TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE REVIEW
HOGGET SURVEY

With the Review for September, 1963 (No. 5) we issued a questionnaire on the feeding and rearing of hoggets on tussock properties. Two hundred runholders returned the questionnaires and many of them added useful general comments. The following figures provide a summary of answers to the specific questions.

1. Breeds represented: Merino 34, Halfbred 73, Corriedale 36, Romney or Crossbred 56, Perendale 2.

2. Wintering on unimproved pasture—83. Of these, 36 use no other feed. Of these 36, Merinos numbered 17, Halfbred 14, Corriedale 3 and Crossbred 2.

3. Wintering on oversown and topdressed native pasture—50. Of these, 10 use no other feed.


5. Using hay—113. Of these, 33 use meadow hay, 65 lucerne, 18 some of each. One uses silage.

6. Roots are fed on 114 properties. On 40 the roots are sown with grass, on 49 without, on 25 some with and some without grass. Kale is used on 7 properties and chou moeller on 3.

7. Green feed is used on 22 properties (ryecorn 13, oats 4, oats and barley 3, barley 1, wheat 1).

8. Nuts are fed on 15 properties and oats on one.

9. A run-off is provided for roots or green feed on 110 properties.

10. 138 farmers drench regularly for worm parasites.

11. 90 farmers use selenium but only 5 use calciferol.

12. Weaning varies from November to May with one case in each month. Other dates are December 9, January 71, February 89, March 25, April 4.

13. Lambing percentages recorded vary as follows:
   Merino 39-103, Halfbred 60-115, Corriedale 75-140, Romney and Crossbred 65-120.

14. Bowie. This problem is reported to have occurred on 50 properties but in most cases the incidence is low. However up to 10 per cent of cases may occur.

The number of properties on which bowie occurs is rather disturbing particularly when it is realised that many runholders who did not reply are known to have a high incidence of bowie. The Committee of Management of the Institute is considering whether it should sponsor a research project on the cause and possible prevention of bowie. In the meantime the Institute would welcome any further information which runholders are willing to supply in confidence.
COMMENTS BY RUNHOLDERS

The following comments were made by runholders in addition to their answers to the specific questions.

A. General Management

1. Wintering hoggets is our number-one problem and many of us are running our five-year ewes so as to enable us to run fewer hoggets.
2. I gave up feeding hoggets on roots on account of pulpy kidney. Now I winter my hoggets on the hill.
3. I find that with frequent changes of paddocks on topdressed native pasture and keeping the grass fairly short my hoggets do much better than on first-class pasture of English grasses.
4. I winter on topdressed native pasture lying to the sun and shift every 21 days.
5. Hoggets require scope. The movement on and off greenfeed daily on to a run-off keeps them active and is good training for mustering later.
6. We winter our hoggets on warm run country with plenty of scope.
7. On all occasions when handling lambs through to hoggets, e.g., tailing, shearing, weaning, crutching, try to eliminate any unnecessary holding or keeping about yards without food or water. I have always practised drafting lambs from ewes in the morning, crutching and dipping during the day and having the lambs out on to feed and water by nightfall.
8. I always endeavour when hoggets have to come in for any purpose to get them back on their own country as soon as possible to avoid upsets caused by change of feed. Avoiding stomach upsets helps to avoid flystrike which with Diazanon dip and the activity of the German wasp has been largely cleared out in this district which was once severely affected.
9. With Merino hoggets I like to put them on a warm, dry bit of country for the winter where a little good hay is fed on the block.
10. It seems to me to wean a good lamb must be a big step towards rearing a good hogget. The tail-end lambs, say 20 per cent at weaning, don't ever catch up to the top 20 per cent even as four-tooths.
11. There is only one answer to malnutrition and it doesn't come out of a drenching gun. Dead soil and dead hoggets are closely related.
12. Hoggets at all times require the best in cleanliness of grazing and must be kept in forward condition.
13. We believe in, and follow rigidly a policy of keeping young stock completely segregated from the rest of the flock until after they have had their first lamb and it is weaned.
14. Keep them spread over as much country as possible.
15. It is my experience that where hoggets have scope without an abundance of feed, they give higher lambing percentages and a lower death rate than where they are well fed in the winter.
16. Hoggets are wintered on three blocks of autumn-saved topdressed country up to 2,500 feet. I have had a marked improvement since I stopped cultivation. I use selenium.
17. We winter our Merino hoggets on unimproved tussock country which has been spelled all summer.
18. We start feeding our hoggets on unimproved native pasture which is saved in the summer and autumn. We start about March with the poorest block and work up to the best block in August-September. Right from weaning we feed a few bales of hay weekly.

19. At weaning, crutching and shearing don't have your hoggets round the homestead paddocks one day longer than necessary. If they pick up worms or otherwise get a check it takes them a long time to recover when put out on the unimproved native pasture.

20. After many years of hogget losses up to 50 per cent, we have changed the policy over the last three years and have reduced losses to four per cent. 1,600 hoggets are run in one mob of 1,800 acres, subdivided into three blocks. The mob is shifted every three or four weeks to the large blocks and every ten days on the smaller one. Drenching is done at weaning time and after, as necessary. It is believed that a much greater build-up of internal parasites occurs on hill country than most people think?

21. The essential thing in rearing hoggets is to keep them going in their first winter. A poorly-done hogget will never grow into a good two-tooth ewe.

22. Any hogget that does not make the desired size by the time it is a two-tooth should be run dry with the wethers on the higher country for a year and put to the ram as a four-tooth.

23. If hoggets are to be wintered on native country they should be weaned straight on to their block and not held on improved pastures for any length of time.

24. I rear my hoggets on unimproved native pasture but run them on the the best block with a fair percentage of ewes to coax them from one ridge to another. This also helps in the case of a bad snowfall.

25. My hoggets are kept in the paddocks until shearing at the end of September, and then put on the run. I have no doubt this is the best system in my case, as well-fed lambs grow into better sheep.

26. Hoggets need plenty of scope. They should be established on the winter blocks of native tussock before winter starts, at least by early April. Topdressed areas are very beneficial. If put out early on the hill country they become familiar with the country before the snow arrives.

27. Merino hoggets do best if offered a fresh block at the end of July.

B. Weaning

1. Lambs after weaning should be spread out on the hill, say 200 or so to a block. A big mob on one block tend to stay together and chew out the feed.

2. We take care to wean hill lambs on to clean pasture, preferably clover (in flower). It is important never to hold lambs in paddocks between mustering and weaning.

3. I endeavour to wean hoggets on to good Montgomery red clover pasture. They never seem to get a weaning check or feed scour. Feeding on good feed from weaning to spring is essential. After ten years of trial and error I am certain that a well-wintered hogget means a big, aggressive profitable ewe, while a poor, small one is just a dead loss.
4. In this area it is rather wet for the feeding of roots. We get excellent results from weaning on to improved native pasture.

5. We wean our hoggets on to an oversown and topdressed tussock block which has been shut for four months.

6. I find that our lambs do far better on unimproved tussock and native grass after weaning than on improved sow pasture.

7. I used to wean 15 April. I weaned 25 March last year and I intend to wean early February this year, as I am sure they are better on fresh pasture than with the ewes. I wean on to topdressed native pasture that has been oversown and the red clover at that time fairly makes them jump away. I lost only one hogget out of 570 this year.

8. Hoggets are weaned from run country to topdressed native pasture to sown grass and finally to roots and chou moellier. I lost only six out of 1,500 last year.

9. From weaning I watch my hoggets and start at one end moving them from paddock to paddock every 10 days. I have lost only two out of 500 this year.

10. Out lambs are weaned on to clean hill country. After weaning they go back on to larger blocks with ewes or wethers and these older sheep pilot them over the range country. If an exceptional snowfall occurs you have acclimatised sheep to help lead the younger ones out of trouble.

11. I try to spell my hogget block for five to six weeks before putting the weaned lambs on it. I try to wean the lambs on to a small, spelled grass paddock for about five days to get them settled down before putting them on their block. I then spread them about so there are not too many in one place.

12. Hoggets need clean pasture to wean on to and plenty of scope to graze. With selenium they grow much better and wool weights are higher.

13. We find that by keeping lambs in the paddocks after weaning and winter feeding until after shearing in September, they do much better. This winter we have lost 20 hoggets out of 2,000.

14. (i) Drench when necessary.

(ii) Do them on the best class of country you have.

(iii) Have a long bite of worm-free pasture with clean water available from the day of weaning.

15. Hoggets should be kept going right from weaning on to spelled warm country. It is an unwise practice to allow hoggets to lose condition in April, May and June, and then try to catch up by feeding turnips in July and August.

16. Ewe hoggets are shorn at weaning, drenched and moved to fresh English grass pastures every 10 days until early June. They are then crutched, drenched with selenium and thibenzoic and fed on good hay in one netting hay-feeder 150 yards long. With nuts in feeders, 95-97 per cent learn to feed on dry matter. Later they get one hour per day on autumn-saved pasture and are shorn mid-September. Although we have snow most winters (above 1,250ft) our losses over 13 years are less than half per cent.
C. Winter Feed

1. Growth rates and wool weights have been greatly improved by rearing hoggets on topdressed country. It is all above 1,000 feet and winter conditions are severe.

2. All my country is now topdressed. My death rate over 12 years is 1½ per cent. I feed chou moellier and turnips with a run-off but make the breaks small and change them often.

3. I have found that in the severe weather of July and August hoggets do better on autumn-saved pasture and hay. I try to keep the turnips and greenfeed for September.

4. I wean in March on to clean, spelled, lower topdressed native pasture. I used to give them two months on turnips but these were so uncertain I think it is better to use a clean block of spelled country which has been topdressed and oversown.

5. We find that hoggets do better if given plenty of scope. With our turnips we leave the dry, unploughable portion, put out plenty of lucerne hay and don't put off at nights. We start them on turnips early before they start to lose condition.

6. The main essential in rearing hoggets is a continuous supply of fresh feed from weaning right through until they are fully grown. They should never be grazed on country previously grazed by ewes until at least six weeks. You need ample supply of roots, break-fed with a dry, clean run-off paddock where good-quality lucerne hay is fed. I like to have a few nuts and mineral lick available.

7. H1 ryegrass is the secret. After bringing in from the native block we put on improved pasture then on to H1, kale and swedes, then on to straight swedes and hay with a run-off. They are on swedes until the end of August and then back on to H1 and kale which has by then fresh growth on it. We lost only three out of 850 this year.

8. Up until six years ago my hoggets were wintered on unimproved tussock—poor results. Then for two years on meadow hay—a little better. Then two years on lucerne—better still. For the last two years on turnips and Italian ryegrass with run-off on topdressed native pasture—best results.

9. We find that feeding hoggets in the winter causes them to be a bit poor in their first winter in the high country as two-teeth, but it is better than wintering them on unimproved country as they get a good start as young sheep.

10. It is vitally important that hoggets have a raised level of feed during winter. If turnips cannot be grown, then a topdressed, oversown tussock block should be available. It may seem costly initially but this will be recovered in the performance of the ewe throughout her lifetime.

11. It is essential to have plenty of good-quality hay to supplement swedes. Since I have been feeding roots and hay I have put my hogget wool weight up 3½ pounds.

12. A run-off with hay is most necessary when feeding turnips. We put our hoggets on and off turnips every day. This year I have lost only one hogget out of 2,300. I believe the secret is to drench and immediately break them into turnips hoping for a fine week during the middle of May.
13. I prefer to start my hoggets on turnips early so as not to have them slip back before we get hard weather. I am convinced hoggets do much better with a clean run-off when feeding roots.

14. Turnips provide a most convenient method of feeding. They produce a large amount of feed per acre and require no harvesting. Although indigestible in severe frosts and often unpalatable, with hay and nuts they are reasonably satisfactory most years. Because of high transport and labour costs it is difficult to start any form of feeding before condition starts to fall away. One advantage with turnips is that, in the event of snow, all hoggets are concentrated within easy reach of feed and do not require snow raking.

15. If our hoggets are brought in from the hill without going to any other paddocks, given hay on the third day and moved on to another break, they will all eat hay and turnips. They are given a clean run-off later on.

16. We put hoggets on turnips leaving them on for five days. We take them off on to a run-off with hay for two days, then put them back on the turnips.

17. When hoggets are on turnips, always give a free run on to a run-off. Never shut them on turnips during the day and shut them off at night. On no account force hoggets to eat a break of turnips right off before giving access to a fresh break. Each break should be big enough to last about a week.

18. We use hay and nuts only to supplement a poor root crop. Once feeding starts, hoggets are not shut off the feed at any time but have free access to roots and run-off.

19. We find it pays to put hoggets on small breaks even to the extent of giving a fresh break every three or four days. Also, they are better shut on a break during the day and put on a dry run-off of large acreage at night.

20. I think it is important that hoggets be trained to eat hay so that as two-tooths they will eat it readily the following winter.

21. We always get our best hoggets when we start feeding hay early—end of May or first week of June. We feed the hay on topdressed native pasture and have brought our death rate down to one per cent.

22. We consider it important to get hoggets on to supplementary feed quickly. We find it helps to put out odd bales of hay around the camps during March, April and May. We also find that a change on to the very best hay during late August will keep them eating hay longer.

23. Hoggets are unpredictable. Three years ago ours had a bare ration of autumn-saved grass and lucerne hay and no turnips. They were the best hoggets we ever had and shore 11 pounds of wool. The following year they were started on turnips and grass in May with our best hay. This continued through to September; they shore 10 pounds of wool!

24. I consider it essential that they run on a good clean topdressed block of native pasture after weaning. I introduced them to turnips on a block sown with grass so that they do not get a check through being starved on to roots. If a good run-off is not available with turnips, hay must be fed. I have found they do better, once they
have started eating turnips, by being allowed to run on and off at will.

25. We find that hoggets thrive on turnips with a large run-off of saved feed, whether native or sown, plus hay as required. With the old drenches we still had a tail-end of 10-20 per cent at the end of the winter. Since using selenium we have very little trouble.

26. The best hoggets we have had were put on to turnips for four to five hours daily and then shifted to a dry run-off where they got lucerne and meadow hay. We never leave hoggets on turnips or greenfeed more than two hours in wet or muddy conditions.

27. I think regular times for putting on the turnips is essential—not 11 a.m. one day and 2 p.m. the next. It is essential to drench them when going on to turnips.

28. I find if I put a bit of chou moellier with the roots, hoggets will start eating them a little sooner. As large a run-off as possible should be given.

29. Plenty of good-quality feed must be given early before the grass starts to go off. A high plane of feeding is important to maintain good health and condition in severe winters. Hoggets must have access to feed all the time except for shutting off roots when ground conditions are very wet.

30. We leave hoggets on turnips continually with a run-off.

D. Drenching

1. My hogget losses used to be five per cent. I have cut them to less than one per cent by the following system: Before going on to turnips they get thibenzoate and are vaccinated for pulpy kidney. They get a good run-off and good lucerne hay.

2. We had a gain of a pound in selenium-treated lambs over control and a 10-pound gain with drenching and selenium. The results were quite spectacular considering that on a visual inspection there was no indication of worm infestation.

3. This is the first year we have used selenium. The results have been outstanding with practically no losses in 1,400 hoggets.

4. I consider that with selenium and thibenzoate our Merinos now have the ability to utilise fully swedes and lucerne hay. Not only are growth, health and wool weights improved, but the survival rate has improved from 10-40 per cent losses in the old days, to less than one per cent loss in 1900 ewe hoggets wintered on swedes and lucerne hay last year. A truly exciting change for us here.

5. I have found selenium of the greatest assistance in rearing hoggets. I give one dose at tailing and one at weaning when I give the first drench of thibenzoate.

6. Selenium and thibenzoate have opened up a new era in hogget rearing and our hill hoggets in the spring are now almost the equal of lowland sheep.

7. By using selenium two or three times from weaning to July I have cut my losses in hoggets to six or seven out of 950.
E. Bowie

1. Bowie as I know it occurs between tailing and weaning (not afterwards). Not only the small lambs seem to be affected. It is more prevalent under hard conditions (hot and dry) when there is little attractive feed. Some parts of the run seem to be more prone to the trouble than others.

2. We used to have cases regularly but have had none since the hill country was topdressed.

3. All breeding ewes were run on turnips, with very little roughage, from May to September one year. Eight per cent of the lambs developed bowie. We now run the ewes on turnips and swedes from mid-August until the end of September when we shear. The lambs are almost completely free of bowie.

4. In one mob of ewes and lambs running on untreated hill country eight per cent of lambs had bowie. The same year, with a mob run on the topdressed pastures, there were no cases at all.

5. Since a big area was topdressed I have had only an odd case of bowie. (They say bowie is caused through hanging on to the rocks in nor-westers!)

6. My tussock block runs to 2,500 feet. A strip through my country continuing on through adjoining runs is known to produce bandiness in lambs. This is not apparent at tailing but develops between mid-November and the end of January. In a bad year five per cent can be affected. In recent years I have given the ewes three to four weeks on swedes in September prior to pre-lamb shearing and this has practically eliminated the complaint. Some affected lambs will straighten on good feed; others are so bandy they are beyond correction. From my observations the trouble appears to be nutritional, although many of the affected lambs appear to be in good condition.

7. From 1925 to 1935 we had quite a number of bowie lambs. Since then the number has dwindled to almost nothing. We blamed lambing on big blocks because, once lambed, the ewes seemed to trek more with the result that the lambs were always trailing. Combined with a deficiency of bone structure, that seemed to throw the joints out. We now have smaller lambing blocks and improved pasture.

8. Bowie on this place occurs on tussock blocks that are overgrown through a lack of burning. Some affected lambs will straighten out if put on to good feed.

9. I have had bowie on only one block. It had never been topdressed and was predominantly browntop. Since it has been regularly topdressed I have had no recurrence of the trouble.

10. We lamb our ewes on three hill blocks and only on one of these do cases of bowie occur. We wean all lambs on to improved pastures and all cases quickly straighten.

11. I am convinced that bowie is largely hereditary. Up till 30 years ago we used to get only one or perhaps two cases a year. Then we got a stud ram which threw nearly 50 per cent of bowie lambs. Very foolishly we kept and used those that were straight. For many years we had up to 10 per cent of bowie and have only now worked out of it.
STAFF APPOINTMENT

Mr G. A. Dunbar, a Senior Scientific Officer with the Farm Advisory Division of the Department of Agriculture in Christchurch, has been appointed as Agronomist to the Institute. Mr Dunbar graduated B.Agr.Sc. at Lincoln College in 1948 and M.Agr.Sc. in 1952. In 1948 he was appointed Technical Research Officer at the Tara Hills Experiment Station of the Soil Conservation and Rivers Control Council, and except for periods at Lincoln College and in the United States he was at the station until December 1955. His work there was concerned with the improvement of cover on denuded and eroded fescue tussock and snow-grass areas.

Under a Fulbright award and a foreign tuition scholarship from the Colorado State University at Fort Collins, Mr Dunbar spent a year at that University in the School of Forestry and Range Management. After returning from the United States he worked with officers of several Government departments on attempts to establish standards for judging safe use of high-country grazing lands. In 1956 he was transferred to Christchurch and since then has been in charge of land inventory and capability surveys in the South Island, and has co-operated with catchment authorities in advising standard survey techniques.

In his new appointment, Mr Dunbar will be concerned with revegetation of depleted and eroded areas on both occupied and unoccupied land. Particularly in the higher altitudes, he will work on the effects of various systems of management on cover and hydrology, the bringing up-to-date of existing knowledge on condition and trend and on the establishment of conservation standards. He will also participate in catchment surveys on the basis of which the Institute will make recommendations on land use.

OUR COVER

In 1855, James MacKenzie, a 35-year-old Highlander, was accused and convicted of stealing 1,000 maiden ewes from the Levels run owned by the Rhodes Brothers. He was pardoned 10 months later.

The monument stands on the inland side of the MacKenzie Pass near the junction of two streams generally accepted as being the place where the freebooter was captured.

The three-sided monument was erected by the late Mr T. D. Burnett, M.P. of Mount Cook station. The inscription is in Gaelic, Maori and English.

ON THIS SPOT
JAMES
MACKENZIE
THE FREEBOOTER
WAS CAPTURED BY
JOHN SIDEBOTTOM
AND THE MAORIS
TAIKO AND “SEVENTEEN”
AND ESCAPED FROM THEM
THE SAME NIGHT
4th MARCH 1855
CONTROL OF SHOOTING ON RUNS

Most runholders have experienced the problem of shooters wanting permission to shoot or perhaps just to pass over their properties on the way to shoot elsewhere. Some owners, realising that men belonging to an organisation such as the New Zealand Deerstalkers' Association, with its strict rules of behaviour, are likely to respect stock, gates and huts, stipulate that they will give permission only to association members. Others make their decision entirely on their knowledge and experience of the individual, regardless of whether he is a member of an organisation or not. In either case the runholder is exercising his right, conferred on him by the law of the land, to decide who shall enter on and remain on his property.

Recently the Committee of Management of the Institute has been disturbed to find that some runholders are handing over to an outside organisation the right to the shooting on their properties, the right to say who will and who will not be permitted to enter on and shoot on their private land. One agreement, at least, stipulates that the runholder himself surrenders all jurisdiction—he cannot himself permit any one to shoot unless permission is first obtained from the organisation. The Institute would warn runholders to study closely any such agreement before becoming a party to it. Such agreements if widely entered into, could give the impression that the public, as of right, may enter on to private land, leasehold or freehold.

The Committee of Management is also concerned at the contention in a leading article in a recent number of "New Zealand Wild Life," the official publication of the N.Z. Deerstalkers' Association Incorporated, that "all Crown lands, both occupied and unoccupied should by law be open to the outdoor sportsman." While it believes that the services of the private shooter should be used to the maximum possible in the control of noxious animals, the Institute will do its best to ensure that the runholder retains the right to say who he will permit to enter on his land.

RESEARCH GRANTS

To enable research projects to be undertaken which might not otherwise be possible, the Institute has made further grants as follows:

1. Dr T. W. Walker, Lincoln College, for work on sulphur and on inoculation of legumes.
2. Mr B. D. Fahey, University of Otago for work in the hydrology of forest and tussock grassland.
3. Mr A. Gillingham, Lincoln College, for investigations into infiltration under different land treatments.
4. Mr H. McPherson, Massey University of Manawatu, for an ecological study of a snowgrass community in the Tararua Mountains.
5. Dr I. E. Coop, Lincoln College, for a study of live-weight-production relationships in high-country flocks.
6. Mr N. C. Lambrechsten, University of Canterbury, for studies in the autecology of sweet vernal.
7. Dr R. H. M. Langer, Lincoln College, for the testing of strains of Alsike clover in tussock country.
LAND CAPABILITY CLASSIFICATION EXPLAINED

Any area of land can be classified in many different ways and for many reasons.

Most classifications are of two types

(i) physical classifications such as soils erosion crop yields
(ii) economic classifications such as tenure use expected financial returns market values.

We are concerned with (i)—a physical classification. Since it is physical it is concerned with material and natural features.

In this case the classification is concerned with the soil and its erodibility. The erodibility is an important factor affecting the possible productive level of the land and the way in which it can be farmed.

It is called a Land Capability Classification.

"Capability" is used here as meaning the suitability for productive use after taking into account the various limitations which the land may have, e.g. steep slope or infertile soil or others.

Thus it could be called a Land (Use Risk) Classification. The classification was originally developed in the United States, has spread now almost worldwide and has in this country been partly modified by New Zealand workers to suit our special conditions.

Briefly, the Land Capability Classification divides land into eight classes with Class I having the highest capability and Class VIII the lowest.

Classes I-IV are considered arable and

Classes V-VIII are considered non-arable or suited in varying degree to pastoral farming.

The division is made on an assessment of the permanent limitations to use of an area, as is discussed later.

Any classification is usually for a single purpose (e.g. a grouping of types of vegetation), but if the information appears suitable it can be used afterwards for other purposes than that for which it was first intended. This has happened to the Land Capability Classification. Its classes are often used when discussing many matters other than erosion which are associated with land, such as its potential production (sheep per acre, or acres per beef animal), its responsiveness to fertiliser, or its seasonal use.

It must be remembered however that the Land Capability Classification is primarily an assessment of the intensity of use to which land can be put consistent with the risk of erosion to it.

It does not itself give "recommended land use" or the particular use to which an area of land should be put.

Thus, for Class VII land, it lists the limitations to a more productive use being made of it (e.g. steep slopes). It does not say it shall be lightly grazed or spelled for a temporary period—that is recommended land use, a different but associated matter.
For Class VIII land, the limitations are again listed and it is usually added that these are so severe that there can be few recommended uses open to it—e.g. watershed protection.

The Land Capability Classification is itself based upon a field survey of the features of an area of land or Land Inventory Survey, and is a particular interpretation of the information in it.

The Land Inventory is a recording of FACT; the Land Capability is an interpretation of that fact for a particular purpose, to sort out which parcels of land have similar erosion risks and thus similar safe-use potential.

THE LAND INVENTORY SURVEY is made to map the

— Soils (and perhaps Geology)
— Angle of slope
— Vegetation and Present Land Use
— Erosion Extent and Type, of an area.

In practice, after a thorough field survey during which the above data usually are recorded directly on to aerial photographs of the area, a Land Inventory Map showing all these features is drawn. It is a composite map and could be further broken up if necessary into

— a soil map
— a vegetation map
— an erosion map
— a present land use map

but for practical purposes has all this information on one sheet.

In mapping, the land region is broken up into small areas or Land Inventory Units. The minimum size depends to some extent on the purpose and intensity of the survey, e.g. reconnaissance of land condition, or preparation of a run plan, but mainly, of course, on the variability of the country.

Each small mapping area has within its boundaries, roughly similar soils, vegetation and erosion. It differs from its neighbouring areas by a change in one or more features such as a different soil type, or a different plant association.

A key to the map symbols and what they represent is printed on the map itself.

THE LAND CAPABILITY CLASSIFICATION

is based on the information shown on a Land Inventory Map, but also depends a great deal on the classifiers' knowledge of the characteristics of the soils and vegetation and what use has been made of them elsewhere.

They group the individual inventory areas (or units) together in large or small bundles. The units within each bundle have some similarity to each other.

The broadest groupings of units with roughly similar characteristics are called Land Capability Classes.

All the land within a class has about the same degree of limitation to the use which can be made of it.

Within classes, smaller groupings each with a different principal kind of permanent limitation are Sub-Classes.
The conventional limitations or conservation problems are:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>erosion</td>
</tr>
<tr>
<td>w</td>
<td>excess water</td>
</tr>
<tr>
<td>s</td>
<td>soil restrictions to plant growth</td>
</tr>
<tr>
<td>c</td>
<td>climatic limitations.</td>
</tr>
</tbody>
</table>

The subclasses are again subdivided, when the classification is to be used for farm planning, into even smaller Capability Units.

Each unit should, because of its particular characteristics, be managed (i.e. grazed, seeded, manured) in a different way from its neighbours for best use to be made of it.

In fact the Capability Units may be so small as to be only one or a grouping of two of the original Land Inventory Unit areas.

It is sometimes easier to think of the classification the other way round.

A number of Land Inventory Units needing similar management are grouped to make a Land Capability Unit.

A number of Land Capability Units having a similar kind of limitation (e.g. wetness) to their maximum use are grouped to make a Land Capability Subclass.

A number of Land Capability Subclasses having broadly similar degrees of risks involved in and thus restrictions on their use are grouped as Land Capability Classes.

It should be noted that:

1. If it is reasonably and economically possible to remove a limitation to further use, e.g. stones, droughtiness or wetness, then this limitation is said not to be "permanent."

   Thus, if an area has good soil but is restricted in use by summer droughts, and if there is water nearby and it is economic to irrigate then the area may be classified as better than it would presently seem to warrant. In other words the soil is classified on the basis of being without the limitation.

2. Changes in technical knowledge which could enable us to alter the productivity of a soil may be a reason for later change in the use within a class. The class of an area itself however cannot normally be later changed since it is originally given this class on the permanent soil and climatic limitations to use which affect it.

   Thus Class VIII is considered to have permanent severe soil and climatic limitations. These at present make it too risky (because of the possibility of erosion) to graze. Better vegetation (if any will grow) may change its use, but cannot change its class.

3. The skill of the farm manager or owner has nothing to do with the classification.

4. The classification is based on soil and climate which are permanent, rather than on plants which may vary according to many things such as the soil and climate where they live, competition amongst themselves, and the effect man and his animals have had upon them.

   The Land Capability Classification is not a universal all-purpose classification. It is meant for a special purpose but is, in New Zealand, often successfully adapted for other associated purposes.
Separate classification or groupings would be needed for pastoral productivity, suitability for forestry, possible grazing intensity, suitability for irrigation or expected crop yields.

The Land Capability Classifiers

study

climate  permanent soil characteristics

and their

results of field trials
personal and farmer experience
research findings

combined effect

on
— soil erosion risk
— restriction to use
— potential production
— management.

The classification is done by men who are trained to map the distribution of plants, soils and erosion of an area and then, taking into account the climate, assess the amount of erosion risk in the use of each part of the area.

If the same men then suggest what can be done in view of the soil potential but erosion risk, they are making Recommendations on Land Use.

It may well be that a separate map is drawn for this purpose as is often done after reconnaissance surveys.

However with conservation farm plans, the annual programme map and its associated script give these recommendations.

CLASSIFICATION IN NEW ZEALAND

Two organisations undertake official Land Capability Classification in New Zealand,
— Soil Conservation Service of the Department of Agriculture.
— Soil Conservation staff of Catchment Authorities.

The Soil Conservation and Rivers Control Council supervise standards through the Department of Agriculture and its Soil Conservation staff frequently check the accuracy of other surveys.

A reconnaissance Land Capability Survey of the more important upper catchment areas is being carried out over a period of years by the Soil Conservation Service. Catchment authority staff carry out Land Inventory and Capability surveys for Conservation Farm Plans.

THE LAND INVENTORY SURVEY

Land Inventory symbols and mapping procedure are not as yet standardised throughout the country but reference should be made to the legend on the map or in the associated script.

A description of the factors mapped in the Land Inventory Survey and examples of the symbols and scales used are given in the following pages.
LAND INVENTORY SYMBOLS

Within the boundary of a land inventory unit on a map some form of lettering is used to show the physical features of that area. An example is given below.

<table>
<thead>
<tr>
<th>Soil</th>
<th>Land Use</th>
<th>Vegetation</th>
<th>Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tekoa</td>
<td>Native</td>
<td>Fescue tussock</td>
<td></td>
</tr>
<tr>
<td>Steepland</td>
<td>Grassland</td>
<td>Blue tussock</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sweet vernal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manuka &lt; 40%</td>
<td></td>
</tr>
</tbody>
</table>

TkS G1 Fno Pco Aod m(Lsc) NW
E 2 Sh Slp

Slope Angle Present Erosion Type of Erosion
26°-35° Slight Sheet and Slip
10-20% bare ground

There are several different ways of presenting the information by symbols. The above is a typical example. What the map symbols represent will be described preferably on the face of the map, otherwise in the report.

LAND USE

A symbol for this is sometimes included, for instance
- P grassland
- P1 native grassland
- L cropland
- L1 cereals
- F woodland
- Fl native forest.

SOILS

New Zealand soils have been mapped by the Soil Bureau, D.S.I.R., at a scale of four miles to the inch. Some areas are of course mapped in more detail.

The Land Inventory Survey uses these maps, checks them on the property and adjusts boundaries if necessary. For practical purposes the soils on a property are mapped as several soil types, each of which can be expected to react differently under various treatments.

The Soil Type is the unit of soil mapping.
It has: Name of Series e.g. Kaikoura
It may also have:
  Texture of topsoil e.g. sandy loam
  Colour or colour pattern e.g. mottled
  Depth e.g. shallow
  Other profile features e.g. stony
A soil type can have one or more soil phases. The Soil Phase is an additional feature of agricultural significance e.g. steepleland phase or severely eroded phase.

A Soil Series is a group of soil types — with fairly similar profiles (changes in characteristics with depth) — formed from similar parent materials (e.g. greywacke rock) — in similar climates (e.g. cool, 40-inch rainfall).

A series usually carries the geographical name of a district where the series is common or was first found e.g. Omarama series.

Example:

<table>
<thead>
<tr>
<th>Series</th>
<th>Texture</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaikoura</td>
<td>silt loam</td>
<td>Steepland</td>
</tr>
</tbody>
</table>

Map symbol: [Kr] [S]

soil type

Each soil type has particular site and internal features which are assessed in the field and in the soil laboratory.

VEGETATION

The natural vegetation of an area depends on

(1) environment:
- soil
- temperature
- rainfall
- evaporation
- wind
- light
- exposure

(2) plant competition.

Plants growing in an area usually indicate

(i) conditions for growth there e.g. soil fertility
or soil moisture
or climate

or (ii) past management e.g. burning or grazing

The plants present determine (along with the climate, slope, aspect and erosion risk)

(i) the amount of available grazing
(ii) the type of management necessary for grazing.

A natural collection of plants living in similar conditions is known as a plant community.

Each community has some members which have a controlling influence; these are dominants. They are the most plentiful and vigorous and usually the tallest.

Smaller groupings of similar plants are called plant associations. Associations are named after the dominant species e.g. Beech-forest association or Fescue-tussock-grassland association.

Land Inventory mapping is concerned principally with Associations.
It maps the associations by naming the dominants usually in order of number thus

- silver-tussock association
- fescue-tussock association.

It usually lists somewhere the principal plants associated with the dominant plants thus

- fescue tussock dominant with blue tussock, mingimingi, strathmore weed, and catscar.

The named plants, to the trained man, show the quality of the site and its history.

Farming is concerned with **plant successions**. Under natural conditions vegetation tends to change from small plants (pioneers) to larger and taller plants. Change is due to environment, plant competition and management.

Thus bare shingle → tussock grassland → matagouri or manuka → beech forest or rain forest.

Grassland is desirable for grazing and can be retained by various management practices (sowing seeds, grazing, topdressing, burning) but there is a constant battle between natural succession and farming. Where management is imperfect or the environment too strongly favours scrub, "second growth" succeeds.

**RECORDING OF VEGETATION**

(i) The symbol used is the first letter (or two letters) of the generic (group) name and the specific (particular) name.

For instance: Chionochloa rigida (narrow-leaved snow tussock)

\[
\text{C } \text{ri}
\]

Map symbol Gri or Chri

The most common plant is recorded first, next common second, and so on.

For instance: Fno Dto

Festuca novae-zelandiae Discaria tounatou

(fescue tussock) (matagouri)

(ii) Letter M means greater than 40 per cent scrub.

\[\text{m}\] means less than 40 per cent scrub.

Similarly N more than 40 per cent bush.

\[\text{n}\] less than 40 per cent bush.

Sometimes, instead of this system, a symbol may be used to denote a plant association, e.g.

P pasture, P1 native pasture,
Ple blue tussock association,
F woodland, F1 native forest,
F1b beech forest,
and the members of the association described in the text.
ASPECT

The aspect of a face (for instance, north-east, north-west) may be noted in the map legend but is usually obvious from the map itself.

Aspect is important for determining
— vegetation
— sward management
— stock management.

ALTITUDE

Altitude is not usually drawn (by means of continuous lines) on land inventory maps. It is however a very useful record if it can be shown.

Altitude is usually assessed by
— field notes of altimeter readings on survey
— changes in vegetation
— changes in soils
— trig heights and spot heights on maps.

SLOPE

Slope (grade or steepness) affects
(i) possibility of cultivation
(ii) risk of erosion
(iii) soil characteristics—for instance,
— droughtiness
— fertility
— stability.

Often, in tussock grasslands steeper slopes have
— better draining soil
— higher natural fertility (due to more soil movement and rock breakdown)
— lower stability than lesser slopes or terraces.

But length of slope is also important.

A long, moderate slope may be more susceptible to erosion than a short, steep slope because of the higher speed and volume of runoff water.

Steepness of slope and aspect also are important determinants of the rate of snow clearing. Steep, north slopes generally clear more quickly from snow.

Slope is measured in the field by the Abney level.

Angles are grouped in mapping.

<table>
<thead>
<tr>
<th>Angle Range</th>
<th>Letter</th>
<th>Description</th>
<th>Usually</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°— 3°</td>
<td>A</td>
<td>flats and terraces.</td>
<td></td>
</tr>
<tr>
<td>4°— 7°</td>
<td>B</td>
<td>fans and gentle slopes.</td>
<td>fans and gentle slopes.</td>
</tr>
<tr>
<td>8°— 15°</td>
<td>C</td>
<td>rolling downs and steep fans.</td>
<td>rolling downs and steep fans.</td>
</tr>
<tr>
<td>16°— 20°</td>
<td>D</td>
<td>back slopes of hills, moderately steep.</td>
<td>back slopes of hills, moderately steep.</td>
</tr>
<tr>
<td>21°— 25°</td>
<td>E</td>
<td>scarp slopes of hills, steep. (The</td>
<td>scarp slopes of hills, steep. (The dominant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dominant angle of slope in the high</td>
<td>dominant angle of slope in the high country)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>country)</td>
<td></td>
</tr>
<tr>
<td>26°— 35°</td>
<td>F</td>
<td>rock faces and cliffs, very steep.</td>
<td>rock faces and cliffs, very steep.</td>
</tr>
<tr>
<td>Over 35°</td>
<td>G</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EROSION

Erosion is either geological (natural) or accelerated (man-induced).

Any erosion present may be mapped as

(i) total visible erosion (past and present)

and active erosion (happening now)

with a figure given to each according to the scale

below.

Or (ii) total visible erosion including active erosion with a single

figure given to denote amount. This system is more

common.

Degree of erosion is represented by a figure which usually has some

relation to the average proportion of bare ground present in an area.

<table>
<thead>
<tr>
<th>Erosion</th>
<th>Map Symbol</th>
<th>Estimated Percentage Bare ground or Area eroding</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>No significant erosion</td>
</tr>
<tr>
<td>Very slight</td>
<td>1</td>
<td>1% - 10%</td>
</tr>
<tr>
<td>Slight</td>
<td>2</td>
<td>10% - 20%</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>20% - 40%</td>
</tr>
<tr>
<td>Severe</td>
<td>4</td>
<td>40% - 60%</td>
</tr>
<tr>
<td>Extreme, and unvegetated</td>
<td>5</td>
<td>Greater than 60%</td>
</tr>
</tbody>
</table>

Past erosion is recognised by

— the state of the vegetation succession
— the layers of the soil (top layer may be gone)
— other factors, such as evidence of old gullies, plants on soil
pedestals, healed slumps and slips.

Active erosion is recognised by

— the state of the bare ground present
— the new appearance of gutters and gullies.
— lichen on scree, snow grass “duff” on ground surface
— new material e.g. scree covering vegetation or vegetation
 growing on scree
— the place of the plants which are present in normal succession
— the state of stream channels.

Erosion is academically divided into many types. An effort is
made to map these separately.

Erosion

<table>
<thead>
<tr>
<th>Erosion</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind—shifting of loose soil</td>
<td>W</td>
</tr>
<tr>
<td>by wind action</td>
<td></td>
</tr>
<tr>
<td>Sheet—more or less uniform</td>
<td>Sh</td>
</tr>
<tr>
<td>removal of a thin</td>
<td></td>
</tr>
<tr>
<td>covering of soil by rainfall</td>
<td></td>
</tr>
<tr>
<td>Gully—often develops from</td>
<td>G</td>
</tr>
<tr>
<td>a rill which may develop</td>
<td></td>
</tr>
<tr>
<td>from sheet erosion</td>
<td></td>
</tr>
<tr>
<td>Slip—sliding or slipping</td>
<td>Slp</td>
</tr>
<tr>
<td>of soil and underlying</td>
<td></td>
</tr>
<tr>
<td>material</td>
<td></td>
</tr>
<tr>
<td>Slump—characterised by top</td>
<td>Slm</td>
</tr>
<tr>
<td>drops and toe heaves up</td>
<td></td>
</tr>
<tr>
<td>Scree—may be stable or creep</td>
<td>Sc</td>
</tr>
<tr>
<td>depending on slope angle</td>
<td></td>
</tr>
<tr>
<td>Geologic (natural)</td>
<td>n</td>
</tr>
</tbody>
</table>

There are other types of erosion known but the above are the most
common in the South Island high country.
LAND CAPABILITY CLASSES

The description of each class which follows is made with acknowledgement to the Soil Conservation and Rivers Control Council and the New Zealand Association of Soil Conservators.

A note on recommended land use is appended to each class.

CLASS ONE (I)

Very Good Arable Land

Nearly level.
Very deep easily worked soils (usually 3ft deep or over, soil and sub-soil).
Soils well drained but not droughty.
Soils fertile or highly responsive to fertiliser.
Favourable climate for wide range of crops, grasses or trees.
Erosion risk very slight.
(Factors can be alone or together.)
Map colour LIGHT GREEN.
Uses: Wide latitude for use.

CLASS TWO (II)

Good Arable Land with Slight Limitations

More difficult to manage than Class I because
Soils less than ideal depth.
Fertility lower than I.
Soils have poor structure and are difficult to work.
Some occasional damaging overflow.
Some wetness even after drainage.
Slight climatic limitations.
Risk of wind or water erosion slight to moderate.
(Factors can be alone or together.)
Map colour YELLOW.
Uses: Mainly rotational cropping with some grazing.
CLASS THREE (III)

Arable Land with Moderate Limitations

Grows restricted range of plants and/or needs special conservation practices because

- shallow soil or hardpan limits root growth
- tight subsoil restricts drainage
- frequent damaging overflow
- droughty or wet (even after drainage)
- low fertility soils (not easily corrected)
- climate not very favourable for plant growth
- moderate to severe erosion or risk of it.

(Factors can be alone or together.)

Map colour CRIMSON.

Uses: Rotational cultivation possible if the erosion hazard is reduced.
CLASS FOUR (IV)

Arable Land with Severe Limitations

Plant choice restricted and/or soil requires very careful management because

— moderately steep to steep slopes
— very shallow soils (less than 10 inches deep soil and subsoil)
— frequent overflow risk with severe damage
— poor climate
— severe erosion or risk of it.
(Factors can be alone or together.)

Map colour BLUE.

Uses: Suited for occasional cultivation.
CLASS FIVE (V)

Very Slight Erosion Risk but not Arable due to Some Limitations
Impractical to Remove

- Soil may be fertile, slope easy, erosion risk low but
  - too stony
  - too wet

or
- overflow too prone to cultivate.
  (Factors can be alone or together.)

Map colour MID-GREEN.

Uses: Cannot be used for cultivation but suited to grazing or forestry.
CLASS SIX (VI)

Land not Arable but with Moderate Limitations because of

- fairly steep slopes
- stony
- shallow soil
- persistent wetness or possibility of overflow damage
- moderate fertility (but responsive to fertiliser)
- poor climate
- moderate erosion or risk of it.

(Factors can be alone or together.)

Map colour ORANGE.

Uses: Is usually stable hill country suitable, with care, for grazing and forestry.
CLASS SEVEN (VII)

Not Arable and with Severe Limitations to Use

High use hazards—needs very careful management because
— very steep slopes
— very shallow soils
— very stony
— very wet or liable to overflow
— severe climate
— severe erosion or risk of it.
(Factors can be alone or together.)

Map colour BROWN.

Uses: Typically, unstable hill country which can be used for restricted grazing or forestry.
CLASS EIGHT (VIII)

Land Not Suitable for Crops, Grazing or Commercial Forestry because of

— extreme erosion hazard
— very severe climate
— very low fertility
— rock and scree.

(Factors can be alone or together.)

Map colour PURPLE.

Uses: Recommended for watershed protection and recreational use.
The **Land Capability Classification** is used as the basis for conservation [*Farm Plans*](#) or conservation [*Run Plans*](#) because

(i) it helps in choosing a use for which the land is best fitted (cultivation, grazing, or watershed protection).

(ii) It shows how much use can be made safely of that land.

For instance, heavy grazing or light controlled grazing with spelling.

How much depends mainly on

(a) soil productivity

(b) risk of erosion when used.

The classification points to the correct methods of soil conservation which should be used. These will reduce the amount of erosion that is likely to happen. If effective conservation measures and good farming practices are carried out, a sustained level of production is possible.

This is the whole aim of Conservation Farm Planning—**maximum safe production from each piece of land consistent with its limitations.**

**References for further reading**


A Manual on Conservation of Soil and Water.


Land Capability Classification.


Soil Conservation and the Planning of Land Use.

Papers read at the Conservation Section of the 10th N.Z. Science Congress 1962.


“Official Handbook to Land Capability Classification.”

(N.Z. Soil Conservation and Rivers Control Council.)
RAISING THE HEIGHT OF FENCES

Mr John Peter of Awapiri Station, Marlborough, has sent to the Institute a type of standard section which he uses for raising the height of iron fences.

Details of the section can be seen in the sketch. The cost of each section is 1/- to 1/3 in Blenheim and at this price, one such section fitted to each old standard of a fence can, with the occasional post, Mr Peter says, make a fence much more stock-proof quite cheaply. By cutting the section longer, provision can be made for two barbed wires.

Old standards can be re-cut to make three or four sections.

---

[Diagram of fence section with annotations]
FULBRIGHT RESEARCH SCHOLAR

Dr Robert E. Dils will join the Institute as a visiting Fulbright scholar for nine months from September 1964. Dr Dils who is a graduate in forestry and in soil science is Professor of Watershed Management and Leader of the Cooperative Watershed Management Unit at the Colorado State University, at Fort Collins, U.S.A., and is recognised as an authority on watershed hydrology and management.

It is expected that Dr Dils will make a critical evaluation of river catchment problems and research needs in New Zealand, particularly in the South Island mountain catchments. He will delineate special problem areas in selected catchments and suggest research results from other countries which are likely to apply to New Zealand conditions. In addition to suggesting remedial measures based on existing knowledge, Dr Dils will advise on the planning of a programme of research in surface hydrology and its relation to catchment control. In this he hopes to work with the hydrological unit of the Soil Conservation and Rivers Control Council.

Dr Dils will also work closely with the Forest and Range Experiment Station of the New Zealand Forest Service at Rangiora and at its field station in the Craigieburn mountains and with members of the staffs of catchment authorities.

All communications should be addressed:

TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INSTITUTE BOX 56, LINCOLN COLLEGE, CHRISTCHURCH.