

TUSOCK GRASSLANDS AND  
MOUNTAIN LANDS INSTITUTE

# REVIEW



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**Our cover: This drawing of a Hereford bull emphasises the use of beef cattle as a means of diversifying production. In this issue Mr R. Chaffey of Mt Possession station discusses how he is adapting the station's environment to accept cattle.**

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Editor—*J. Runga*

## PROSPECT

This issue of *Review* marks the end of what might be called the first development decade of the Institute. This is the last issue before we move on to a subscription list. The rates are set out elsewhere in this issue. We hope that in these days of rising costs these subscription rates will not be found a burden.

Review has grown in size and stature as a periodical devoted to the sharing of interests in tussock grasslands and mountain lands. It has also grown in demand. We now find it difficult to keep up with this demand unless we make a charge to defray publishing costs. We are confident that our more than 2000 readers will come to accept their need to share in our enterprise.

The present time is one of rapid change and growing uncertainty. Traditional markets for pastoral produce enter into new economic alignments. Prices for wool exports decline relative to costs of imports and of local services. Were tussock grasslands and mountain lands to face the future on the plank of the single pastoral commodity with which they survived the past, their future would be pastorally gloomy.

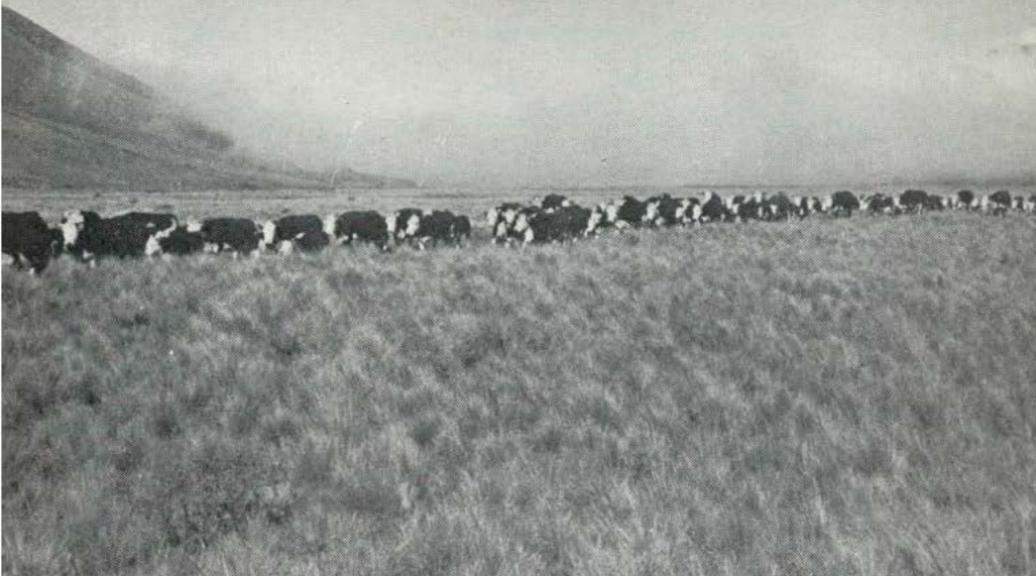
It is not so. The growing and now vigorous development of a high-country beef industry provides a new basis for pastoral enterprise. Where terrain is suited, small seeds crops and cereals are being integrated into run enterprises. Recreational use of the mountains by New Zealanders and by visitors to this country is growing at probably an even faster rate than the beef cattle industry. Beef cattle in South Island hill and high country increased by 102 percent in 10 years from 1959. By what percentage will the number of visitors on recreation bent in the high country increase in the next 10 years?

Many runholders and other entrepreneurs are adjusting their ways to meet these rapid changes. Those who make their adjustments quickly are likely to profit more substantially.

This Institute will aim to be of service to all men and women who live and work and enjoy themselves in the tussock grasslands and mountain lands, so long as their presence and activities are consistent with the restoration and maintenance of the mountain resources in good condition.

We have this aim, in the confident attitude that of all the agricultural and pastoral sectors of New Zealand, the high country is at the present time the best fitted for rapid and profitable diversification and development.

— K. F. O'Connor.



## DIVERSIFICATION WITH CATTLE ON MT POSSESSION

R. Chaffey

Manager, Mt Possession Station

*Mt Possession is one of the oldest and largest of New Zealand's high-country runs. Built and settled in the mid-nineteenth century, it covers 108,000 acres between the head waters of the Rangitata and Rakaia rivers in Canterbury. Virtually abandoned because of snow in 1918 it was taken up by a private company until death duties forced a sale in 1954. The New Zealand and Australia Land Company then took it over until their absorption in 1969 by Dalgety and New Zealand Loan Limited.*

The station is ringed by mountains and has a central plateau that had been scarred by the action of glaciers which left terminal moraines across it. Soil had been pushed down side valleys and deposited around the many lakes. It is around the foothills and the lakes that development is increasing. It is a land of contrasts, with altitude ranging from 1600 ft to 9000

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Title photo shows Mt Possession Herefords crossing Paddingstone valley ahead of a storm.

Photo: R. Chaffey from a colour print.



**Boundary Creek hut during an autumn muster.**

**Below: Lake Clearwater, and the Two Thumb range in the background. The sheep are part of a flock of 16,000 drys.**

Photos from colour prints: Courtesy R. Chaffey



ft and wide variations in rainfall from one area to another, 24 inches and up to 70 inches at high altitudes.

Slightly less than half the property is University Endowment lease, half is Pastoral lease and there is a small area of freehold. Currently the station carries 25,000 Merinos and 900 Hereford breeding cows. We have Merinos, not only as the money earner, but mob stocked they are a low-cost means of developing the land for cattle.

## General Management

In the autumn we take out every open-faced ewe that is big enough to mate and inspect every one of them for physical defects and wool, usually finishing up with about 6,500 breeding ewes. All rejected ewes are run dry and are sold to keep total flock numbers constant. Cull Merino lambs are worth very little but cost a lot to breed so we don't breed more than we need for replacements. The number required and the ram activity at tugging determines how long the rams stay out. If the season is good and only 4,500 lambs are required, this joining period may be as short as three weeks. Dry ewes are removed at tailing time so all lambs have the maximum available feed. As very few will be undernourished we have very few cull lambs.

Lambs are weaned onto improved land — if the season allows — and some lucerne hay is fed (in feeders) immediately. We have found that a newly-weaned lamb will chew at anything and this is an ideal time to teach them to eat hay in case it may be necessary later on. In May they go onto native pasture for the rest of their lives, except for those that get into the breeding flock, which from mid-August to the end of September are fed turnips and grass.

We pre-lamb shear with blades in September and shear the dry sheep in October-November. All sheep are dust-dipped off shears so there are no lice or ticks. Hoggets are swim-dipped in December for itchmite control.

All dry sheep are used in the spring and summer to control winter blocks and improved country, and the climate determines if or when the real high country is used. This allows for the maximum number of wethers to be available for mob stocking.

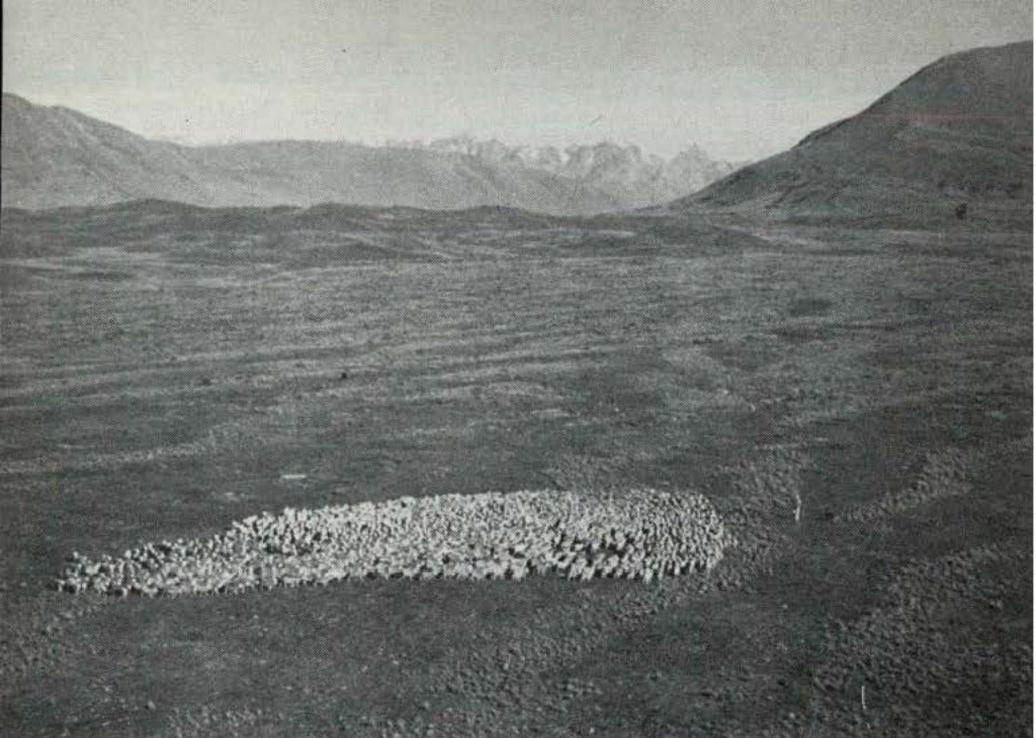


Planning the muster during the lunch break at 7,500 ft on Red Mountain.

Photo from a colour print: Courtesy R. Chaffey.

### Cattle Policy

Sheep numbers are static and controlled, but cattle have been substantially increasing. Steer calves and approximately 20 percent of heifer calves are sold at weaning. The remaining heifer calves are wintered on lucerne hay and some ryecorn. At the end of November these heifers are tagged, weighed and recorded and animals over 600 lb are run with Hereford bulls for one cycle and then with Angus bulls. Also at this time the remaining heifers are weighed and any that have then reached 600lb are included with the Angus bulls. These bulls are removed at the end of January and all the heifers are then put back in one mob. Heifers are quite well fed until late May when they go out onto the best available hill block. Exercise on the hills prior to calving is most important to avoid calving difficulties. They are calved on paddocks and have the best of treatment all summer, joining the rest of the breeding herd at weaning.



The central plateau that was formed by glaciers. A terminal moraine can be seen in the middle distance.

Photo from a colour print: Courtesy R. Chaffey.

So far the cows have had no supplementary feeding but this will have to change as numbers increase, and it is hoped that bought-in ryegrass straw, oaten-hay and perhaps urea may provide the answer for increased numbers.

Bulls now go out about the beginning of December for three months. The supply of suitable bulls has been a problem, but substantial improvement has been achieved by buying bulls from a select herd that has been built with high-performance cows from large herds. Once numbers allow, a select herd will be used to supply all replacements, and a Hereford cow will need to have reared a calf when it was a two-year-old to qualify for entry.

### Development

A large area has potential for development, but all this land goes under snow and in some years it is feet-deep for short periods. On much of the lower areas where the tussocks have gone out a few inches of snow will freeze for many weeks on end.



Land that cannot be cultivated is oversown and topdressed, then rotationally grazed for two summers by mob-stocking with Merino wethers at 50-60 head per acre. Cattle are introduced when the soil fertility has been raised. Here 8000 wethers are put to work.

Photo: R. Chaffey from colour negatives.

In the sequence of development, a small block is fenced off, oversown and topdressed at rates of up to half a ton of superphosphate per acre over a two year period. Mobs of Merino wethers grazed on here at 50 or 60 to the acre through the spring and summer build up the fertility. After two years the block is set stocked with cattle and, provided that for a period each spring it is mob stocked with sheep, it appears that maintenance topdressing will be necessary only every six or seven years.

Where land can be cultivated, shelter belts are planted and the native pastures are attacked with a chisel plough — two strokes in the winter, three more plus some heavy harrowing in mid December, then the area is sown in York globe turnips and H1 ryegrass. This is spring fed to breeding ewes and mob stocked until the end of December, then closed up for the lambs at weaning. Rough worked with a chisel plough in the winter the block goes into oats in the spring, hay in January, and is chisel ploughed again and grassed in February. In this fashion the danger of windblow is averted and each cultivation is paid for the same year.

Mt Possession is limited for natural cattle country. It is therefore of great importance that we balance development with the year-round experiment of increasing cattle numbers, but it is even more important that we breed an animal that can be profitable in this environment. Selection for breeding purposes is essential for our flock and performance recording is equally essential in the herd.

**Shifting the Hereford cows and calves.** On the left is Mt Guy, 4336ft.  
Photo: R. Chaffey from a colour print.



# UTILISING TALL TUSSOCK

Dr K. F. O'Connor

Tussock Grasslands and Mountain Lands Institute

There is probably more total mass of standing crop of tall tussock grass in New Zealand at any particular time in the year than there is of ryegrass. *Chionochloa* is the dominant grass over millions of acres of mountain grasslands. Even on grazed blocks its standing crop may vary from one to several tons per acre in contrast to merely a few hundredweights of dry matter per acre with most ryegrass varieties — except in pastures shut for hay or silage, or deferred for winter use.

Ryegrass varieties are much more rapid in growth than are the tall tussocks. Ryegrasses are eaten freely, frequently and thoroughly. On the other hand, tall tussocks are eaten sparingly, and often when there is little else to graze. Ryegrasses on moist sites thrive on frequent, thorough defoliation. Tall tussocks die from it.

## Pastoral History

Short grass swards and tall tussock communities contrast so strongly in appearance that it is hard to realise that their present distribution is often accounted for by different reactions in different places to similar attempted treatments over the last 120 years.

There were no scientific principles to guide our early pastoralists when they began to use the tall tussock grasslands, themselves often successors to a previous forest cover. Samuel Butler wrote them a good practical manual for the task. At first there was little short-sward grassland in New Zealand but consciously or unconsciously our pioneers set about making short-sward grassland by firestick and grazing animal. Sometimes they succeeded, sometimes they did not.

Much tall tussock persisted, often reduced in density or as remnants in a new mosaic of subsoil and scree. Much was changed to short tussock grassland. Some eventually became sward grassland. Sward grasslands have been induced by grazing as well as by cultivation, whether from tall tussock, scrubland or forest.

Many of the early tame pastures on arable land were sown with poor-quality seed mixtures and many more were not sown down at all after crops but merely filled up with volunteer grasses suited to the soil and climate. Thus, what we have now at any site depends not only on its environment but also on its cultural history.

In the last half century scientists have shown how sward grasslands can be improved by plant breeding and nutrition. We also understand better how plants function and how they react to the presence of other plants and to differences in soil, climate, and defoliation. But despite our early dependence on tall tussock grasslands, and despite the millions of acres which remain, we know few of the scientific principles on which our use of them should be based.

Brief reviews of scientific experiments and detailed surveys on New Zealand tall tussocks have been made by Mark (1969), Connor *et al* (1970). This literature represents about 20 papers by half a dozen people — most of them written in the last 10 years. Some dealt with cutting and burning but none dealt experimentally with grazing. Only recently have we known about how the chemical composition of tall tussocks might affect their acceptability, intake, digestibility and nutritive value to sheep (Connor *et al* 1970, Macrae and O'Connor 1970). We still know little about the diet sheep select, or their grazing behaviour in this region.

This dearth of data and understanding has not lessened the willingness of people of many walks of life to argue the pros and cons of tall tussock grassland management — nor to plan and regulate its future use. For instance, many conservation run plans control or prohibit the grazing of land on which tall tussock is the dominant vegetation. The decision is based not on detailed scientific evidence of grazing value, grazing behaviour or grazing response. This kind of decision is based on the general awareness of the common and often serious consequences of grazing in the past. Such consequences have been inferred from widespread observation of soil erosion and vegetation depletion. These observations and inferences have induced runholders, advisers and planners to be cautious in the use of tall tussock grassland. They have not been sufficiently widespread, detailed and thorough to allow runholders, advisers and planners to draw up rules and guidelines for that caution to be exercised intelligently and consistently. By comparison with road traffic safety

campaigns our tall tussock grassland safety programme is very poorly developed. The present situation in the tall tussock is comparable with a highway traffic situation in which we have agreed to reduce the speed to 20 miles per hour but have not yet agreed whether we should drive on the left, right or both sides of the road. This discussion cannot be sufficiently long to allow a full "tall tussock grazing uses" code to be drawn up that is valid for all circumstances. Certainly there is no proposition herein of raising the speed limit above 20 m.p.h. for the present. If some of the fog is lifted there may be lower risk of collisions at 20 m.p.h.!

### Tall Tussock Grasslands are Varied

Tall tussock grasslands make up a vast array of different landscape units. Differences exist in the dominant species. From Connor *et al* (1970) and Mark (1969) we may interpret that narrow-leaved snow tussock (*Chionochloa rigida*) is perhaps the most widespread in the pastorally used areas, extending from Banks Peninsula and south of the Rakaia River to Otago and Southland, ranging over terraces, downs and slopes from sea level to 5,500 ft.

Slim snow tussock (*C. macra*) is abundant north of the Rakaia on all except rubbly slopes. South of the Rakaia it is predominantly on the upper shaded slopes and rolling tops of mountain ranges.

*C. rubra* (red tussock) is widespread from Southland to the North Island, on both wet lands and dry rolling lands and hill soils. It is dominant over large areas in the northern half of the South Island as well as in the southern portion which has been traditionally accepted as its territory.

Broad-leaved snow tussock (*C. flavescens*) is abundant at the Main Divide and on rubbly slopes, especially in the northern half of the South Island. The species bearing this name in the Tararua Mountains of the North Island has been found (Williams 1970) to have a greatly different ecology from that understood for the South Island species. It is conceivable that these may be separately classified in future. There may indeed be distinct entities within other presently-understood species. It is important for runholders and their counsellors to know what they have and where it is. There are other *Chionochloa* species of importance in the tussock grasslands but they are less significant in the pastorally used region.

There are differences within tall tussock grasslands in the abundance and identity of associated plants. These have been well illustrated by Connor and Macrae (1968). In the easier topography of the eastern ranges and downlands, tall tussock grassland often grades almost imperceptibly into short tussock grassland. In contrast the tall tussock grasslands of the high steep mountain slopes often occur as facets in a mosaic of sub-alpine scrub, scree, herbfields, fellfields, and grasslands dominated by shorter grasses. When animals are admitted to land parcels containing such variety, we can expect that they will show different preferences for the different vegetation components and communities. We have no grounds for presuming that the animals' welfare or their effects either beneficial or deleterious on the landscape will be determined by the character of the tall tussocks themselves but we would be foolish to ignore the possible influence of differences in acceptability to animals of the tall tussocks.

### Tall Tussocks Vary in their Grazing Use

All tall tussock species common in the pastorally used sectors of the tussock grasslands are used by both sheep and cattle. They are not always used by livestock. As Connor *et al* (1970) have pointed out, "quite extensive use may be made of tall tussocks by domestic animals when no emergency exists". Situations are known when *C. macra*, *C. rigida*, *C. flavescens* and *C. rubra* are thoroughly used. Situations are also known when each of them is unused. No quantitative field studies have been made of animal use but in a series of feeding trials with Romney sheep on chaffed tussocks at Applied Biochemistry Division, D.S.I.R. (Macrae and O'Connor 1970), more *C. macra* and *C. rubra* tended to be eaten than *C. rigida* and consistently more of the first two species were eaten than of *C. flavescens*. Where eating of *C. flavescens* has been observed in the field, especially by cattle it has been several times noted that grazing may be right down to the butts. Numerous chemical analyses of *C. flavescens* tillers (unpublished data) reveal that concentration of nitrogen and phosphorus may be several times higher in the sheath tissue than in the leaf blades.

Two other important features have been noted in the Palmerston North feeding trials. All species showed considerable increase in intake when supplemented with protein-rich and mineral-rich lucerne meal, even though all trials were done with access to ad lib mineral lick. It was also noteworthy that there

was markedly lower intake of mineral lick with *C. macra* and with *C. rubra* when fed with lucerne meal than when each of these species was fed without the lucerne supplement. This suggests that acceptability of tussocks to sheep may not be independent of mineral supply either in the tussock tissue or from other sources.

Field surveys of mineral composition (Connor *et al* 1970) showed the extreme ranges summarised in Table 1.

Table 1 — Range of Values for Mineral Composition in Percentage of Oven-dry Weight of *Chionochloa* Leaf Blades

		<i>C. macra</i>	<i>C. rigida</i>	<i>C. flavescens</i>	<i>C. rubra</i>
P	mean	.117	.113	.082	.078
	range	.067-.180	.056-.159	.045-.126	.040-.130
Ca	mean	.123	.145	.220	.100
	range	.06-.18	.08-.22	.18-.28	.04-.20
Mg	mean	.084	.098	.097	.066
	range	.05-.13	.05-.15	.08-.13	.05-.09
K	mean	.91	.87	.85	.72
	range	.75-1.19	.64-1.12	.73-1.04	.59-.87
Ash	mean	5.96	4.17	4.83	3.74
	range	3.22-6.57	2.52-5.96	4.11-5.88	2.80-5.58

Some of the variation within species could be accounted for by allowing for swamp conditions. Ash and phosphorus contents were found to be lower in tussocks growing in swampy organic soils than in zonal soils. When these swamp samples were excluded significant differences between species were found (Connor *et al* 1970). Red tussock, traditionally the least used by stock, was lowest in all mineral constituents. In view of the wide ranges of values for each species (threefold for phosphorus and calcium; about two-fold for magnesium and total ash) it would not be surprising if further field investigations showed some relationships between mineral content and acceptability to livestock. Current investigations in this Institute, with active co-operation from Grasslands Division of D.S.I.R., New Zealand Forest Service and Department of Agriculture officers reveal that there is almost as much variation among tussocks of one species in nitrogen and phosphorus content at one site as has been indicated earlier for variation between sites. Runholders no doubt have themselves seen that in the one site some tussocks may be fairly thoroughly grazed while others are only sparsely used.

At the present time no proposition can be confidently advanced that tall tussocks are grazed preferentially in relation to some feature or other of their mineral content. Substantial variation within species occurs between sites and between individual tussocks as well as the significant mineral differences revealed between species in the field (Connor *et al* 1970) and in glass-house studies (Molloy and Connor 1970, O'Connor *et al* unpublished). All of these features suggest that continued investigation is warranted along the line of thought that acceptability to livestock is perhaps affected by mineral content which may be in turn related to natural or induced soil fertility conditions.

### Tall Tussocks Vary in their Feeding Value

Connor *et al* (1970) found that leaf blades of *Chionochloa* tussocks had about twice the level of cellulose and hemicellulose commonly found in ryegrass, the average values for each tussock species being in the common range observed for cereal straws. The level of these structural carbohydrates differentiate tall tussocks from fresh ryegrass but not from mature cocksfoot. The levels of lignin in tall tussocks were found to be much lower than those common in cereal straw and more like those found in cocksfoot and meadow fescue. Nitrogen levels in tall tussocks were found to be low in leaf blades. Macrae and O'Connor (1970) examined the digestibility of these energy and protein components in chaffed tussocks leaves when fed to stalled Romney sheep. For all carbon components examined the digestibility coefficients were higher for *Chionochloa flavescens* and *C. rigida* than they were for *C. macra* and *C. rubra*. Note that this is the reverse of the situation described for intake.

When both intake and digestibility were taken into account none of the tussocks when fed without lucerne meal provided sufficient digestible organic matter to meet the maintenance requirement for sheep housed indoors. When fed with lucerne meal supplement, intake of *C. macra* and *C. rigida* was sufficiently improved to have digestible organic matter approach maintenance requirements of sheep housed indoors. This level was still substantially below the maintenance level required under outdoor grazing conditions.

Protein requirements for maintenance were not consistently met when the tussocks were fed alone. Lucerne meal supplement not only resulted in increased tussock intake but also led to positive nitrogen utilisation values. Lucerne meal supple-

ment did not alter materially the digestibility coefficients for organic matter and structural carbohydrates. It did, however, apparently provide sufficient nitrogen for microbial growth within the rumen so that the animals were able to eat more tussock and thereby show large increases in utilisation of organic matter and structural carbohydrates.

It should be emphasised that values for the bulked and chaffed tussock materials varied somewhat from the mineral composition of the leaf blade samples referred to earlier. Perhaps especially important were the very low nitrogen contents of the chaffed *C. macra* and *C. rubra* in particular. We should apply these studies to any practical field conditions with considerable caution. Nevertheless, as we have so little field information we should put the indoor evidence to what use we can, tempering it with what else we know.

### **Practical Applications to Grazing Management**

If tall tussock is to provide a substantial proportion of maintenance requirements it must be supplemented with nitrogen and minerals even to approach satisfactory intake. Whether this supplement be obtained from urea and mineral block, from concentrates, from more nutritious grasses or from legumes or indeed from chewing wool or soil (and runholders may be familiar with such behaviour in sheep) may be a more practical than academic question. So far as urea supplements are concerned careful management and cost are both important. The same considerations probably apply to concentrates, although these have the added value of providing readily available energy source as well as protein and often essential minerals. Mineral blocks are probably worth considerably more investigation especially when we know more of the possible influence of particular mineral constituents on the intake of tall tussocks. Sward grass, legume and other herb supplements are probably most important in practice. It should not be presumed that the presence of sward grasses among tussocks will ensure adequate digestible nutrients for livestock on tall tussock, especially in winter conditions or on untodressed land.

### **Winter Use**

We already have some evidence that even oversown grasses such as cocksfoot may suffer from substantial loss of nutritive value as a result of winter frost damage and leaching (Douglas 1970). On the other hand, we have evidence from sample

areas in improved tall tussock associations in the Castle Hill Basin and at Glentanner in the Mackenzie Country that the amount of reduction of green grass and clover herbage over winter under a tall tussock canopy may be much less than that in open ground as a wholly improved sward (Table 2).

Table 2 — Estimated Weights of Green Sward Herbage in Open Sward and Under Tall Tussock Before and After Winter

(lb Dry Matter/Acre)

	Before Winter	After Winter	Reduction	Apparent % Loss
<b>Castle Hill</b> — 3,000 ft a.s.l.				
Under <i>C. rubra</i>	4,000	2,400	1,600	40
Under <i>C. rubra</i>	6,200	4,800	1,400	23
Open sward	3,000	900	2,100	70
Open sward	5,100	3,000	2,100	41
<b>Glentanner</b> — 2,500 ft a.s.l.				
Under <i>C. rigida</i>	2,000	1,200	800	40
Under <i>C. rigida</i>	3,500	2,100	1,400	40
Open sward	1,800	100	1,700	94
Open sward	2,800	700	2,100	75

It might be inferred from these limited observations that improved tall tussock grasslands may have some beneficial interactions between different plants, the tall tussock harbouring the sward components against cold damage and the sward components improving the nutritive value of the tall tussock by promoting intake. The value of tall tussock in breaking snow is well known, especially the early spring phenomenon of "melt tubes" from the warming air. Early winter snows in contrast usually disappear more rapidly from bare ground among the tussocks because melting is then outwards from the warmer soil. Tall tussock breaking snow can make sward feed more accessible. Low growing plants such as catsear and uninvigorated white clover may need thorough snow-melting before they become accessible to livestock. These plants have the virtue of being richer in protein and in minerals (Coop, Darling, Anderson 1953) than many grasses in tussock grasslands. Some cultivars of *Lotus uliginosus* have shown signs of frost resistance. This character added to their rambling habit and apparent ability to tolerate rather low supplies of soil phosphate may make them especially valuable as tall tussock grassland constituents.

Intensive winter use of tall tussock cannot be practised annually with impunity. Full restoration of the canopy after thorough defoliation may take three or more years, depending on the site. Tall tussock as a winter standby is an emergency resource to be used sparingly and to be valued for its insulating properties. Where it has to be used as the only feed available and accessible, it should be remembered that even with protein and mineral supplements, animals will have to draw on body reserves as outdoor grazing maintenance is not likely to be satisfied by a dominantly tall tussock diet. Body reserves have to be built up when feed is available. There is probably no substitute for eating the herbage of improved tussock grasslands when that herbage is available and in a nutritious state. The recent work of Vartha and Clifford (1971) has demonstrated the value of using improved pastures during the growing season to reduce supplementary feed needs during the winter.

### Summer Use

Where snow tussocks or red tussocks are present in topdressed and oversown swards they may be expected to react to grazing use in the manner demonstrated for fescue tussock by O'Connor (1966). Periodic lax grazing at low or moderate topdressing invigorates them. Periodic hard grazing especially with heavy topdressing reduces them. Such has been the experience at Glentanner and Ribbonwood with *C. rigida*.

There are many runs which no longer have tall tussock on land which is safe for winter. Traditional use has involved stock moving higher up slopes or further up gorges for three or more months of summer. With the advent of topdressing and oversowing, the development of conservation run plans, and a tendency to declining wether flocks on many properties, shorter or less heavy demands may be placed on the snowgrass blocks. It would be rash to conclude that such reduced use always results in universal improvement. Where land is a mosaic of tall tussock and overgrazed areas, scrub and scree, sheep may still find their way to the most favoured and often most vulnerable sites.

It takes a great deal of courage as well as a new understanding of the principle, "eat grass to grow grass" for traditional pastoralists to fence in their stock during the growing season onto land which they have topdressed and oversown. When dry summers affect oversown tussock grasslands as they have this year, the tall tussock of traditional summer country may be a valuable safety valve. If it takes courage and foresight to fence stock in onto topdressed country, it likewise takes planning and foresight to allow stock to be turned out on "retired" or "spell-

ed" tall tussock country to avoid catastrophe from drought. In similar drought conditions owners of lowland smaller flocks might be seeking land for agistment grazing or drought relief. In such circumstances, infrequent summer use of tall tussock grassland may have entirely different effects from those which occurred under regular annual use. We have little experience in New Zealand of such grazing use systems. We do not know if animal behaviour will remain constant to previous patterns. We might expect that animals may make more use of the possibly more abundant inter-tussock vegetation. It is conceivable that in some circumstances animals may require more herding. In the less damaged tall tussock grasslands runholders may be disturbed to observe on such visits to the high basins that such tall tussock is beginning to deteriorate as an environment suited to grazing animals. They may be consoled by the evidence (Rowley 1970, Mark and Rowley 1969) that it would be improving as a water yielding environment, principally perhaps by the tussocks trapping more mist and rain. It is quite probable that the high-altitude tall tussock grasslands of the Otago block mountains, often characterised by the frequently palatable *Chionochloa macra*, were subjected to longer and heavier grazing pressure because of the influence of drought and rabbits on the lower altitude sectors of the runs in that region. High-altitude *Chionochloa macra* on the Craigieburn Range, is adversely affected by close defoliation (O'Connor 1963).<sup>\*</sup> Repeated efforts at rabbit and drought evasion in Otago by shifting more and more sheep to the tops may have led to more serious drought if the depletion of tall tussock did indeed lead to less water harvesting. The lesson should not need to be relearned in the present century if it should have been learned from the past.

"In New Zealand's short pastoral history water and not wool has been the most important product of the rangeland" (O'Connor 1958). If we are to continue to make use of tall tussock grasslands by grazing animals then we must clearly and thoroughly know what if any is the price to be paid in loss of water regulation and whether or not that price is met by the value of the animals. Tall tussock grasslands could be viewed in the future as a carefully husbanded but convenient haystack. Whether pastoralists should use such a haystack in their own interest depends on its cost and value to them. Whether or not they should use it in the nation's interest depends on the benefits and costs to the nation. It is probable that these benefits and costs to the individual and to society will vary from place to place.

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<sup>\*</sup>When this study was done, the material studied was included in that known as *C. rigida*. As Molloy and Connor (1970) have pointed out, the material of the locality is now known as *C. macra*.

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## CHEMICAL SHEARING

Sheep shorn without the aid of clippers is a possibility in the future. The Meat Research Institute, Langford, Bristol, is studying techniques that could mean the entire removal of the fleece by the bare hands alone.

Because of the high danger of contamination a fleece offers in the slaughterhouse, the Institute has been trying to find easy methods of removing the wool. Now, with a drug called Cyclophosphamide which was originally developed as a treatment for cancer, and following work in the USA, the British researchers are getting successful results.

The drug stops cell division, and in the sheep it checks the growth of the wool follicle for a few hours, causing a point of weakness in the wool fibre. This weak point reaches the surface of the skin after about a week and the wool can therefore be pulled or knocked away from the skin. If the fleece is removed three weeks after treatment a short new growth is left on the animal.

Removing the fleece is simple, the sheep being laid on its back and the wool parted down the breast and pushed down and around the body. With a little experience an operator can remove the fleece in one piece, and roll it in the traditional manner.

At the moment the cost of treatment per sheep is 6d. The animal does not appear to suffer any adverse effects, and there is no other stoppage of vital cell growth. However, many chemical and scientific tests have yet to be made before the technique can be considered safe.

— Farm News from Britain—B.I.S. May 1971/5

## **RANDOM SELECTIONS**

A.H. & A.W. Reed Ltd — in press

### **Manapouri**

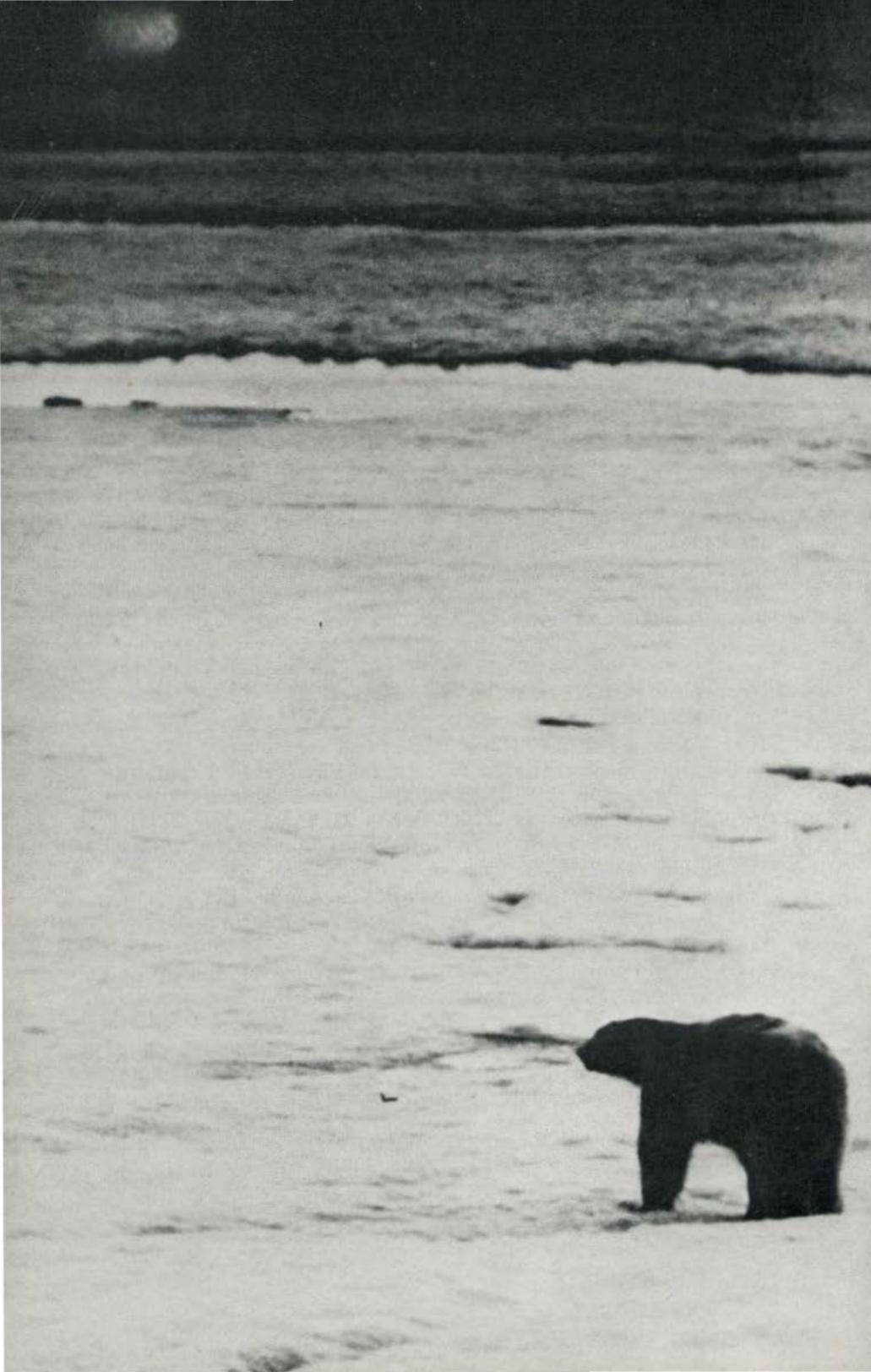
At this moment there is probably no more controversial spot in New Zealand than Lake Manapouri. Invercargill artist John Beadle keeps clear of all dust and fury, however, in this forthcoming portrait, although his hope is that the lake will stay exactly as it is for centuries to come. Whether the lake will be changed or not, these paintings record for all time its beauty in the years 1970/71. Mr Beadle knows the area intimately and his text is affectionate and informative. The book is in the same format as John Castle's WELLINGTON and is due to be published in June.

### **New Zealand Insects**

Dr David Miller, former director of the Cawthron Institute, Nelson, is a senior New Zealand scientist and an entomologist of international standing. About August, Reeds will be publishing his COMMON INSECTS IN NEW ZEALAND which will be the first comprehensive, detailed study of this subject. Superbly illustrated with the author's own scientifically immaculate paintings in colour and many photographs and drawings, it contains a clear, vigorous text written with all the 81-year-old author's genial wit. The book will be essential to amateur collectors, teachers, libraries, practising entomologists and to all interested in New Zealand natural history.

### **New Zealand Science**

Two staff members at the Physics and Engineering Laboratory of the Department of Scientific and Industrial Research are due to publish their new book PROBING PLANT STRUCTURE in the next few months. Dr John Troughton and Mrs Leslie Donaldson of the PEL have been working on New Zealand's only scanning electronic microscope, examining the structure and processes of various plants. They have compiled a 120-page book of three-dimensional photographs of plant structure which gives a new insight to scientists and students of biology and botany about plant structure. Never before have micro-photographs of such fine quality and detail been published. Reeds initiated the book, and large sales are expected in the United States and Europe. Separate European and American editions are being published simultaneously and will be released around the world at the same time. A second book, THREE-DIMENSIONAL STRUCTURE OF WOOD by another D.S.I.R. scientist, Brian Meylan, and a Canterbury University botanist B. G. Butterfield, will be published shortly after PROBING PLANT STRUCTURE.



# A HISTORY OF THE SYRINGE WEAPON

C. A. Murdoch \*

To make possible the convenient immobilisation of wild animals I set about designing a cartridge fired weapon which would project an automatic syringe containing a tranquiliser or anaesthetic drug. Although my rifles and pistols were the first of this type, an American group had already fired a syringe, using an airgun, and since then various methods of projection, including bow and arrows, crossbows, and even modified cartridge-powered weapons, have been used.

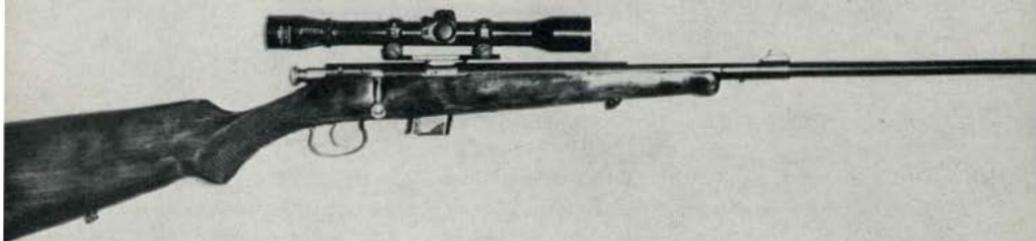
## The Need to Immobilise Animals

About 12 years ago in a research project concerned with game animals and particularly with that of the Hermitage area, much of the information we gathered was unreliable because we could not with certainty identify individual animals. We needed a method of immobilisation and marking. In this way we could more easily collect reliable information on diet, growth, weight, reproductivity and behaviour. The animals could then be released for later observation.

**Opposite:** In the Arctic spring of 1969, polar bear, reindeer, and Arctic fox were captured, weighed, marked and released. The rifle in the photo below is the Paxarms Mark 19.

Photos: E. S. Nyholm and courtesy C. A. Murdoch.

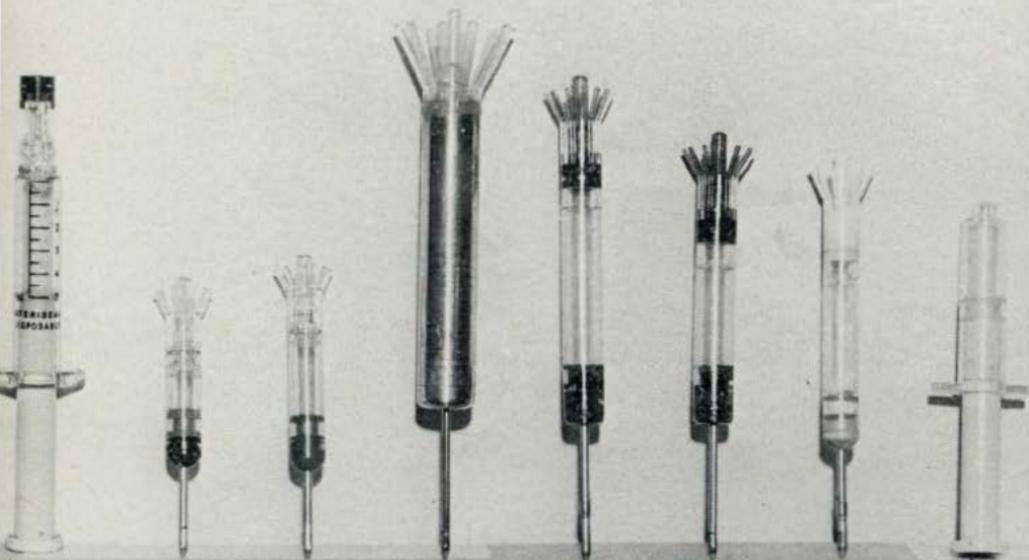




Above: The latest Paxarms rifle, the Mark 20.

Below: Left to right, filling syringe, and syringes .465-1.0 mil. and 1.5 mil., .750-14 mil., .527-4 mil. and 3 mil., .465-2.5 mil., and the hand pump.

Photos: C. A. Murdoch.



## Developing the Rifle and Pistol

The history of these weapons represents a vast amount of work on designs, prototypes, and testing. Standard firearms were modified to vary projectile velocities so that range and terminal impacts could be controlled. This was done by fitting a prototype gas regulator. With the ability to set a projectile velocity before firing, the terminal impact of the syringe could be pre-determined and therefore used to govern needle penetration to suit specific animals. Test firing showed that if the sight angle remained constant and the projectile velocity alone was changed, the range of the projectile could be considerably varied. The energy of impact at each distance was found to be similar, with air resistance acting on the syringe, much as it would on a dart.

The terminal impact could also be increased. Small animals require a high angle of trajectory, a low scale of projectile velocities for low terminal impacts. Larger animals require greater impacts to penetrate tough hide — a lower sight angle, and a corresponding increase in projectile velocity.

A series of tests showed that by altering the velocity control and setting various sight angles within one degree the terminal impact of the projectile could be adjusted to give desired needle penetration for small animals where perhaps only 0.26 foot pounds of energy would be required, or it may be increased in infinite stages to greater impacts for large animals with tough hides, where 50 to 60 foot pounds of energy is required.

Since the impact for soft skinned animals such as buffalo, giraffe and deer species is only 10 to 12 foot pounds, a maximum range of over 200 yards is possible. A rhinoceros on the other hand may require 50-60 foot pounds which is obtainable at a maximum range of 140 yards.

By pre-setting a suitable sight angle for the species, the only adjustment required while hunting will be to the velocity control to provide the range needed.

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\* Mr Murdoch is a pharmacist and the Managing Director of Paxarms Ltd., Timaru. The modified rifles and pistols and the syringes described in this article were designed by him and patented. — Ed.





**The Paxarms Mark 10 syringe pistol.**

Photo: C. A. Murdoch.

The latest models in rifle and pistol follow these principles but include greater versatility in the ease of carrying and use in the field. The weight of the earlier Marks in the rifle has been reduced from 9 lb to almost 6 lb including a telescopic sight. Range has been increased to slightly over 200 yards, compared with about 80 yards in the earlier types. Projectile velocity is variable from 30 ft per second to 700 ft per second.

Interchangeable barrels in .465, .509, .527 inch are available for the mark 20 rifle and the mark 10 pistol and a special new calibre of .750 inch is available for the rifle. These allow a choice of syringe capacities from 0.5 mil to 14 mil.

### **The Cartridge-propelled Syringe**

The syringe required an automatic injection system that could withstand the punishment of being fired. Drug capacity had to be limited so the weight of the syringe did not increase the energy of impact too much. Compressed air, trapped behind the piston, expands when the drug is given passage through the needle. This pressure made necessary a valve system which would open on impact. The valve also stops air suction over the needle during flight thus preventing the loss of drug. As the rate of injection can be adjusted by variation of the air pressure in the syringe and because air pressure is released on filling a syringe, it is sometimes necessary to use a specially designed hand pump to replace air pressure just before loading the syringe.

**Opposite: The author checks the pulse of a captured hind.**

Photo: Courtesy C. A. Murdoch.



**Opposite:** Top photo shows four drugged stags that were captured in 1968 in Otago for the Lincoln College deer research farm. Nine hinds were also taken. The last stag in the line is pictured below in the holding pen.

Photos: C. A. Murdoch.

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Alternatively the syringe may be loaded into the weapon and fired, allowing cartridge gas to enter the tail nipple and be trapped there. Since it is now possible to replace air pressure it is also possible to release the pressure for storage of the syringe while it still contains a drug.

Plastic projectiles are inexpensive, light and strong and allow the drug to be seen. As they are made in identical mould dies they are consistent for bore-fit. Each calibre of syringe is reproduced to identical weight and will therefore have the same flight accuracy.

## **Drugs**

Early drugs used did not always give the same results in all animals injected. Variations in drug tolerances and even the dose levels from one species to another were found to be considerable. Some animals of the same species responded very well while others were found to be highly distressed by the same drug. The drug dose is not directly related to body weight, but rather to the blood chemistry of the species.

New drugs however have been found or developed and combinations of various drugs too have proved much more predictable and are well tolerated by many more differing animal species. Some drugs are rigidly controlled by laws and even international laws and are available only to persons with the required skill and qualifications to use them.

There are a number of very useful drugs which may be used by lay people, lacking the technical knowledge of a qualified person, providing the dose levels are adhered to as given in drug dose tables, but these drugs must be obtained through a veterinary practitioner's prescription as they too are controlled by drug laws.

## **Use of the Equipment**

So many and varied are the applications to which the equipment is put today that we frankly are no longer surprised. A crocodile farmer in Indonesia Malasia uses special syringes fired from one of our weapons to handle his animals for their skins. This makes handling less dangerous for him and damages

the skin only slightly. Museums collect specimens for taxidermy by injecting a lethal dose and there is little damage to the carcasses of the animals or birds recovered by this method. Some sheep farmers have found the equipment valuable for lambing as it makes mothering of lambs or the replacement of a prolapsed uterus much easier. With lambing or calving, a drug selected to restrain and relax the mother can simplify delivery.

Then there are the usual applications such as the capture of deer for deer farms being established in New Zealand, and a number of countries overseas.

Our part in developing this equipment has not been easy but we have the satisfaction of knowing that our weapons are being used in 70 countries or more, and many animals are being handled to allow research, conservation, or treatment which previously could not be done.

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## **HIGH-COUNTRY HOGGET MANAGEMENT**

K. Thompson

Farm Advisory Officer (Animal Husbandry)  
Department of Agriculture, Oamaru.

Where runholders have developed their properties and increased ewe numbers, the increase in stock performance has been slow. Low lambing percentage is a major limiting factor. A few runholders are achieving 100 percent from Merinos and Halfbreds, but the majority average 80 percent. A lambing percentage as low as this restricts the number of ewe hoggets available for replacements, and this limits the scope for flock improvement by hogget selection.

An initial survey has shown that many runs tup ewes at 85 lb with a range of liveweights, within a flock, from 55 to 100 lb. Low ewe liveweight is associated with:

- (i) Inadequate hogget feeding producing small two teeth.
- (ii) The low nutrient value of unimproved tussock and periods of semi-starvation where large blocks are grazed.

With development a limited area of improved country can be used for hogget grazing, but even with this advantage two tooth performance has been disappointing.

A survey is being undertaken to determine how feeding and management can give better hogget performance. Three Merino and three Halfbred North Otago flocks were selected and two hundred hoggets in each flock were tagged at weaning. Live-weight and production are being recorded.

## HOGGET MANAGEMENT SURVEY

### Weaning to Winter

Well grown hoggets should be 70 to 75 lb liveweight by the beginning of winter, but few runholders achieve this. Most high-country hoggets are less than 65 lb in June. The survey showed that lambs were weaned at 40-45 lb and that autumn management had a big influence on early-winter liveweights. In the four months after weaning, lambs gained 10-20 lb and this gave small 50-65 lb hoggets at the start of winter.

Hogget growth was poor where they had been intensively stocked on improved blocks. Mob stocking and rotational grazing of hoggets failed to give good growth rates. This year some runholders have changed their methods of grazing with good results. These changes are discussed later in this article.

### Early Weaning

Where the post-weaning management has succeeded in giving good growth rates, additional advantages can be obtained by earlier weaning. Lambs born and reared under normal run conditions grew to about 45 lb on their mothers, although there were variations in time of weaning. Weaning weights and dates are shown in the following table:

**Lamb Weaning Dates and Liveweights**

Flock	Weaning Date	Liveweights
* 1. Merino	3 Jan. '70	51 lb
2. Merino	20 Jan. '70	42 lb
3. Merino	25 Feb. '70	52 lb
* 4. Corriedale	3 Jan. '70	53 lb
5. Halfbred	28 Dec. '69	42 lb
6. Halfbred	30 Jan. '70	40 lb

\* Tara Hills Merino and Corriedale flocks.

Tara Hill records provide a comparison for lambs born on paddocks, while flock 3 represents traditional weaning in late February. Although the weaning weight of 52 lb is satisfactory, had the lambs been weaned six weeks earlier, they would have been 5-7 lb heavier.



**Opposite:** The author (right) weighing hoggets on Taramea, Haka valley. Hoggets do not respond well to sudden or frequent changes of diet.

(Photo: J. D. Currie from a transparency).

In this survey the sheep breed had little effect on weaning weight. This confirms work at Tara Hills by Scales (1968), when no significant difference was found in weaning weights from Romney, Corriedale and Merino lambs. Difference in weaning weights are due only to feed. From these results it is recommended that tussock reared lambs be weaned before mid January or when they are 40 lb liveweight.

Earlier weaning is possible and Scales, Lewis, Ludecke (1968) at Tara Hills showed that lambs weaned at 10 weeks of age grew satisfactorily. When feed is very short the practice of early weaning has been tried on some runs. This was seen on Ribbonwood Station in the 1969/70 season. Halfbred lambs were weaned on 28 December at 8 weeks of age. Although feed was short these lambs grew at a rate of 0.4 lb per day. By 3 February they were 52 lb and reached 74 lb liveweight by winter.

This season, very early weaning has been tried successfully on two other runs. At Otamatapaio feed was short in mid-December so ewes were mustered from the improved lambing blocks and put on a hill block. The 2,000 lambs were weaned on 15 December at an average liveweight of 33 lb. These Merino lambs were only 4 to 9 weeks old but good lucerne was available and they were 45 lb by early February, and have continued to grow satisfactorily.

A comparison between early and normal weaning was made at Mt Dasher when 800 Halfbred lambs were weaned on 20 December at 4-10 weeks. These lambs came off the hardest block, averaged 31 lb, and were weaned on a good grass paddock. The remainder of the flock were weaned at the end of January weighing 44 lb. By this time the early weaned lambs had gained 12 lb and were 42 lb liveweight, thus comparing favourably.

This practical experience proved that early weaning is possible in the high country but quality feed must be available to make it a success.

### **Feed Quality**

Growth rates better than 0.2 lb/day are required for hoggets to reach the target of 75 lb by winter. A good supply of quality feed is essential to maintain this growth throughout the autumn. High protein feeds will give this, and this suggests that legumes are an essential part of a hogget's diet.

Tussock swards were shown by Macrae and O'Connor (1970) to be of inadequate nutritive value for maintenance feeding and hoggets in this survey stocked at 1 to 4 acres, gained only 15 lb in four months. Most runholders realise this and have improved blocks, clover pasture or lucerne available for hoggets.

On developed country, use of feed is sometimes poor and hogget growth disappointing. The two main problems noticed in this survey were the effects of changing the type of feed, and type of stocking. *Hoggets take 10 to 14 days to adapt to a change in diet, and the growth rate is checked over this period.* This is associated with digestion in the rumen, particularly when changing to and from lucerne. In the survey, hoggets shifted regularly from grass to lucerne, to grass, or from improved tussock to grass to native, did not grow. These feeding changes were made on runs where only a limited area of good feed was available. These results suggest that management must be planned to have a similar type of feed available for both suckling and weaning. Hogget mobs may have to be split to facilitate this management. This may increase the work load, but the improved growth rates will make the job worthwhile.

## Stocking

Careful stocking is required to obtain the full use of available feed. Set stocking can be successful although a system of rotation may be necessary to keep a good, fresh supply of feed in front of the hoggets. To maintain growth rates hoggets must be moved before they are forced to clean up a paddock or block.

Stocking rates can be too high. It was observed that 100 hoggets per acre on lucerne were severely checked. Also stocking rates can be too low and both feed and growth rates suffer. A summary of stocking rates that gave good results on different feeds is given in the following table:

### Recommended Hogget Stocking rates on Different Feeds

Type of Feed	Stocking rate Hoggets per acre
Improved tussock — set stocked	2 - 5
— rotationally grazed	8 - 15
Clover pasture — set stocked	5 - 10
— rotationally grazed	20 - 30
Lucerne	30 - 50

## Drenching

Anthelmintic drenching to control worms is essential. Generally it can be recommended that hoggets be drenched every six weeks from weaning to July, and more frequently if worm infestations are heavy. In periods of wet and overcast weather or when feed is rank and damp, conditions are suitable for worm infestations, and more frequent drenching will be required.

It is pointless to drench only some of the hoggets in a mob; if a few are scouring then all will need drenching. Selenium will be required in many inland areas but its use should be confirmed by a veterinarian.

## Summary

Weaning to winter is an important stage in the growing of good two toothed. The aim should be a 75 lb hogget by the beginning of winter. To achieve this lambs must be weaned by mid-January. It is practicable to wean earlier but quality feed is necessary for satisfactory hogget growth. A high proportion of legume is required in the diet and lucerne or clovers are best. These must be grazed to give the best utilisation without affecting growth rates. Worm drenching is necessary and climatic conditions are an important indicator of frequency.

## Acknowledgements

Interest from several runholders made it possible for this survey to be carried out, and their assistance is acknowledged. In particular I thank the managers and staff from Ribbonwood, Omarama, Otamatapaio and Mt Dasher Stations.

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# THE FEEDING OF SHEEP ON PART-IMPROVED TUSSOCK GRASSLAND

Dr E. W. Vartha and P. T. Clifford  
Grasslands Division,  
Department of Scientific and Industrial Research,  
Lincoln.

Legume and grass oversowing with fertiliser gives an increased quantity of better quality herbage from tussock grassland as well as an extended season of growth. However, in terms of annual distribution of feed supply, the winter gap is widened. Hay, or pasture conservation in autumn as a standing crop, and supplementary feeding are thus used to supply winter needs. Important questions that arise in the improvement of tussock grassland are how to best utilise this extra feed in conjunction with the remainder of the unimproved grassland, and the need for and means of providing supplementary feed.

## The experiment

Over the past three years, we have been studying management of part-improved tussock grassland where:

- (1) the improved area was spelled from February to May and then fed to sheep at tugging.
- (2) the improved area was overdrilled with ryecorn in February but *not* fed to sheep until prior to lambing.

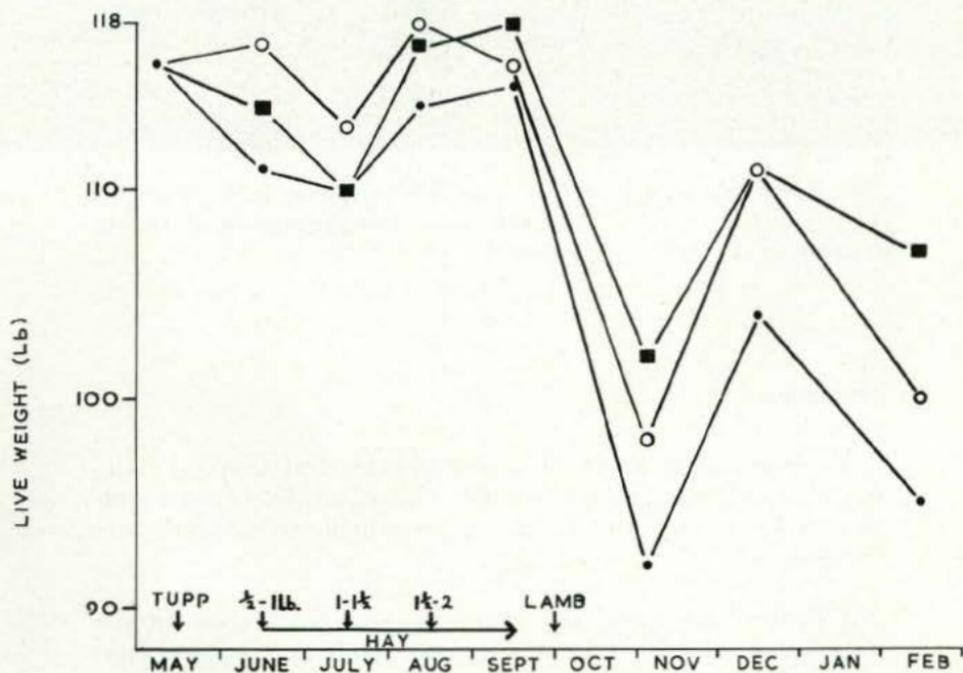
Winter hay ration for sheep fed conserved herbage in early winter was a  $\frac{1}{2}$  lb per head per day (1 bale per 100) in June, increasing to  $1\frac{1}{2}$  lb by August. For sheep fed overdrilled ryecorn in late winter this was 1 lb increasing to 2 lb. These systems were compared with sheep on unimproved tussock grassland, with a winter hay ration of 1 lb increasing to 2 lb.

The study was of half-bred ewes grazing a block of 450 acres of fescue tussock grassland on terrace land at the foot of a range of low hills near Lake Pukaki. The block was split into three comparable sectors. In two of these, a 15-20 percent portion of their total area was overdrilled with grasses and clovers in 1968, with 10 lb Manawa ryegrass,  $2\frac{1}{2}$  lb cocksfoot, 2 lb alsike clover,  $2\frac{1}{2}$  lb Montgomery red clover and  $1\frac{1}{2}$  cwt of 400-S Mo superphosphate per acre.

Results given are from the 1970 experiment which commenced when all three sectors were spelled from grazing from February until May and then stocked. The ryecorn was overdrilled in February with  $1\frac{1}{2}$  bushels ryecorn and  $1\frac{1}{2}$  cwt 400-S Mo superphosphate and 100 lb nitrolime.

In previous issues of *Review* we have described experimental overdrilling of ryecorn into clover-improved tussock grassland. Satisfactory results encouraged us to try this in practice. In dense clover the establishment and growth of ryecorn was considerably less than we had obtained in the experimental plots. However, as shown in the figure below, feeding ryecorn-clover in late winter improved ewe liveweights prior to lambing.

Liveweight changes for 3-5 year ewes are shown in the figure. The pattern was similar for two-tooth ewes.



LIVEWEIGHT OF 3-5 YEAR HALF-BRED EWES

- O — O Part-improved, autumn clover
- — ■ Part-improved, winter ryecorn
- — ● Unimproved

Marked drop in liveweight caused by pre-lamb shearing and lambing



The clover improved pasture on the left is shown as at December 1970. This had not been grazed since the end of the preceeding August. Pasture on the right is unimproved.

Photo: E. W. Vartha from a transparency.

## Discussion

The feeding of improved tussock grassland at tuppung maintained liveweights in early winter. Consequently we were able to feed less hay in winter without prejudicing liveweights prior to lambing.

Clover had a marked effect on ewe liveweights in the critical feeding period from shearing to tailing. In this short period, differences of 10-12 lb were obtained between the ewes grazing part-improved and unimproved pasture and in general these were maintained until weaning.

Differences in winter feeding practices had little effect on greasy fleece weights when shorn pre-lambing. These (including bellies) ranged from 7.6-7.9 lb per head. Quality of the fleeces was better for ewes on part-improved tussock grassland.



On the left is overdrilled ryecorn in an experimental plot. Research results show that rather than grow the cool season ryecorn crop it may be more profitable to learn to utilise feed which can be grown with less difficulty in the warm season.

Photo: E. W. Vartha from a transparency.

Lambing percentage was higher where clover-improved pasture was fed at tugging (108 percent compared with 96-100 percent). Lambs on part-improved pasture grew faster to weaning. Mean liveweights of ewe lambs were:

Part improved — autumn clover	59 lb
Part improved — winter ryecorn	63 lb
Unimproved	56 lb

Saving unimproved tussock grassland for winter feeding at best provides only a low quantity of quality herbage, so that supplementation of the animal diet is necessary, usually with hay. Both in terms of limited opportunity to make hay and difficulties in feeding out, reduction in hay requirements by alternative management would be desirable practice.



Sheep carried on part-improved autumn-clover pasture prior to shearing in August. These are in good condition despite lower levels of hay feeding.

Photo: E. W. Vartha from a transparency.

Few of the species that are oversown in tussock grassland can be satisfactorily conserved as standing herbage for use in late-winter. Clovers, particularly white clover, are 'frosted off' early in winter.

**Therefore it is desirable to use conserved standing herbage by early winter whilst its quality is still high.**

The results have shown that, not only has this practice improved lambing percentage, but has enabled savings in hay, amounting to 1 bale per head in 1970. Thus part of the winter supply of hay can form an emergency reserve. Regular stock weighing enabled us to capitalise on differences in liveweight which were not readily apparent to the eye and gave confidence that under-feeding was not being practised.

Provision of high quality feed by overdrilling ryecorn had only a minor effect on animal performance probably because there was only a small quantity grown. The difference between part-improved tussock grassland treatments, in ewe liveweights over spring-summer, can be explained as the greater amount of clover grown *where superphosphate was overdrilled in autumn* than where topdressed in late winter.

**Rather than attempting to grow the cool season ryecorn crop from overdrilling, attention could more profitably be focussed on utilisation of feed which can be grown without difficulty in the warm season.**

Our experiments were with improved tussock grassland in the clover dominant phase of development. Appropriate grasses such as tall fescue may ultimately provide herbage with greater frost resistance than that grown in the early stage of tussock grassland development.

The importance to animal production of adequate live-weight at mating has been stressed in a previous issue of *Review*. In our experiments, ewes that were fed on part-improved pasture had almost regained their previous tugging liveweight by mid-summer. There is then opportunity to spell the improved pasture for tugging feed.

## Summary

Our experiments have shown that part-improvement by oversowing with grasses and clovers, and appropriate utilisation by stock whilst quality of feed remains high, can give overall improvement in the nutritive value of herbage grazed and a lessened need for supplementary feed. The improvement was in terms of performance per head of stock. A greater proportion of grassland development could increase stock numbers per acre, but even at 1 ewe per acre all year round, the 20 percent grassland improvement gave several dollars per acre increase in profit.

## Acknowledgement

This project was in part funded by the Tussock Grasslands and Mountain Lands Institute. The authors thank the runholder, Mr R. Hosken, for provision of facilities and personal assistance and his run managers Messrs P. Allen, A. Parkes and T. O'Carroll for stock management.

# MAPPING THE COMMON BIRDS OF NEW ZEALAND

J. B. Hamel \*

Many farmers find that the most important and numerous forms of wildlife on their farms are common species of birds such as blackbirds, skylarks and gulls. Yet if an ornithologist visits his farm looking for birds, the farmer usually finds the visitor is looking for rare and unusual birds. Certainly there is much to be learnt from this but New Zealand ornithologists have recently decided to find out more about the detailed distribution of the commonest and most widespread species, since these after all have the greatest impact on our countryside.

With this as one of its aims, a bird mapping scheme has been started by the Ornithological Society of New Zealand. Dr Peter Bull at Ecology Division, D.S.I.R., is its chief instigator and co-ordinator. Instructions have been sent out to regional representatives in each province and they coordinate the efforts of their local O.S.N.Z. members. Country members are assigned areas to cover in their own districts and town members (who are in the majority) drive out at weekends into the districts not covered by country members.

What sort of results have we been getting? Lists are made for each of the 10,000 yard squares on the National Grid and there are 1600 of these squares in the North Island and about 2000 in the South Island. The lists will be used to prepare maps showing where a given species has been found, where it seems to be absent, and where it has not been sought. Inevitably some species will be missed in some squares but by compiling these lists mostly between August and January, when the birds are breeding and at their most conspicuous, we hope to reduce this source of error to a negligible level. Also, a shrewd ornithologist can usually predict from a map where he will find most birds. In inland squares the lakes, rivers and streams are the most fruitful places. Along the coast the best places are usually the mouths of rivers, low reefs and jutting headlands. By visiting between two and five places in a square the obser-



Fantail

ver probably finds about 95 percent of the species present. In open tussock country with a few scrubby gullies, visits to two places would probably be sufficient.

During the first trial year, 1969, 530 squares were covered and many more will have been done during this last summer. When I last spoke to the North Auckland organiser he expected every square of their region to be covered by the end of January 1971. In Otago I am not so ambitious, but already there are lists for 90 of Otago's 450 squares.

Even after the trial year some interesting results have appeared. The blackbird takes first place as New Zealand's most common bird, being recorded in 460 of the 530 squares covered. The song thrush, chaffinch and starling were about equally common but house sparrows came well below these four other species (381 squares) and when lists come in from the more remote areas, with fewer farm buildings and trees, house sparrows will probably move even further down the list.

Another way of looking at the figures is to first group the lists according to province and then extract figures for a single species. Then for each province it is possible to calculate the percentage of lists in which the species occurs. Dr Bull did this for silver-eyes using the 1107 lists returned in 1969-70. The results were as follows:—

	% of lists with silver-eyes
Northland	70
Auckland	57
Central North Island	56
Hawke's Bay-Manawatu	41
Wellington	35
North and West South Island	49
Otago	30
Southland	19

It seems that silver-eyes are more abundant in the North Island and become less common further south. Goldfinches show a similar pattern but redpolls are much more numerous in the south and those that do occur in the north are mainly at higher altitudes (Bull 1970). I think the silver-eye and goldfinch figures surprised many of us. When a bird is common it is very difficult to pick up trends like this and yet obviously if we are to discover how to reduce or conserve a species these distribution trends are required basic facts.

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\* Mrs Hamel is regional representative of the New Zealand Ornithological Society (Inc.) for Otago and member of the society's Council.  
— Ed.



Above are chicks of the black-fronted tern. Below is an adult black-fronted tern. This bluish-grey bird is widespread on the riverbeds and nearby paddocks of the South Island from Marlborough to Southland during summer. Its black cap and dipping flight also help to distinguish it from black-billed gulls which occupy the same habitats in summer.

— Lincoln College photos from plates.





**Wrybill.** This greyish dotterel is found during summer on the river beds of Canterbury and North Otago. The markings on the crown and forehead distinguish it from adult banded dotterels and the narrow black collar from juvenile banded dotterels during summer.

— Lincoln College photo from a plate.

If you look at standard texts you will find that pipits are described as birds of the drier areas of New Zealand, but what seems not to have been realised is that pipits are absent from the driest areas during the breeding season. This still has to be confirmed. An analysis of the lists we so far have from Otago shows that except for two sightings no pipits have been seen between August and January in areas with under 30 inches mean annual rainfall (Hamel: in press). We do not know why this should be and it is rather puzzling when skylarks and other small passerines are quite abundant around the Maniototo, Manuhierikia and other dry Central Otago valleys. Many of these areas carry vegetation similar to that in areas where pipits do breed. If we can find out why pipits will not breed in these dry areas we may find out something interesting about why the other little passerines *can* tolerate low rainfalls.



Banded dotterel. This is one of the commonest birds of South Island riverbeds and dry paddocks during summer. The large patch of chestnut brown on the breast indicates it is a male in full breeding plumage.

— Lincoln College photo from a plate.

In drier areas the 30 inch isohyet may wind in a complex way across the face of a mountain range. Around Queenstown and to the north of Millers Flat there are few or no pipits on the lowlands, but they are present at higher altitudes where rainfall is more than 30 inches. If the correlation of pipits with rainfall holds true for Canterbury, Blenheim and Hawke's Bay (where there are also areas of less than 30 inches rainfall) the presence of pipits may be a useful casual indicator of the 30 inch isohyet.

Since the lists are being made for known periods of time they will also be useful base line data for measuring changes in bird populations. If in twenty years time a research worker suspects that pesticides have greatly reduced blackbird populations over certain parts of the country, he will have a means of comparing blackbird populations at two different points in time. Though each list is a fairly minor piece of work on its own the large numbers of lists being compiled makes useful generalizations possible. The massiveness of the scheme is one of its great strengths.

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The Ornithological Society is to repeat the survey from 1st August 1971 to 31st January 1972 and would appreciate the valuable assistance that can be offered by persons living in remote areas. A good knowledge of the common birds of these areas will assist with the accuracy of the survey. Those wishing to help may write to:

Mrs J. B. Hamel, 42 Ann Street, Roslyn, Dunedin.

Dr P. C. Bull, Ecology Division, D.S.I.R., P.O. Box 30466, Lower Hutt.

— Ed.

# TRESPASS

R. B. McLuskie

Legal Adviser,

Federated Farmers of New Zealand (Inc.), Wellington.

Trespass, especially with gun and dog has become a major social problem in rural areas. Frequently there are heavy stock losses as a result either of indiscriminate shooting or of dogs. The farmers' quarrel is not with the responsible shooters but with the irresponsible ones, often unskilled in the use of firearms, who are prepared to roam over private land without the permission of the owner.

The statutory provisions on trespass in New Zealand were strengthened in 1968 with the passing of the Trespass Act in that year. The Act was passed following representations over a long period by Federated Farmers and individual farmers. Although the 1968 Act strengthened the inadequate provisions prevailing at that time, statutory protection in this country against trespass is still considered insufficient by many farmers.

At common law the person in possession of land is entitled to the use and enjoyment of the land and anyone who interferes with that right, by trespassing, commits a tort or injury to him.

Trespass can be committed when a person enters without lawful justification upon land in the possession of another person; or by a person who remains on land after his right of entry has ceased. If the person in possession can prove trespass he is entitled under a civil action to claim damages but these will be nominal unless loss of stock or damage to stock arising from the trespass can be proved.

The common law has been reinforced by various statutory provisions in New Zealand. Most of these were consolidated and some strengthening given to the statutory provisions by the Trespass Act 1968. Under this Act a person commits an offence and is liable to imprisonment or to a fine if he wilfully trespasses on any place and neglects or refuses to leave that place after being warned to do so by the owner or occupier or any person acting with the authority of the owner or occupier. This provision does not make trespass in itself a statutory offence. It does, however, make it a statutory offence if a trespasser refuses to leave after being asked to do so.

Under another provision in the Act it is a statutory offence for a trespasser, who has been warned to stay off any place, to trespass in the same place any time within six months after the warning.

An offence can also be committed by any person who goes on any private land without the authority of the occupier, and by means of a dog, firearm or vehicle disturbs any domestic animal on that land or, though not in possession of a dog, firearm or vehicle, wilfully or recklessly disturbs any domestic animal on the land. There are difficulties of proving disturbance under this section.

One of the innovations in the 1968 Act was the section which makes it a statutory offence for any person to discharge a firearm on any private land without the authority of the owner or occupier, or discharge a firearm *across* any private land.

Another new offence created by the 1968 Act is that of the wilful trespasser who opens and leaves open a shut gate on land used for the farming of domestic animals.

The Act also places an obligation on the trespasser to give name and address and satisfactory evidence of its correctness on being required to do so by the owner or occupier or person acting under his authority.

Some people consider the proceedings section of the new Act to be a major weakness. This section states that proceedings under certain sections of the Act are to be taken only on the information of the occupier of the land in respect of which the offence was committed. The laying of information amounts virtually to a private prosecution by the landowner or occupier. The section goes on to state that where the information has been laid by the occupier, any constable may appear at the hearing of the charge and conduct the proceedings on the informant's behalf. In other words it is at the complete discretion of the Police Department whether they will prosecute or whether the owner or occupier has to conduct a private prosecution. The offences to which this discretionary power applies are the disturbance of domestic animals by trespassers with a dog, firearm or vehicle, the discharging of a firearm on or over private land, failure to shut gates and failure to give name and address when requested.

The Police also state that they are not required to investigate and collect the evidence under the sections where they have this discretionary power. It is for the occupier to do this. However, the Police Department has stated that where further details need to be examined in any case that would otherwise warrant

prosecution they will attend to these. *The Department has also said that if an occupier is having a great deal of trouble with trespassers the Police may assist the landowner to collect evidence under the discretionary sections.*

The Trespass Act 1968 was the culmination of a number of years of intense pressure by Federated Farmers to get some amendment to the law then prevailing. The statutory provisions still fall short of those obtaining in many other countries. For example, the United Kingdom Firearms Act 1965 makes it a statutory offence, punishable by either a fine or imprisonment, for a person who trespasses with a firearm.

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**Table of Food Values of Common New Zealand Foodstuffs**

Foodstuff	Dry Matter %	Metabolizable Energy (Mcal ME/kg DM)
Poor-quality hay	86	1.6 - 1.9
Medium-quality hay	86	1.8 - 2.0
Good-quality hay	86	2.0 - 2.2
Clover hay	84	2.2
Lucerne hay	84	2.1
Wheat straw	86	1.4
Oat straw	86	1.6
Ryegrass straw	86	1.7
Leafy pasture	20	2.6 - 3.0
New pasture	16	2.8 - 3.0
Winter pasture	35	2.4 - 2.6
Brown summer pasture	60	2.1 - 2.4
Silage	20	1.8 - 2.3
Green oats	20	2.7
Italian ryegrass	20	2.8
Chou moellier	15	2.7 - 2.8
Kale	15	2.9
Lupins	15	2.8
Rape	14	3.0
Green maize	25	2.4
Swedes	12	2.9 - 3.0
Turnips	9	2.9 - 3.0
Fodder beet	15	2.5
Barley	87	3.1
Oats	87	2.8
Wheat	87	3.3
Maize	87	3.1
Linseed meal	88	3.2
Meat meal	89	2.6
Sheep nuts	89	2.9
Skim milk	9	3.5
Butter milk	9	3.5
Cow's whole milk	13	4.4
Whey	7	3.4

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Dr K.T. Jagusch and Professor I.E. Coop.

# REVIEW

## JOURNAL OF THE TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE

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# REVIEW

A PERIODICAL DEVOTED TO THE  
SHARING OF INTERESTS IN TUSSOCK  
GRASSLANDS AND MOUNTAIN LANDS

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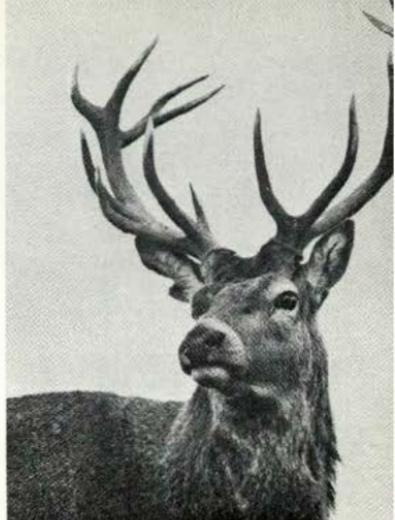
## BOOK REVIEW

### **WILD ANIMALS IN NEW ZEALAND**

Compiled under the direction  
of A. L. Poole;

photographs by J. H. Johns.

Published by A. H. & A. W. Reed  
1970, 151 pp.



Red Stag from page 25.

This book by the New Zealand Forest Service aims to show all our wild animals, "from the mighty Wapiti to the ubiquitous mouse, in their natural state . . ." It outlines their distribution and describes how they have adapted to their new environment. The first chapter is by J. T. Holloway who points out that there is still fire in the debate as to whether the introduction of exotic game animals was a good thing for New Zealand. Evidence for an overall lack of agreement is seen in the book. In the introduction we are told that private hunting is being encouraged, "eventually to lower wild animal populations enough for forests to tolerate them". But Holloway points out that although new types of resistant vegetation may evolve, "there are few signs of this happening yet . . ." The reaction of the Forest Service to these conflicting hypotheses are explained by Holloway in what is the best writing in the book.

This could have been the one opportunity to clear up once and for all the myth of the "bush rat". But with no photographs of either of the introduced rats, or the mouse that we are promised on the dust jacket, no comparison is possible.

The 91 black and white photographs are a credit to the patience and skill of J. H. Johns. The colours of the animals are described in the text but in the plates they do not reach the standard of photographs of animals in a similar book by Gordon Roberts. The several beautiful plates of landscapes in the present book indicate the potential that was lost in characterising the animals. The technical reproduction of the half-tone photographs is not high, several of them being spoilt by a flat murkiness. Similarly the text is somewhat smudged in places.

While the book began with a stimulating discussion, the rest of the text is not up to this standard. There are some details of the ecology and breeding biology of a few of the smaller animals, but for the majority of animals this information is lacking. Even where it is included, it is presented in rather a drab style.

There are six distribution maps but these could have been improved by indicating the relative density of the animals, particularly in the case of the red deer. Readers may then perhaps have been able to guess for themselves the influence of these animals on their surroundings. For instance, the diversity and vigour of the vegetation in the Raukumara range near East Cape, where there are very few deer has to be experienced to be believed.

The commercial aspects of game farming are discussed, but none of the authors have been prepared to comment on the affect this is having on the efforts of the Forest Service to control the animals. Deer farms have been legislated for, but I suspect that the production from unlicensed herds will be very much greater. It is the same story as the rabbit — no one is going to eradicate the deer if they are worth \$40 each.

The book finishes with notes by J. H. Johns on the methods used to take the photographs.

It is for the photographs that the book will be bought if this first impression is still procurable, although there is much of interest in the text for the general reader.

Peter A. Williams.

## TRAMPING:

### The Sociable Years

I know now that half the golden haze that seems to surround those years in my memory must be attributed to the people who shared in what one was doing. I once spent most of the weekends of one year generally alone in the bush, and I cannot now for the life of me remember any of its highlights — except getting lost for a half a day, a singularly lonely experience. But when one was with people — how different this could be. Each trip, no matter how minor, had its incidents. Few of us were hairy goats, prancing head-down over vast distances; most were in the mountains to be with the people they liked, for mountains and people both were aspects of freedom.

I call them the sociable years, for that's how I remember them, but it is amazing how much of the sociability was expressed in the exchange of ideas — or, to be more precise, in good old-fashioned argument. Any trip which included A.H. (Bonk) Scotney in the party had its fill of debate; other notable argufiers over the years included L.B. (Pip) Piper, Gunter Warner, Paul Cotten, R.M. (Ross) Martin, Conrad Bollinger and H.C.A. (Tony) Somerset.

R. KNOX—"V.U.T.C. '71" a publication to mark the 50th Jubilee of the Victoria University Tramping Club.

# FORESTRY ENCOURAGEMENT SCHEME

N. Barr  
Helensville

This article, an editorial note in the New Zealand Journal of Forestry Vol. 15 (2), 1970, is reproduced here by arrangement with the New Zealand Institute of Foresters, Inc.

In April 1970, the new Forestry Encouragement Grant Scheme for private and small company plantings replaced the previous Farm Forestry loan scheme, and by mid-May applications to plant some 42,000 acres had already been received by the Forest Service. The two schemes differ greatly. The loan scheme resulted from a request by landowners for money at a cheap rate of interest for planting trees; the grant scheme appears at first sight to be a rather unsatisfactory substitute method of tax deduction. In the brochure produced to launch it, the "Basis of the Scheme" is set out as follows: "The grants under this scheme are an alternative to the existing tax concessions whereby companies can deduct against current income the cost of planting, maintaining and developing a forest. The grants will be equal to one half of the qualifying expenditure incurred in planting, maintaining and developing an approved new planting programme".

The loan scheme ended up as something of unexpected generosity. Briefly, loans up to \$80 per acre for planting and tending were granted to farmers (not landowners, as originally intended). Provided work was satisfactory, 50 per cent of this loan was written off, and the balance went forward at 3 per cent compound interest until the time of the first major sale. This was a courageous piece of legislation, and was favourably commented upon by agricultural interests who, incidentally, could have administered such a scheme, with their experience of State Advances and Marginal Lands loans. The scheme was quickly copied by two Australian States, and in July 1969 the US Forest Service was introducing a similar scheme to supplement, by long-term lending, the well-tried grants scheme, which had been found wanting in this respect. Dropping the scheme in New Zealand after so short a period in view of these overseas developments, prompts the thought that it may not have been given a fair trial, for there were three false starts due to some time-consuming delays in altering faults in the original legislation; loans were less readily available during the 1967-8 recession; and

finally there was the *Dothistroma pini* scare. There were administrative difficulties too, and one felt the N.Z. Forest Service, after its first initial venture into the money-lending business, was rather too eager to drop the burden. But it seems possible that, with a more persistent approach, the legal and administrative aspects could have been much simplified, and it now appears that it might have been best had this scheme been retained to supplement the grant scheme now in vogue. There is no doubt that a simple grant scheme, up to (say) 100 acres, or for large areas where the owner has sufficient capital, is commendable. But for farmers with heavy calls on tax-paid profits, or for city folk with family or business commitments, the 50 per cent grant might be inadequate, especially when the earliest plantings use up all available resources. This is exactly what the U.S. Forest Service found to be the main difficulty with a grants scheme, and why they had to introduce a supplementary loan scheme. Thus, in New Zealand, the loan scheme could have also been retained to assist applicants for larger plantings when, after the grant scheme had been operated for a few years, they were found to be reliable and competent managers.

There is one aspect of the new scheme which seems hard to justify. It would have been simpler and fairer, if the object of the scheme is to encourage planting of timber stands, to provide a grant with no strings attached, similar to subsidies given to manufacturers and farmers to increase export production. Any land converted from marginal productivity to an income-earning forest must be in the interests of the country, and also contribute to the taxation pool. But according to the basis of the grant scheme, the grants are "an alternative to existing tax concessions". This appears to abrogate one of the basic principles of business, that any moneys expended in the production of goods for profit are deductible against returns, as a cost of production. Under the grant scheme no residual qualifying expenditure can be used as a deduction either at time of planting or when carried forward under the "cost of bush" formula. This means that any farmer, businessman or company participating in the scheme and having other taxable income, cannot claim any deduction for residual expenses. Other persons, eligible for other types of grants or subsidies, can do so. Thus, the planting enterprise will go forward to the final sale, and, when this takes place, the whole stumpage income will be due for taxation, with deductions for non-qualifying expenditure only — depreciation on plant, fences, etc., repairs and maintenance of roads and plant, and rates. It is generally accepted in

Britain that large private plantings have been encouraged because of much more attractive tax conditions than in the grant scheme. After all, it is only a little more cheese in the mousetrap. The spring trips eventually, and the tax is gathered in.

The new scheme is, however, more liberal in some respects. Under the loan scheme the total allowable expenditure was \$80, under the new it is \$240 per acre. Farmers, and some other landowners, with their built-in overheads, are not worried a great deal by "social costs" — housing, roads, and so on; nor is fire control a problem, with grazed land up to the margins of timber stands. Indeed, for most farmers, half the allowable sum would be adequate.

Recent cuts in the allocation of money for new planting by the Forest Service do not allay concern about the money that will be available for planting under the grant scheme. There is obviously a case for dealing with private planting under a separate vote. No mention has yet been made as to how many acres will be allowed each year, nor in what localities, although it is understood that this matter is under action at present. Moreover, it is most desirable that the "stop-go" progress of the loan scheme should be avoided.

However, in spite of these criticisms, the new scheme must result in an increase in private planting of marginal and idle land. Assistance is available to the public generally, and this is as it should be, for money for forestry is not readily available elsewhere. The scheme has clearly been well received by the public. But the thought still persists that, if growers were sure of an economic stumpage, either in the free market, or ensured by a strong marketing organization, and if, in addition, long-term loans were available from a Development Bank, there would be little need for such schemes. A consistently profitable stumpage would be a powerful incentive.

The next article, on the Federated Mountain Clubs of New Zealand, comes at a time when there are 97 clubs with a total of 15,865 financial members in the Federation. There is no way of reliably estimating the number of

people who have enjoyed aspects of mountain sport, but these figures of current membership indicate that many New Zealanders are turning to the mountains for their recreation.

— Ed.

# THE FEDERATED MOUNTAIN CLUBS OF NEW ZEALAND

M. S. Milne

Secretary of The Federated Mountain Clubs  
of New Zealand (Incorporated), Wellington

To constitute an association of mountain clubs in New Zealand united together for the internal purpose of safeguarding and advancing their common interests, while at the same time preserving to each individual club its own identity and the right to conduct its internal domestic affairs independently of the Federation.

This extract from the preamble of the constitution would seem to provide a satisfactory introduction to the general purposes for which the Federation exists.

The move for the formation of a federation of clubs came from New Zealand Alpine Club, which had been revived in 1914 after a period of inactivity, and on 11 September 1930 representatives of 12 clubs met to consider the proposal. Agreement was reached and a constitution was tentatively adopted. The address by the chairman, Mr Arthur P. Harper, the president of N.Z.A.C. told of the need for the federation. What is now the Mt Cook National Park had been leased to a tourist company which sought to make money from mountain club members by virtue of its control over the park and its facilities. The constitution proposed that persons with interests in tourist resorts should not be eligible to hold office in the Federation or serve on the committee. One of the first organisations to send congratulations to the Federation was the tourist company whose practices the Federation had been formed to combat.

At the first Annual General Meeting the first president, Mr F. W. Vosseler, is recorded as stating:

“Since the formation of the Federation practically every alpine and tramping club has linked up. In the beginning, for various reasons, several important organisations had held aloof. Their objections which, in the main, were more fanciful than real, have, I am glad to say, been removed, and now there are only one or two of the smaller clubs not in. Perhaps later on we shall be able to state that we have 100 percent strength. The original idea that the Federation would carry more weight than individual clubs has already proved its value in various dealings with legislators and departmental heads. In every instance where we have approached these, your Federation has received courteous consideration.

"It is our duty to watch not only our members' interests but that of the public as well, particularly the interests of future generations. We must guard closely the welfare of our National Parks and Reserves. These latter we should not regard as the property of our Ministers and our Government Departments, but that they belong to the people of today and tomorrow. We must fight for their protection if necessary. The Government has been approached, and it is hoped that in future appointments to Park Boards your Federation will receive consideration, and that amongst those appointed will be some closely allied to the Federation and able to represent its views.

"The growth of mountaineering sport and tramping from a small and casual beginning has in the past five years developed tremendously, and will no doubt continue to do so. It is the Federation's job as well as that of the individual clubs to see that safe and correct methods are instilled into devotees and that reasonable and proper protection is afforded them.

"The Rules and Constitution under which the Federation works, were drawn up by the sub-committee to whom the task was allotted and carefully scanned by the committee as a whole. The work has been carefully done, but, as may be expected, minor flaws have already been discovered and no doubt there are other imperfections that as time goes on may need amendment".

So began the work of the Federated Mountain Clubs of New Zealand. It is significant that the present aims and objectives remain basically the same as those initially considered by this national body which was authorised to act in the interests of all those clubs whose sport is found in mountain and bush areas.

These objects are included in the constitution as:

- (a) The promotion of climbing, mountaineering, skiing, deer-stalking, winter sports, or any form of active recreation in the mountains of New Zealand, or overseas and of the better knowledge of those mountains through literature, art or science.
- (b) The promotion of good fellowship and cooperation amongst all clubs or associations formed for any of the above objects.
- (c) The safeguarding and promotion of sound development of all mountainous districts in New Zealand and of every kind of recreation connected with mountains in the interests of those indulging in such recreation and the public

generally and to take such joint action as may be necessary to carry out these objects.

- (d) The publication of literature and information appertaining to any of the above objects.
- (e) The investment, control and disposal of the funds and property of the Federation and the raising of money for the purposes of the Federation upon the security of its property.

For approximately forty years the executive has actively pursued the objects of the Federation through its many standing committees.

The management of the Federation is vested in an executive consisting of (i) offices of President, four Vice-Presidents (two of whom are resident in the North Island and two in the South Island), a further Vice-President, ex officio, who is the immediate Past-President, and Honorary Secretary and an Honorary Treasurer and (ii) nine members, all of whom shall be elected at an annual general meeting of the delegates of all clubs affiliated to the Federation.

From the first days of formation the minutes of meetings have featured reserves and accidents. Registration of guiding was also a regular topic and it is interesting to note that these three subjects are still prominent in the work of sub-committees.

### **Reserves**

In the initial stages, the work of the Reserves Sub-Committee was concerned with producing maps and catalogues of reserve land throughout the country. The amount of Crown Land administered by Government in some form or another was found to be extensive. As most of this is either back-country forest or scenic reserve it provides much of the recreation grounds for clubs in the Federation.

The formation of National Parks, National Forest Parks and Scenic Reserves as areas set aside for preservation has been welcomed by the Federation. In fact a policy for a national authority for national park administration in New Zealand was drawn up by the Reserves Sub-Committee in 1938 and adopted at the Annual General Meeting of that year for presentation to Government. The National Parks Act of 1952 did not differ greatly from Federation policy.

With the increasing number of National Forest Parks being established, the Federation is concerned with the need for a consistent national policy comparable to that for National Parks which existed prior to the Act of 1952. Crown Land which is neither classified as Park or as Reserve is also the recreational area of the trumper, climber, hunter or skier and it

is with deep concern that the executive has seen signs again of commercial exploitation of the back-country coming into conflict with recreational use. Safari type tourism on back-country stations has tended to close access even though legal but undefined access exists. With representation being made by the executive at present it is hoped that amicable solutions to this problem will be found.

### **Accidents**

Quite early in the life of the Federation, there was a need to investigate all mountain mishaps, not to lay blame or fault with any individual or group, but to obtain information whereby lessons could be learnt to prevent further accidents happening. The records of the Accident Sub-Committee have been analysed periodically to determine any trends in the nature of accidents. Education and publicity can therefore be given to any areas of weakness.

So that mountain recreation can be enjoyed in safety the Federation's publication *Safety in the Mountains*, first printed in 1937, has become a by-word of safe practice and technique throughout the country. As techniques have changed over the years the publication has been revised to its fifth edition, which is now out of print and shortly to be replaced.

### **Safety**

With the growing popularity of recreation in the bush and mountains by members of youth organisations, secondary schools and adventure groups, there has become an increasing need to reduce accidents by eliminating those that are avoidable. The Federation has continued a campaign of education and information on safe practice and technique. However, because of financial problems this campaign has been spasmodic in the past. With the setting up of the Mountain Safety Council the campaign has become a continuing service, directed by the Council's management committee and regional committees throughout the country. Through this organisation, the production of educational material, the dissemination of information, and the training of potential leaders has resulted in a better understanding of mountain recreation.

### **Search and Rescue**

Accidents will always happen. Risks must be taken — in fact part of the attraction of the sport lies in the hazards that must be overcome by individual effort and team work. The achievement is all the better for it. However, a system for search and rescue has become necessary and has grown into an efficient administration. It is evident that the use of safe techniques and the elimination of avoidable accidents, would leave

search and rescue free for its true purpose. Although control rests with the New Zealand Police, the support given by members of the affiliated clubs ensures the continuing success for the system.

### **Guide Registration**

The subject of guide registration has been a controversial one for many years and really stemmed from the proposal to lease the Hermitage to a private company in 1922. The formation of Federated Mountain Clubs added a little pressure resulting in the passing of the Mountain Guides Act at the end of 1931, but the Upper House of the day deleted the clause which provided for a licensing board.

Repeated concern was expressed over the next few years that whilst it was desirable that guideless climbing should be encouraged it should be undertaken by only those reasonably skilled. The legislation was considered necessary for the protection of the public and because inexperienced men were being employed as guides. However, despite representation, the Government would not amend the Act but instead made it a condition that the words "for remuneration" be deleted. The Federation's reaction (in 1938) was that such a proposal was incapable of enforcement since it could be implied that every leader of a party, whether amateur or professional, must have a licence.

With the advent of the war the whole question went into abeyance.

The executive is once more in the process of promoting legislation which will provide a practical solution to a problem that is almost half a century old.

### **Skiing**

There has been no greater advance in mountain recreation than that of skiing, both in overseas countries and New Zealand. In the early formation of the Federation, ski matters were handled by a sub-committee of the executive but this was quickly reformed as the New Zealand Ski Council with representation on it from the executive of Federated Mountain Clubs.

In more recent years, the New Zealand Ski Association has been established with affiliation by the many ski clubs throughout the country. A great number of these clubs are also affiliated to Federated Mountain Clubs and the executive has maintained an appointment as liaison to the Ski Council, the executive body of the New Zealand Ski Association.

The work of the Federation has increased greatly over recent years; the main concern remaining is the conflict between preservation for recreation on the one hand and commercial exploitation on the other. Continuing education and publicity

must surely help to keep these environmental problems in perspective. The executive of Federated Mountain Clubs feels it has a duty, not only to its members of affiliated clubs but to the public as a whole, to protect the bush and mountain areas of this country so that we New Zealanders may enjoy our recreation in pleasant surroundings and in safety.

## THE FEDERATED MOUNTAIN CLUBS OF NEW ZEALAND

(Incorporated)

P.O. BOX 1604, WELLINGTON

Club	Secretary	Address
Alpine Sports Club		P.O. Box 131, Auckland
The Amuri Ski Club Inc.	O. J. T. Grigg	"Cascade," Culverden
The Aorangi Ski Club Inc.		P.O. Box 1945, Wellington.
Ardmore College Tramping Club	The Secretary	Ardmore College, Papakura
Auckland Catholic Tramping Club		P. O. Box 3690, Auckland
The Auckland Tramping Club Inc.		P.O. Box 2358, Auckland C.1
The Auckland University Field Club		P.O. Box 2175, Auckland
The Auckland University Tramping Club		P.O. Box 2175, Auckland
Auckland University Ski Club		P.O. Box 6290, Auckland
Bay of Plenty Branch, N.Z.D.A.	Mr D. J. Longstaff	10 Paine Street, Tauranga
Canterbury Mountaineering Club		P. O. Box 2415, Christchurch
The Canterbury University Ski Club		P.O. Box 1471, Christchurch
The Canterbury University Tramping Club		University of Canterbury, Private Bag, Christchurch
The Canterbury Winter Sports Club		P.O. Box 1893, Christchurch
The Catholic Tramping Club		P.O. Box 2393, Christchurch
Christchurch Ski Club Inc. c/ R. H. Mitchell,	Low and Egden	P.O. Box 429, Christchurch
Christchurch Tramping Club Inc.		P.O. Box 1948, Christchurch
Christiania Ski Club		P.O. Box 367, Hamilton
Craigieburn Valley Ski Club Inc.		P.O. Box 463, Christchurch
Desert Alpine Club		P.O. Box 3415, Auckland
Eastern Bay of Plenty Branch N.Z.D.A.	Mr I. A. Simons	14 Kowhai Avenue, Edgecumbe
Gisborne Canoe and Tramping Club Inc.		P.O. Box 289, Gisborne
Golden Bay Alpine and Tramping Club Inc.	Mrs B. E. Soper	R.D. Puramahoi, Takaka
Happy Valley Ski Club	D. L. Kennedy	P.O. Box 2876, Auckland
Headquarters and Overseas Branch N.Z.D.A.		P.O. Box 263, Wellington
Heretaunga Tramping Club Inc.		P.O. Box 386, Hastings
Hokonui Tramping Club		P.O. Box 147, Gore
The Hutt Valley Tramping Club Inc.		P.O. Box 183, Wellington
The Kahui Alpine Club Inc.	The Secretary	P.O. Box 20, Rahotu
Lincoln College Alpine Sports Club		Private Bag, Lincoln College
The Levin-Waiopēhu Tramping Club	N. Wildbore	P.O. Box 144, Levin
Manawatu Branch, N.Z.D.A.	N. L. Ingram	Sanson, R.D. 9 Palmerston North
The Manawatu Tramping & Skiing Club Inc.		P.O. Box 245, Palmerston North
Matamata Ski Club	Secretary	P.O. Box 126, Matamata
The Marlborough Tramping Club Inc.	Mrs B. A. North	P.O. Box 341, Blenheim
Masterton Tramping Club		P.O. Box 334, Masterton
The Massey University College Alpine Club		Massey University College, Palmerston North
The Mt. Egmont Alpine Club Inc.		P.O. Box 62, Hawera
Nelson Ski Club Inc.		P.O. Box 344, Nelson
Nelson Tramping Club Inc.		P.O. Box 225, Nelson
N.Z. Kayak Group	Hon. Secretary	P.O. Box 3580, Auckland
N.Z. Alpine Club Inc.	A. H. MacCormack	P.O. Box 2211, Christchurch
Nga Tapuwāe o Tāneatua Tramping Club		P.O. Box 360, Whakatane
North Canterbury Branch N.Z.D.A.	Mr F. P. Eade	26a Bowenvale Avenue, Christchurch
North Canterbury Ski Club Inc.	N. Milne	P.O. Box 2718, Christchurch
Northland Branch N.Z.D.A.	P. T. J. Coe	P.O. Box 86, Kaikohe
North Shore Tramping Club		P.O. Box 33-262, Takapuna
Otago University Ski Club		Otago University, Dunedin
Otago Ski Club Inc.		P.O. Box 995, Dunedin
Otago Tramping Club Inc.		P.O. Box 1120, Dunedin
Otago University Tramping Club		Otago University, Dunedin



# TRENDS AND FACTORS IN SCOTLAND'S HILL-COUNTRY FARMING

Dr A. J. F. Russel

Hill Farming Research Organisation, Edinburgh.

Interviewed by J. Runga.

Four-fold increases in production at relatively low costs are possible on some types of Scotland's hill country, as a result of new systems of management based on controlled grazing. This is the opinion of Dr Russel, a recent visitor to the Institute.

Dr Russel, the purpose of this interview is to reveal the trends in Scottish hill farming, and how these are affected by the research work of H.F.R.O. This is of interest to our high-country farmers because of the similarity of their problems with those of your hill country farmers. In broad terms what are these trends?

The Organisation's main work involves research on factors affecting the production of plants and animals in the hill and upland environment.

Recently we have also embarked on a programme of development work. In this we are putting into practice on a field scale the results of research carried out on small plots, in the animal house and in the laboratory, and we are incorporating our findings from these more fundamental research programmes in new systems of sheep management. At present we have a number of these development projects, each of about 700 to 800 acres, on our three research stations. All these projects are based on some form of controlled grazing.

The objective of these new systems of management is to increase production per sheep and per acre, and as the systems become more intensive we are continually monitoring the changes which take place. As well as measuring increases in sheep production, we are examining changes in the botanical composition of the herbage; we are measuring the nutritional state of the ewes at critical times of the year; we are measuring the recycling of nitrogen and phosphorus in the soil-plant-animal relationship; and we are continually keeping an eye on animal health, and particularly on parasite problems.

So far these new systems are working well, and the intensification of production is beginning to gather momentum, but if any system should fail, we will know why, and will be able to take the problem back to the laboratory.

**I understand that Scotland's hill country is generally run on a free-grazing system.**

Yes, almost completely.

**Is there much fencing?**

No. Frequently the only fence is the boundary fence, and even that is not always present.

**But boundaries must be determined in some way.**

Our hill sheep are territorial and tend to stay on the area of ground where they were born and reared.

**They are shepherded, however.**

Yes, traditionally they are moved up to the tops in the evening and brought down during the day. The shepherd may try to keep them off the better areas at certain times of the year to save pasture for more critical times, but I doubt very much if this is at all effective.

**Is this system changing?**

Yes, it is changing slowly, and I believe that our work is influencing the direction of the change. Progressive farmers, of course, will always try to improve existing systems and we must not overlook what they are doing in this respect. The new systems of management which H.F.R.O. are examining and testing are all based on sound experimental evidence. For a long time Scottish hill farmers, and research workers too, had difficulty in looking beyond the supposed problem of winter nutrition, and there was a lot of talk about the "hungry gap" between autumn and spring. Under the traditional system, stocking rate is determined by the winter carrying capacity of the herbage. If the stocking rate is such that the animals are forced to eat more than the best 15 percent of the poor quality herbage available at this time, the level of nutrition will not support even the present low levels of production.

In the new systems of management which we are developing and testing, we believe that winter nutrition is relatively

unimportant, and we have switched our attention to nutrition at other times of the year. Our ewes are now going into the winter in much better body condition and with adequate body reserves.

Incidentally, an increasing proportion of our ewes are now carrying twin lambs as a result of the improved autumn nutrition and better body condition at this time of year. We are prepared to give quite liberal amounts of supplementary feeding in the weeks before lambing, and to continue this after lambing until the new season's grass growth begins. Our controlled grazing is giving us improved levels of nutrition during the spring for lactation, and during the summer when the ewe is regaining the weight lost during pregnancy and lactation, in preparation for the next mating season.

**Of the hill country how much could be classed as having an improved system of controlled grazing?**

A negligible amount. Only a few hill sheep farmers practise any system of controlled grazing at the present time, although an increasing number are showing considerable interest in what we are doing, perhaps because the industry is under fairly severe economic pressure just now. This whole approach is still in its infancy in Scotland, and our first development project has only been under way for about two and a half years.

The change from traditional systems of management to new systems requires an input of capital, but this need not be large, and investments in fencing and extra stock, equivalent to several thousand dollars, can be more than recouped in a relatively short space of time from increases in output. It is worth pointing out, however, that the financial commitment does not end with the investment of capital. Increases in stock numbers bring with them increases in annually recurring costs — for example, feed bills and the cost of drenches and dips will be higher than previously. Nevertheless, fences and stock are still good investments, and they are essential to the survival of our industry.

**Are there many flocks housed?**

Not many. I doubt if it would be more than two per cent.

**Are you proposing this?**

We are studying what we call "off-wintering systems", that is, where the sheep are removed from the hill pastures during the winter, but this does not necessarily mean keeping them in



**Lochs Doine and Voil in typical hill country. To get better utilization of pastures closer subdivision fencing is required in hill country. The fence in the foreground is of stone and iron standards.**

Photo: A. Nicol from a transparency.

a house. Apart from the increased output required to justify the cost of the house, an increase in output of between 80 and 100 percent is needed to cover the annual recurrent costs associated with off-wintering. In our situation winter feeding costs are between four and five dollars per ewe.

### **How many acres are you concerned with in Scotland?**

The area of Scotland is about 19 million acres, of which 18 million are devoted to agriculture. Two-thirds of this — about 12 million acres — is hill land or rough grazing, and supports about 1300 hill farms averaging 4000 acres and 3500 upland farms averaging 890 acres. We have a sheep population of 8½ million of which about 5 million are on the hill and upland areas.

**The unit average of 4000 acres on the hill country is a fairly large holding.**

Yes, but almost one third of our hill sheep are stocked at rates of less than one ewe to five acres, and about 10 per cent are stocked at less than one ewe to ten acres.

### **What are the altitudes?**

Not high by New Zealand standards. Many hill farms start at sea level, particularly on the West Coast of Scotland, and run up to perhaps 1800 or 2000 feet.

### **What are the pasture species?**

Mostly we have native pasture species on the hill land, with a few introduced grasses in the inbye fields. On the better areas of grassy hills — these are acid soils with a pH of about 4.5 — the pastures are mainly *Agrostis/Festuca* species, and on the poorer areas with lower pH *Nardus/Molinia* communities. A lot of ground is peat covered, very wet, and predominantly in heather.

### **What type of sheep do you run on these?**

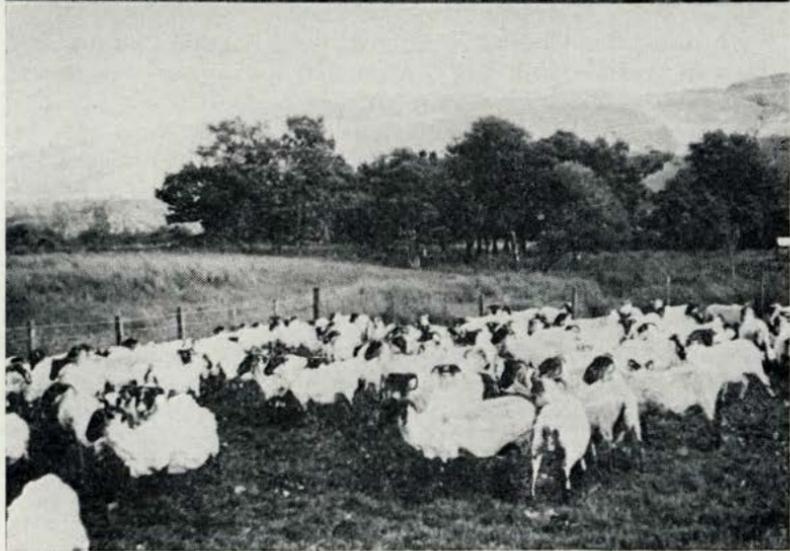
As a generalization, Scottish Blackface sheep run on the heather-covered areas, and Cheviots on the grassy hills. The Blackface is a carpet wool breed. There are two distinct types of Cheviot which are regarded as separate breeds — the North Country Cheviot and the South Country Cheviot. They were separated more than 200 years ago when some Cheviots were taken from the border country to the north of Scotland, where they evolved as a separate breed. The North Country Cheviots have now come back to the border country as bigger sheep and are generally considered to be superior as regards growth and wool production.

**We find in New Zealand that pure Cheviots are vigorous and hardy but limited by low wool production under harsh conditions.**

I think the Cheviot you have is the South Country one, which in Scotland still has a place, but is gradually giving way to the North Country Cheviot. All our Scottish Halfbreeds (that is Cheviot ewes crossed with Border Leicester rams) for fat lamb production on lower ground are out of North Country Cheviots.

**Would wool be the highest percentage of income from the hill farms of Scotland and what becomes of surplus lambs?**

Wool accounts for only about 20 percent of our income. The largest proportion of our returns comes from selling lambs. Few farms can manage to sell fat lambs off the hill and the vast majority are disposed of in the store market. There the hill



**Opposite: Scottish Blackface are well known for their hardiness. These generally graze the heather pastures while Cheviots graze higher-producing pastures in the hill country.**

Photos: A. Nicol.

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farmer is at a disadvantage, in that he cannot keep these animals over winter and is forced to sell them for whatever price the lowground farmer offers. If the lowground farmer has had a disappointing harvest or if, for any reason, grain prices are poor, this is reflected in the returns for store lambs and has effects throughout the hill farming sector.

**The hill farmer supplies purebred Blackface and Cheviot store lambs then?**

Yes.

**Do they fatten well?**

Yes, they fatten readily after a store period, and although I do not think they compete with the New Zealand product, most hill lambs produce light weight carcasses by our standards and many find their way to the Smithfield market. Those farmers producing Halfbred ewe lambs for sale as fat lamb dams put their wether and surplus ewe lambs on to the store market. These, of course, give a heavier carcass.

**What returns do the hill farmers get from Blackface and Cheviots?**

The income is generally between £4 and £5 per ewe. Most of this comes from the sale of store lambs, which average about 50 lb liveweight and may be worth £4 — that is £3 per ewe at 80 per cent weaning. The sale of cast ewes may be equivalent to another 15 shillings per breeding ewe, and wool, that is from ewes — we do not shear our lambs — brings in another £1. We clip about four pounds of wool per ewe — less on the harder areas.

**What lambing percentages are being obtained?**

This varies greatly with the type of land and the severity of the winter. On the better class of hill farm this might be 100 per cent with a weaning of 85 to 90 per cent. On poor land where stocking rates are five acres to a ewe, lambing percentages may be as low as 50 per cent in a bad year.

**Are cattle run complementary to sheep on hill farms?**

Yes. Generally, however, hill farms do not carry as many cattle as they could or would like. There are two main problems. One is that there is not sufficient cultivatable ground to



**Opposite: "Clipping." A method of shearing still practised. Blades are also used in the yards or open paddocks. More progressive farmers have adopted machine shearing under cover. The wool is a premium carpetwool from a Scottish Blackface.**

Photo: A Nicol from a transparency.

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grow winter feeding for large numbers of cattle, and the other is the heavy capital investment required to go into cattle in any numbers. And, of course, there is always more risk with cattle — one mortality in the cow herd is much more serious than one death in the ewe flock. Traditionally there have always been cattle on hill country and I believe the numbers will increase.

**In the case of a farm of say 4000 acres running 2000 ewes, how many cattle would there be?**

Probably about 100 or even 150 breeding cows.

**How well does wool sell?**

There is a premium for Blackface wool for the carpet trade, and at present we export some of this wool to New Zealand. We also export quite a lot of Blackface wool to Italy where there is a tradition that one of the bride's wedding presents is a mattress filled with Scottish Blackface wool. I hope this tradition survives for a long time.

**Is the Scottish Blackface wool pure white then?**

You do get black patches and black fibres which downgrade it. I believe we could eliminate these faults if we paid more attention to wool quality.

**The Cheviot wools go into the Scottish and English looms for suiting I suppose?**

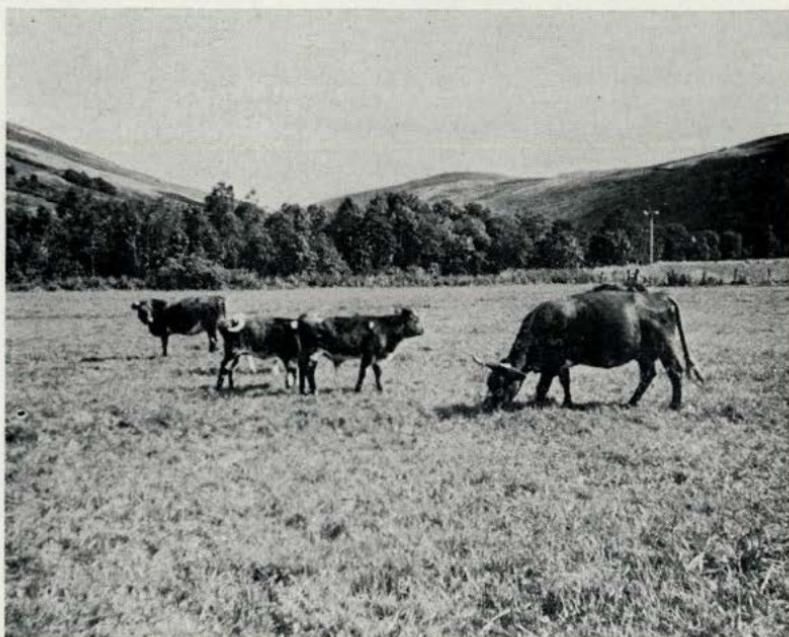
Yes. Some goes to the tweed industry and a lot of it is blended with imported wool for suiting.

**Are Harris tweeds still being made?**

This is still a flourishing industry, but there is a movement away from home spinning to mills.

**Is the U.K. lamb market aiming for lean meat?**

There is this growing tendency. There are still large regional differences in consumer demand, or so the butchers tell us. In the south and south-east of England the demand is for the New Zealand type of carcass, but the further north you go, the heavier the lamb becomes. Many Down-cross lambs from Scottish lowground farms are slaughtered at 90 to 100 pounds live weight, which is considerably heavier than anything coming



The weaners are Beef Shorthorn-Ayrshire cross, which, together with Beef Shorthorns, Aberdeen-Angus, Galloways and Highland Cattle, are common in the hill country of Scotland.

Photo: A. Nicol from a transparency.

from New Zealand. We are now exporting some lambs from Scotland to France.

**This is rather out of the fat lamb class into the wether class.**

From the New Zealand point of view, yes. But they are still lambs — of about 40 to 45 pounds carcass weight.

**How big is this export market?**

Very small at present and very erratic. The market may be closed at 24 hours' notice, depending on French lamb prices.

**What other exports are there to Europe?**

Venison from Scotland to West Germany is worth about half a million pounds sterling per year. This is largely a by-product of the sporting industry. Very few people shoot deer simply for the meat.

**That half million pounds worth is virtually the total for the U.K., Scotland being the main deer area. New Zealand venison exports are worth about £1.2 million.**

Yes, our venison exports are of a similar order, but many people can get as much as £100 a stag from sportsmen. Meat production cannot compete with that.

### **Is deer farming starting up?**

Some people are beginning to move away from the sporting interest and looking at the possibility of increasing their income from venison production. They may leave the best hinds for breeding, but there is always the likelihood of these animals moving on to neighbouring properties and being shot there. We have no deer farming as such.

The H.F.R.O. and the Rowett Research Institute have a collaborative project on one of our research stations in the north-east of Scotland where the feasibility of deer farming is being studied. We have fenced off 500 acres of what is, by our standards, high country. This is a predominantly heather area. There are many problems to be studied, and perhaps the main one is that of handling the animals.

### **I understand that U.K. farming is heavily subsidised.**

In reality these are subsidies to the consumer in keeping food prices low.

### **How much is the hill-country farmer subsidised?**

At present the subsidy is between 130 and 190 per cent of the profit. In other words, if subsidies were abolished and nothing else changed, present profits of about £1 per ewe would become losses of about £1 per ewe. In practice, however, prices must increase if subsidies are reduced. Subsidies come in a variety of ways. For instance, the subsidy on lamb is paid to the fatterer, but is reflected in the price the fatterer pays to the hill farmer for store lambs. There are grants for improvements to buildings, and for fencing, drains and fertilisers.

### **Is hill farming uneconomic in its present form then?**

The whole of agricultural production in the U.K. is supported by subsidies at present. Hill farming is receiving a larger share of these subsidies than its output warrants — about 8 per cent of the total subsidy for about 4 per cent of the total output. There is, however, a greater dependence of one form of agriculture on another in the U.K. than in New Zealand, and much of the hill production is ultimately marketed through the low-ground farm.

At present there is considerable economic pressure on hill farming, but I believe the industry has a future. Using the new systems of management we mentioned earlier, I believe that on

certain types of land weaning percentages can be doubled — from say 80 to 160 per cent — and I see no reason why stocking rates cannot be doubled too. Taken together these represent a four-fold increase in production per acre.

**For a three-fold increase in costs possibly?**

No.

**That would leave a margin.**

Labour is the single greatest cost at present, accounting for between 30 and 40 per cent of total costs. Many shepherds are looking after only 500 to 600 ewes. It is difficult to reduce the number of shepherds, particularly if you employ only one or two, but it is possible to increase the number of sheep. And in a controlled grazing system one shepherd can give more attention to 1000 ewes than he could to half that number spread over several thousand acres.

**Is it true that there are many of what might be economically termed surplus farmers in the U.K. on crofts that in themselves are uneconomic?**

Considered on their own, crofts are certainly uneconomic, but this is as much a social problem as an economic one. Not many crofters are solely dependent on their croft — some will have a share in a fishing boat, others have different jobs, and for most, crofting is now a part-time occupation. If these people were to leave their crofts the depopulation of the remoter areas would increase.

**There has been talk that one of the answers is co-operatives and companies that could make the farms larger. Have you noticed this?**

This applies more to lowground farms which require very high capital investments in equipment and machinery such as combine-harvesters and grain drying and handling plants.

**If the crofts are amalgamated the rich may get richer?**

I hope the crofters, and not the already well-off, become better off, and I think there are signs that this is happening. The Highlands and Islands Development Board are having some success in bringing non-agricultural industries to the remoter areas. They are generally concerned with small indus-

tries, but have recently brought a multi-million pound aluminium smelter to the north of Scotland.

**Is forestry competing with the sheep industry?**

It is.

**Has forestry got economic value?**

This depends on what you mean by economic. Last year the Forestry Commission produced £900,000 worth of timber at a cost of £2,000,000. At the moment fiscal arrangements — mainly certain tax benefits and exemption from some death duties — favour forestry, but these could change at any time.

**I suppose your farmers do not have a direct personal equity in the forests as these are run by a State service.**

The Forestry Commission is a State service, but a number of landowners are being attracted to forestry by the present taxation advantages.

**So forestry is becoming economic for farmers who have land suitable for it.**

Yes, but they have to wait a long time to get their money back. Trees do not grow as quickly in Scotland as they do in New Zealand, and they may take 40 to 50 years to mature.

**Would the Forestry Commission enter into partnership with landowners?**

No. The Commission buys the land. If the Department of Agriculture and Fisheries consider that the land should not be planted, they will farm it on behalf of the Commission. Anomalies can, however, arise, and if in an area where the Department believes the Commission should not plant, a private individual plants trees, then the Department release a similar area to the Commission so that they can compete with the private landowner. This is certainly detrimental to the sheep industry, and I believe the Department should further restrict the State's planting, rather than make more land available to them in such a situation.

**I take it that cultivation in the hill country is minimal.**

Yes.

**Is there a place for change?**

There are many ways to improve hill country. Cost-benefit analyses suggest that fencing and the use of stock to improve hill land in the way practised to such effect in New Zealand,



The farmhouses of Scotland may be quite old but are usually large and well built. The sheep are Scottish Blackface.

Photo: A. Nicol from a transparency.

are more likely to be economic than large scale cultivation.

**Of the 1300 hill sheep farms would 1000 of them be on the open grazing system still?**

At least 1000. There is a great variety of land types and ways of farming amongst our 1300 hill farms, but most of them are still managed under the traditional free-grazing system. The majority have only small areas — two or three per cent — capable of being cultivated. They may use this area to make hay, to bring ewes into before mating or at lambing time, and to graze ewes with twins, but this is the extent of grazing control in most cases.

**It appears that the phase the hill country has reached is one of better utilization rather than advanced development forms.**

Yes. Taking a farm or a hill as a whole, only about 20 per cent of the dry matter production of the pastures is ever eaten by sheep. The other 80 per cent dries off and creates problems in the following season in that it dilutes the sheep's intake of better quality herbage. I believe we can solve this problem of poor utilization, and that this is the key to the increased production we have discussed.

**Thank you Dr Russel.**

# THE RESPONSIBILITY FOR WEEDS

M. M. Chisholm  
Molesworth Station

*An address to the 1971 Conference of  
Weed Inspectors, Nelson*

We today are confronted with a problem in weed control that I am sure will surpass the task set by the first Rabbit Destruction Council some 23 years ago to deal with rabbits. To shrink from this problem will be disastrous for those on the land, and those who will follow in future generations. Weeds have a direct and retarding effect on our economy. In the back country they constitute a serious threat to the down country, like rabbits and erosion. Like these, weed infestations and their control have become matters of national importance.

I am sure we cannot look back or try to apportion blame — the problem is with us and ours to be faced. At this moment the only solution we can offer those in authority is that we will reduce the weed problem to the point where we can live with weeds, and that we can guarantee to protect country capable of increased production, clear from the insidious encroachment of weeds.

Especially since the control of the rabbit in so much of our country, weeds have without competition, assumed alarming proportions. You will agree that the sums spent on rabbits will be surpassed by the cost necessary to control weeds.

Finance for eradication is at present extremely short, among Government, local bodies, and private individuals. Can anyone remember a period when this has not been so?

I can well remember some years ago lifting rabbiting on Molesworth from £5,000 to £22,000 per annum. The benefit today reflects in an estimated gross income just short of \$250,000. I would suggest expenditure on weeds will also have a marked influence on further stock increase and income.

You are confronted with the direct administration of weed control on behalf of local bodies. Your local bodies have had this responsibility for weed control thrust upon them. To my mind they have been created as lions and tigers to administer weed control but without teeth and certainly without funds. You will without my suggestion know how futile is the role of elected members of rural local-bodies to direct discipline on fellow electors, and the personal animosity generated in trying to administer weed control. To achieve this role of weed inspectors your qualifications must surely befit the diplomatic corps.

I have great sympathy with land holders — so many with meagre resources to tackle an inherited problem of weeds. We also have minorities who seem to have little interest as to the future well-being of the land that has sustained them. To these people the responsibility of weeds is for someone else — and of course you people as servants bear the venom of this group.

Government Departments cannot escape criticism for their lack of effort in weed control. I am well aware of the efforts some Departments are making — my own Department is one, however the time is late and an example immediately required. It is perhaps of little comfort to land holders and Departments to suggest that the problem of rabbits and weeds today stems from the lack of enforcement of the acts of land tenure seventy or eighty years ago. One could ask how could inspectors enforce such acts in face of powerful political and influential land ownership of by-gone days or periods of low returns like today. Weeds of course will flourish and will not be influenced by reduced returns of the past, present or future. Further reluctance on our part to face squarely the problem of weeds will of course have to be tackled by future generations from behind scratch.

A factor of great importance in weed increase is the very much improved fertility, especially in the back country. It seems so illogical to be hailing the great advances made in land development and the increase of productive land and at the same time to be giving over to weeds, land that is already producing.

Riverbeds have for many years been a source of weed infestation to good land. These riverbeds are getting progressively worse. In a desire to improve great areas of back country we are threatening this country with impurities from seed mixtures. Development roading and the increase of vehicle traffic is increasing the weed problem in the back country.

I feel sure that change in the administration of weed control is desirable and necessary — control that is consistent, unified, impersonal and guaranteed of income. This lack of control with its adverse effect on farming and grazing is now of national importance — but this in no way absolves the land-occupier from a share of the burden.

Because of its consistent killer policy in the eradication of rabbits, the Pest Destruction Council is an obvious choice to take over the task of weed control. The Council may find no great appeal in having to shoulder the responsibility of weeds — but I am sure they are admirably equipped to do so. I do not suggest that Pest Destruction field staff include weeds in their every day job — but with this wide ranging staff, excellent coverage, identification and information on weed infestations could be of immense benefit to weed inspectors. Administratively there could follow an increased and full utilisation of an already tailor-made organisation.

## **Briar**

Briar has presented a problem to runholders in the low rainfall areas of Marlborough, Canterbury and Central Otago. Besides the preference for low rainfall, briar thrives at elevations around 1,000 to 3,000 feet in much of this area. Since the reduction of the rabbit and the general improvement of the country, briar on Molesworth has certainly, if not increasing, become more mature.

This maturing of briar has concerned owners and managers during the past seventy years.

There seems little doubt the all-time financial low of the late 20s and 30s, the wild pig on the numbers they were in, has been responsible for the problem we have with briar in the Awatere - Clarence watersheds.

Today we have a problem that is now increased with the additions of broom and ragwort. However, I would place the threat in order of broom, ragwort and briar.

In a letter to his manager, 6 May 1905, Mr Acton Adams expressed concern at the spread of briar on the country. He at that time demanded if the sub-lessee did not dispose of his horses on Rainbow the lease would be cancelled. Mr Acton Adams was convinced horses could spread the briar.

The Lands Department on 3 May, 1948 asked for a report regarding briar and its spread on Molesworth. I feel my reply at the time is appropriate to be included here.

"Sweet briar introduced by our early settlers has found our back country very much to its liking and is strongly competing with the rabbit for the total destruction of some of our back-country grazing areas of Otago and Marlborough.

The spread of briar in Molesworth has been rather alarming but the Department should in no way feel apologetic for its introduction and spread. Neighbouring properties in this locality are equally infested, each have vast areas involved. These neighbouring properties are grazed by sheep and although the spread on them is less rapid than on Molesworth, nevertheless briar is increasing on them.

Rabbits in numbers are a retarding factor in the spread of briar, and it is very noticeable that where rabbit populations have decreased, the recovery and spread of briar is quickly revealed.

Grazing animals, pigs, horses, cattle, deer, etc. are responsible for the spread, and in particular the pig which has been the largest contributing cause on Molesworth.

In the Elliott where briar is worst, pigs have been very numerous, some 2,000 were shot to try and combat the spread of briar, this done, a noticeable increase in rabbits has been apparent.

It will be noted in the early records of Molesworth, that gangs were employed on Molesworth and St. Helens grubbing briar in the Dillon and Half Moon and Guide etc. Through the years this concern and practice of control has been discontinued chiefly through economic reasons, with the result briar has been allowed to continue its relentless spread in this area.

On Molesworth the two chief areas involved are the Elliott and Awatere, the Elliott and Saxton Pass are extremely bad, and to a lesser degree on the Tarndale area where combative measures although formidable would be worthwhile.

These bad areas are now practically beyond physical recovery, and if they were, the expenditure now involved in labour and other costs would come very close to the expenditure involved in rabbiting, a burden which no grazing property could carry without assistance.

In the past, some £60 has been provided for each year in our estimates against maintenance pastures to try and control briar in homestead and yard paddocks. This job is done by the way of grubbing and is effective, but each year brings a fresh crop of seedlings so that the procedure appears indefinite and in a few years becomes a financial burden on the land which in the first place is of low value.

Burning by flame thrower has been used but is only effective after the plants have had at least three applications of heat, and is practically of no value on the large bushes.

Although not familiar with the various sprays available, it would appear that on the smaller bushes this would be effective, however the large area covered by bushes with a diameter of 8-12 feet and 10 to 12 ft high would require cutting to allow any weed killer to penetrate to the roots and become effective, this would entail considerable labour at high rates to induce men to carry out the job in way back areas.

In this district St. John's wort reached alarming proportions and had latterly put many acres of grazing land out of use. Investigation by Cawthron Institute has resulted in the introduction of a parasite which has proved most successful, perhaps investigation by the Institute and research may result in similar success on the Sweet Briar.

If on the other hand, spraying, grubbing etc. was to be undertaken by some approved method, to be

successful, all infested areas would need to be done, otherwise if one property proceeded with eradication and the briar allowed to increase elsewhere, a re-occurring expense would go on indefinitely.

Regarding the employment of permanent hands, experience has shown that when these men have finished their seasons occupations, the ground is frozen with the result that grubbing only takes the top off the briar without the necessary root structure which is most essential to destroy. By the time the ground is suitable in the Spring these men are required at their respective jobs again.

In the early 1950s, farmers in the area adjacent to the mouth of the Clarence became aware of a potential threat of broom infestation from the upper reaches of the Clarence. An inspection and report was made by the local stock inspector of the Agriculture Department, the late Mr J. A. Miller. Today, twenty years later, the fears of these farmers, plus an added threat of ragwort, prove to have been well founded. This comes at a time when we see virtually the complete destocking of sheep from the Clarence watershed. Sheep grazing however, will not destroy ragwort, but will certainly suppress the growth of this weed.

### **Trials with Sprays**

Not until 1964-65 were we on Molesworth able to take action on weeds with some of the weedkillers then available and an improved financial position. To tackle the weed problem we had to curtail all expenditure previously spent on grassing and to channel this money into the weed effort. A campaign on broom in the Clarence in 1962, using 245T applied by helicopter, was spectacular but most misleading. The seedling regrowth was worse than the original problem. Several other preparations were used with various rates of water including 100 gallons of water in 100 yards. Water-based sprays were applied by wing aircraft and by helicopter until 1964. It became quite obvious that, in the search for an effective agent in briar and broom control on Molesworth, we must have something similar to superphosphate to apply from the air.

Usually outside labour is engaged to do the grubbing and of late difficulty has been experienced in getting anyone to do this work for less than 30/- a day.

In conclusion it is fully agreed to the seriousness of the situation and full co-operation will be given to any measure taken to prevent the spread.

Consultation with the Agriculture Department may produce some method of eradication, but it is felt to do the job by known methods will entail considerable costs and if acceptable to the Department, may not be to the neighbouring properties".

## **Trials with Tordon**

In 1964-65 Messrs Ivon Watkins Dow through Mr G. Mason made available a small quantity of granulated Tordon as a trial on the property. The results were sufficiently encouraging to embark on an aerial trial of some three tons in the Spring of 1965, in the Elliott. Increased briar on the tracks in the Elliott had made the movement of stock difficult. Tordon has made possible the opening of these tracks as an access and roading programme, enabling the free movement of stock in the area. After the application of this first quantity of 100 lb per acre by air it became apparent aerial application was much superior to that done by hand. It is quite apparent too that aerial application is giving wide penetration of the root system and one that is far in excess of the plants drip line.

Having applied Tordon 2G on briar for another two years it was quite clear that briar could be effectively destroyed by fixed-wing aircraft. The recent innovation of the 'Sling King' attached to the helicopter has given added control in aerial distribution rates and not nearly the same discrepancies associated with height, speed and change of direction.

I feel that in dealing with large areas of weeds, the helicopter and fixed-wing aircraft are complimentary, the aeroplane to make the initial kill and the helicopter to follow up. This is as it affects us on Molesworth.

We have an extensive area of briar but during the past three years have discontinued our campaign on briar, the reason being that we are satisfied briar can now be successfully dealt with.

On the other hand broom and ragwort in the Clarence area are increasing at an alarming speed and our whole attention is being devoted to this area, and on our farm at Hanmer. The work on broom should be completed in the Clarence within five years.

Rates of application had been reduced to 60-80 lb on broom — since the possibility of using unemployed labour on weed control loomed large some time back. In consultation with technical staff of I.W.D. a decision was made to reduce the possible wastage of hand application by reducing the active ingredient by half, this would have allowed increased rates of

application without wastage. Little hand application was carried out and 1G was applied from the air. Observation has shown a quite marked variation in kill and the advisability to return to the original full strength 2G.

During a brief period, attapulgate was used as a carrier for Tordon instead of the calcite chips. Considerable difficulty was experienced in controlling drift of the product with the lightest of wind, slip stream or directional change of the aircraft. We have reverted to the calcite chips again.

### **The Effectiveness of Tordon**

We seem to have established the fact that Tordon at 100 lbs per acre can effectively kill briar ranging from old man briar ten feet high to sparse and small plants. After five to six years no evidence is seen of regrowth in the main swaths. Odd suckers have been noted here and there within four to five feet on the edge of the swath, but this is a very low percentage of the area covered.

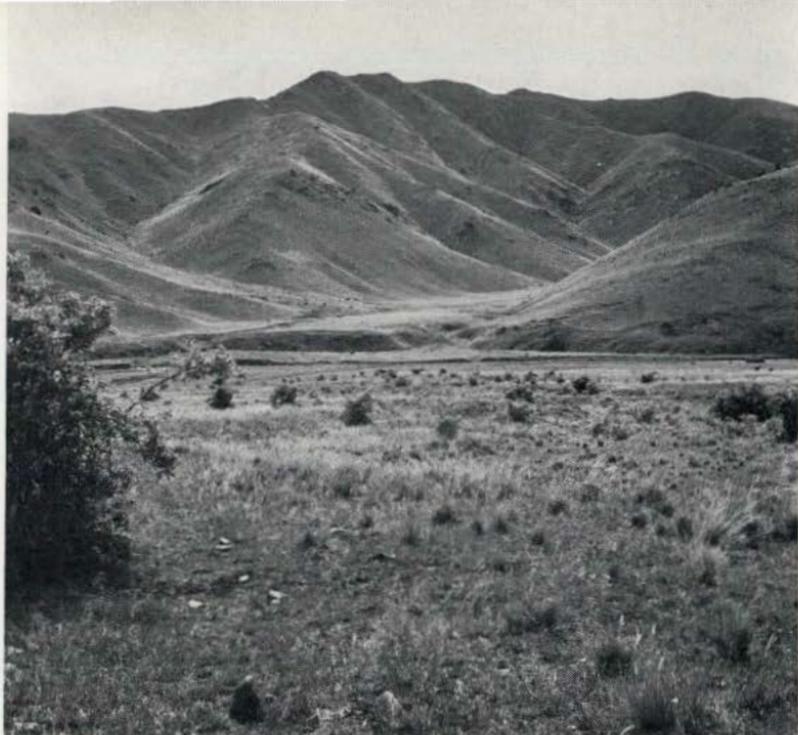
It appears that as much as 70 percent of the briar infestation on Molesworth could be treated with a lesser rate than 100 lb per acre. Further investigation would be needed to confirm the lesser rate. I see difficulty in changing rates of application whilst in flight to cover heavier infestations. Small isolated patches of weeds are more difficult to treat than areas of complete cover.

Matagouri up to 3 in. thick have been killed but some have shown regrowth. The main observation in the Tordon treated broom is an absence to date of any reseedling — but a very marked and stimulated grass growth. Clover of course has been temporarily suppressed.

We have used limited amounts of Tordon with success on oxide daisy, hemlock and docks besides considerable quantities of T50 D spray on ragwort, blackberry, broom and some gorse.

### **Conclusion**

We have now spent a very considerable sum on weed control over the years. To save this investment we must continue a campaign on weeds for many years yet and within our resources. Briar and broom deny us the grazing of 1,000 or more head of cattle and without some attempt at eradication and control they will encroach and threaten further areas of grazing, especially the lower moist and better areas.



Scattered briar in Cow Creek, Alma Valley on the Tarndale block, Molesworth. The author rates this weed third in importance in this type of country. Photo: G. Dunbar.

No great effort in mental arithmetic will show that considerable sums can be spent profitably if only as a business proposition. To protect a viable commercial enterprise priorities have changed from rabbiting, grassing, and fertiliser to weeds.

We have, like so many areas in the country, a weed problem — yet we are not chemists or trained observers. However, I feel we have this responsibility to the property and to the farming community, to continue investigations in weed control. Unfortunately we and many farmers have spent large sums on weeds and have been disappointed and disillusioned at times by results.

With so much productive land threatened by brush weeds besides other weeds of one sort or another, it is regrettable the financial position of those on the land is in a state of decline. We can only hope this decline is of short duration and will not delay a full and permanent national campaign on weed eradication and the guidance of you, the weed inspectors of the country.

# THE BLACK MOUNTAIN RINGLET BUTTERFLY

Dr. G. W. Gibbs

Victoria University of Wellington.

The black butterfly with 3-5 small white spots towards the apex of its wings should be familiar to anyone who has spent much time on the high scree slopes of the Southern Alps. One of New Zealand's eight native butterflies, the "Black Mountain Ringlet" (*Percnodaimon pluto*) was first reported in 1872 when Mr John D. Enys of Castle Hill, a farmer with a keen interest in entomology, sent some specimens to his friend, Mr R. W. Fereday for scientific description. It is an alpine specialist, occurring only in the South Island above about 4,000 ft, where it can be quite common from December to March. Always seen on bare rocky surfaces, it seems to have a strong aversion to any vegetation. The significance of this behaviour is discussed below.

Confusion with other related alpine butterflies is unlikely, although two other species of "Ringlets" (so named because of the wing-tip spots) can be found in the same general area as the Black Mountain Ringlet. One is the orange and brown "Tussock Butterfly" (*Argyrophenga antipodum*), featured on our current 2c stamp, which is often very common on tussock areas but is seldom seen in the rocky habitat of the black species. The other, a rarer species known as "Butler's Ringlet" (*Erebiola butleri*) could possibly be confused with the black ringlet, especially in flight, since the male is a uniform dark brown on the upper surface of its wings. However, Butler's Ringlet is more often on tussock or carpet grass areas than on shingle, and moreover the underside of its hindwings have several silver dashes which are not present on the Black Mountain Ringlet. The larger 'Red Admiral' (*Vanessa gonerilla*) can sometimes be seen in the Alps but it is really only a tourist at high altitudes since it breeds in the valleys.

Insects inhabiting the rocky zone above 4,000 ft must be specially adapted to withstand the extremes of alpine weather, in particular the sudden changes of temperature, the winter snows and the short growing season. These adaptations are well illustrated by the Black Mountain Ringlet.

Probably the most fascinating feature of this butterfly is its behaviour in response to changes of temperature. We used to think that the body temperature of all cold-blooded organisms,

including the insects, was the same as the temperature of their surroundings. But we are now aware that many insects enjoy a body temperature that is much higher than the surrounding air, and in fact, approaches closely to that of man. Butterflies achieve this by distinct behaviour patterns whereby they derive their heat almost exclusively from the sun.

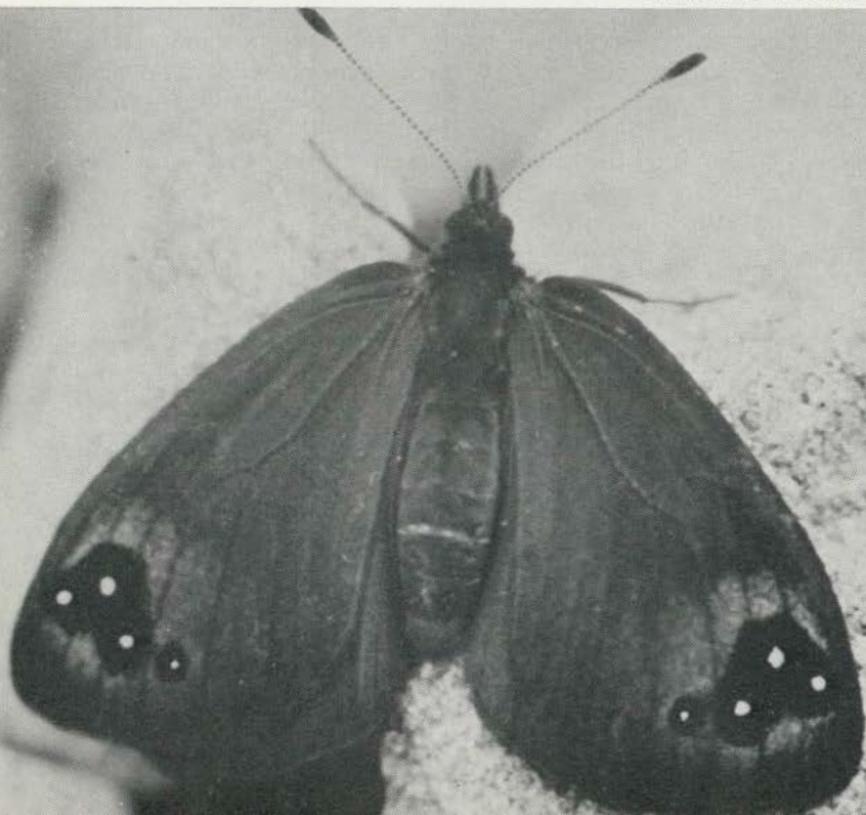
Early New Zealand entomologists commented that the Black Mountain Ringlet flew only during periods of sunshine and settled as soon as a cloud reduced the intensity of the sun's rays. During periods of windless sunshine, they are extremely active and alert as anyone who has tried to catch one will know. To maintain this level of activity, the body temperature must be around 90°F, a step-up of between 20-30°F above the normal air temperature at 4,000 ft.

How is this high temperature reached?

The answer is a combination of behaviour, colour, and the rocky habitat. Black objects in the sun are warmer than light coloured ones. This is almost certainly the reason for the dark wing pigment. To warm up, the butterfly basks on a rock in the sun with its wings held down flat against the warm rock

**A female Black Mountain Ringlet butterfly basking on a warm stone. Note the knobs on the antennae that distinguish butterflies from moths. Wingspan in this position is approximately 1½ inches.**

Photo: G. W. Gibbs.



surface as shown in the photograph, so that the maximum area of heat-absorbing black pigment is exposed. The wings are strengthened by a pattern of tubular struts (the "veins") which also carry the circulating blood, so that the whole system functions as an efficient solar heating element. Insulation is from a thick hairy covering on the head and body.

The warm rock imparts some heat which is boosted by the black pigment to give a temperature higher than even the rock surface. Once at its optimum temperature the wings are raised off the rock and held overhead in a V position. The butterfly is then capable of its typical soaring flight, sweeping along close to the shingle on the rising wind currents and alighting from time to time on the rocks, perhaps to make any necessary adjustments to its temperature by aligning itself in a particular way to the sun. Occasionally they may be seen to feed on the nectar of small alpine flowers that grow well out on the open scree surface.

As every mountaineer knows, the temperature can drop very suddenly at high altitudes. If the sun is obscured, thereby cutting off the source of heat, the butterfly's body temperature will start to fall and it will become steadily less capable of active flight and perception. In such a situation it usually alights and takes up its basking position, where it can absorb some of the stored heat of the rock through its wings. However, if the sun does not reappear soon, the stone will cool to such an extent that heat lost from the outstretched wings is greater than heat gained from the stone. Then the wings are raised so as to offer the minimum exposure to the cooling wind. In this position, with a low body temperature, approaching that of the air, the butterfly has lost its alertness and can be easily caught in the hand. It is incapable of proper flight but can flick its wings back and forth, a behavioural mechanism that usually leads it to a protected position amongst the cavities of the shingle.

Adaptations of this butterfly to its rocky environment involve the life history stages as well as the adult butterfly mentioned above. Its reluctance to settle on vegetation, except for an occasional sip of nectar, has already been discussed. One would expect a female butterfly to seek plants to lay its eggs on. But no, in this case the eggs are carefully placed on the underside of stones. This unusual habit is also found in some Himalayan butterflies. In the sun, rock heats up more than vegetation, so that the eggs, gaining this warmth, would tend to develop faster than if laid on vegetation. The barrel-shaped eggs are sky blue at first and become mottled after a few days, but since they



**Opposite: A caterpillar of the Black Mountain Ringlet butterfly. Its length is approximately 1 inch.**

Photo: G. W. Gibbs.

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are just 1 mm high, a search for them on mountain stones is difficult. They hatch in about 12 days and the tiny caterpillar must go off in search of its food, a small alpine grass. This seemingly impossible task is no doubt made easier by the female butterfly which, one would hope, chooses stones close to vegetation.

The caterpillars are slow moving and slow growing. They cannot gain the benefits of solar heating in the way the butterflies do and in fact their behaviour is virtually the reverse of the adult butterflies. When the butterflies are flying on warm summer days, their caterpillars lie motionless amongst the shingle or within the dead leaf-bases of their foodplant. Surprisingly enough, they are best looked for in cold, overcast conditions, or at night when they climb up on the grass stems to feed at the tips. Perhaps the caterpillars are largely nocturnal to avoid the attention of day-feeding birds; whatever the reason, it is a deep-seated one, characteristic of many related 'Ringlet' butterflies throughout the world. The colour of the caterpillars varies from pale straw to quite dark brown or grey, with a prominent darker line along the back. A characteristic feature is a short double 'tail'.

Caterpillars of this butterfly do not make such ideal subjects for home study as do White butterflies or Red Admirals, because the life cycle takes at least two years. In their natural surroundings, eggs are laid in January and February. These hatch in about two weeks and the tiny caterpillars grow to about a  $\frac{1}{4}$  inch before winter. Normally they would be covered with snow for several months, during which time they hibernate at temperatures which are too low to permit feeding. The following summer the caterpillars feed at their leisurely pace and reach about 1-1 $\frac{1}{4}$  inches before entering their second winter. At the lower margin of their altitude range, in localities where the summer season is relatively long, they will have reached mature size by their second winter. These caterpillars pass into the chrysalis the following spring and emerge as butterflies a few weeks later. However, at higher altitudes where growth is slower, the caterpillars require a third summer to reach maturity.

The chrysalis, like the eggs, is fastened onto the underside of stones and presumably also gains some benefit from solar heating. The duration of the butterfly stage is unknown but probably does not exceed one or two months.

## NUFFIELD FOUNDATION GRANTS

### \$3000 FOR EROSION RESEARCH

The Nuffield Foundation has announced a grant of \$3000 for an Institute co-ordinated programme of erosion research.

Led by Mr John Hayward of the Institute, a team of scientists will study the nature and consequences of erosion in a severely eroded 800 acre catchment on the eastern flank of the Torlesse Range. Many aspects of erosion and the related problems of sediment in stream channels will be considered by the team which includes:

**Dr A. J. Sutherland** of the Civil Engineering Department, Canterbury University, who will investigate streambed erosion and stability.

**Dr D. J. Painter** of the N.Z. Agricultural Engineering Institute, who will investigate the mechanisms of land erosion.

**Professor J. M. Soons** of the Geography Department, Canterbury University, who will investigate the nature and extent of erosion within the catchment.

**Dr W. McCave** of the N.Z. Institute of Nuclear Sciences, who will investigate the sources of sediment by labelling soil particles with radioactive isotopes.

**Mr A. P. Ryan** of the N.Z. Meteorological Service and **Mr R. D. Dick** of the North Canterbury Catchment Board are also associated with the study.

The team have a common need to know how much soil and gravel is being lost from the catchment. This is what the Nuffield grant will be used for. A special flume will be built which will incorporate devices to trap and weigh the sediment. Although the study will extend over at least five years it is hoped that the first results will emerge within two years.

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**Opposite:** At top is a contour model of the proposed flume site built to a vertical scale of 1 inch to 8 feet and a horizontal of 1 inch to 10 feet  
(Photo: T.G.M.L.I.).

**Below:** The flume will be sited in this narrow passage in the Torlesse stream.  
(Photo: D. J. Painter)



# EFFECT OF PRE-SLAUGHTER STARVATION IN CATTLE

Dr. A.H. Kirton and D.J. Paterson,  
Ruakura Agricultural Research Centre, Hamilton.

A paper presented to the 1971 Conference of the New Zealand Society of Animal Production, Lincoln College.

## SUMMARY

Mixed aged cattle of beef and dairy origin were used in two starvation experiments. Cattle from a variety of sources were given a standard nutritional treatment for two days before the experiments commenced.

In the first experiment, 100 cattle were randomised to five treatment groups. The cattle ranged from 2-14 years of age and averaged 317 kg in live weight at the commencement of the experiment. The control group were slaughtered straight off pasture with the remaining groups being killed after 1, 2, 3 and 4 day's starvation in a concrete yard with access to water. Live weight loss was fastest over the first two day's starvation and reached 10 percent (31 kg) of initial weight after four day's starvation. There was no evidence of carcass loss over the first three day's starvation with a suggestion of a slight loss (6 kg;  $p < 0.10$ ) as a result of the 4th day's starvation. Treatments resulted in a loss of stomach weight, stomach contents, and intestines with contents. Treatments caused no reduction in the weights of the heart or omental fat, but losses of liver weight approached significance.

In the second experiment, forty-five cattle were randomised to three treatment groups. The cattle ranged from 2-11 years of age and averaged 331 kg in initial live weight. The control group was slaughtered straight off pasture with the remaining groups being slaughtered after four and eight day's starvation. Live weight losses amounted to 15 percent of initial weight after eight day's starvation and loss of carcass weight was estimated to be 14 percent after the longer starvation time.

## INTRODUCTION

A series of New Zealand lamb experiments (C.C.C.A.B. 1943; Kirton, Clarke, Carter and Sinclair 1965; Kirton, Clarke and Carter 1967; Kirton, Quartermain, Uljee, Carter and Pickering 1968; Kirton, Moss and Taylor 1971) have indicated that carcass weight reduction resulting from pre-slaughter starvation is a probable source of loss to the meat industry. Carcass losses

start to occur between eight and twenty-four hours off pasture and a loss of around half a pound (0.23 kg) by twenty-four hours has been noted in at least two series of experiments (C.C.C.A.B. 1943; Kirton, Moss and Taylor 1971). A South African experiment (Heever, Sutton, Grosskopf and Fourie 1967) using twelve Afrikaner oxen per group has indicated that transporting this species for up to four days by rail without access to feed and water produced no evidence of reduced carcass weights provided that before slaughter, feed and water were made available for twenty-four to forty-eight hours.

As beef is, next to lamb, the second most important national meat export, the length of time that cattle could be starved before losses started to occur seemed worth investigating.

## MATERIALS AND METHODS

### Animals:

(1) Experiment I. One hundred cattle (48 Jerseys, 27 Aberdeen Angus and 25 other dairy breeds or crosses) ranging in age from two to fourteen years and including 23 steers and 77 cows were randomised to five groups of similar mean age and live weight and containing similar representation of the different breeds and sexes. One animal in Group 2 was found dead in the yards before it was due for slaughter and was omitted from the experiment.

(2) Experiment II. Forty-five cattle (26 Jerseys, 10 Aberdeen Angus, and 9 animals of other breeds or crosses) ranging in age from two to eleven years and including 12 steers and 33 cows were randomised to three groups of similar mean age and live weight and containing similar representation of the different breeds and sexes.

### Design:

Groups of cattle from other completed experiments including cull cows from the Ruakura dairies, were used in these experiments as they became available. The cattle were brought to a holding paddock at the abattoir on a Friday or sometimes earlier and were fed what limited pasture was available plus hay over the weekend. If the cattle had been recently weighed this weight was used as a basis for randomisation, otherwise they were weighed on arrival. On the following Monday morning all cattle were weighed live off pasture between 7 and 8 a.m. to give initial live weight and were then confined on a concrete yard without feed but with access to water until their appropriate slaughter time. In Experiment I, groups of cattle were slaughtered straight off pasture (Group 1) and after 1, 2, 3 and 4 day's starvation (Group 5). In Experiment II, groups of cattle

were slaughtered straight off pasture and after four and eight day's starvation. All remaining cattle were weighed live before the slaughter of the appropriate group designated for a particular day.

### SLAUGHTER AND CARCASS INFORMATION

Cattle were slaughtered using procedures similar to those applied in commercial practice and the hot dressed carcass plus some of the remaining parts of each animal were weighed. The dressed carcasses in this experiment contained perinephric and channel fats. The gall bladder was removed from the liver before weighing and the lungs with trachea were weighed as a unit. Because of the watery nature of the stomach contents after longer periods of starvation, some losses of this component occurred before weighing in some cases in later slaughter groups. This will result in a slight over-estimate of this source of weight loss. The carcasses were graded commercially and after chilling were separated into edible meat, fat trim and bone according to the system described by Everitt (1961).

### STATISTICAL ANALYSIS

In both experiments treatments were tested for significance by analysis of covariance (Snedecor, 1956). Means were adjusted by covariance for differences in full live weight at the beginning of the experiment. Dressing percentages were tested for significance by analysis of variance and actual means are given.

TABLE 1. EFFECTS OF STARVATION ON LIVE WEIGHT AND SOME COMPONENTS IN CATTLE (EXPERIMENT I)

Item	Treatment group					S.E. <sup>1</sup>	Sig.
	1	2	3	4	5		
No. animals	20	19	20	20	20		
Starvation time (days)	0	1	2	3	4		
Mean age (yrs.)	4.3	5.1	4.4	4.6	4.6		
Initial live weight (kg)	312.9	322.0	317.4	316.8	314.4		
Final live weight (kg)	—	307.8	291.9	288.9	283.4		
Live weight loss (kg)	—	14.2	25.5	27.9	31.0		
Loss as % of initial weight	—	4.4	8.0	8.8	9.9		
Hot carcass weight (kg)	148.0	146.8	150.3	148.2	142.1	2.72	(*) <sup>2</sup>
Carcass loss (kg) <sup>3</sup>	—	-1.2	+2.3	+0.2	-5.9		
Dressing % <sup>4</sup>	47.8	46.3	47.4	46.8	44.9	0.83	ns
Stomach weight (kg)	12.4	12.7	11.3	10.5	10.5	0.25	**
Stomach contents (kg)	38.5	32.2	24.9	26.3	30.8	2.02	**
Intestines with contents (kg)	26.3	22.1	21.0	19.5	18.6	0.77	**
Liver (kg)	3.89	3.61	3.46	3.62	3.54	0.10	(*)
Omental fat (kg)	3.33	2.67	3.44	3.44	2.36	0.36	ns
Heart (kg)	1.72	1.59	1.68	1.65	1.67	0.05	ns

<sup>1</sup> Of adjusted means except for dressing % where actual means are given.

<sup>2</sup> In tables, ns = not significant, (\*) indicates  $p < 0.10$ , \* indicates  $p < 0.5$  and \*\* indicates  $p < 0.01$ .

<sup>3</sup> Negative figures indicate an estimated loss and positive figures an estimated gain. Calculated relating to Group 1 mean.

<sup>4</sup> Defined as  $(100 \times \text{hot carcass weight}) / \text{initial live weight}$ .

TABLE 2. EFFECTS OF STARVATION ON LIVE WEIGHT AND SOME COMPONENTS IN CATTLE (EXPERIMENT II)

Item	Treatment group			S.E.	Sig.
	1	2	3		
No. animals	15	15	15		
Starvation time (days)	0	4	8		
Mean age (yrs)	3.9	4.7	4.3		
Initial live weight (kg)	334.6	323.3	335.1		
Final live weight (kg)	—	291.8	285.9		
Live weight loss (kg)	—	31.5	49.2		
Loss as % of initial live weight	—	9.7	14.7		
Hot carcass weight (kg)	164.7	151.7	142.5	4.72	**
Carcass loss (kg)	—	-13.0	-22.2		
Dressing %	49.3	44.9	43.0	1.52	*
Stomach weight (kg)	12.96	9.94	9.26	0.38	**
Stomach contents (kg)	37.45	25.57	22.55	2.44	**
Intestines with contents (kg)	25.00	20.82	19.72	1.06	**
Liver (kg)	4.63	4.05	3.88	0.17	**
Omental fat (kg)	5.23	3.87	2.81	0.45	**
Heart (kg)	1.64	1.63	1.55	0.06	ns
Lungs (kg)	2.85	3.19	3.11	0.12	ns

Footnotes as for Table I.

## RESULTS AND DISCUSSION

(1) Experiment I. The results from Experiment I are given in Table 1. Live weight loss was greatest over the first two days of the experiment and then slowed for the third and fourth days of starvation. Over the later stages the weight losses were less with some animals losing very little which suggested they were maintaining weight by drinking water which was available. Live weight had been reduced by 10 percent of the initial weight after four day's starvation. The estimated carcass loss figures indicated no treatment effect up to three day's starvation with a suggestion that loss was starting to occur by the fourth day. Starvation did not significantly affect dressing percentage.

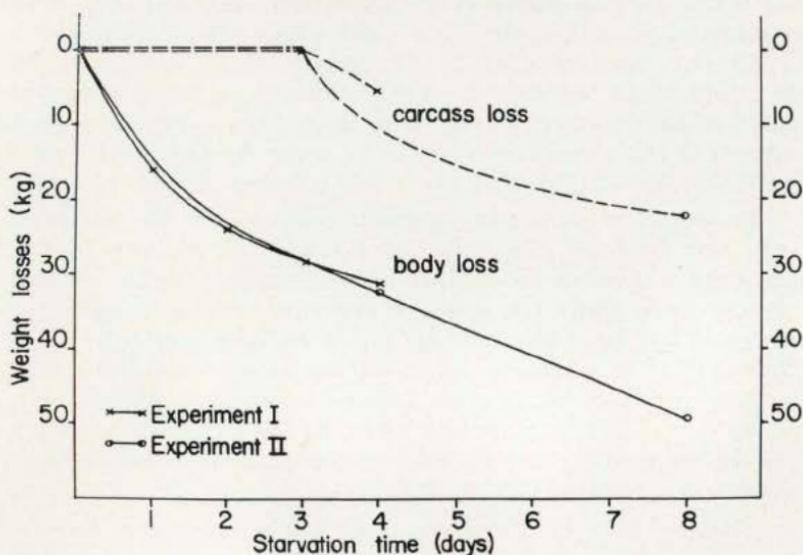
The weight of stomachs, stomach contents and the intestines with their contents plus attached fat were all reduced by the starvation treatments in the present experiment. With increasing starvation times the stomach contents became increasingly watery as has been observed for lambs by Kirton *et al* (1968). The increase in contents weight in the group starved for four days can probably be accounted for by water consumption. Up to four day's starvation had no effect on the weight of the heart and the omental fat and the liver with gall bladder removed was only slightly affected.

(2) Experiment II. The means for the treatments in Experiment II are given in Table 2. The pattern of live weight loss

appeared similar to that in Experiment I with initial live weight being reduced by 10 percent after four day's starvation and this figure increasing to 15 percent after eight day's starvation. One of the cattle on the eight day treatment collapsed in the yard after seven and a half days and had to be slaughtered early (final live weight was estimated by missing plot technique; Snedecor, 1956) and a second beast on the same treatment dropped unconscious after final weighing while waiting last in line for slaughter. This second experiment confirmed that a carcass weight loss had occurred after four day's starvation. This loss had reached 13.5 percent of initial carcass weight after eight day's starvation. The lowered carcass weights resulted in lower dressing percentages when carcass weights were related to initial live weights, reflecting the more extreme treatments applied in Experiment II.

All organs and contents measured were reduced in weight by the starvation treatments with the exception of the heart and the lungs with trachea. The reduction in weight of omental fat indicated that the cattle were starting to metabolise body reserves and this reduction was apparent after four day's starvation in Experiment II. The body components weighed and losses estimated were sufficient to account for the measured live weight losses, and in fact over-estimated the losses from Group 2.

### BODY AND CARCASS WEIGHT LOSSES EXPERIMENTS I and II



## GENERAL DISCUSSION

In contrast to the situation for lambs reviewed earlier, the present experiments have shown that the carcass weights of cattle were unaffected by three day's starvation with indications of loss starting to occur by the fourth day. In general, the present results are similar to those of Heever *et al* (1967) with Afrikaner cattle who showed live weight losses of 13 percent in cattle kept in a pen for four days without feed and water. Their cattle had lower dressing percentages (carcass weight relative to initial live weight) when slaughtered immediately after removal from the pen than when allowed feed and water for forty-eight hours after the treatment before slaughter. The lower dressing percentage of the cattle immediately following removal from the pen was explained by the authors as being due to carcass dehydration with the water being restored when feed and water again became available.

The present results, together with those of Heever *et al* (1967) who reported on the effects of rail transportation as well as starvation, suggest that starvation resulting from handling and transportation is not likely to be an important source of loss to the New Zealand meat industry. However, additional starvation while cattle are held at the works such as those occurring during labour disputes could result in carcass losses unless the cattle are fed after total starvation time exceeds three days. Other factors such as the build up of *salmonellae* with increased starvation times (Grau *et al* 1968) may also be matters for concern to the meat industry.

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