation of the report. The process of resource use planning thus begun is still far from complete, especially in evaluation of different resource use combinations. Confined in the main by its terms of reference to the floor of the valley, the Interdepartmental Committee in its published report gives little sign of genuine evaluation of the different combinations of land and water resource uses that would be possible in the whole region subtending the Clutha River system were one or other of the hydro-electric proposals to be put into effect. Attention has been given in the Clutha valley report to effects on wildlife as a recreational resource, to effects on travel and settlement,
and some summary attention to landscape interference. The wider issues of recreational value of small lakes or big lakes, or flowing water or still water, of dry or flooded tributary valleys all need more thorough assessment. So also must be assessed what the power proposals mean to the future development of existing recreation uses and to the development of new overall patterns of agricultural and pastoral use.

The Interdepartmental Committee recommends an early decision “as to the way in which the river will be developed for power” to allow people and local authorities to plan for the future with confidence. It would seem of equal if not greater importance to come to an early decision as to the way in which these regions will be developed for people. For that decision the report is inadequate.

To assert that the published Interdepartmental Committee report on the Clutha is an inadequate basis for the development of the regions surrounding that river valley does not imply that other considerations are more weighty than power generation. Power generation may or may not be the most important or dominant consideration for the people of New Zealand. It may be only a minor consideration for the people of Otago. Even were it conceded that electricity generation is to be a dominant use in the upper Clutha, for example, the worth of any planned pattern of resource use for the people of New Zealand cannot be evaluated by reckoning the value of the dominant use and taking some notice of side effects on associated resources. The upper Clutha region is already historically dedicated to a complex pattern of multiple use of some resources and of varied use of some other resources. Agricultural and recreational developments of various kinds are at present altering the existing patterns of resource use. The scene is in many ways comparable to that experienced in the Taupo basin except that the many land resource use purposes in the upper Clutha are represented by a range of private citizens rather than by land developing Government departments. An adequate assessment of the true worth of power generation proposals in this context must also estimate the value of the real or probable resource uses of the region as affected by the proposals. It should be emphasised that such effects on other resource uses may be positive as well as negative. In neither recreation nor in agriculture will the resources affected be confined to lands and waters directly affected by dam buildings and related events.
Waimakariri

The integrative exercise in resource evaluation and use planning that was carried out for the Waimakariri basin\textsuperscript{10} gave little attention to the planning of recreation, although it was noted that future recreational use would probably increase. That report emphasised that recreation development must not be allowed to conflict with watershed protection function. The present report\textsuperscript{11} shares some of the deficiencies of its predecessors for other basins even if it has the virtue of considering recreation in its own right, as a claimant for resource allocation. It has faced the problem of estimating the character and size of recreational demand. It has not solved this problem but foresees some solution in sociologic and economic research. It has faced the problem of dimension or scale, recognising that the Castle Hill region cannot be isolated in consideration from the upper Waimakariri. Nor perhaps can it be held aloof from the upper Rakaia. It has faced the problems of the environment itself and while it fails to arrive at complete solutions to the problems of providing accommodation facilities for recreating man, it accepts the constraints of the environment in formulating a pathway to reach such solutions. It acknowledges the variety of recreation and the reality of multiple use. Accordingly it does not propose allocation of resources to recreation until the specific goals of recreation are known and it takes account of other resource uses in considering possible localities for the development of recreational facilities and in estimating the tolerable size of such developments. No attempt has yet been made to assess quantitatively the worth of the resource uses affected by the suggested recreational developments nor even of the recreational developments themselves.

Recreation and agricultural developments may interact positively as complementary uses in certain sectors of the tussock grasslands and mountain lands just as hydro-electric developments can be planned or sometimes adapted to provide recreational benefits of great magnitude. In the present instance of the Castle Hill area, it is conceivable that without recreational development the present little-developed pastoral enterprise may wither in the face of further worsening of wool prices. Conversely it is evident that recreational satisfaction will be safeguarded or enhanced by ensuring vigorous imaginative agricultural development of shrewdly chosen land areas in the locality. Not least in this respect is the maintenance of the charm of the present Castle Hill scene for the significant number of people whose recreation is principally driving for pleasure.
The landscape analysis employed in this study for the first time in New Zealand is unashamedly the subjective appraisal of a professional landscape architect. The analysis is not the less real because it retains the personal stamp of the interpreter. Quantitative elements have been introduced into the evaluation of the visual and cultural landscape by overseas landscape architects such as Zube. The application of such elements to the Waimakariri landscape is not likely to subvert the evaluation already reached.

The particular areas of scientific and biological resource conservation interest at Castle Hill are identified in this recreation study as well as the areas of special landscape quality. Some suggestions are made for the creation of a sanctuary area to be buffered by a peripheral zone of probable recreational value. In general, the problems of tenure affecting availability of particular areas for planned use have not been dealt with in this presentation except in outline. In this as in other matters the report acknowledges that the planning process is still far from complete.

Measures of Success in Recreation Planning

Success in planning pastoral land use might be measured in the eventual flow of pastoral produce consistent with the condition of the resources. Success in planning a highway might be measured in the proportion of safe and satisfied arrivals. Success in planning recreation can seldom have such simple criteria. For resource-based recreation planning success can be measured at a primary level by the joint fulfilment of several criteria:

1. the rigorous preservation of the quality of the environment;
2. the maintenance of flexibility so that free choice in recreation goals can be exercised consistent with the preservation of quality of the environment;
3. the integration of recreation in multiple use systems so that recreation can be enjoyed in living cultural or natural landscapes with concomitant value from other products and services;
4. sufficient spatial dimension of planning to allow for the "stepping stone" behaviour of recreationists without harmful effects in adjacent areas.
To meet such criteria planning policies and procedures may well have to be revised for all manner of resource use objectives in the tussock grasslands and mountain lands. We may well be obliged, by force of our own circumstances, to adopt the principles concerning resource planning policies and procedures agreed to by the four major departments of the United States Government concerned with resource planning.  

With such principles as a guide we shall probably do well to remember that the end of planning is making and doing, not planning. Aaron Wiener has demonstrated for undeveloped countries the appropriateness of what he calls cybernetic-biological models for planning development of resources rather than the classical or mechanistic models of developed countries. His reminder that even developed countries contain "islands of underdevelopment" is appropriate to our tussock grasslands and mountain lands. Our planning can well have its perfectionism of principle tempered with a pragmatic-activist approach. We should not assume on the one hand that we have sufficient self-regulating mechanisms in our socio-economic structure to make the classical planning model work, limiting the development programme "to its heavy engineering aspects and their direct economic implications, adopting a passive laissez faire attitude to all other essential programme elements". On the other hand we should be wary of the blandishing digital computers that make mechanistic models so appealing. Wiener cites the philosopher Alain:

"These people with set ideas, whom I propose to call idealists, were convinced that an enterprise in which everything had been foreseen had to succeed; results surprised them without teaching them anything. They readily realized that something was lacking in their fine schemes; and they therefore devised some new project in which, this time, nothing was missing; nothing was missing, in fact, that human foresight could provide. But real events, those that face us in real life situations, are made up of a myriad of details that nobody can fully predict".
Literature Cited


Light Weight Insulated Hut for Inaccessible High Country

C.W. Duck
Deputy Chief Soil Conservator,
Marlborough Catchment Board.

For the past eleven years the Marlborough Catchment Board has been involved in tree planting and associated works for the stabilization of severe soil erosion between 3,000 and 4,800 feet above sea level in the Wye Catchment. This work, on behalf of Soil Council, has primarily been carried out from a hut built by the Board at 2,600 feet. The hut is situated beside an all weather 4 wheel-drive track and serves an area of 1,300 acres. Primary work in this area is now nearing completion but further work remains to be done within the catchment. Particularly in need of remedial work is a large basin known as the “Turkeys Nest” lying between 4,000 and 6,000 feet and of some 400 acres in extent. The Turkeys Nest is very severely eroded and requires almost total revegetation.

Roading into the area is completely out of the question on the grounds of cost and practicability. To walk into the basin from the nearest road takes six hours, and from the nearest hut (New Zealand Forest Service) 4½ hours. At this altitude camping out for extended periods is neither practical nor safe.

A hut in the “Turkeys Nest Basin” with work staff based there for three to four weeks during the planting season and during checking etc. in the summer seemed the most practical answer. A suitable site for such a hut existed at 4,200 feet.

The proposed hut had to fulfil the following requirements:
1. Light weight — for helicopter lifting.
2. Capable of rapid erection in case of weather deterioration during erection.
3. Capable of being dismantled and removed easily once work at site is completed.
4. Well insulated.
5. Of sufficient size to house four men with a fifth for short periods.
6. Compact — as suitable sites limited in extent, and to minimise wind resistance when helicopter lifting.
7. With 6. in mind — be reasonably congenial to live in, as space would be a premium.
8. Preferable if such a hut could be built locally, allowing transport costs to be kept to a minimum and to allow for consultation during construction.
Glenroy Products, of Blenheim, a firm which has been making freezer panels, freezer truck bodies and insulated housing panels since the early 1960s were approached and were most helpful during both the design and latterly during construction.

The final size and type of construction chosen were:

**Internal Measurements** — 13'6" x 9' x 7'6" high at roof apex.

**Construction**

*Walls and Roof:* Outer skin aluminium, inner skin formica backing veneer, core 2" polystyrene foam.

*Floor:* Outer skin formica backing veneer, inner skin plywood, core 2" polystyrene.

*Weight:* Hut in two equal halves each section weighing no more than 700 lb (including fittings).

*Lifting and Tying Points:* Eight lifting points per half section (four at floor and four at roof line), same to be utilised for tying down the hut when on site.

*Cooking Facilities:* Gas was chosen as the means both of cooking and heating, as no ready supply of wood handy. Cleaner, quicker, and the safest from a fire risk point of view — although certainly not the cheapest method.

*Fittings:* Manufacturers to supply twin metal bunks, mattresses, sink and bench (with water tap and waste pipe), table and chairs, spare bunk (to double as seat bench and storage cupboards), gas stove, lino for floor covering. Cupboards above and below the sink and between bunks.

**Erection:** At 7 a.m. six men together with the perishable stores, loose hut fittings and trees for trial planting arrived at the lift off point at 3,000 feet some two air miles from the hut site. All men and stores were lifted on to the hut site by 8 a.m. and final tying down of the bearers and stacking of loose stores commenced. The site had been blown, levelled and bearers laid in an earlier operation.

The hut which had been towed on a 16 foot trailer was lifted from a pad (900 feet a.s.l.) beside the main highway some 7½ air miles from the site.
The first section was easily swung into place on the bearers at 9 a.m., and the second section, at 9.45 a.m. Seven hundred pounds as a load appeared a little on the heavy side and with lift conditions not ideal the Bell helicopter had to do a certain amount of searching about to find lift. Some modifications to the lifting points might be required in future as the second half spun badly beneath the helicopter.

By 11.45 a.m. both sections were levelled and bolted together, the hut partially tied down, water disposal pipe fitted, water supply started and the prefab latrine erected. At this point the helicopter picked up two men and they returned to Blenheim. It was anticipated that six men would be required to position the hut. In fact four could have managed.

By 2 p.m. both water and gas were laid on and by 6 p.m. the hut was fully tied down, joints sealed, all stores put away, the site tidied up and a trial plot laid down.

**General Comments**

*Insulation*: In November 1971 two nights were spent in the hut during moderately heavy frosts. The gas heater proved unnecessary, as the stove used during cooking proved more than adequate, and even during the night with one window open the hut was warm. Condensation on the windows was considerable and adequate let out points for this are essential.

*Gas Cooking Facilities*: Clean and easy but somewhat slow and it would appear that some adjustments to the gas flow at this altitude are required.

*Storage Facilities*: Good — confined space makes for tidiness!

*Size*: Adequate.

*Finish*: Very high standard.

*Total Cost*: Includes all labour and transport:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site preparation</td>
<td>221</td>
</tr>
<tr>
<td>Hut erection</td>
<td>457</td>
</tr>
<tr>
<td>Hut</td>
<td>1,936</td>
</tr>
<tr>
<td>Water and Waste Disposal</td>
<td>49</td>
</tr>
<tr>
<td>Latrine (prefabricated) &amp; outside storage</td>
<td>56</td>
</tr>
<tr>
<td>Gas Bottle and outside insulated cabinet for same</td>
<td>80</td>
</tr>
<tr>
<td>Gas heater</td>
<td>57</td>
</tr>
<tr>
<td>Cooking utensils etc.</td>
<td>69</td>
</tr>
</tbody>
</table>

$2,925
In the breeding herd, either stud or commercial, the cow has a very small part to play in improvement and a big part to play in efficient production. She should have two main uses—to produce a live calf regularly, and to wean it to a high weight. She is in point of fact, if the farmer has a constructive breeding plan, just a gestation medium for the superior sires purchased.
What must be remembered is that the cow only produces one calf per year and no matter how superior that calf may be, unless it is a bull and can be used, it has little part to play in lifting the herd performance.

All the improvement then must come from the sires. With their multiplicity of offspring they control not only the kind of improvement or deterioration, but also its extent. Present casual methods of beef rearing have proved to be of little value in raising production. It has been estimated that the average daily liveweight gain for beef herds in New Zealand is approximately 1.5 lb per day. In America each 1 lb of liveweight gain is being produced from 8.1 lb of dry matter. The estimated biological limit (again American) is a 4 lb gain per day for a dry matter intake of 5 lb for each 1 lb of liveweight gain.

Had farmers and stud breeders endeavoured to make more money from their herds by buying bulls that would improve them we would be a lot nearer the biological limit than we are today.

What then should be the criteria for bull selection to prevent deterioration and begin improvement. A decision must be made as to what characteristics are needed to raise production. There are only two main factors in beef production. These are:

(a) Fertility, or get a live calf upon the ground;
(b) Growth rate, or how fast the calf will grow through to a saleable weight.

These are, luckily, two factors which are easily measured and bulls should not be purchased without details of this performance.

Not only should the sires be selected from a plane of nutrition similar to that on which they are to perform, but also from studs with something constructive to offer in breeding for more efficient production. Such practices as foster-mothering, rearing on hard feed, changing environments of inferior bulls in an effort to sell them, is not only detrimental to improvement but disastrous for the breed as a whole.
The amount of progress in a herd is governed by two factors:

(a) The selection differential, or how far above the population average in growth rate the bull is;

(b) The generation interval, or how quickly a bull can be used and replaced.

For every year that a bull is used his progeny remain genetically static. Also the more he is used the greater effect he has upon the total lifetime production of the herd. In a single sire herd of 30-40 cows, one bull sires the complete calf drop whereas each cow only has one calf. If the bull is used for three years then he would sire the equivalent of a generation.

Can you then afford not to use measured standards of performance for the sires you use, rather than as at present basing your selection upon the rather airy fairy eye appraisal, which although probably not particularly harmful is most certainly of little value.

Conclusion

As fertility and growth rate are the two most important factors, and both can be measured, then figures should be demanded with every bull purchased.

The sire of the future will be expected to raise the production of the herd from the present New Zealand average of 1.5 lb per day on 8.1 lb dry matter per 1 lb of liveweight gain to 4 lb per day on 5 lb dry matter per 1 lb liveweight gain. Or look at it another way—instead of having to wait 23 months for our 1,000 lb liveweight finished animal (540 lb carcass weight), it can ultimately be grown in 8½ months. If present methods of selection were correct and constructive then we would already be at our aim of 4 lb per day liveweight gain.

A lino cut of the rare Castle Hill buttercup reproduced on page 76 of Recreation in the Waimakariri Basin by J. A. Hayward and F. D. Boffa is the work of Dunedin artist Dr Gary Blackman. Dr Blackman has supplied the Institute with reprints of the lino cut which are for sale at the nominal price of $5. Proceeds will be donated to a fund devoted to the protection of the natural environment. Enquiries for this fine work of art are welcomed. —Ed.
In this study the authors have approached the problem of fitting recreational development into this mountainous countryside of high scenic, recreational and amenity value by placing emphasis on the constraints imposed by the environment itself; the condition, quality, variety and present uses of the land.

RECREATION IN THE WAIMAKARARI BASIN: Illustrated pp. 140.

P.T.O.

51
RECREATION in the WAIMAKARIRI BASIN

J.A. Hayward and F.D. Boffa

The Director,
Tussock Grasslands
and Mountain Lands Institute,
P.O. Box 56,
Lincoln College,
Canterbury,
New Zealand.

Dear Sir,

I would like to purchase ... copy/copies of the above publication for which my cheque/postal note of $NZ ... is enclosed.

Kindly post to:
Print Name:
Address:

Yours faithfully,

Signature
Date
Shed Preparation Guidelines for Wool

R.A. Bonifant
New Zealand Wool Board

Amongst wool growers and the wool trade generally, wool preparation has always been a very controversial subject. Growers over the years have tended to receive conflicting and confusing advice with the result that probably few growers have a really clear idea of the levels of preparation which are appropriate for the kinds of wool they produce. The high cost and the difficulty of obtaining suitable shed labour, coupled with the apparent indifference of wool buyers to paying more for well prepared wool as opposed to the less well prepared, has caused many farmers to question the necessity for any preparation at all.

It is with this background that the Board has recently issued ‘Shed Preparation Guidelines’ to all wool growers. Fine wool growers will have received copies of these guidelines in early April and will therefore be familiar with the details of the guidelines as they apply to Merino, Halfbred and Corriedale wool.

Background to the Guidelines

In July, 1970, the Wool Board set up a small committee to make recommendations on the application of standards for New Zealand wool. At that time the Board decided that some of the early work which had been undertaken by the Wool Research Organisation under Dr Ian Fraser, in collaboration with the New Zealand Woolbrokers Association, should be carried a stage further.

This committee, called the Wool Board Standards Committee, comprised executive staff of the Woolbrokers and Woolbuyers associations, Wool Research Organisation, the Wool Board and Wool Commission. The committee undertook two areas of work:

1. Firstly, during the early part of 1971, trials with the Woolbrokers Association were conducted at auction sales using small-samples and objective measurement. These trials indicated that:
**IEOW PREPARATION GUIDELINES**

**HOW TO USE THESE CARDS:**
These cards should be hung in a prominent place on your woolshed wall. The first thing to decide is the style description that applies to the bulk of your clip. The style descriptions are set out below and the bulk of your clip should fall into one of these categories. If you are unsure of the style description that applies, consult your Woolbroker, Wool Merchant or Sheep and Wool Inspector.

Having determined the style into which the bulk of your clip falls, the guidelines for sorting and grading according to that style should be followed.

In general, wools of 48-50's and finer require careful preparation and should be handled by an experienced classer. However, wools 48's and stronger can generally be bulk prepared without needing the services of a classifier. Where possible, farmers should draft sheep before shearing so that different breeds, or widely differing fleeces and lengths, are not mixed during shearing. Drafting in this way will greatly assist subsequent preparation.

### Descriptions of Style

**EWE, WETHER & HOGGET BODYWOOL**

<table>
<thead>
<tr>
<th>Good to Super</th>
<th>Good</th>
<th>Average</th>
<th>Poor (Fleeces and staples over 8 inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free from all discoulorsation (remove all yellow and persiant), well skirted (remove necks, bulky and short pieces, bellies, locks, and backs containing vegetable matter), free or practically free from vegetable matter.</td>
<td>Only slight discoulorsation (remove definite yellow and persiant), well skirted (remove necks, bulky and short pieces, bellies, locks, and backs heavily contaminated with vegetable matter), may be slightly weedy or tender but free from definite vegetable matter.</td>
<td>May contain slight vegetable matter.</td>
<td></td>
</tr>
<tr>
<td>May be generally discoulored, unskirted (remove bellies and locks), any wool heavily contaminated with vegetable matter. As above but bellies may be included.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LAMBS’ BODYWOOL**

<table>
<thead>
<tr>
<th>Good</th>
<th>Average</th>
<th>Inferior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free from all discoulorsation, even in both length and fineness. Free from vegetable matter.</td>
<td>Fair colour (without any heavily discoulored wool, free from very coarse or laspe wools, may be lightly contaminated with vegetable matter.</td>
<td>May contain discovered wool and or vegetable matter. Remove splice stains and doggy wool.</td>
</tr>
</tbody>
</table>

### CRUTCHINGS

<table>
<thead>
<tr>
<th>Good</th>
<th>Average</th>
<th>Inferior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free from nearly free from discoulorsed wool, free from vegetable matter. Uniform in length no eyecaps.</td>
<td>May contain some discoulorsed wool and or slight vegetable matter. No eyecaps.</td>
<td>May contain discovered wool and or vegetable matter. Free from pieces, clips and doggy wool.</td>
</tr>
</tbody>
</table>

**SHED PREPARATION GUIDELINES**

**MERINO, HALF-BRED, CORRIDALE AND FINER CROSSBRED—48/50’s and finer**

**SKIRTING**

Full length and early shorn. At average and better style wools must be fully skirited.

- **Good to Super:** Remove necks, pieces and staples to obtain even colour in fleeces. Locks, second pieces and puzzle or persiant wool must be kept separate.
- **Good and Average:** Remove bellies, locks, second pieces and stained wool. No skirts required but locks, second pieces and stained wool should be kept separate.
- **Poor:** In the preparation of second shear bodywool the principal factors are length and colour. If possible, remove drums, bellies and short discoulored wool on the board. The bodywool should then be picked over on the table and then, preferably, taken to a heap on the woolroom floor for checking and binding before pressing.

**GRADING**

Full length and early shorn.

- **Good to Super:** Remove cots, yellow fleeces, heavily conditioned and excessively fluffy fleeces and any wool obviously affected.
- **Good and Average:** Remove any heavily discoulored wool (pieces and bellies) and very short or very long wool.
- **Poor:** Remove doggy pieces and wool which obviously does not conform with the bulk.

**FINENESS AND LENGTH**

**Full length and early shorn**

Guidelines for classifiers are printed at the foot of this card.

**SECOND SHEAR**

These wools require less precise grading than full length or early-shorn bodywools. The following categories are adequate:

<table>
<thead>
<tr>
<th>Fineness</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merino, Half-bred, Corridale and Finer Crossbred</td>
<td>52/56’s</td>
</tr>
</tbody>
</table>

**GUIDELINES FOR CLASSERS**

**FINENESS** normally, the clip will fall into three grades of fineness. Where there is a wide variation a larger number of fineness grades will have to be made. As a guide to classifiers, the following descriptions and quality numbers apply:

<table>
<thead>
<tr>
<th>Merino and Quarterbred</th>
<th>Medium Merino</th>
<th>Strang Merino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Merino</td>
<td>64’s to 70’s and finer</td>
<td>64’s to 66’s</td>
</tr>
<tr>
<td>Medium Merino</td>
<td>64’s to 66’s</td>
<td>60’s to 68’s</td>
</tr>
</tbody>
</table>

**LENGTH**

Provided that obviously long or short wools are separated from the bulk, most clips will fall into one of the following length brackets:

<table>
<thead>
<tr>
<th>Length</th>
<th>Fineness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>6 to 9</td>
</tr>
<tr>
<td>Medium</td>
<td>9 to 12</td>
</tr>
<tr>
<td>Long</td>
<td>12 to 15</td>
</tr>
</tbody>
</table>

For information, contact your Woolbroker, Wool Merchant or Sheep and Wool Inspector.
(a) The small (25lb) sample represented a far too radical change from the conventional showing for buyers to adjust easily;
(b) The methods of sampling used did not easily fit into some woolstore routines;
(c) The costs of objective measurement, especially yield measurement, were greater than the immediate savings in the reduced display.

2. Secondly, after these sale-by-sample trials were completed and in still considering how standards could be applied to the wool clip, the Standards Committee decided that minimum standards of wool preparation in the shearing shed were desirable as a first step towards a national system of classification.

Accordingly these minimum standards of preparation were recommended to the Board to be issued as ‘Shed Preparation Guidelines’ to growers. These guidelines were prepared by a small group of men with wide practical experience. In addition the views of a wide section of the woolbuying trade were sought.

However the Board considered that if guidelines were to be issued these should come from a body fully representative of the industry. Accordingly a meeting was convened at the beginning of December last year to which all sections of the industry in New Zealand were invited. This meeting agreed that the guidelines should be disseminated to growers and the various organisations represented undertook to support the guidelines and to canvas their members.

**Minimum Cost to Woolgrowers**

The Board considers that the guidelines satisfies the criteria of a minimum cost to growers, at the same time meeting present marketing requirements.

Broadly the guidelines deal with the clip in two categories:
48/50’s and finer,
48’s and stronger.

It is into this latter category of 48’s and stronger that 70 percent of the New Zealand clip falls. Generally the guidelines advocate careful preparation by competent classers for the 48/50’s and finer group but for 48’s and stronger a level of preparation is advocated which will not generally require the services of a wool classer.
Crossbred – 48’s and stronger

SKIRTING

Full length and early shorn

Good to Super

1. Remove neck, cheeks and beard. The body wool should be kept separate.
2. Remove any heavily discolorated wool (pieces and balled wool) and any short or very long wool.
3. Remove any obviously short or long fibres which do not match the bulk for length.
4. No grading required.

GRADING

Full length and early shorn

Good to Super

1. Remove cots, yellow fibres, excessively dusty fibres, and any obviously short or long fibres which do not match the bulk for length.
2. No grading required.

FINENESS AND LENGTH

Full length and early shorn

FINENESS

1. All wool of Good to Super quality should be separated into at least two fineness brackets and this will require an experienced classifier.
2. However, providing the grading guidelines have been followed, Good, Poor and Interior style clips will not require further separation. These clips will normally fall into one of the following fineness brackets without any further attention.

LENGTH

1. Providing that obviously short and long wool have been removed from the bulk, second shears (body wool) will normally fall into one of the following length brackets:

Second shear

- 10 to 15 mm
- 15 to 20 mm
- 20 to 25 mm
- 25 to 30 mm
- 30 to 35 mm

Note: Where there is insufficient wool to produce a suitable length even in both fineness and length, the wool should be sent forward for specialised classing.

FINENESS AND LENGTH

Guidelines for classifiers are printed at the foot of this card.

FINENESS

1. Wool should not be mixed with wool of a different fineness.

GUIDELINES FOR CLASSES

FINENESS

Merino and Quartered

- Fine Merino: 64/73’s and finer
- Medium Merino: 64’s and 60/64’s
- Strong: 58’s and 56/58’s

Halfbred and Corriedale

- Extra Fine: 58/60’s and finer
- Fine: 56/58’s and 54/58’s
- Medium: 58’s and 54/58’s
- Strong: 50/54’s and 52’s
- Extra Strong: 50/54’s and 52’s

CRossbred (including Paradeal)

- Extra Fine: 54/56’s and 52/54’s
- Fine: 50/52’s and 46/50’s
- Medium: 44/48’s

LENGTH

Providing that obviously long or short wools which do not match the bulk have been removed, crossbred hogget clips will fall into one of the following length brackets. However, shorn hogget clips are frequently very mixed in length and particular attention is required to ensure the presentation of uniform lines.

- 1 to 1 1/2
- 1 1/2 to 2
- 2 to 3 1/2
- 3 1/2 to 5
- 5 to 10
- 10 or more

Hogget clips require careful preparation and should be priced when a comparison in length is necessary to produce wool of a uniform quality even in both fineness and length. Where there is insufficient wool to produce a suitable length even in both fineness and length, the wool should be sent forward for specialised classing.

Note: The term ‘Halfbred Hogget’ refers to hoggets which have been shorn as lambs.

Woolly and Shorn Hoggets – All breeds

SKIRTING

All average and better style wools must be fully skirted.

Good to Super

1. Remove necks, pieces and second or older wools of every colour from the body, and any obviously short or long fibres which do not match the bulk for length.
2. No grading required.

GRADING

Good to Super

1. Remove cots, yellow fibres, excessively dusty fibres and any obviously short or long fibres which do not match the bulk for length.
2. No grading required.
In effect the guidelines do not advocate any sweeping changes and the majority of farmers throughout New Zealand would be already preparing their wool in accordance with the guidelines. *This is especially true of fine wool growers to whom the guidelines will simply appear as normal practice.*

However, some growers will be able to quote specific examples where wool prepared according to the guidelines has not paid or has actually cost money. The Board cannot say that if growers prepare their wool according to the guidelines, they will always receive a higher nett return. So long as wool is sold under the auction system, premiums and discounts will be obscured and anomalies will occur. What the Board *can say* is that:

1. The guidelines are straight forward and represent a minimum amount of work and cost to woolgrowers.

2. They have been agreed to and have received the support of the wool industry organisations in New Zealand. There has never been this agreement before.

3. The guidelines advocate a minimum amount of handling, consistent with present trade requirements. They have been formulated in an effort to reduce to a minimum the amount of handling required at the overseas mill.

4. It can be expected that if the majority of growers prepare their wool according to the guidelines, the wools which do not conform will be obvious to the buying trade.

5. Farmers over the years have tended to receive conflicting advice on wool preparation. These guidelines should clear up this confusion.

6. The guidelines are a national operation in an effort to get uniformity of shed preparation throughout the country. *It is this uniformity which will form the basis for any improvements in marketing.* As these guidelines have been agreed to by the industry in New Zealand they are immediately applicable in the preparation of our wool.
LAMBS BODYWOOL

In the preparation of lambs' wool the principal factors are length and colour. It is possible to remove, diggs, bellies and short discoured wool on the board. The body wool should then be checked over on the table and, preferably, taken to a steamer on the woolmarket floor for checking and blending before pressing.

**Colour**

If the bulk of the body wool is of good colour, then from all discouresions remove all discoured wool from the bulk line. If the bulk of the body wool is of fair colour (containing light discouresion) remove only the heavily discoured wool from the bulk line. If the bulk of the body wool is of poor colour (heavily discoured) remove only pieces of the transferred wool and denuy wool from all lines. Purges and rubber rings must, without exception, be separated.

**Length**

It is necessary to produce uniformity of length within the bulk line. Provided that obviously short or long wools are removed, the bulk line should fall into one of the following length brackets:

- **Inches**
  - 3½ and up: 95 and up
  - 3½ to 3: 65 to 85
  - 3 to 2½: 45 to 65
  - 2½ to 1½: up to 40

- **Finesses**
  - It is essential that wools of widely varying fineness (e.g. Southdown, Hubbard and Crossbred types) be separated. This can best be achieved by grading before shearing. All bristle and coarse lustre wools should be removed. It is important even in cases where main lines are composed entirely of Crossbred wools.

The wool should then fall into one of these fineness brackets:

- Southdown and Southdown Cross: 56/58's
- Halfbred and Corriedale: 56/60's
- Crossbred (including Champion-Perendale): 60/64's

**Lambs Pieces and Bellies**

Remove pieces-stained, heavily discoured fibres and denuy wool from all lines. Purges and rubber rings must, without exception, be separated.

CRUTCINGS

Uniformity in length is necessary in all cases of discouresion. Remove eye, extra-stained and denuy wool from the bulk. Discoured wool should be picked from good colour wool. The out should then fall into one of the following styles:

- **Good**
  - Free or rarely free from discoured wool, free from vegetable matter. Uniform in length. No eyecasts.

- **Average**
  - May contain some discoured wool and/or slight vegetable matter. No eyecasts.

- **Inferior**
  - May contain discoured wool and/or vegetable matter. Free from eyecasts and denuy wool.

OFFSORTS

All offsorts from both fleeces wools and oddments must be kept separate from the main lines. They should be packaged in hedges or bales with pase divisions between them. A specification of the contents should be sent forward with the wool.

ODDMENTS

**Skirtings from Full Length Wools**

- **Neck**
  - All neck flax containing excessive vegetable matter, particularly heavy grass contamination, from the main line. Uniform length should be maintained by the removal of obviously short wools.
  - **Bulky pieces**
    - Short pieces and locks must not be included in the main line. Remove all heavily discoured, excessively muddy and dirty pieces.
  - **Bellies**
    - Remove all short, heavily discoured wool, including fringes, and remove excessively muddy and flat-stained wool.

- **Second pieces**
  - Remove, and excessively muddy wools.

**From Early Shorn and Second Shorn**

- **Necks**
  - Remove necks containing excessive vegetable matter from the main line.

**Bellies and pieces**

- Remove heavily discoured wool including fringes, and remove excessively muddy, doggy and flat-stained wool.

**Second pieces**

- Remove, and excessively muddy wools.

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**SHED PREPARATION GUIDELINES**

**Lambs wool, Crutchings, Offsorts and Oddments**

---

**Down, Down Cross and Cheviot**

As many of these wools contain black or grey fibres which may severely affect their sale value, all fleeces containing offending fibres should be removed.

**SKIRTING**

Except in interior style wools, remove all pieces and bellies. Larks and pinze staps must not be included in any of the pieces and bellies.

**GRADING**

- **GOOD**
  - Remove discoured, heavy conditioned fleece and fleeces containing vegetable matter.

- **AVERAGE**
  - Remove discoured and heavily conditioned fleece and fleeces carrying excessive vegetable matter.

- **INFERIOR**
  - No grading required.

**FINESS AND LENGTH**

- **Finesses**
  - These wools should be divided into the following fineness brackets:
    - Extra Fine 56/60's
    - Fine 52/56's and 48/52's
    - Medium 46/50's

- **Length**
  - **Good**
    - Reasonably even length must be obtained.
  - **Average**
    - Remove any fleeces not consistent in length.
  - **Inferior**
    - No division for length is required.

**Finesses & Length**

- **Fineness**
  - These wools should be graded into the following fineness brackets:
    - Extra Fine 56/60's
    - Fine 52/56's and 48/52's
    - Medium 46/50's

**Paper Felts**

- These wools should be prepared by a competent classier. As well as reasonably good even length, absolute smoothness and bleakness of staple is essential. Generally, good colour and freedom from seed or burs is required. However, very slight vegetable fault and slight discouresion may be permitted provided the fleeces are well grown and absolutely sound.

**Skirting**

- Complete removal of all necks, pieces and bellies is essential. Looks, second pieces and pieces or persamed wool must be kept separate. All back wool containing vegetable matter should be removed.

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**SHED PREPARATION GUIDELINES**

**Down, Down Cross and Cheviot**

---

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- **GOOD**
  - Remove discoured, heavy conditioned fleece and fleeces containing vegetable matter.

- **AVERAGE**
  - Remove discoured and heavily conditioned fleeces and fleeces carrying excessive vegetable matter.

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Education Programme

During the week before Easter and prior to the guidelines being mailed to farmers, the Board held meetings in each of the wool selling centres to explain the guidelines to representatives of Federated Farmers, Young Farmers Clubs, Sheep and Wool Instructors, brokers, merchants, scourers, shearing contractors and registered shed classers. These were not intended as growers meetings but were rather meetings to explain the guidelines to the people involved in advising growers on woolhandling. The Board hopes that through the active support and co-operation of these people the guidelines will have an impact on growers generally. If any growers are unsure as to how the guidelines apply to their particular clip they should consult their woolbroker, wool merchant or Sheep and Wool Instructor.

Preparation of Fine Wools

Having explained the general background of the ‘Shed Preparation Guidelines’ it is now proposed to review some of the main points that apply particularly to the preparation of fine wools.

In August of last year a meeting was held in Timaru between fine wool growers, wool brokers, wool buyers and the Wool Commission, to discuss the handling and classing of fine wools. This meeting was organised by the Wool Board’s Standards Committee at the instigation of the High Country Subsection of Federated Farmers, and was held before the ‘Shed Preparation Guidelines’ were finally agreed upon. The woolbuyer representatives present at the meeting currently purchase a large portion of the New Zealand fine wool clip.

The most important point that arose at this meeting was the continuing need for very careful preparation of New Zealand’s finer wools, as is now being advocated in the ‘Shed Preparation Guidelines’.

The selection of raw material by textile manufacturers depends on the profitability of using those materials, and there is always a danger that end users will walk away from wool, or any other raw material for that matter, because of technical difficulties in manufacture. In the past, mills overseas have employed large numbers of skilled sorters, but due to high labour costs these mills are now doing very little sorting to the
extent that perhaps only about 5 percent of offsorts would be removed from a bulk line, according to the type of wool being processed. Manufacturers are therefore looking for ready made lines of wool suited to their requirements and which need little or no additional handling. Consequently careful preparation of fine wools is even more important and necessary than in the past. Fine wools should therefore be classed by brokers or competent shed-classers as specified in the guidelines.

The principal factor looked for by woolbuyers and the Wool Commission when valuing fine wool clips is uniformity throughout a line particularly uniformity of length, quality number and colour. The importance of length uniformity was stressed at the meeting in Timaru as fine wools are purchased on very exact length limits. Similarly uniformity of quality number throughout a line was considered very important and although it is not necessary to class to a straight 58’s, 60’s or 64’s etc., a line should fall into a single quality bracket of 58/60’s, 60/64’s, 64/70’s etc. One of the buyers present at the meeting buys for a large local mill. He emphasised that he could not buy unskirted clips and his purchases could only contain very, very light seed of up to 1 percent.

The Wool Commission take account of preparation when valuing prior to a sale. For instance if lengths are mixed in a line of fine wool the Commission take into consideration the likely cost of sorting, and their valuation is correspondingly lowered. Therefore less monetary protection is given to the offending grower at auction.

Demands by manufacturers are more exacting than ever and consequently careful preparation of fine wools is now even more important and necessary than in the past. Fine wool growers should therefore maintain their traditionally high standards of wool preparation, as apparel wools, unlike carpet wools, require close specification and therefore good classing by competent woolclassers.
Shooter W. Randall about to harness up as pilot K. Naylor lifts off. In its bracket is an FN 7.62 mm (.308 in.) self-loading rifle. (Photo: D. Osmers).

Venison Recovery
D. Osmers
Wanaka

The first shipment of venison was sent away in 1959. This was a trial run with only the best hindquarter cuts being sold. Deer carcasses were worth 15 cents per pound for those shot through the head or the neck, 10 cents shot elsewhere. Payment was made on the amount of meat processed from each animal. The average deer carcass was worth a nett $3 - $4, but as there was a plentiful supply it seemed feasible an industry could be made.
In 1961 the first helicopter attempt at recovery was made in the Marlborough area with a New Zealand Limited Bell D1 machine. As this machine needed critical balancing and could carry only 200 lb, it was passed off as an experiment only.

In 1962 a further trial was made in the Matukituki Valley (not far from Wanaka), using six foot shooters and a Bell G2 flying out the deer carcasses tied to the side racks two at a time. Deteriorating weather made it impossible to haul the full total of shot deer from the hill. The operation only just paid the flying time.

Westland Frozen Products financed the next recoveries in 1963 and this paid off as the weather conditions were perfect for shooting and flying. May 1963 a major attempt was again made in the Matukituki Valley and after four days of complete success two shooters lost their lives working too close to the rotorblades. Each attempt gained further knowledge, the shooters learning the limited capabilities of the helicopters and the pilots trying gamely to make things work.

The hire of the Bell G2 was a financial risk as each day the machine could not work it would cost $156 on the ground, and every minute of flying time cost $2 when operating.

To make it pay the shot deer had to be ready on a flat area where the machine could land, have the load tied on quickly then when the carcasses were away, another load made ready. Finding places for the helicopter to land was a problem, and where deer had to be carried uphill on steep faces it was hard work. Tallies of 20 and 30 per day were becoming common. On one day almost 50 were carried out making it an all time record.

A newly formed firm of Graham Stewart and Company, hiring Bell G3 helicopters from the States, started operations at Haast, and one pilot, John Sharborough, slung a long chain under his machine and had the loads clipped on to this. The same man really showed how it could be done, and with a drawl would say ‘there ain’t no hills too steep or rough to get deer off’ and he proved his point by doing so.
Luggate Game Packers, another young firm, using Hiller 12E helicopters, soon followed suit and the recovery rate per hour was increased. Estimates of how many animals recovered per year per machine were guessed at, and Mr T. Wallis, pilot-director of Luggate Game Packers thought that 3000 animals would be absolute maximum. Little did he realise then that his machine would soon be averaging 1000 per month, 12,000 carcasses a year.

The deer were driven into large basins or benches where the shooters could be strategically placed to get total kills, and daily tallies of 100 animals were commonplace.

The shooters knew almost as much about the capabilities of the helicopters as did the pilots flying them, and new pilots coming from the States were shown the 'right way to do it'.

Venison prices fluctuated like the Stock Exchange, starting at 10 cents and 13 cents per lb, increasing to 15 cents and 18 cents. The shooters started splitting the profits after the helicopter had been paid for, and 8-10 cents were top wages. As tallies increased, wages dropped to 5 cents then 2 cents per lb, to be shared equally among the shooters. The last day the writer spent on a paid basis with the helicopter (about 1967) he was one of a team of six persons assisting two helicopters. A total of 150 deer were retrieved and each man netted $35 for the days work. Nevertheless, some shooters at the right time made small fortunes as did the pilots working on bonus schemes, but it did not last long.

By this time nearly all the shooting was from the helicopter with .308 FN self-loading rifles. Barrels needed replacing often and rifle scopes lasted an average one month. The competition was fierce and both men and machines were working in every type of weather to keep production up. Setting off at 4 a.m. and shooting in the cool of the morning was the only way to find deer, and after 50-60 had been shot the circuit would be retraced and all animals gutted and flown to the main base, usually in the heat of the day. A few hours break then away for a late afternoon shoot and finally finishing the day about 9 p.m. with nerves and spirits weakened. The stress of competition resulted in many accidents. Every week or month brought news of another machine crashed. Power settling, white-outs, cutting tree tops and nicking rocks were part of the deadly troubles that almost all pilots ended up doing sooner or later. Some of them lost their lives.
Like the gold rush, everyone wanted to be in, and the fierce competition forced several firms to amalgamate while others could not keep the pace financially and were wound up.

The professional shooters working a block of country by foot and having their deer flown out by fixed-wing aircraft play an important part in the industry. Collectively they account for thousands of deer each year. To keep these deer in good condition chillers and deepfreezers are flown in to the block and each week the plane comes in to collect whatever loads are ready. It is amazing how the big stags are loaded into the plane, through sheer strength, and how the plane bumps its way down a short rough strip only just making flying speed on the last few yards. Any equipment capable of transporting carcasses to the selling point is used, jetboats, landrovers, gnats, trailbikes, tractors, the lot. Man's ingenuity just never runs out.

It was, and still is, big business, with Germany the main buyer. Export earnings are over $3m yearly, but the price has been high with lives lost and machines wrecked beyond repair.

The main mobs of deer are all gone, and whereas it was once common to find mobs of 30-40 deer it is now a rare sight to find 5-10 deer together in the high basins. The helicopters work the slips, alpine scrub, rocky gullies and the foot shooters work the bush, spotlight flats by night, carry deer on their backs for miles, all to get one here, a couple there.

The helicopter on a very good day will still get 100 animals, but might have to fly 300-500 miles to do so.

The writer recalls one area, the Wilkin Valley, which in the good old days took a helicopter and crew up to five weeks to cover and now the same country is worked over in under one day.

The outlook for venison is good. We have millions of acres of bush forest and this acts as one big farm. The deer that stray onto the tops will give a constant cropping, similar to the deer that come onto the flats and are hunted by all. It is improbable that the venison industry can grow any larger until deer farms are established, but it should reach the stage where a balance of production will keep on year after year.

It is one industry well worth looking after.
The upper Clutha and high country sheep farming of the South Island would be more comparable to our range sheep operations than any other areas in New Zealand. We have one range sheep experiment station in the United States with an inventory of about 4,500 ewes and replacement hoggets and 900 rams. This is located at Dubois, Idaho at an altitude of about 5,600 feet at station headquarters, with summer grazing lands rising up from 7,000 to 9,000 feet.

The station comprises 48,000 acres owned by the station and an additional 20,000 acres of federal grazing permits. Approximately 27,000 acres in a low rainfall area (10-15 inches) is used for grazing in the spring and autumn another 30,000 acres (25-35 inches rainfall) for summer grazing and 13,000 acres in another low rainfall area for from 30 to 45 days grazing in the winter provided that the snow does not become too deep.

Most sheep are herded and moved in flocks of about 1,000 head great distances from spring-summer to autumn-winter grazing allotments and to the winter feedlot. The ewes are in the winter feedlot from about 60 to 90 days each winter depending on the availability of the winter range which is determined by snow conditions.

Daytime temperatures at the headquarters during a typical winter range from 30°F to —15°F and during the summer from about 60°F to 90°F. The winter feedlot area experiences even colder winter temperatures.

Very little of our ranges are fenced necessitating herders to accompany the sheep at all times. Predators such as the coyote, bobcat and bear are a serious problem in many range areas.

* U.S. Sheep Experiment Station, Animal Science Research Division, A.R.S.
It is becoming increasingly difficult to get competent herd-
er and herding costs a large amount. This coupled with preda-
tor losses and a long winter feeding period makes it a challenge
to keep an operation profitable. These factors in addition to
periodic cuts in federal grazing allotments probably account for
the continuing decline of sheep numbers in the United States
which at the present time number only 18.5 million.

Sheep produce two important primary products, wool and
meat. At one time in the fine-wool breeds, wool was the most
important of these and still is in certain areas of the world. How-
ever, because of changing economic factors it has been a long
time since this has been true in the United States.

May I digress at this point. I see changes and adjustments
going on in New Zealand and Australia now, which occurred in
the United States 20 to 40 years ago. Is your sheep industry fol-
lowing the same pattern but at a later date? If so, early recogni-
tion of these pressures for change and aggressive adjustment
could prove very beneficial to the New Zealand fine-wool Indus-
try.

In the Rambouillet ewe (64's fleece) in the United States
today, wool accounts for only about 20 percent of the income
and lamb and mutton 80 percent (most of this is fat lamb).
Our fine wool industry could not possibly have survived on the
income from wool alone. There was a time when large Merino
and Rambouillet wether flocks were common in the Western
States. Now they are unknown. Other adjustments to meet the
decaying importance of wool have taken place.

A swing to lambs

More emphasis has been placed on the mutton character-
istics of our fine-wool sheep so that they would produce accep-
table lamb for the fat lamb market.

The adjustment and change did not stop here. Crossbreed-
ing of mutton type rams on Rambouillet ewes has become in-
creasingly popular. Only enough ewes are mated to Rambouil-
let rams to provide replacement stock. The Suffolk ram is es-
specially popular on the Western Range for production of fat
lamb because it not only produces lambs with rapid growth and
good market quality but produces a lamb which is born with
less difficulty than breeds such as the Hampshire or Dorset.
We have found it much more efficient to produce, market and merchandise 45 to 50 lb lamb carcasses. Smaller lambs except in specialized markets are no longer acceptable to the meat industry. Our sheep industry is talking now of larger lambs still.

A further adjustment to the declining relative importance of wool to lamb has been the development of the so called dual purpose sheep. The first dual purpose breed of real significance in the United States was the Columbia. The most comparable sheep in New Zealand would be the Corriedale. However, it was found that many areas were a bit hard for this breed. Therefore, the Columbia was back crossed to the Rambouillet to produce a strong fleeced (62's) sheep which was found to be well adapted to large areas in the West. The only place in the United States where the Rambouillet seems to be the preferred breed now is in the relatively dry, barren Southwest. This includes primarily Texas and New Mexico.

With this background, which I feel probably foreshadows adjustments which the fine-wool industry will find necessary to follow to a certain degree in New Zealand, let us talk of the production potential of the fine-wool sheep.

Fig. 1: An Australian Merino ewe with a litter of six lambs.
This (figure 1) is a picture of a Merino ewe with her litter. Thus, we see that fine-wool ewes are capable of giving birth to large numbers of lambs. Many of you will say we don’t even want twins. Why do you show us that picture? The climate on the western ranges of the United States has not changed appreciably over the years. Twenty years ago most range men said we don’t want twins. In fact, they either gave away or killed the poorer of the twin lambs born. Except in very isolated, extremely hard conditions, you do not hear this anymore.

They are now asking, how can I get more twins.

It has been clearly shown and they have found from their own experience that ewes giving birth to twins not only wean significantly more lambs they also wean more pounds of lamb and markedly improve the net return. Therefore, we are engaged in research programs to rapidly improve the prolificacy of our sheep.

<table>
<thead>
<tr>
<th>Breed</th>
<th>No. of ewes</th>
<th>Ewes pregnant</th>
<th>Ewes lambing</th>
<th>Lambs born</th>
<th>Lambs weaned</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>18</td>
<td>17</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>T</td>
<td>27</td>
<td>52</td>
<td>48</td>
<td>52</td>
<td>41</td>
</tr>
<tr>
<td>D x T</td>
<td>26</td>
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<td>90</td>
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<td>77</td>
</tr>
<tr>
<td>F x R</td>
<td>66</td>
<td>100</td>
<td>97</td>
<td>158</td>
<td>123</td>
</tr>
<tr>
<td>D x T x F x R</td>
<td>6</td>
<td>100</td>
<td>83</td>
<td>100</td>
<td>67</td>
</tr>
</tbody>
</table>

1 R = Rambouillet, T = Targhee, D = Dorset, F = Finnsheep.
2 Lambs born or weaned of ewes bred.

We believe sheep have the potential (and this includes fine-wool sheep) to:

(1) Give birth to their first lamb at 12 months of age and raise that lamb.

This should mostly pay for the cost of raising replacements. Also, it has been found that hoggets which either lamb or even show oestrus their first winter will produce more lamb throughout their lifetime. The decline in wool production has been found to be very little following this procedure provided the ewes are adequately fed.
The table shows the lamb production of hoggets of several breeds following mating at 7 to 8 months of age. A high level of nutrition is required to develop hoggets so that they will mate their first winter. Some breeds and breed crosses perform better than others. Selection for early breeding should tend to improve this characteristic.

(2) **Bear and raise twins regularly each year.**

The realization of this is not far away and will very soon be achieved through incorporating the genes from prolific Merino strains and exotic breeds into our present stock with careful selection to retain the desirable traits of both strains or breeds. Plans are now being made by the New Zealand government to import the litter bearing Finnish Landrace (Finnsheep) and other exotic sheep which show promise of improving efficiency.

*Figure 2* shows some Finnsheep rams. *Figure 3* shows Finnsheep x Rambouillet crossbred hoggets at 12 months of age with twin lambs at their sides. Slow, steady progress is being made in selecting for twinning ability. Several high fertility flocks have been initiated by one of the following methods (a) select ewes which give birth to twins as two-tooths, (b) select mature ewes which have given birth to triplets.

![Two-tooth Finnsheep rams.](image-url)
Fig. 3: Twelve-month old Finnsheep cross Rambouillet ewes with twin lambs at their sides.

Fig. 4: Effects of selection in Australian Merinos for lamb production

- - - - - - - - - - - - Selected for single births.

- - - - - - - - - - - - Selected for multiple births.

- - - - - - - - - - - - An initially high fertility line selected for multiple births.

(Courtesy Helen Newton Turner, C.S.I.R.O.)
These usually have to be gathered over large areas to get enough to establish a suitably large selection group. From this point on careful selection of both ewes and rams for twinning potential must continue.

Rams are selected primarily on the twin production records of their dams and grand dams.

Figure 4 shows the relative fecundity of two highly fertile Merino lines being selected by Dr. Helen Newton Turner of Ryde, Australia. The bottom line has been selected for having single lambs.

The most rapid way for a farmer to improve prolificacy in his flock is to purchase rams from available flocks with records of high twinning performance and at the same time select his own replacement ewes from dams with high lamb production records.

(3) Raise two crops of lambs per year.

It is reported by Dr Robinson of the University of Sydney that 50 percent of a sheep breed in southern France lamb twice a year and usually produce twins at each lambing. The balance produce twins at the one lambing. An occasional Rambouillet ewe has been reported to have lambed twice a year. Attempts are being made to achieve this potential in our common breeds of sheep through crossbreeding, hormone therapy and selection. Some progress is being made.

Fig. 5: Autumn born lambs from ewes mated in the spring while nursing spring lambs.
Figure 5 shows autumn born lambs from ewes bred in the spring while raising spring lambs.

(4) Produce an 8-10 lb fleece of high quality fine wool while achieving the above potential in lamb production. Although wool does not have the important place it once held it is still a valuable by-product and its production and care should be given continued careful attention. While intensive selection for improvement in wool characteristics is probably not justified, good management and nutrition will continue to be important.

Techniques to help achieve the above goals

Let me show you some of the things which we and others are doing. Perhaps one or two of these management practices or techniques suggested may be useful in the immediate future.

(1) Pregnancy testing:

If you knew that a ewe was barren at the end of your breeding season would you be justified in keeping her for another year in the hope of getting a lamb or would it be an advantage to replace her immediately with another ewe known to be pregnant? If you breed hoggets would it be an advantage to know far in advance of lambing which were pregnant?

We are now using a practice of the beef industry. They palpate all mated heifers for pregnancy. Thus, non-pregnant heifers go to market.

We pregnancy test our hoggets. The non-pregnant hoggets at 9 or 10 months of age sell for fat lamb prices.

Raddled rams can be useful and should be used when and where applicable for determining barren ewes, recognizing observational errors, breeding season problems, and time lags which occur.

May I present to you a simple, rapid accurate method of pregnancy diagnosis which has the potential to permit the examination of up to 200 ewes per hour. Ewes which are 60 to 110 days postbreeding and have been fasted overnight are placed on their backs in a comfortable horizontal position. The area of the cradle supporting the loin area of the ewe should be relatively flat and the rear end must be unobstructed to allow for manipulation of the palpation rod described below.
The hind legs should be held in such a position that the stomach muscles of the ewe are relaxed.

A plastic rod 1.5 cm (O.D.) x 50 cm with a bullet shaped tip is lubricated and inserted into the rectum by gentle forward and backward motion until it has reached a depth of about 30 to 35 cm.

If the rod is initially inclined toward the backbone insertion appears to be much easier. After insertion, the palpating rod is pressed gently but firmly upward in the posterior abdominal region where the pregnant uterus is characteristically located. The free hand is used to feel and identify the relatively solid form of the foetus. If the solid form and shape of a foetus is felt the ewe is pregnant. If no foetus is felt after examining from the extreme left to the extreme right of the posterior abdominal cavity the ewe is nonpregnant.

The rod can be clearly palpated through the abdominal wall in the nonpregnant ewe. Care should be taken to avoid sliding the rod between the ventral surface of the uterus and the abdominal wall which could lead to an error in observation. The Ruakura Animal Research Station is currently training veterinarians to diagnose pregnancy and twinning by this method. Hopefully interested farmers can learn the technique in the future.

(2) Lamb survival:

Simple things like lambing ewes in tall grass or shrubs on stormy or windy days, lambing slightly later in the season, changing the sire breed to reduce dystokia and more attention at lambing have dramatically improved lamb survival.

How can you improve your lamb survival? Overfeeding single bearing ewes tends to increase losses from dystokia and underfeeding twin bearing ewes tends to increase losses from small birth weights associated with weak lambs and starvation. Determining the number of lambs ewes are carrying before they lamb and feeding and managing them accordingly could help to reduce losses and also save feed. We are optimistic that the new palpation technique will prove practical for sorting out the ewes carrying twins from the ewes carrying only singles. Experimentally it has proved to be about 90 percent accurate. Veterinarians are being trained to do this.
(3) Other factors:

There are obviously many other factors such as pasture management, stocking rate, disease control and marketing which have not been mentioned. All of these factors should be given due consideration.

Conclusions

A sheep in a sense is a factory. Each factory requires a certain amount of energy and labor to maintain operations. The more it can be made to produce above maintenance costs the more profitable it will be. Suppose that it costs the value of one fleece and a 3/4 lamb to pay maintenance costs. A 75 percent lamb crop would produce no net income. Another 1/4 lamb (100 percent lamb crop) would produce a small net return. An additional 1/4 lamb would nearly double the nett return. Can we recognise the impact of a 200 percent lamb crop? This is an over simplification but dramatically demonstrates the importance of improving lamb birth rate and survival.

Finally the future of the sheep industry in New Zealand is dependent upon the aggressiveness with which sheep farmers will adopt new, more efficient methods of production. This is the age of imagination and innovation. Without these we can soon be overwhelmed by more efficient competition.

The Pressure of Recreation in the United Kingdom

Professor J. T. Coppock, Geography Department, University of Edinburgh, interviewed by J. Runanga.

The second of three articles on outdoor recreation and its effects on land use in the United Kingdom. The first article, Review 22, was entitled Lambs or Caravans.

Professor Coppock I believe the U.K. was estimated to earn from tourism about £500 million in foreign currency in 1971 and to net about £50 million. But one of the consequences of tourism is that the local people are having their facilities grasped from under their noses by the tourist traffic and there seems to be a growing resistance to further expansion in tourism. Is this so?
The figures you mention are of the right order — certainly tourism is a major source of foreign currency. But I don’t think one can easily distinguish here between tourism and outdoor recreation. In Britain where there is very little recreational land, outdoor recreation has to be fitted into the countryside, and in a country where there is approximately an acre of land per head for all purposes this is difficult. In the past when the population was less mobile and less affluent the use of open land for recreation, that is moorland or rough vegetation mainly used for rough grazing, was tolerated. As the population becomes more mobile and has more leisure time so frictions increasingly develop.

There is competition for facilities and space.

Yes, there are two kinds of competition. There is competition between recreationists and other users of land, and there is increasing friction between different classes of recreationists — between anglers and waterskiers, between walkers and grouse shooters and so on.

Is there proof that people need recreation for their well-being?

This is rather taken for granted and certainly it is a worldwide trend, associated with levels of affluence, education and mobility. You can also argue this on philosophical grounds and many people do, but whether outdoor recreation is a necessity or not, it is certainly a fact. There is undoubtedly an increasing desire to get away from city life, to the countryside at weekends and holidays.

Would you draw the distinction between city oriented recreation and outdoor recreation, and which is participated in the most.

We have done estimates of the rates of participation. If you take the total spectrum of leisure pursuits and use of leisure time, most of these are city oriented. They are concerned with watching football, going to the cinema or theatre and watching television and so on. One could also make the distinction between user-oriented outdoor recreation which tends to be located in and around cities such as golf, football, urban parks and so on, as against resource-oriented outdoor recreation, located where particular recreational resources occur. That is, attractive countryside for informal outdoor recreation, suitable rocks for climbing, suitable slopes for skiing and so on.
Greater London, with its surrounding Green Belt, a large area of protected land where development is restricted because of the high quality of the scenery and farmland. Some 8 million people live in Greater London.

To what extent are these pursuits influenced by economics, time and space?

There is a continuum between these. Informal recreation is conditioned by the distance from the centre of population. We have been able to show in a number of studies that an outward journey of 50 miles represents the maximum distance most people are prepared to travel on a day's outing. If they are aiming for a particular resource or kind of recreation, such as skiing, they may travel greater distances. Activities such as golfing are also conditioned by distance but these recreation grounds have to compete for land with other urban uses and tend to get displaced outwards. They are not able, in the main, to compete in rent terms with very intensive uses of land on the urban fringe. A proportion of this land is public but much of it is private, owned or rented by clubs or industrial firms for recreation grounds. One of our biggest needs is for open land or comparatively wild land, woodland, moorland, or heathland, within convenient distance from our centres so that the people have some place to go rather than trespass on intensively-used farm land. We have been trying to cater for this by creating country parks of some 100 to 1,000 acres in extent. These parks would act as honeypots to
attract outdoor recreation and so relieve pressure on farm land. This is not such a problem where there is open land fairly close but in Greater London where there is a population of eight million there is relatively little land of this kind and here recreation pressures are greatest and difficult to accommodate.

What percentage of the London population would use the Green Belt within the 50 mile perimeter?

I do not know — a study of recreational travel in the Greater London area is underway. On our Edinburgh and Glasgow experience I would expect most of those with access to a car (about half of the population) to make some recreational journeys into the Green Belt. But I must make it clear that the Green Belt is not a recreation area as such. There is recreation on land within the Green Belt, but the Green Belt is so designated to prevent urban expansion and it strengthens the case for planning authorities to resist proposed development. Some of these pockets of land are under intense pressure to the extent that there are problems of land management and maintaining vegetation in the face of visitor pressure and parking.

At the beginning of the second world war there were about two million cars, but today there are about ten million and by the turn of the century we expect to have about 30 million.

These numbers would pose problems in traffic flow.

We have a well developed network of rural roads. The main problem arises in the approaches to urban centres but there is also a problem with summer traffic in some remote areas, particularly caravan traffic.

How well developed are the stopping facilities for the motorist?

Catering facilities are generally fairly adequate but the provision of picnic facilities and the like is a weak spot in British recreational development. The kind of picnic places I have seen in New Zealand, Canada and North America are not at all frequent in Great Britain. The location of stopping places in the past has been largely governed by traffic considerations. They are under the control of the Minister of Transport. They might have been sited closeby in much more satisfactory recreation sites. However, out of this increasing concern for the design of recreational areas is a greater use of landscape architects. For instance the Forestry Commission now employs a landscape architect to ensure its plantings enhance the visual amenity of the countryside.
Some Land Uses in Great Britain c. 1960

<table>
<thead>
<tr>
<th>Use</th>
<th>000 acres</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>49,790</td>
<td>88</td>
</tr>
<tr>
<td>Horticulture</td>
<td>720</td>
<td>1</td>
</tr>
<tr>
<td>tillage</td>
<td>10,800</td>
<td>19</td>
</tr>
<tr>
<td>improved grassland</td>
<td>17,980</td>
<td>32</td>
</tr>
<tr>
<td>rough grazing</td>
<td>17,540</td>
<td>31</td>
</tr>
<tr>
<td>common grazing</td>
<td>2,750</td>
<td>5</td>
</tr>
<tr>
<td>Forestry</td>
<td>4,170</td>
<td>7</td>
</tr>
<tr>
<td>state</td>
<td>1,500</td>
<td>3</td>
</tr>
<tr>
<td>private</td>
<td>2,670</td>
<td>5</td>
</tr>
<tr>
<td>Urban</td>
<td>4,510</td>
<td>7</td>
</tr>
<tr>
<td>housing</td>
<td>2,000</td>
<td>4</td>
</tr>
<tr>
<td>urban open space</td>
<td>900</td>
<td>2</td>
</tr>
<tr>
<td>other urban land</td>
<td>1,610</td>
<td>3</td>
</tr>
<tr>
<td>Minerals</td>
<td>680</td>
<td>1</td>
</tr>
<tr>
<td>derelict land</td>
<td>160</td>
<td>—</td>
</tr>
<tr>
<td>water gathering grounds</td>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>other land</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>Transport</td>
<td>1,000</td>
<td>2</td>
</tr>
<tr>
<td>roads</td>
<td>710</td>
<td>1</td>
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<tr>
<td>railways</td>
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<td>—</td>
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<tr>
<td>airfields</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Defence</td>
<td>800</td>
<td>2</td>
</tr>
<tr>
<td>military training grounds</td>
<td>700</td>
<td>1</td>
</tr>
<tr>
<td>other land</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>Recreation</td>
<td>18,010</td>
<td>32</td>
</tr>
<tr>
<td>deer forests</td>
<td>2,800</td>
<td>5</td>
</tr>
<tr>
<td>grouse moors</td>
<td>4,500</td>
<td>8</td>
</tr>
<tr>
<td>lowland shooting</td>
<td>10,000</td>
<td>18</td>
</tr>
<tr>
<td>golf courses, recreation grounds</td>
<td>400</td>
<td>1</td>
</tr>
<tr>
<td>public recreation</td>
<td>310</td>
<td>1</td>
</tr>
<tr>
<td>Amenity</td>
<td>44,000</td>
<td>79</td>
</tr>
<tr>
<td>National Parks, England and Wales</td>
<td>3,360</td>
<td>6</td>
</tr>
<tr>
<td>proposed National Parks, Scotland</td>
<td>1,660</td>
<td>3</td>
</tr>
<tr>
<td>National Forest Parks</td>
<td>510</td>
<td>1</td>
</tr>
<tr>
<td>Areas of Outstanding Natural Beauty</td>
<td>1,510</td>
<td>3</td>
</tr>
<tr>
<td>Green Belts</td>
<td>6,000</td>
<td>11</td>
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<tr>
<td>Areas of Great Landscape Value</td>
<td>14,860</td>
<td>26</td>
</tr>
<tr>
<td>rough open land</td>
<td>16,000</td>
<td>28</td>
</tr>
<tr>
<td>National Trust properties and covenant</td>
<td>410</td>
<td>1</td>
</tr>
<tr>
<td>nature reserves and refuges</td>
<td>270</td>
<td>—</td>
</tr>
<tr>
<td>Total land area of Great Britain</td>
<td>56,200</td>
<td>100</td>
</tr>
</tbody>
</table>
Who else has this responsibility for visual amenity?

The Countryside Commissions, one for England and Wales and one for Scotland, have a dual role. One is to promote the conservation of the visual beauty of the countryside and the other is to encourage public access and enjoyment of the countryside. The commissions have power to provide funds to local authorities to help towards the costs of developing the facilities we have just discussed. They have power to designate (or more strictly, to recommend the designation of) particular areas of high landscape value and to approve proposals by local councils to establish country parks. The Countryside Commission for England and Wales was formerly the National Parks Commission, established in 1949 and re-designated in 1968. The Countryside Commission for Scotland was created in 1967. There are also the Tourist Boards, one for Great Britain and one each for England, Scotland, and Wales, which also have powers to help with development as well as the provision of accommodation. The Highlands and Islands Development Board is also very much concerned with the promotion of tourism and recreation in its area. So there is obviously some overlap of responsibility among these organisations.

Apparently the National Trusts are also involved.

In that they are landlords. There are two National Trusts — one for England, Wales and Northern Ireland and one for Scotland. Together they own about 250,000 acres. The land is held in trust and the Trusts can also acquire land in lieu of estate duty. (There is no rating of farmland as this was abolished in 1926). Land that is placed under the Trust cannot be alienated for purposes other than trust purposes. These are mainly concerned with conservation of land for amenity and for its contribution to visual scenery and with encouraging public recreation. The Trusts lease land for farming and it is a matter of interest that in such areas as the Lake District they will reduce rents in compensation for heavy recreational pressure that is a hindrance to the farmer.

I believe there are many private companies providing accommodation for the tourist trade. To what extent is the Government assisting?

Most of the accommodation has been provided by private companies. The direct building of hotels by the Highlands and Islands Development Board is a rather uncommon feature. On
the other hand there have been public grants and loans for hotel development. We have a big tourist development at Aviemore, in the Highlands, that was financed mainly by public companies, breweries and other bodies, with some support from the Government. This has created a major focus of outdoor recreation in the ski area in the Highlands. The Government is certainly assisting with accommodation where it is inadequate. But this inadequacy is greater in the larger cities such as London and Edinburgh where there is an urgent need to relieve accommodation pressures.

New Zealanders are reluctant to pay the marginal costs associated with outdoor recreation. They will spend large sums of money travelling but dislike paying small charges such as parking.

There are two elements here. One is the lack of knowledge of the true costs. If they think of this at all it is the petrol cost. Some marginal costs are easily avoided, such as going where parking is not a charge. The other aspect is the traditional feeling that there is an inherent right of access to outdoor recreation. Our intensively used farmland is interlaced with a complex network of public rights-of-way that originated to serve the rural community but which now have the important role of access for recreation. But where specific resources are required these are increasingly being made available on payment. There is a tendency for land owners to enter agreements with sports societies, who accept responsibility for the management and use of a resource. This kind of controlled access is becoming more common.

Outdoor recreation is more easily accommodated on forest land than it is on farmland except in areas of high fire risk such as you may have in production forests like those of New Zealand. This risk is not so great in the United Kingdom, where the Forestry Commission has provided camping sites and access if these do not conflict with fire protection or obligations with other land owners. The distinction between this sector, which constitutes about half our improved forests, and the private sector, is that the latter provides very little public access — but I am sure this can be given without any real damage or risk. The area available is considerable, some 2.8 million acres of forest in the private sector and 1.8 million acres under the Forestry Commission.
Forest of Bowland on the Lancashire/Yorkshire border. The farmstead was abandoned as part of the process of farm enlargement, the land now being farmed from another holding but less intensively. Such abandoned farmsteads and cottages are being increasingly acquired by city dwellers as holiday homes. (Photo: J. T. Coppock from a transparency).

So in the planning of forests there is an obligation to provide for recreation?

The Forestry Commission has a remit from the Government to take this into account. It was on its own initiative that this was done in the first place, as early as the 1930s and before the national parks concept was given formal recognition. Throughout its forest land there is this policy of permitting access on foot, but cars are generally not allowed in the forest area. Although there is ready access to these areas, recreational facilities such as picnic facilities are limited. A lot of the Commission's forest lands are in upland margins which are unsuitable for intensive agriculture but at least some provision for access is made here and this is more than is provided for in the private forests. Throughout the United Kingdom there are about 100,000 miles of footpaths and other walking tracks and some 15 percent of the land surface of England is in National Parks.
Is there a need for these facilities to increase with the growth of population?

There is a need for more recreational land. The way in which recreation was accommodated when pressures were low is impractical in the future. The population has grown by more than twice the population of New Zealand in the post-war period and is likely to grow by three times the population of New Zealand in the rest of the century. Because the population is concentrated in urban areas the impact of recreation, whether on rough land or on intensively used farmland, is highly localised. Pressures were light before but now it is an increasing source of friction. There are now farms near London that are surrounded by chain-link fences and the gates are padlocked. These are the exception but they arise from the friction between the farmer and the recreationist, and the difficulty in obtaining a prosecution against the recreationist.

How much public land is available for recreation?

There are probably less than half a million acres, or less than 1 percent of the land surface of Great Britain in the form of public land that is available for recreation. A national park in the British context is simply an area of high amenity (attractive scenery) which is normally in agricultural use. This contains little, if any, public land whereas New Zealand national parks do so in very large areas. I mentioned the move to create country parks. This will relieve the situation. There is also the development of what are called “access agreements”, an agreement between a landowner and local authority whereby the owner will permit controlled access to open land and in return will receive help, through by-laws, wardening and finance towards the control of this recreational use. Although the amount of land in such access agreements is at present small, landowners are recognising that this may be one of the ways they can minimise disadvantages in agricultural and other commercial activities on the land.

The pressure of recreation is a very real problem in the United Kingdom. What more can be done about it?

We are still relatively ill-informed on recreational uses and demands. There is a need for research, a need to know more about the attitudes of farmers and other land managers toward recreationists. We are just beginning. This is going to be a very important aspect of land use. There has been a suggestion from the “Economist” that most of the rural land around London
should be primarily recreational in nature and that farming should be subordinate to recreation in such areas. One might look upon farmers in this context as gardeners who keep the land in good order — because one of the implications of outdoor recreation is that it involves management of some kind.

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**Ram : ewe Ratios and Ewe Management**

Dr A.J. Allison* and G.H. Davis**

* Invermay Agricultural Research Centre, Mosgiel.
** Tara Hills High Country Research Station, Kurow.

The fertility of Merino and Halfbred ewes running under high-country conditions has received scant attention in the past. In a survey of 70 tussock runs in the Omarama and Mackenzie basin regions concluded in 1968 it was found that 43 had Merino sheep while the remainder had Halfbreds.

On slightly over half of these properties ewes were mated for the first time as four-tooths, presumably because they were too small to mate as two-tooths. The mean tailing percentage was 78 percent (range 30 to 110 percent) and was lower on properties where ewes were mated as two-tooths.

These statistics paint rather a dismal picture of the reproductive performance of finewool sheep in the region. With these statistics in mind a trial was carried out at Tara Hills to investigate possible factors involved.

**Tara Hills Trial**

Two possible factors were examined. Firstly the effect of ram/ewe ratio at mating and secondly the effect of paddock size and stock density at mating. These factors were examined in two-tooth and older ewes.

Two ram/ewe ratios were selected:

1:33 and 1:100.

Each ratio was examined under intensive stocking:

10.7 ewes per hectare (4.3 ewes/acre)

or extensive stocking:

1.9 ewes per hectare (0.7 ewes/acre).

Intensive groups were mated on flat paddocks whereas the extensive were mated on hill blocks of steep terrain.
Eight hundred Merino ewes half of which were two-tooths were divided into four groups:

Two groups of 100 ewes.
Two groups of 300 ewes.

Each group was joined with three semen tested rams for three oestrous cycles (51 days). By the use of different coloured crayons in the ram harnesses it was possible to determine whether ewes had been mated by one, two or three rams during the first cycle and whether they had been mated during the second and third cycle.

At lambing full records were taken of each ewe's performance.

All ewes were weighed two days before the start of mating (May 10). Mean liveweights were 35 kg (77 lb) for two-tooths and 44 kg (96 lb) for mixed-age ewes respectively. These weights are lower than normal for Tara Hills and are attributable to the feed shortage in the summer-autumn period of 1970/71 due to very dry conditions.

RESULTS

Ewes mated: Effect of ram/ewe ratio and paddock size

Table 1. The incidence and time of first mating (percent)

<table>
<thead>
<tr>
<th>Ram/ewe ratio</th>
<th>Mating conditions</th>
<th>Two-tooths mated</th>
<th>Mixed-age ewes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in cycles</td>
<td>Nevermated in cycles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 2 and 3</td>
<td>mated 1 2 and 3</td>
<td></td>
</tr>
<tr>
<td>1:33 (3:100)</td>
<td>Extensive</td>
<td>94 2</td>
<td>98 2</td>
</tr>
<tr>
<td>Intensive</td>
<td></td>
<td>94 2</td>
<td>98 2</td>
</tr>
<tr>
<td>1:100 (3:300)</td>
<td>Extensive</td>
<td>52 11</td>
<td>87 12</td>
</tr>
<tr>
<td>Intensive</td>
<td></td>
<td>52 11</td>
<td>87 12</td>
</tr>
</tbody>
</table>

At 1:33 almost all ewes were mated during the first cycle on both intensive and extensive areas.

At 1:100 only half of the two-tooths were mated during the first cycle and many were not mated at all. A much higher percentage of mixed-age ewes were mated at this ratio.

The use of fewer rams therefore caused mating to be more protracted. Effects due to intensity of stocking on the percentage of ewes mated were small and relatively unimportant.
Multiple matings

Table 2. The percentage of ewes mated during the first cycle

<table>
<thead>
<tr>
<th>Ram/ewe ratio</th>
<th>Mating Conditions</th>
<th>Two-tooths mated by</th>
<th>Mixed-age ewes mated by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 Ram</td>
<td>2 or 3 Rams</td>
</tr>
<tr>
<td>Intensive</td>
<td>1:3:3 (3:100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>Extensive</td>
<td>1:3:3 (3:100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Intensive</td>
<td>1:10 (3:300)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>Extensive</td>
<td>1:10 (3:300)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>86</td>
<td>14</td>
</tr>
</tbody>
</table>

A further factor which might influence the success of mating may occur where ewes are mated by more than one ram. The incidence of such multiple matings was shown to be affected by ram/ewe ratio and by both age of ewe and paddock size at the 1:100 ratio.

Fig. 1: Spread of Lambing.

![Graph](image-url)
Ewes were mated at 4.3 ewes per acre (10.7/ha) on irrigated flat paddocks (above). Or were mated at .7 ewes per acre (1.9/ha) on steep hill country (below).
At 1:33 ratio almost all ewes were mated by more than one ram under both intensive and extensive mating conditions.

At 1:100 however the occurrence of multiple matings decreased, particularly under extensive conditions where a high proportion of ewes were mated by one ram only.

Within each of the four experimental groups the total number of ewes mated by each of the three rams was similar suggesting that the mating capability of all rams used was similar.

Conception rates

There was no difference in the proportion of ewes lambing to first service between two-tooths and mixed-age ewes. Approximately 80 percent lambed to first service irrespective of whether this service occurred during the first, second or third cycles. Conception rates of ewes returning to service were also high: comparable with those recorded above.

Lambing performance

The number of ewes lambing and the spread of lambing can be seen in Figure 1. The data closely parallel the mating data.

At 1:33 most ewes in both age groups lambed to service during the first cycle and the number of barren ewes was low.

At 1:100 the proportion barren was low in mixed-age ewes (5 percent) but the spread of lambing was slightly greater. However in two-tooths the spread of lambing was considerably wider and 23 percent of ewes were barren (70/300).

Effect of liveweight on barrenness

This cannot be examined in this trial because of large ram/ewe ratio and area effects in two-tooths. Of a total of 76 barren two-tooths 48 were never mated at all during the mating period.

Effect of liveweight on twinning (Figure 2)

In the range of two-tooth mating weights observed here (65 to 90 lb) the proportion of ewes lambing which had twins was approximately 5 percent. In older ewes, less than 90 lb, twinning was also very low but above this weight 17-20 percent of ewes lambing, lambed twins.
Fig. 2: Influence of liveweight at mating on lambing.

DISCUSSION

Number of ewes mated

At a ram/ewe ratio of 1:33 most two-tooths were mated during the first 17 day cycle. This would indicate that most if not all two-tooths were in fact coming into heat and would take the ram. However at 1:100 the proportion mated in the same period was much lower, approximately 50 percent.

Differences in the proportion of two-tooths mated between ram ratios of 1:33 and 1:100 must therefore be due to differences in mating behaviour between two-tooths and older ewes.

It is likely that two-tooths are not in heat for as long as are older ewes and that they are not as likely to seek out the ram during the short period that they are in heat.

The major effect on the number of ewes mated was due to ram/ewe ratio and not due to the size and terrain of the mating areas. However it should be stressed that at 1:100 under extensive mating conditions most ewes mated during the first 17 day cycle were mated by only one ram. This effect was almost certainly due to the area of the extensive blocks and not the competition between rams. Ewes and rams were probably spread over such a large area that special separation of animals has contributed to this situation.
Reproductive performance of two-tooths

Provided two-tooths were mated their ability to conceive was equal to that observed in older ewes. In fact at 1:33 ram/ewe ratio 94 of 100 two-tooths mated had lambs. It would seem that for a satisfactory lambing performance from two-tooths they must be mated in a situation where all ewes have the opportunity to be contacted by a ram, i.e. with plenty of rams in a restricted area most two-tooths will take the ram even at low liveweights as in this experiment. With fewer rams and in extensive areas mating will be spread over a longer period and many ewes may not be mated at all.

In an extensive mating situation where many ewes are mated by one ram only the fertility of each ram is critical. At present very few rams are semen tested prior to mating and therefore no prior assessment of fertility is possible.

At ram/ewe ratios where many ewes are mated by more than one ram the effect of an infertile ram or rams will be minimised.

Conclusions

1. Two-tooth ewes should be given preferential management at mating time. Higher ram/ewe ratios than those required for older ewes are necessary and intensive mating conditions are desirable. Under these conditions the proportion of barren two-tooths is likely to be extremely low.

2. A ram/ewe ratio of 1:100 has given quite satisfactory results with mixed-age ewes. This ratio is inadequate for two-tooths due to differences in the mating behaviour of two-tooths.

The next article is the Institute's 12th annual report, reproduced here to promote a wider understanding of the work of the Institute. —Ed.

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The tussock grasslands and mountain lands of New Zealand are the scene of change. Changes in attitudes and in trends of use are now more obvious than changes in physical land conditions and land use conditions. Recognition of changes in social attitude and trends of use is vital to prepare ourselves for the consequent changes in scene that will become more and more evident in succeeding years. Some of these changes and the role of the Institute with respect to them are reviewed in this report.

The Beef Industry on Tussock Country

Changes in trend are evident in the pastoral sector. Cattle stock units have doubled in ten years on the high country runs. Ten per cent of New Zealand’s beef cattle are now in the tussock grassland regions. Percentage increases in cattle numbers are greater in the South Island foothills and mountain lands than they are in other major pastoral categories. The hills and high country of the South Island are now making proportionately as great contributions to the national beef industry as they are to the national sheep industry.

The Institute can take credit for assisting the economic evaluation of beef cattle on tussock country as well as for presenting a manual for cattle management for productive profit and the good of the environment. This publication was issued as the first of a new series, Lincoln Papers in Resource Management, published by the Lincoln College Press.

The Changing Sheep Industry

Within the sheep industry proper changing trends are not so spectacular as in the cattle sector but they are clearly marked. Recent years have witnessed increased interest in Perendale sheep on some tussock country where Romneys have been dominant before. Deviation from the Merino breed on high country has been less evident but there are more abundant signs of shifts in flock composition. In general, wethers, traditionally preferred as fleece producers, are being outnumbered by ewes kept for their lamb-raising potential in addition to their wool production.

The precise directions and dimensions of such changing trends as these will be revealed in the resurvey of the high country runs to be carried out during the next two years by Institute staff.
The last complete enumeration survey covered the years 1965-67. During 1971 the Institute staff carried out a run-by-run, region by region comparison of pastoral production in the upper Clutha between 1950-52 and 1965-67. Substantial increases occurred over those 15 years, especially in drier regions.

**Changing Pastoral Technology and Management**

Steeply rising costs and fluctuating sheep product prices have influenced changes in production trend. Changes are also marked in the technology of sheep raising. Greater attention is given to winter feeding efficiency. Topdressing and over-sowing programmes are often designed and managed more shrewdly, although they are still subject to the fluctuations of available investment capital. Co-ordinated planning of pastoral development and soil conservation rationalises and accelerates the process of retirement from grazing of difficulty-managed, often vulnerable land resources. Some evidence suggests that the economics of retirement may vary greatly between regions and between runs in the one region not only because of differences in costs of alternative feed but also because of the varied significance of the retired country. This retirement process has been evident in the nominally occupied high country for many years. More recent economic conditions are likely to accentuate the trend.

The Institute is involved in several projects serving pastoral range management: the study of diet selection and grazing behaviour on unimproved and improved country; the development of techniques for evaluating condition and trend of land resources and of their use; and the study of management effects on feed quality. A substantial contribution to the understanding of the economics of land retirement could eventuate from intensified analysis of run management practices in conjunction with the Institute’s pastoral production survey.

**Denudation and Revegetation**

While pastoral patterns are taking new form and shape, other influences are at work. Withdrawing stock from high altitude tall tussock grasslands is not often followed by spectacular improvements in vegetation vigour. It is important to know whether other factors are at work causing denudation.

The Institute entomologist has almost completed field work on a major study of the population dynamics of three species of
grasshoppers in modified or depleted tall tussock grasslands at high altitude on the Craigieburn mountains. This work has developed new methods for the study of animal populations. The population studies and associated insect diet and consumption studies indicate that grasshoppers may not be of major significance in primary depletion of vegetation, although they may serve to maintain high grazing pressure on preferred species or plant parts in already depleted situations. Their significance in zones of managed revegetation will be estimated in future work.

The primary revegetation of exposed, high altitude, eroding soils has been fruitfully investigated by Grasslands Division DSIR, and the Institute, using heavy fertiliser mixtures and fast-growing introduced grasses to grow sufficient herbage in one season to counteract the disturbing forces of needle ice. This work has been developed and greatly expanded by the New Zealand Forest Service in both the North and South Islands and scientific research is being accelerated in the many aspects of this promising field by these three agencies as well as by Water and Soil Division of Ministry of Works, Catchment Boards and graduate students at Lincoln College and other universities.

The work of the Institute has been especially important in establishing the need for magnesium for revegetation of many soils in addition to phosphorus, nitrogen and other bases. Attention to indigenous grasses, especially for drier mountains is also a feature of the Institute's revegetation work.

Sediment and Water Quality and Regimen

There are many millions of acres requiring healing. These areas appear to be the primary source of sediment, the principal pollutant of natural water in New Zealand. To estimate the dimensions, costs and priorities of healing by revegetation it is important to determine the proximate sources of sediment in streams and to relate the activity of such sediments to intensity and frequency of storm events.

The Nuffield Foundation has assisted the Institute to establish a working base for such studies in Torlesse Creek near Porters Pass in Canterbury. With the collaboration of engineers from the University of Canterbury and Lincoln College, geomorphologists, nuclear scientists, and experts in aspects of climatology and meteorology, the Institute has begun a new phase in erosion research in South Island high country, introducing novel methods of bed-load sampling and measurement.
At the present time Canterbury people's attitudes to rivers are changing from dominantly a fear of flood to a hope and expectation of adequate, managed water of good quality for agriculture, industry, and a multitude of recreational uses. To understand the influence of watershed management on water regimen in minor and major streams has become an urgent need of our times.

The Institute has fostered the formation of a working group of scientists concerned with geology, soils, climate, plants, water and animals to contribute to such a general understanding of a stream and its catchment in good condition in the Ashburton hinterland. Until now hydrological studies in this locality have been confined to the beginnings of climatic recording in cooperation with scientists from the Geography Department of University of Otago. It is hoped that this coming year will see the formal assessment of the area as a basin for systems research to allow watershed simulation. Survey of geology, soils, vegetation, and plant growth and decomposition rates is already proceeding.

Managing Nutrients

The tussock grasslands and mountain lands have had very brief experience of the age of fertiliser technology. For a hundred years these lands were managed in ignorance of possible nutrient deficiencies. The accumulating evidence of agronomic trials and of studies of soil genesis reveals that deficiencies of nitrogen, sulphur and phosphorus are widespread, especially on older surfaces or with high rainfall. Only a tiny fraction of these lands have been topdressed with fertiliser in the last 20 years yet concern about deterioration in water quality and possible eutrophication of lakes is already being expressed concerning tussock grasslands as about other lands longer in developed pastoral or agricultural use.

As its first concern with nutrient conditions the Institute has fostered the study of mineral deficiencies affecting the establishment and growth of legumes and grasses that would reclothe the land and support the livestock that would otherwise often be the agents of further denudation and erosion. More recently it has joined with Grasslands Division and Applied Biochemistry Division of DSIR in an assessment of the mineral regimes of herbage and of sheep grazing that herbage on untoppedressed and topdressed blocks on Ribbonwood in North Otago.
During recent years the Institute has developed a much wider and deeper study of the mineral economy of the tall tussock grasslands. In this work it has had the co-operation of Grasslands Division DSIR, Botany Division DSIR, and the Department of Agriculture at Invermay. The mineral composition of the basal sheath, the growing blade and the dying portion of the blade is being assayed for tall tussock grasses growing in typical habitats from Southland and South Westland through the main pastoral areas to North Island mountains. Soil analyses are also made for the uppermost horizon. These allow some estimation of the volumes of minerals involved in the organic cycle. Coupled with knowledge of the rates of plant growth and decay they make it possible to estimate the rate of nutrient cycling within the plant-topsoil system. This survey and related detailed studies at two sites at Paddle Creek in the South Ashburton basin are being done by a graduate student at Lincoln College, assisted by the Hellaby Trust, as part of the Institute programme. He will also seek to determine the rate and volume of nutrient movement involved in decay of plant litter in different situations and in leaching under the plant cover.

Already the survey and growth studies in which the Institute has participated reveal that between and within different species of tall tussock there are great variations in mineral content and apparently in mineral efficiency. Plants originating from soils with lower supplying power for particular nutrients such as potassium, nitrogen, phosphorus and magnesium generally have greater ability to accumulate such nutrients in herbage than do plants originating from soils of greater nutrient supply.

The same kind of phenomenon of apparently wide differences in nutrient efficiency is apparent in recent studies of introduced grasses and legumes in the field and at Lincoln College. Such a phenomenon is of major economic significance in a country with large areas of low fertility soil, especially where many of these areas are denuded and urgently demanding revegetation and where there is low economic likelihood of their being developed for intensive pastoral use at high fertility. The Institute will foster and develop research in this area to the limits allowed by its resources.

**Competition for Resources**

The tussock grasslands and mountain lands have hitherto generally had their uses in simple accord with their administrative designation. National Parks were used for preservation of native flora and fauna and the enjoyment of people, generally
at low density. State Forests were dedicated generally to watershed protection. Pastoral lands were used almost exclusively for pastoral purposes, at low intensity and chiefly with sheep. Unoccupied Crown land has been little used except in traverse by climber, musterer or deer stalker. Rivers were used to drain land. Rivers and smaller lakes were used to catch fish from. Larger lakes were little used except to reflect mountains and to dream upon.

All this has already changed. Multiple use has already arrived in the tussock grasslands and mountain lands. It has usually come in unplanned and unco-ordinated fashion. It has merely happened. Resource use planning in the tussock grasslands and mountain lands must not be designed for the future as though these were empty, uncommitted lands. Resource use planning must also deal with the tangle of the present. To plan wisely for the future we must take account of the present by understanding the past with its mistakes and its partial failures as well as its successes.

The Institute is charged under its original Cabinet directive with, among other tasks, investigating the various aspects of management of tussock grasslands and mountain lands. Management of resources for single objectives is often complex and sometimes difficult. Management of resources for multiple objectives is always complex, frequently difficult and sometimes impossible.

The incursions of new resource uses into the tussock grasslands and mountain lands have generated a vast range of new management problems which have hitherto received only sporadic and piecemeal attention. Some of these problems represent the initial competitive clash of major industries such as in the displacement of farm life in various forms by electric power generation. Military use of central North Island tussock grasslands is also affected by hydro-electric development and by the ingress of pine forests. Other problems represent the competitive invasion of new technologies and new cultures, such as is seen in intensive pastoral development in central North Island or northwestern Southland and in the effective enclosure of certain tracts of land for private recreational purposes. Still others represent the somewhat hesitant and sometimes uneasy alliance of developing uses with existing use patterns perhaps little modified. Examples are seen in the opening of State Forest areas in the mountains to recreational use as Forest Parks, the integration of deer stalking with traditional pastoral use, the utilisation of National Parks for international tourism. New uses not only limit the evolution of
old uses. New uses often compete with other new uses. Jet boating and angling, game meat packing and trophy hunting, electric power development and flood control works, are not easily welded in a common assault on an old way of life.

The Institute is aware of many of the dimensions of these complex problems of resource planning and allocation. It is in a unique position to facilitate and co-ordinate efforts by individuals, groups, public bodies and government and university agencies to solve such problems. The Planning Officer of the Institute has led a small group in the past year in an introductory study of recreation capabilities in the Waimakariri Basin with special reference to the Castle Hill sector. Involvement with such studies has already led to further enquiries for the services of the Institute in planning for multiple use of other mountain land resources. It can fulfil such a role only when it is given by Government the authority and financial resources to do so. Its role in such matters would seldom be to become self-sufficient except perhaps in small exercises. Its role would be to evolve and apply new or better methods of resource evaluation and resource allocation. It would serve to meet the varied demands of society with a real assessment of the varied capability of the environmental resources to fulfil such wants. In a region where past resource use has produced dramatic and poorly foreseen consequences, being conscious of the limitations of the environment as well as of its opportunities is a prerequisite for survival.

Systems Analysis and Synthesis

The role of the Institute as an accessible information centre concerning tussock grasslands and mountain lands is one of increasing importance for the whole community. The publication of Review three times a year, public lectures and displays and participation in field days and more recently the preparation of bulletins for the Lincoln Papers in Resource Management series all contribute to this role. Simple matters of fact are seldom sought in enquiries received at this Institute. More frequently enquiries are concerned with real or possible effects on profits or on environmental quality of some kind arising from real or proposed changes in resource management which are themselves complex. If the Institute is to be of great social worth in this role in the future it will not suffice for it to increase its files of information like some compendious dossier. The unity of natural systems with emphasis on the quantitative relationships between components of such systems must be the model for the assembly and use of information about such real world systems.
A small but increasing proportion of data acquisition and data use in all aspects of the Institute’s work is being adjusted to systems methods. International co-operation is being provided in this process through the International Biological Programme (IBP). Currently proposals are being developed for greater co-ordination in assessing the impact of man’s activities on mountain ecosystems. This project has been suggested as a major field of New Zealand scientific activity in the international “Man and Biosphere” programme (MAB) of UNESCO. It is confidently hoped that such work will not only improve our own ability to live in harmony with our own environment but will also provide a training ground for resource management personnel from developing countries whose environmental problems often closely resemble our own.

Conclusion

When the Institute was established a little more than 10 years ago there were areas of neglect in scientific attention in the mountains. There were other areas where scientific effort seemed to be fitful and perhaps unco-ordinated. The dominating problems were erosion of soils, sediment in rivers, hazardous land use practices for which there seemed little or no alternative. There is now more scientific effort in the mountains. Areas of previous neglect have been penetrated. New areas of ignorance emerge. The need for scientific co-ordination continues and indeed grows with increasing volume of work. The Institute has never sought to be powerfully self-sufficient, thereby making the growth and development of other existing organizations unnecessary. At the present time the Institute has no continuing programme of research except in conjunction with research programmes in other organizations. Its future policy will be to use its resources to promote such integration, as the best way of facilitating and co-ordinating scientific research. Our ability to live in harmony with our mountain environments in the future will not be decided by the volume or even the quality of scientific research. Important as that research may be, the determinant of the mutual welfare of our mountain landscapes and ourselves will be in our ability to translate our knowledge into valid, acceptable and practical plans for individual and community action. For that task the Institute has a substantial and continuing responsibility.

For the Committee of Management.

D. McLeod,
Chairman.
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