1920.

NEW ZEALAND.

SOUTHERN PASTORAL LANDS

(REPORT OF THE COMMISSION APPOINTED TO INQUIRE INTO AND REPORT UPON).

Presented to both Houses of the General Assembly by Command of His Excellency.

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COMMISSION.

LIVERPOOL, Governor-General.

To all to whom these presents shall come, and to Robert Thomas Sadd, Esq., Commissioner of Crown Lands and Chief Surveyor for the Otago Land District; William Blyth Buckhurst, Esq., Land Valuer, of Christchurch; Leonard Cockayne, Esq., F.R.S., F.L.S., F.N.Z.Inst., Ph.D., of Ngaio, Wellington; Dickson Jardine, Esq., Pastoralist, of Birchwood, Southland; Robert Scott, Esq., Farmer, of Kyeburn, Otago; Archibald McInnes, Esq., Farmer, of Otiake, Otago; and Charles Todd, Esq., Merchant, of Dunedin: Greeting.

WHEREAS it is desired to ascertain whether the pastoral Crown lands of the Land Districts of Canterbury, Otago, and Southland are being leased and utilized in the best manner, and whether the pasturage of the said lands is deteriorating; and, if so, the cause of such deterioration, and how best to remedy the same and to improve the conditions of settlement of the said lands:

Now, therefore, I, Arthur William de Brito Savile, Earl of Liverpool, the Governor-General of the Dominion of New Zealand, in exercise of the powers conferred by the Commissions of Inquiry Act, 1908, and of all other powers and authorities enabling me in this behalf, and acting by and with the advice and consent of the Executive Council of the said Dominion, do hereby constitute and appoint you, the said—

ROBERT THOMAS SADD,
WILLIAM BLYTH BUCKHURST,
LEONARD COCKAYNE,
DICKSON JARDINE,
ROBERT SCOTT,
ARCHIBALD MCINNES, and
CHARLES TODD,

to be a Commission to inquire into and report upon the above matters generally, and in particular to inquire into and report upon—

(1.) The present tenures under which the said lands are held, and whether they are in the best interests of the State and of the tenants.

(2.) Whether they should be amended; and, if so, in what direction.

(3.) The conditions now existing regarding the occupation, cultivation, and stocking of the said lands, and the improvements which may be and are effected by tenants and for which valuation is allowed under the existing conditions of the Land Act, 1908, and its amendments, or any previous Land Act under which the said lands may be held.

(4.) Any steps that should be taken to further subdivide the areas in which the said lands are held and to prevent undue aggregation thereof.

(5.) The causes of the deterioration or depletion of the grass lands; the best methods of regrassing of depleted areas, either by surface sowing or by spelling to allow of the regrowth of natural grasses, or by other means.

(6.) The present condition of the sheep-runs with regard to producing winter feed, and the methods (if any) which should be undertaken to encourage more extensive cultivation on suitable parts of such runs.

(7.) The best utilization of the existing water-supply for lands situated in areas where the rainfall is especially low, and whether it is desirable that expert inquiry should be made into the supply of additional water either by means of races or otherwise for the purposes of irrigation.

(8.) Whether the burning of tussock land is desirable; and, if so, under what circumstances.

And, with the like advice and consent, I do further appoint you,

ROBERT THOMAS SADD,

to be the Chairman of the said Commission.

And you are hereby authorized to conduct any inquiries under these presents at such times and places as you deem expedient, with power to adjourn from time to time and place to place as you think fit, and to call before you and examine on oath (or otherwise) such persons as you think capable of affording you information as to the matters aforesaid, and to call for and examine all such documents as you deem likely to afford you information on any such matters.

And, using all due diligence, you are required to report to me under your hands and seals not later than the thirty-first day of May, one thousand nine hundred and twenty, your opinion on the aforesaid matters.

And you are hereby strictly charged and directed that you shall not at any time publish or otherwise disclose, save to me in pursuance of these presents or by my direction, the contents or purport of any report so made or to be made by you.

And it is hereby further declared that these presents shall continue in force although the inquiry is not regularly continued from time to time or from place to place.

And, lastly, it is hereby further declared that these presents are issued under and subject to the provisions of the Commissions of Inquiry Act, 1908.

Given under the hand of His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Member of His Majesty's Most Honourable Privy Council, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Knight Grand Cross of the Most Excellent Order of the British Empire, Member of the Royal Victorian Order, Knight of Justice of the Order of Saint John of Jerusalem, Governor-General and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies; and issued under the Seal of the said Dominion, at the Government House at Wellington, this first day of April, in the year of our Lord one thousand nine hundred and twenty.

D. H. GUTHRIE,
Minister of Lands.

Approved in Executive Council.

F. D. THOMSON,
Clerk of the Executive Council.

GOD SAVE THE KING!

EXTENDING TIME AND ORDER OF REFERENCE OF PASTORAL LANDS COMMISSION.

LIVERPOOL, Governor-General.

To all to whom these presents shall come, and to Robert Thomas Sadd, Esq., Commissioner of Crown Lands and Chief Surveyor for the Otago Land District; William Blyth Buckhurst, Esq., Land Valuer, of Christchurch; Leonard Cockayne, Esq., F.R.S., F.L.S., F.N.Z.Inst., Ph.D., of Ngaio, Wellington; Dickson Jardine, Esq., Pastoralist, of Birchwood, Southland; Robert Scott, Esq., Farmer, of Kyeburn, Otago; Archibald McInnes, Esq., Farmer, of Otiake, Otago; and Charles Todd, Esq., Merchant, of Dunedin: Greeting.

WHEREAS by a Warrant dated the first day of April, one thousand nine hundred and twenty, and issued under my hand and the public seal of the Dominion, you were appointed a Commission to inquire into and report on the pastoral Crown lands of the Land Districts of Canterbury, Otago, and Southland, and you were directed and required to report to me not later than the thirty-first day of May, one thousand nine hundred and twenty: And whereas it is deemed expedient to extend the order of reference to the said Commission so as to include the pastoral Crown lands in the Land District of Marlborough in the scope of its inquiry and report, and to extend the said period as hereinafter provided:

Now, therefore, I, Arthur William de Brito Savile, Earl of Liverpool, the Governor-General of the Dominion of New Zealand, in exercise of the powers conferred by the Commissions of Inquiry Act, 1908, and of all other powers and authorities enabling me in that behalf, and acting by and with the advice and consent of the Executive Council of the said Dominion, do hereby extend the order of reference to the said Commission so as to include the pastoral Crown lands in the Land District of Marlborough in the scope of its inquiry and report, and do hereby declare and appoint that the time at or before which you shall present to me your report aforesaid is hereby extended to the thirtieth day of June, one thousand nine hundred and twenty.

And with the like advice and consent and in further pursuance of the said power and authority I do hereby confirm the said Commission as herein extended and varied.

Given under the hand of His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Member of His Majesty's Most Honourable Privy Council, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Knight Grand Cross of the Most Excellent Order of the British Empire, Member of the Royal Victorian Order, Knight of Justice of the Order of Saint John of Jerusalem, Governor-General and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies; and issued under the Seal of the said Dominion, at the Government House at Wellington, this twenty-fifth day of May, in the year of our Lord one thousand nine hundred and twenty.

D. H. GUTHRIE,
Minister of Lands.

Approved in Executive Council.
F. D. THOMSON,
Clerk of the Executive Council.

GOD SAVE THE KING!

APPOINTING AN ADDITIONAL MEMBER OF THE SOUTHERN PASTORAL LANDS COMMISSION.

LIVERPOOL, Governor-General.

WHEREAS by a Warrant dated the first day of April, one thousand nine hundred and twenty, certain persons therein named were appointed a Commission to ascertain whether the pastoral Crown lands of the Land Districts of Canterbury, Otago, and Southland were being leased and utilized in the best manner, and

whether the pasturage of the said lands was deteriorating, and, if so, the cause of such deterioration, and how best to remedy the same and improve the conditions of settlement of the said lands: And whereas by a Warrant dated the twenty-fifth day of May, one thousand nine hundred and twenty, the order of reference to the said Commission was extended so as to include the pastoral Crown lands in the Land District of Marlborough in the scope of its inquiry and report: And whereas it is considered expedient that Arthur John Murray, Esquire, Farmer, of Kekerangu, should be appointed an additional member of the said Commission:

Now, therefore, I, Arthur William de Brito Savile, Earl of Liverpool, the Governor-General of the Dominion of New Zealand, in exercise of the powers conferred by the Commissions of Inquiry Act, 1908, and of all other powers and authorities enabling me in that behalf, and acting by and with the advice and consent of the Executive Council of the said Dominion, do hereby appoint the said

ARTHUR JOHN MURRAY, Esquire,

of Kekerangu, to be a member of the said Commission; and with the like advice and consent and in further pursuance of the said power and authority I do hereby confirm the said Commission as herein extended.

Given under the hand of His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Member of His Majesty's Most Honourable Privy Council, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Knight Grand Cross of the Most Excellent Order of the British Empire, Member of the Royal Victorian Order, Knight of Justice of the Order of Saint John of Jerusalem, Governor-General and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies; and issued under the Seal of the said Dominion, at the Government House at Wellington, this fifteenth day of June, in the year of our Lord one thousand nine hundred and twenty.

D. H. GUTHRIE,
Minister of Lands.

Approved in Executive Council.

F. D. THOMSON,
Clerk of the Executive Council.

GOD SAVE THE KING!

REPORT.

To His Excellency the Right Honourable Arthur William de Brito Savile, Earl of Liverpool, Member of His Majesty's Most Honourable Privy Council, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Knight Grand Cross of the Most Excellent Order of the British Empire, Member of the Royal Victorian Order, Knight of Justice of the Order of Saint John of Jerusalem, Governor-General and Commander-in-Chief in and over His Majesty's Dominion of New Zealand and its Dependencies.

MAY IT PLEASE YOUR EXCELLENCY,—

We, the Commissioners appointed by Your Excellency on the 1st day of April, 1920, to inquire by all lawful means whether the pastoral Crown lands in the Land Districts of Canterbury, Otago, Southland, and Marlborough (this latter land district being added to the scope of our inquiries by a Warrant dated the 25th day of May, 1920) are being leased and utilized in the best manner, and whether the pasturage of the said lands is deteriorating; and, if so, the cause of such deterioration, and how best to remedy the same and to improve the conditions of settlement of the said lands, and to report on the several

matters referred to in the Commission, a copy of which is attached hereto, have the honour to report as follows :—

We assembled at Dunedin on the 13th April, and held a meeting, at which our itinerary for Southland and Otago was arranged, and various matters discussed. The Chairman, Mr. Sadd, delivered a short opening address.

Leaving Dunedin on the morning of the 14th April we arrived at Invercargill, and there held a public sitting, taking evidence. On the 15th April a second sitting was held at Invercargill. While in that city we visited the Museum and had an opportunity to examine the admirable collection of indigenous grasses and other economic plants arranged by Mr. J. Crosby-Smith, F.L.S. On the 16th April your Commission proceeded to Manapouri by way of the Aparima Valley, to Mossburn, and thence by the coach-road to the lake. We had an excellent opportunity of viewing the tussock pastures along the route, and seeing their relation to the depredation caused by the rabbit, and their changes according to the nature of the soil and the climate. On the evening of the same day Mr. Robert Murrell, a runholder of Manapouri, gave valuable evidence before your Commission. The next day we proceeded to Lumsden, holding a public sitting there and taking evidence, after which we proceeded by train to Kingston, and thence by steamer on Lake Wakatipu to Queenstown. On the 19th April we held at Queenstown a well-attended public sitting, and obtained a great deal of excellent evidence regarding the neighbouring sheep-stations. The next day we proceeded by way of the Waimea Plains to Gore, where we held a public sitting. His Worship the Mayor of Gore welcomed the Commission, and expressed the hope that evidence of assistance to the Dominion generally would be obtained. The next day we proceeded to Switzers, where a well-attended public sitting was held. In the afternoon we visited Mr. R. S. Charter's Greenvale Station, situated at the base of the Black Umbrella Mountains. We examined the pasture *en route*, and were struck with the large amount of country rendered worthless through the spread of manuka. We also noted that the sweetbrier was likely to become dangerous. The next morning your Commission left Switzers for Tapanui, and observed the beneficial effect of close settlement where there had originally been large holdings. A public sitting was held that evening and a considerable amount of evidence given. An important matter brought before us was a suggestion that the Blue Mountains should be handed over to the Forestry Department. During our stay we visited the Tapanui State Nursery. On the 23rd April we proceeded from Tapanui to Dunedin, having visited on the way the Conical Hills plantation. The morning of the 24th April was occupied by routine business. On the 26th April your Commission held a public sitting at Dunedin and obtained a considerable amount of instructive evidence. We sat again in the same city the following day, when further interesting information was elicited. On the 28th April your Commission left Dunedin in motor-cars for Roxburgh, via Lawrence. A public sitting was held that evening at Roxburgh and was well attended. The next morning we proceeded by way of Fruitlands to Alexandra. At Fruitlands we were at the average northern limit of the south-western rainfall, and observed on the one side the well-grassed Old Man Range, and on the opposite side of the River Clutha the depleted area of part of Central Otago. We also saw the extensive orchards planted a few years ago by the Fruitlands Company on ground which has suffered considerable depletion. The same day we held a public sitting at Alexandra, and heard a good deal of first-hand evidence regarding the special pastural problems of Central Otago. The next day we proceeded to Cromwell, visiting *en route* first the striking example of dry farming conducted by Mr. Barker, and next the power-house on the Fraser River, and investigating the supply of water for irrigation purposes. At Cromwell a public sitting was held, and further important evidence obtained of a similar nature to that given at Alexandra. The next day we proceeded to Northburn Station, under the guidance of Mr. D. Middleton and Mr. W. H. Reid, an officer of the Agricultural Department concerned with tussock-grassland investigation. Here we had an opportunity of carefully examining the experimental plots designed by the Department of Agriculture with the view of finding out some of the fundamental principles on which

the regrassing of the depleted areas depends. This work is referred to further on in this report. The next day your Commission proceeded from Cromwell to Arrowtown, via Kawarau Gorge, and observed the gradual incoming of the tussock as the wetter area was approached. While at Arrowtown the Lake Hayes country was visited and the grassland near the gorge of the River Arrow examined. Here a new pasture weed, hitherto unrecorded for New Zealand —one of the American meadowsweets—was noted. This plant should be at once eradicated so as to prevent its further spread. Observations were also made regarding the spread of that truly noxious weed, St. John's wort (*Hypericus perforatum*). On the 3rd May a public sitting was held at Arrowtown, and, later in the day, we proceeded by way of the Crown Range to Pembroke. A short stay was made on the summit, and the effect of burning the snow-grass and so encouraging the growth of unpalatable plants was observed. Then the Cardrona Valley was passed through and the bad effects of burning at the wrong season noted. In the evening a public sitting was held at Pembroke, and important evidence was given by several runholders. The next day a further sitting was held, some of the witnesses having come a long distance in order to meet your Commission and to give evidence. Later in the day Mr. Scaife's run at Glen Dhu was visited, and an opportunity afforded of seeing his splendid paddocks, where ground originally covered with fern was now growing luxuriant cocksfoot and red clover. Altogether Mr. Scaife cultivates 700 acres of his winter country. In this neighbourhood a good deal of St. John's wort is growing amongst the bracken. On the 4th May your Commission proceeded from Pembroke to Tarras, by way of Lake Hawea and the Hawea Flat. The wide area of land suitable for irrigation, with its soil of fertile mica-schist, was noted. At Tarras Mr. R. K. Smith welcomed your Commission and showed them his fine farm (where as yet but little irrigation has taken place), his extensive irrigation-works, and his plantations, especially his extremely successful plantation of hardy gums grown from seed sown broadcast on dry ground of extreme depletion. In this neighbourhood we also saw the large paddock of excellent turnips grown by Mr. G. Collis from locally grown seed. From Tarras we proceeded to Clyde, holding there a public sitting in the evening, and receiving from Mr. J. R. Marks, of the Public Works Department, important information concerning irrigation. The next day your Commission proceeded to Ophir, where a sitting was held the same evening and a good deal of interesting information given. On the way to Ophir the Agricultural Department's experimental plot at Clyde was visited, and the results of a recent experiment on "palatability" of grasses and clovers noted. We also saw with great pleasure the successful experimental tree-planting on Galloway, and the regeneration of pasture which had taken place in the enclosure. On the 7th May we proceeded from Ophir to Naseby, first visiting the irrigated portion of the Poolburn (Ida) Valley and seeing the splendid result of irrigation in that district, where a depleted area has been turned into dairying-land. In the afternoon a public sitting was held at Ranfurly, a number of settlers giving evidence of value to your Commission regarding the district. The next day your Commission proceeded to Middlemarch, where a public sitting was held and interesting information given regarding pastoral matters affecting that part of Otago. In the afternoon we proceeded to Dunedin by way of the plateau which extends from the Rock and Pillar Range to the Taieri Plain, and were much interested in seeing the large amount of country suitable for improvement which might be greatly benefited by the planting of belts of trees for shelter. On the 10th May a special sitting was held in Dunedin in order to take the evidence of Mr. W. D. Hunt, who had come from Wellington for the purpose of laying his views before us. Later in the same day we proceeded by train to Kurow. The next day a public sitting was held there, and in the afternoon we inspected the pastures of the Hakataramea Valley. On the 12th May your Commission proceeded from Kurow to Omarama, noting *en route* some fine crops of lucerne in the Waitaki Valley, and how, near Omarama, there was on parts of the mountains depletion not unlike that of the worst part of Central Otago. A public sitting was held at Omarama and evidence of interest given by the witnesses. In the afternoon we proceeded

to the Hermitage (Mount Cook), noting first of all how well the experimental planting of forest-trees near Omarama had succeeded; then we had an opportunity of seeing the Benmore country, and near Lake Pukaki, on Ben Ohau and Rhoboro Downs, the runs recently set aside for settlement of soldiers. Further on we observed the great swamp with its abundance of feed for cattle near the head of Lake Pukaki. The next day, as no witnesses appeared, we spent in visiting the high mountain grassland on the Sealey Range, which is in its absolutely virgin condition, with abundance of blue-grass and aniseed (*Angelica montana*), a herb eaten out of sheep-pastures in general. On the 14th May we proceeded to Lake Tekapo, where a public sitting was held and the evidence of Mr. G. Murray, of Braemar, who has greatly improved his country, was taken. Fairlie was reached the same evening by way of Burke's Pass. Between Tekapo and Burke's Pass we noticed that the depletion was the effect of the tussock dying out through some cause other than that of the rabbit or burning—possible the grass-grub. A good deal of depletion in dry areas arises from this cause. On the 15th May a well-attended public sitting was held at Fairlie, and much interesting evidence given regarding that part of Canterbury. In the afternoon of the same day we proceeded to Timaru. On the 17th May a public sitting was held there, and further valuable evidence given regarding the Mackenzie country. The next day we proceeded to Ashburton, holding a public sitting at Geraldine *en route*, where interesting evidence was given by two witnesses. The next day a public sitting was held at Ashburton, but only one witness was present. Later in the day we proceeded by train to Christchurch. The two following days public sittings were held at Christchurch, and valuable evidence on many subjects pertinent to our inquiry was elicited. On the 22nd May your Commission proceeded to the Biological Station of Canterbury College at Cass, under the guidance of Mr. C. E. Foweraker, M.A., F.L.S., Lecturer on Botany at Canterbury College, who explained the work being done at the station, and its bearing on the economic investigation of tussock-grassland. A public sitting was held, and interesting evidence given regarding the runs of that district, where, notwithstanding the absence of the rabbit and the apparent abundance of feed, the carrying-capacity is quite low. On the 24th May your Commission visited Lake Coleridge in order to see the hydro-electric works, and get some idea of the tussock-grassland of the Lake Coleridge Run. The next day we proceeded by train for Hanmer, and saw *en route* the fine tussock-grassland of the Waiau Valley. The next day a public sitting was held at Hanmer, and some important evidence given regarding the large sheep-stations of that district. The following day it had been intended to make an inspection of the Clarence Valley, but rain hindered, and it was only feasible to visit the lower part of the Jack's Pass Valley, where, in many places, European grasses have naturally replaced tussocks. On the 28th May your Commission proceeded to Culverden, where a public sitting was held, after which we proceeded to Waiau, where another sitting was conducted. The next day we proceeded to Kaikoura by way of the coastal road, snow having hindered us going by the Whalesback Road as originally intended. The great spread of fern and manuka near Hunderlee was noted. On the 31st May your Commission held a public sitting at Kaikoura, and gained interesting information regarding that district. On the 1st June we proceeded to Blenheim, calling at Seddon, where a public sitting was to be held, but only one witness appeared. Your Commission was greatly struck, both this day and during their stay in Marlborough, with the excellent lucerne and with the danthonia pastures, this grass having in many places replaced the tussock altogether. On the 2nd June a public sitting was held at Blenheim, and interesting information was given regarding the pastures of Marlborough, and details concerning the growing of lucerne. In the afternoon we proceeded by car as far as the township in the Waiau Valley, here again noting the value of close settlement on Erina and Hillersden. The next day your Commission divided into three sections—Messrs. Scott, Todd, and Jardine proceeding to Cheviot in order to hold a meeting there, Dr. Cockayne proceeding to Wellington in order to procure certain evidence and to spend some days collecting information not otherwise procurable, while the remainder of the Commission proceeded first

to inspect the grassland at Benhopai, and later proceeded to Clarence Bridge in order to hold a meeting. On the 4th June the sub-committee of the Commission held public sittings respectively at Cheviot and Clarence Bridge, and then proceeded to Christchurch, where the next day a general committee meeting was held. On the 7th June your Commission held a public sitting in Oamaru, there being present amongst others Mr. D. Sutherland, whose experience dates back for many years. The next day a public sitting was held at Palmerston South, and a considerable amount of interesting evidence was given. Here Mr. A. S. Orbell appeared, who at present occupies part of the country originally taken up by his father. The same day your Commission proceeded to Dunedin. The next day a public sitting was held in Dunedin, and, this being concluded, your Commission adjourned till the 14th June. On the 14th June a final sitting was held in Dunedin, one or two witnesses examined, and various matters gone into in committee. It is interesting to note that one of the witnesses was Mr. Watson Shennan, whose occupation of pastoral country in Otago dates from 1857. On the 15th June your Commission commenced preparing the rough draft of the report. On the next day Messrs. Scott, McInnes, and Murray proceeded to Alexandra, via Roxburgh, in order to procure further information regarding irrigation, and for Mr. Murray to become conversant with the depleted areas of Central Otago. The remaining members of your Commission remained in Dunedin preparing the rough draft of the report. The following day, 17th June, the sub-committee in Central Otago first visited Mr. Barker's farm and inquired further into his method of dry farming, then proceeded to inspect the upper Clutha Valley, visiting the country on both sides of the Clutha, Tarras, Northburn, and spending the night at Cromwell. The next day they proceeded to Naseby by way of the Galloway experimental plantation, Lauder (where Mr. John Wilson was interviewed in regard to his methods of irrigating grassland—he having had thirty years' experience in this work both with miners' water and with clear water), Ophir, and the Poolburn (Ida) Valley. An informal sitting was held at Moa Creek. On the 19th June the travelling sub-committee proceeded from Naseby via Puketoi to Linburn Bridge, on the western part of the Maniototo Plain, and thence to Dunedin by way of Patearoa, Waipiata, Pigroot, Dunback, and Palmerston South. Those of the party who had known the country at an earlier date were pleased to note how it had improved from about Kyeburn onwards to Dunback. On the 21st June your Commission as a whole assembled at the Lands Office, Dunedin, and commenced revising the provisional report. On the 22nd and 23rd June your Commission continued to work on the report. On the 24th June the report was completed and the final meeting of your Commission held.

In the compilation of our report we have attempted to be as brief as possible, but every subject in the order of reference has received our most earnest consideration. The details of our inspection of the pastoral lands, as already given, is supplemented by the accompanying map,* which shows not only the actual route of your Commission, but also other places in the South Island visited at one time or another by its members.

Coming now to the various questions on which we were instructed to inquire we beg to report as follows :—

PART I.—THE TENURE.

Under the above term, "the tenure," we are dealing with sections (1), (2), (3), and (4) of the order of reference. At the same time certain of our conclusions have been reached by a careful consideration of the details concerning sections (5), (6), and (8), to be seen in Part II of this report.

Two general principles have guided us in coming to our conclusions. These, briefly stated, are: (1) That the tenure must in every detail be such that all rights of the tenant be respected compatible with the best interests of the State; and (2) that the tenure shall not only deal with the occupation of the Crown lands and with other matters to which this leads, but shall also be so constructed that the tenant will be encouraged in every way possible to improve his holding, and to bring it into as high a state of efficiency and productivity as is possible

* Not published with this report.

according to the present state of knowledge. In short, our aim is to suggest what appears to us the very best both for the tenant and the State.

Further, as in our opinion the present Land Acts in many respects fall short of achieving the foregoing results, we endeavour in the following suggestions to point out those means by which we are of opinion that the laws relating to the pastoral Crown lands can be improved, and give that satisfaction to all concerned which alone can enable the desired goal to be reached.

The Present Tenures and their Amending.

(Parts (2) and (4) of the Order of Reference.)

We have most carefully considered all those sections of the Land Act of 1908, and of the subsequent amending Acts, which deal with runs held under pastoral tenures. This has led us to the conclusion that in many particulars the Acts need reconstruction, especially as, in their present form, they indirectly lead to deterioration of the pastures, to the detriment of both the State and the lessees.

Coming now to details, we strongly suggest that the following alterations be made in the Land Act :—

(*a.*) That, as twenty-one years, the longest tenure provided by the Act, is, in our opinion and according to much of the evidence given, too short to induce a tenant to improve and develop the lands contained in his lease, or to give him satisfactory security thereof, the term should be increased to thirty-five years, with a right of renewal, provided the land comprised in the lease or license is not suitable for subdivision, in which case the outgoing lessee shall have a right to a new lease over the subdivision he selects.

(*b.*) That when pastoral lands have been subdivided into areas that will only provide a sufficient living for the maintenance of one settler and his family, as provided in paragraph (*f*), page 9, of this report, and all the conditions of the lease have been complied with, then, after seven years of the term of the lease the lessee may have the option of acquiring the fee-simple, either for cash or on deferred payment. The value of such lands shall be the unimproved value determined by arbitration, but in no case of a less value than the value placed upon the subdivisions at the time of their disposal for lease.

(*c.*) When such subdivisions as are mentioned in recommendation (*b*) form a part of the lands set aside as national endowment, no rights to acquire the fee-simple shall be given or implied until an area of land equal in value is substituted, which may be either Crown land, freehold land (urban or suburban), land purchased for settlement purposes, or Native land acquired by the Crown or obtained by exchange.

(*d.*) That all leases of pastoral lands shall hereafter be offered for selection by ballot, subject to a condition that the lessee shall be required to reside continuously on the run in the discretion of the Land Board, as provided for in section 161 (*d*) of the Land Act, 1908. The object of this recommendation is to put the residential obligations of a pastoral run on the same basis as a small grazing-run. It is hoped by this means to lead to better management of pastoral runs.

(*e.*) That in dealing with pastoral leases or licenses it is necessary to decide two years before the expiry whether the run is suitable for subdivision or not. When the run is not suitable for subdivision the outgoing licensee or lessee shall be entitled to receive a renewal of his lease or license in accordance with the provisions of the Act, but the rental, terms, and conditions of the lease shall be decided upon twelve months before the expiry.

(*f.*) In the case of subdivision mentioned in recommendation (*e*) the method of subdivision shall be decided upon two years before expiry, to enable the survey to be made, so that the outgoing lessee or licensee will be enabled to exercise his right to select a subdivision twelve months before expiry, in order to regulate the disposal of his surplus stock and give the incoming tenant an opportunity of acquiring stock bred on the country. (We have been led to make this recommendation through the well-known fact that sheep bred on a run thrive far better than strange sheep.)

(*g.*) That as practically all the pastoral lands are now held under the existing tenures, in order to make our recommendations effective it is very desirable that these conditions should apply to all renewals of leases or licenses of pastoral lands.

(*h.*) In consideration of the period of pastoral leases having been extended to thirty-five years in the terms of our recommendation (*a*), we recommend that the conditions therein suggested apply to all renewals of present leases.

(*i.*) That, owing to the numerous amendments and re-amendments of the Land Acts—the last consolidation having been made in 1908—it is most necessary that a consolidation of all the Acts since that date be made.

(*j.*) That, with regard to recommendation (*g*), the whole of Part V and Part VI of the Land Act, 1908, and the amendments thereto, require remodelling, special attention being given to clauses 223, 225, 228, 237, 238, 244, and 245, which are either obsolete owing to the amendments of the Act made in the years 1912 to 1919, or are not suitable for the best administration and occupation of pastoral lands either in the interests of the State or the tenant.

2. Concerning the Occupation, Cultivation, Stocking, and Improvements of Pastoral Crown Lands.

(Part (3) of the Order of Reference.)

(1.) *Occupation.*

Under the term "occupation" we include all matters concerning pastoral Crown lands with regard to their acquisition, transferring, and other cognate matters. The following are our recommendations on this head:—

(*a.*) That the disposal of pastoral lands by auction is detrimental both to the State and the tenant, and that all sales by auction are recommended to be abolished and all conditions appertaining thereto, for the following reasons: It is found that when lands have been offered at public auction the rents obtained are frequently excessive, and in consequence the tenant overstocks his land in an endeavour to recoup himself for his outlay, which leads to the deterioration of the country. At present no restriction beyond the holding of another run is placed upon auction sales, consequently inexperienced and speculative competitors are eligible to acquire the said lands.

(*b.*) Also that recommendation (*a*) shall apply to all pastoral endowment lands, which are subject to the same causes of depreciation, and these should in the interests of settlement also be administered by the Land Boards.

(*c.*) That we consider the present system of examination of applicants by Land Boards is not altogether satisfactory, owing to the large number of applicants to be examined in a short time, which has led to a number of inexperienced settlers being placed on the land, thus frequently leading to its deterioration and the loss of the tenants' capital. To avoid this a system of examination by competent Boards should be held at stated times, and certificates of competency issued to prospective applicants for production to the Land Boards or Commissioners of Crown Lands when making application for land.

(*d.*) That it is not now necessary to divide the pastoral runs into two classes of tenures as provided in the present Land Act, but there should be one comprehensive tenure for the disposal of this class of country. The runs should contain sufficient winter and summer country to run a flock up to about five thousand sheep in country that carries a snow risk, and up to about two thousand where there is practically no snow risk. Where there is not sufficient winter country on a run for the purpose of subdivision, land suitable for this purpose should be acquired within a reasonable distance of the run in question. This important matter of acquiring winter country where required is strongly supported by the evidence before us.

(*e.*) That no pastoral lands be held by any public or private registered companies or absentees. It has been proved in practice that trafficking in company shares has been made, without reference to the Land Board, thus defeating the objects of the land laws. Personal residence where possible, as already embodied in a previous recommendation, is absolutely essential to true settlement, and also ensures better management and greater productivity of the pastoral holdings.

(*f.*) That as the facility given for obtaining transfers causes speculation in Crown lands, which leads materially to their depreciation, the following safeguards appear essential :—

(i.) Except on the recommendation of the Land Board and with the approval of the Minister, it shall not be lawful for any lessee to transfer, sublet, or in any way part with any portion of his interest in his lease until the expiration of the seventh year of the term of the lease: Provided that any lease may at any time be surrendered on such conditions as the Land Board recommends and the Minister approves: Provided also that on the death of the lessee, or on the happening of any extraordinary event which in the opinion of the Land Board renders a transfer expedient, a transfer of the lease may be made with the sanction of the Land Board and Minister. This restriction of transfer shall apply to the original lessee and to his successors in title.

(ii.) Except on the recommendation of the Board and with the approval of the Minister, any person who already holds an area of land, whether freehold, Crown lease, or otherwise, which in the opinion of the Land Board is sufficient for the maintenance of himself and family shall not be eligible to acquire a lease of pastoral lands either by way of original application or transfer. Any lessee of pastoral lands who subsequently acquires an area of freehold or other land which in the opinion of the Board is sufficient in itself to maintain a lessee and his family shall within three months of the date of acquiring such land divest himself of his pastoral lease.

(2.) *Cultivation.*

Under the term "cultivation" comes all matters regulating the management of the pastoral lands. On this head a good deal is to be seen in Part II of this report. Here only a few matters are dealt with of a legal character.

The following are our recommendations on this head :—

(*a.*) That where in the opinion of the Land Board it is necessary and expedient to spell portions of land comprised in his lease or license, the tenant shall spell such area or areas as the Board shall from time to time direct for such period as the Board deems necessary, the rent on such spelled areas to be abated *pro rata*. It is suggested that this provision could be applied to the best advantage at the commencement of a lease. This provision is to be mandatory in new leases of pastoral lands, but optional in all leases or licenses of pastoral lands now in existence

(*b.*) No restrictions should be placed on the cultivation to be effected on pastoral lands, with the following exceptions: The lessee shall not take more than three crops from the same land in succession; and, either with or immediately after a third crop of any kind, he shall sow the land down with good permanent grasses and clovers, and allow the land to remain as pasture for at least three years from the harvesting of the last crop before being again cropped.

(*c.*) That no clearing by felling and burning bush and scrub, and sowing the same in grass, is to be effected except with consent of the Land Board.

(3.) *Improvements.*

Generally the provisions governing compensation for improvements of a permanent character effected by the lessees on pastoral runs, such as necessary buildings, fences, and all substantial improvements, are satisfactory, but improvements made in the condition of the pasturage of the run caused by the destruction of rabbits, light stocking, and good management are in many instances quite unsatisfactory. Certain additions should be added to the schedule of improvements to be valued, such as those giving increased accessibility on the run, fertility, working-facilities, shelter and protection and watering of stock, and any further improvements (*e.g.*, electric lighting, power, and telephone) which are of value to the incoming tenant.

As the rentals of pastoral lands are fixed on the unimproved value of the land, it is necessary that greater care should be taken in assessing rentals for renewals of leases, so as not to penalize the tenant for increasing the carrying-capacity of his run by such means as the destruction of rabbits, grassing, clearing the land of bush, scrub, and fern, or by careful management generally. In order to encourage tenants to improve the deteriorated and depleted lands (regarding which see Part II of this report), and to prevent further deterioration, periodical inspections should be made of all pastoral leaseholds every five years, and a record kept of the condition of such lands.

When it is seen that a tenant, by the destruction of rabbits, light stocking, and careful management, is improving the condition and carrying-capacity of the lands comprised in his lease, such improvements shall be placed to his credit, and in no case be a factor in increasing the rent on a renewal. In the case of subdivision the outgoing lessee shall receive the value of this class of improvement, which shall be paid for by the incoming tenant.

Where these periodical inspections disclose the fact that a tenant is causing the value of the land to be reduced by incompetent or careless management and overstocking, the Land Board may forfeit his lease without compensation beyond the value of the substantial improvements, which shall be assessed at their value to an incoming tenant. On the receipt of a statement from the tenant that he proposes to make certain improvements a Crown Lands Ranger shall inspect the run, and furnish his report as to the state of the ground and the advisability of effecting such improvements, which, when consented to by the Land Board and completed, should be then valued and recorded as improvements in favour of the tenant, but these are in no case to be added to the unimproved value for rental purposes. Failure to maintain these improvements shall cancel such recorded value in whole or in part. In all cases the decision of the Commissioner of Crown Lands shall be final. These provisions shall be optional in all leases and licenses of pastoral lands now in existence by application from the tenant.

Every lessee of pastoral lands shall put on the land comprised in his lease substantial improvements of a permanent character to a value equal to the amount of one year's rent of the land within one year from the date of his lease, and to a value equal to another year's rent within two years from the date of his lease; and thereafter, but within six years from the date of his lease, to a value equal to the amount of another two years' rent. A value not less than the above total to be maintained during the currency of the lease.

PART II.—THE PASTURAGE OF THE CROWN LANDS.

1. As to the Causes of Deterioration and Depletion.

(Part (5) of the Order of Reference.)

(1.) *General.*

Before the questions put to your Commission regarding the pastures can be answered it is necessary to clear the way by treating of certain fundamental matters. First of all it must be clearly understood that the South Island mountain sheep-pastures, even in their original condition, were far from being of uniform composition. This lack of uniformity was due in large measure to the extreme range of climate experienced by the pastures. Then, there were also soils differing greatly in fertility, especially the two distinct classes of those overlying greywacke and those of mica-schist.

As for the climate, this depends in no small measure on the rainfall; or better still, on the annual number of rainy days and also their seasonal distribution. These matters concerning the rainfall are governed by the situation of any pastoral area with regard to the north-western rain, and to a lesser degree by the situation with regard to the downpour from the south-west. At a definite distance to the east of the Southern Alps there is a line, marked by forest, which denotes the average eastern limit of the north-western rainfall. So, too, there is another limit, but not necessarily forest, which marks the northern average limit of the south-western rainfall. Farther to the east or

the north of these lines the climate becomes gradually drier, until, at a certain distance from the east coast, easterly rain comes into play. From the above it can be seen that there are two extreme classes of pasture—the "wet" and the "dry"—while between these two are all kinds of intermediates. Nor is this matter of north-western and south-western rain all, for the latter is much the colder of the two and more liable to bring snow.

Besides the average amount of rain to which any piece of pasture is exposed, considerable modifications exist through the effect brought about by change of latitude in passing from the north to the south of the South Island. Finally, altitude plays a most prominent part.

As for soil, that of the mica-schist is of extreme fertility. The limestone soils which occur here and there, but rarely continuously over wide areas, are also excellent. Far poorer than either of the above are the soils overlying greywacke rocks, while these rocks themselves, so readily disintegrated, long before man came to New Zealand had formed on the dry mountains those great masses of unstable stony debris known as "shingle-slips."

Coming next to special climates dependent upon the lie of the ranges, there is that of Central Otago, where rain from all quarters is precipitated on the mountains bounding that district, while in the area itself an extremely dry climate exists in the river-valleys, intermontane basins, and lower hills. Higher up—say, at above 2,500 ft. altitude—the rainfall is greater, but not nearly equal to that of the South Island mountains in general. Other dry areas, but not so arid as Central Otago, occur in the Mackenzie country (Canterbury), and in the Clarence and Awatere Valleys (Marlborough).

From the above brief accounts of the climate of the pastoral country of the South Island it can readily be seen how diverse must be the pastures, and how certain causes leading to deterioration, or even depletion, must be greatly assisted or retarded; and how, in considering remedies for improving the grass-land, the climate of each area to be dealt with must be considered. In other words, the problem of improvement is complex enough, nor can hard-and-fast methods be suggested, since evidently each special pasture must be considered on its merits.

The main constituents of the sheep-pastures are a number of indigenous grasses having one important character in common, the tussock form. Evidently this particular form of growth, as it originally was dominant over all the South Island east or north of the forested area, is highly suited to its environment. This statement is strongly supported by the fact that, even after the pastures have been grazed without intermission for about seventy years, the tussock, except in certain localities dealt with farther on, still dominates in the pastures.

According to the evidence given before us a large number of the witnesses spoke of tussock as if there were only one species, which they called the "white tussock." This name refers not to one species, but to the following two quite unrelated species, mistaken for one another—viz., the poa-tussock (*Poa cæspitosa*) and the fescue-tussock (*Festuca novae-zealandae*), this latter being by far the more common above an altitude of 1,000 ft. Also, there are two more tussocks of about the same size as the fescue-tussock—the tall blue-tussock (*Poa intermedia*) and the blue-grass (*Agropyron scabrum*). There is also a smaller tussock, closely related to *Poa intermedia*—the small blue-tussock (*Poa Colensoi*). Next come two much larger tussocks—the snow-grass (*Danthonia flavescens*) and the red-tussock (*D. Raoulii* var. *rubra*), also called "snow-grass" by a good many. It is necessary to be quite clear about these various tussock-grasses, since they are frequently mentioned in what follows, and the correct determination of each is of great importance in determining the feeding-value of a pasture.

Besides the tussocks, there are in the mountain sheep-pastures—taking only the more common into consideration—at least three hundred species of indigenous plants, together with some forty species of introduced plants—mostly European; so that no pasture is anything like so pure as are even the most weedy artificial meadows of the lowlands. Of these indigenous plants probably only a dozen can claim to be of any feeding-value. With the intro-

duced plants it is different, for at any rate some fifteen possess degrees of palatability from the very highest—*e.g.*, meadow-grass (*Poa pratensis*) and cocksfoot (*Dactylis glomerata*)—to that of rather poor feeding-value limited to one season of the year—*e.g.*, sweet vernal (*Anthoxanthum ororatum*).

(2.) *Causes of Depletion and Deterioration.*

In the order of reference the very necessary distinction between "deterioration" and "depletion" is made—the former a most subtle thing, only to be estimated accurately by one having a wide knowledge of the species present and of their relative feeding-value; and the latter self-evident through the more or less complete destruction of all the members of the grassland, so that, in the worst cases of depletion, actual bare ground is the leading feature of the country. Depletion, then, needs no special definition. On the other hand, deterioration may be defined as reduction in palatability through the destruction of palatable species; and there may be increase of the unpalatable element either through increase in amount of the unpalatable species present, or through the incoming of unpalatable plants absent in the original grassland.

That such deterioration is greatly in evidence in all the land districts visited by your Commission is not only proved by the evidence, but from our personal experience and observations. Further, the sheep returns distinctly show that a more or less gradual deterioration of the grassland has been in progress for many years. But these returns need not receive much attention, since, in order to attain to accuracy, a full history of each run is necessary, and details of this kind are impossible to procure. We will cite only the extreme case of Vincent County, with its 511,188 sheep in the year 1880 and its 315,757 sheep in 1919. Even supposing there had been no deterioration of the pastures, the estimated carrying-capacity of only one sheep to three or four acres of the primitive pastures, as a whole, would show the need for great improvement. Indeed, although lowland farming in New Zealand has made great strides forward, that of the mountain sheep-stations has not merely shown no advance, but has gone backward. This is a state of affairs not at all creditable to the Dominion. Certainly every endeavour should be made to raise the carrying-capacity of the pastures, and to put them on as near an equality with the permanent pasture of the lower country as their disadvantageous circumstances will allow.

In primitive New Zealand the tussock-grassland would undergo no other changes than those brought about by the plants themselves under the action of the environment to which they were subject. There is no need here to go into the life-history of the tussock-grassland as suggested by scientific research. Suffice it to say that the tussock form eventually became the plant form *par excellence*, and through that form occupying nearly all the ground there was little room for any other species to increase its area of occupation. In other words, the tussock-grassland had attained its climax, and was fitted to endure so long as its environment remained constant.

With the exploitation of the tussock-grassland for sheep-grazing, the grazing-animal—a factor unknown in primitive New Zealand—came into play. Unaided the sheep would probably not have made much difference in the composition of the pasture except by eating out the few specially palatable species, and so allowing those particularly aggressive—perhaps the tussocks themselves—to occupy the small amount of ground provided. But the sheep-farmer early found out that none of the tussocks except the blue-grass (*Agropyron scabrum*) were palatable, but that if burned they, in their young leaves, would provide abundance of palatable feed. Consequently, throughout the grasslands year by year the tussocks were set ablaze, and year by year they were exposed to an increasing multitude of sheep. Nor was the burning confined to that season of the year when the tussocks could best recover, but even during hot, dry weather was the tussock burned. Needless to say this indiscriminate burning and, in many cases, extreme stocking led to great changes in the grassland. Of these changes the most momentous were the following: (1) The increase of unpalatable plants on the ground laid bare by burning; (2) the exposure of actual bare

ground subject to erosion. On the credit side was the incoming of foreign grasses and herbs of higher palatability than any members of the original pastures. Had it not been for this invasion of exotics the pastures would have been in a far worse condition at the present time.

Some time about the early "eighties" the rabbit, which had been for some years in the lowlands, crept up into the higher country. In many places, especially where the soil was sandy or silty and where rocks or shrubs were abundant, there were excellent breeding-grounds for this prolific animal. There was also food in abundance, especially in the young leaves of the fescue-tussocks after burning. On this food, under circumstances eminently suited for their increase, the few rabbits soon increased to thousands and tens of thousands. With this increase the tussocks of various kinds and all the plants at all palatable were eaten to the ground, and by degrees, in proportion to the dryness of the climate, were greatly reduced in number, so that areas small and large, according to circumstances, were turned into bare ground, or occupied by unpalatable plants. So far has this depletion proceeded in the driest area—the upper Clutha River basin of Central Otago—that from an altitude of some 500 ft. up to 2,500 ft. the country at the present time has the aspect of a desert. There, instead of waving tussocks, as in the early days of settlement, the landscape, as far as the eye can pierce, consists of bare hills looking like huge sand-dunes. A closer view reveals the fact that here and there the bare ground has become occupied by thousands of greyish or silvery circular mats of the scabweed (*Raoulia lutescens*) and its allies—plants originally of river-beds, whose seeds have been blown on to the bare hillsides and germinated. Between and upon these scabweed mats are a few indigenous or introduced plants, but mostly quite worthless for food—*e.g.*, the mountain-chickweed (*Stellaria gracilenta*) and the desert-poa (*Poa maniototo*). But a few more valuable plants have come in, especially sorrel (*Rumex acetosella*) and the winged (or star) thistle (*Carduus pycnocephalus*). It is the presence of the above two plants, together with the grasses and clovers still remaining in the gullies, and the rich vegetation of tall blue-tussock (*Poa intermedia*) at above 2,500 ft. altitude, which has kept the carrying-capacity as high as one sheep to seven acres.

So far only the causes directly operating on the pastures have been dealt with. There comes in, however, another factor, by no means negligible—the tenure, and some of the conditions of such tenure under which the land has been held. This, as has been seen in Part I of this report, we hold to have been one of the primary causes which have led to the present unsatisfactory condition of the pastures; but no further elaboration of this cause is necessary here.

To sum up the causes of deterioration and ultimate depletion of the grassland, they may be stated as follows:—

(1.) Burning the tussocks, especially at the wrong season of the year.
(2.) Overstocking with sheep.
(3.) Continuous grazing for seventy years without attempt at improvement.
(4.) Allowing rabbits to become extremely numerous. (This latter is the most potent cause of all.)
(5.) The tenures under which the land has been and is held, and some of the conditions of such tenures.

With regard to deterioration of the grasslands, it must be pointed out that the climate, in conjunction with burning, overstocking, and rabbits, is the deciding factor as to how far depletion will proceed. Thus in the extremely wet areas, though there may be great deterioration, no phase of depletion is to be seen.

Greater dryness leads to hints at depletion, but it is not until the really dry areas are visited that the maximum of depletion is apparent. In this regard that portion of Central Otago already defined has the misfortune to stand first, but there are areas in the Mackenzie country, upper Waitaki, and the Clarence and Awatere Valleys where depletion has long ago reached the scabweed stage, and where the evolution of depletion can readily be investigated.

The effect of a gradually increasing rainfall is well exemplified in travelling from Clyde to Dunedin. Up to Omakau the railway passes through country of a maximum depletion. But at that point the altitude has considerably increased, the rainfall consequently is rather higher, so tussocks once more put in an appearance. Proceeding onwards, there are large and small pieces of depletion here and there, but by the time the Maniototo Plain is reached no depletion such as that near Clyde or Alexandra can be seen. On the slopes of the Rock and Pillar there are isolated areas of depletion, but there is no scabweed. Farther on depletion ceases altogether, and foxglove (*Digitalis purpurea*), a weed of a wet climate, appears in quantity. Even in Central Otago itself the sunny face of a shallow gully may be altogether depleted, while the shady face is still covered with tussocks. This occurs again and again.

Another kind of depletion appears on the greywacke mountains of Canterbury and Marlborough. This rock, as already stated, disintegrates rapidly. Once remove the plant-covering and the stony debris beneath is quickly laid bare. Burning tussock near shingle-slips has thus led to their extension. Many such slips once covered with tussock have been again denuded, and, moving downwards, have buried the grassland below. But this matter receives further consideration under the heading of "Burning."

Besides rabbits, deer most certainly, and possibly hares, may assist in bringing about deterioration, but on these matters we have no direct evidence.

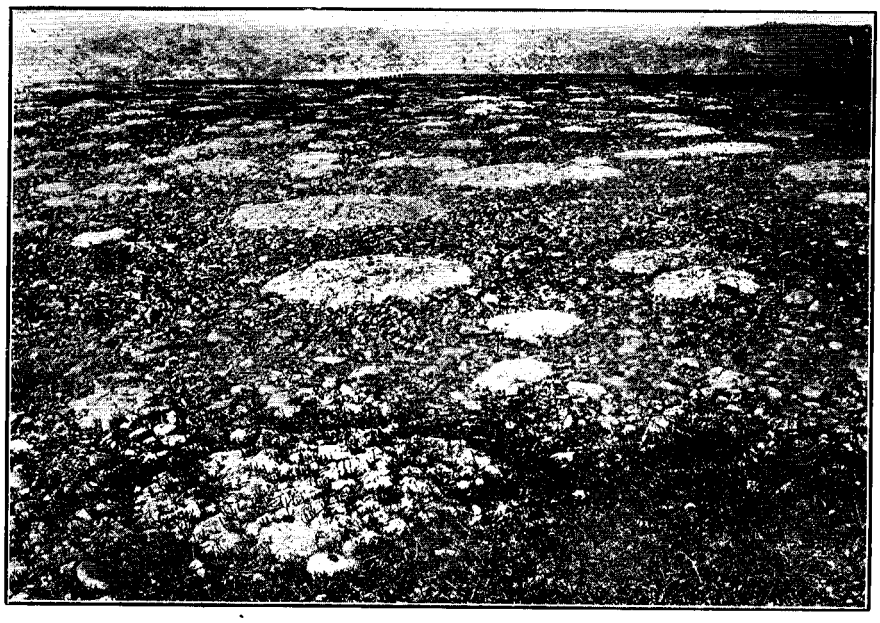
Before leaving this subject of deterioration it must be emphasized that a pasture may to the eye appear quite good—there may be abundance of tussocks, and the ground between these be well clothed with plants—yet such pasture, so far as the ground between the tussocks goes, may with regard to palatability be not much better than bare soil. Nor must it be forgotten that it is upon the ground-plants that the feeding-value of a mountain pasture depends, and not upon the fescue-tussock. The following are some of the indigenous unpalatable plants which are specially aggressive: The different species of piripiri (*Asaena* spp.); various allies of the scabweed, especially the turfy raoulia (*Raoulia subsericea*); the mountain-twitch (*Triedia exigua*); the mountain-cotula (*Cotula squalida*); the Maori onion (*Chrysobactron Hookeri*); the common cotton-plant (*Celmisia spectabilis*). Certain indigenous shrubs may spread greatly—*e.g.*, the mountain-tauhina (*Cassinia* spp.) and the manuka (*Leptospermum scoparium*); and, of introduced plants, the sweetbrier (*Rosa rubiginosa*), especially in dry areas; and, where the rainfall is fairly high, bracken-fern (*Pteridium escelentum*) may occupy much valuable country, as in the neighbourhood of Lakes Wanaka and Wakatipu.

(3.) *The Regrassing of Depleted Areas.*

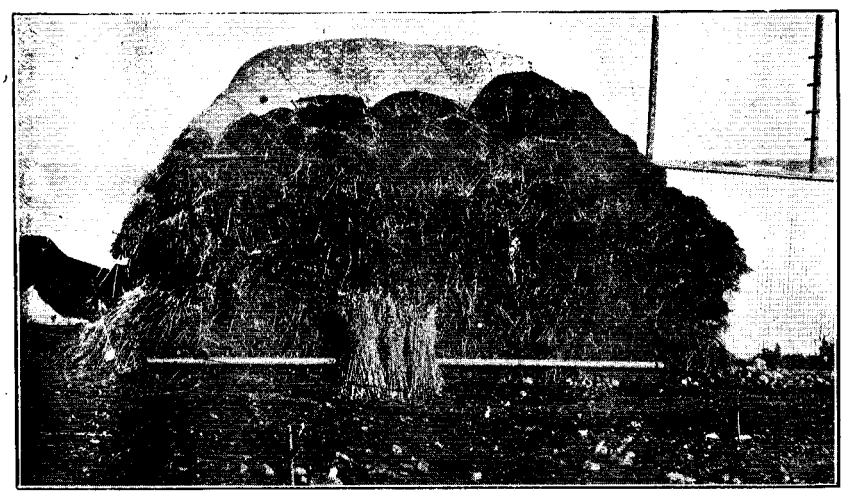
(Part (5) of the Order of Reference.)

In this section the term "depleted areas" is taken to mean not only those defined by us as "depleted," but also those areas treated of as "deteriorated," since many intermediate grades occur, and both classes equally require being brought into a far better state of palatability. If the carrying-capacity of the grasslands under consideration could be increased only one-fourth, how great the gain to New Zealand! Even without any new discoveries in the treatment of tussock-grassland it does not seem absurd to think that better management of the runs should accomplish this.

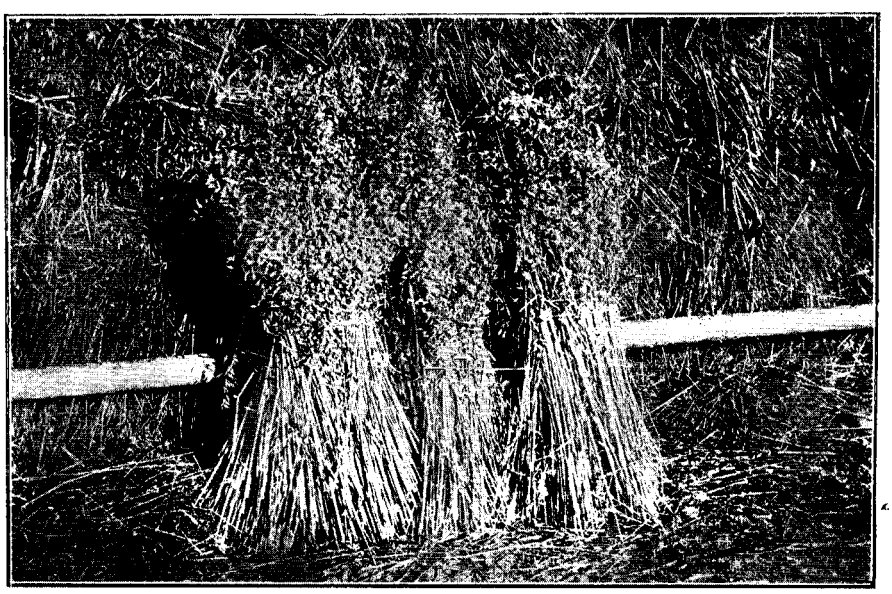
With regard to what follows under this head it must be pointed out that we have to guide us only the evidence of our witnesses and our previous experience. On the other hand, very little, perhaps nothing, is known for a certainty regarding the actual regrassing or improving of depleted and deteriorated lands, and in order to arrive at any just conclusions several years of well-considered experiments are required. Then there is the almost equally important work of studying the grasslands themselves and seeing, *inter alia*, what nature is doing in the way of destroying or restoring. This work is, in fact, being carried out on a small scale by the Department of Agriculture, and from what we have seen we are strongly of opinion that such work should



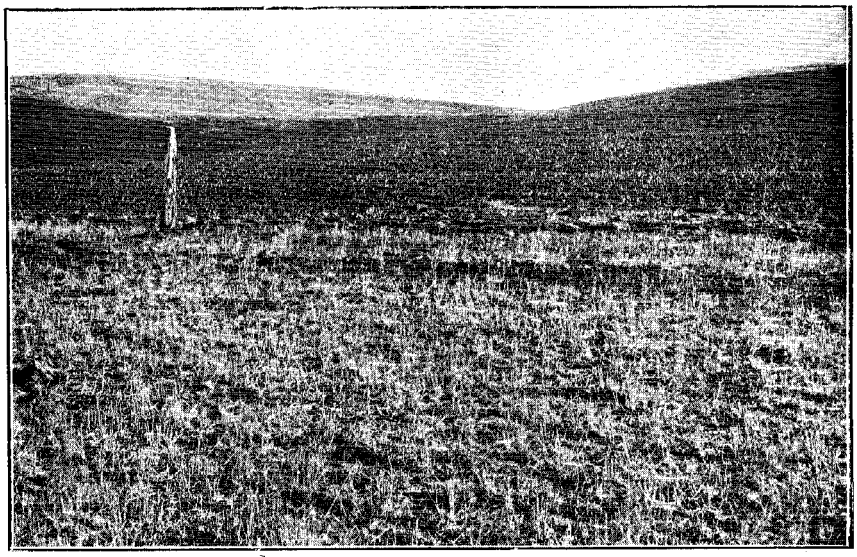
Class of Lands in Native Condition which is being utilized for Cropping.



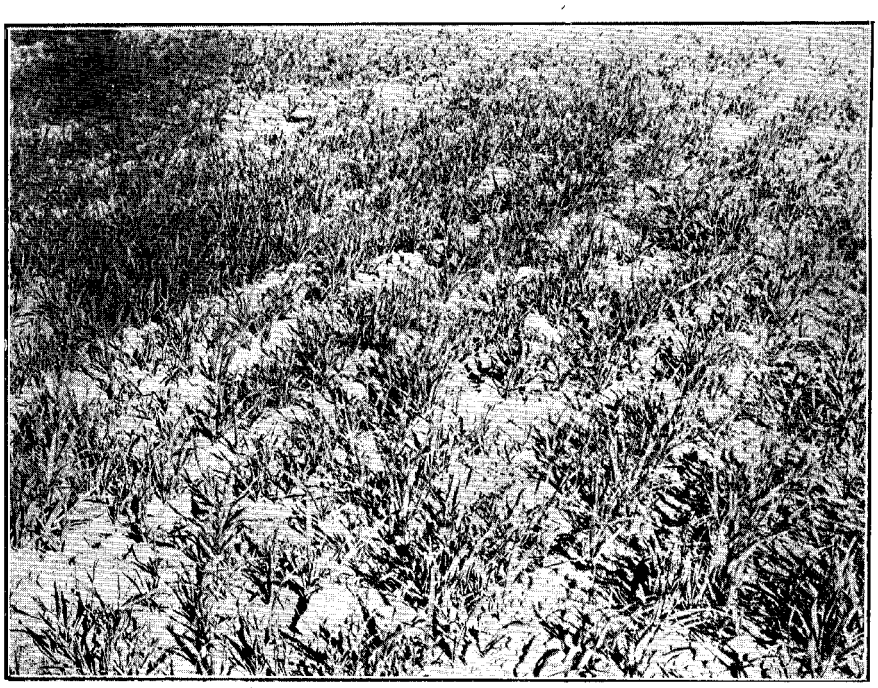
Oat Crop cut in January, 1920.



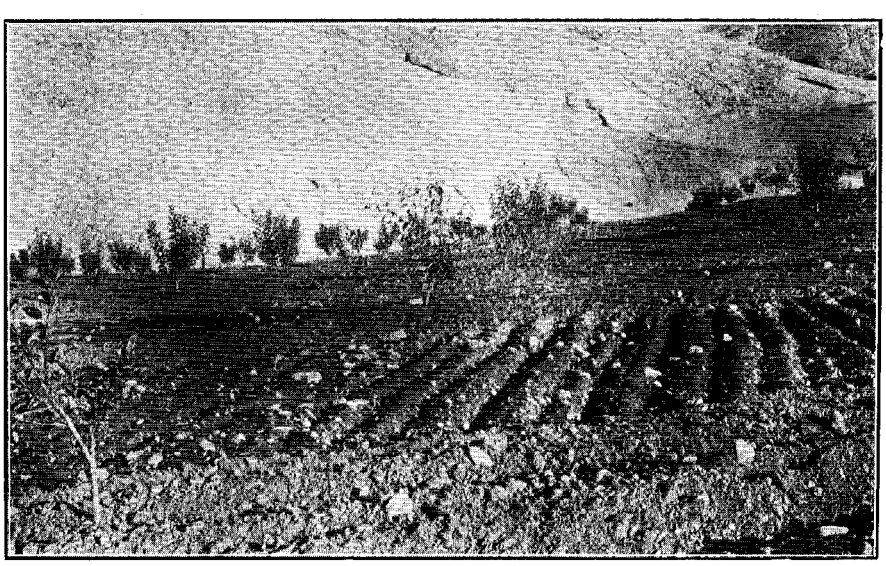
Oat Crop, Gartons, showing Sheaves 3 ft 6 in. high, taken from Stack in Photo above.



Autumn-sown Oat Crop beyond Fence.—Stubble of last Crop and unsuccessful Grass-sowing in Foreground.



Close View of Oat Crop mentioned in previous Photo.



Young Orchard, showing deep ploughing and harrowing.

not merely be continued but expanded. In fact, as suggested by one of our witnesses, a properly equipped scientific station for a searching investigation of grassland problems is urgently needed.

No hard-and-fast line can be drawn between deterioration and depletion; nevertheless, regrassing the latter when complete, and the ground virtually bare and ready for recolonization by plants, appears a far easier proposition than introducing on ground already closely occupied by aggressive, non-palatable plants species of higher palatability suitable to hold their own under fair sheep-grazing.

Coming next to actual details, the proceedings requisite for improvement fall under the three heads—getting rid of rabbits, surface-sowing, and spelling.

(4.) *Getting rid of Rabbits.*

Great unanimity is to be seen in the evidence given by our witnesses regarding the control of rabbits. With but one or two exceptions the witnesses are strongly of opinion that there is one way alone in which rabbits can be reduced to a minimum, or indeed eradicated: this method is by poisoning. On the other hand, trapping is almost universally condemned. With these verdicts we unanimously agree.

Certainly, on minor points there are differences of opinion amongst the many practical men who have given evidence before us. Most look upon what they call "the natural enemy" (*i.e.*, stoats, weasels, ferrets, cats, and hawks) as a valuable adjunct in the destruction of rabbits. Trapping is objected to partly because it is carried out by professional trappers against whose interests it is to reduce the pest, and partly because many stoats, weasels, ferrets, and cats are caught in the traps. Obviously we could make no observations during our inspection of pastures regarding methods for the destruction of rabbits, so can only rely on the unanimity of our witnesses and the experience of some of us.

That rabbits have been greatly reduced in numbers on many sheep-runs may be taken as true. Indeed, it seems that on runs generally, if heroic measures were taken, the pest could be got under.

The following are the methods for the destruction of rabbits that we think most efficacious: (1.) Fencing the lower country into comparatively small areas by means of rabbit-netting. (2.) In order to make the use of netting general we strongly urge the Government either to make it in this country, or to procure it from abroad and sell it at cost price, for cash or on deferred payment, for *bona fide* rabbit-destruction. (3.) Poisoning should be carried on simultaneously by owners of adjoining land. (4.) When rabbits are appreciably reduced by systematic poisoning, that the remainder be got under by means of dogs, ferrets, guns, and digging out. (5.) Protection by law of all natural enemies, and the breeding and liberating of ferrets and cats. (6.) Fumigation, where suitable, should be practised.

(5.) *Surface-sowing.*

In any consideration of a depleted area regarding its regrassing, or the substitution of palatable for unpalatable species on better-grasses pasture, it stands forth clearly that only those methods can be adopted which can be carried out on a remunerative basis. Nor can any one be expected to attempt regrassing or other pasture improvement on a large scale until experience or experiment can be emphatically declared that this or that method properly carried out will succeed. Unfortunately, neither experience nor experiment can yet supply any reliable information regarding regrassing mountain lands. In fact, nearly all the information available is concerned with pastures, or depleted ground, at a low altitude. Thus, from the evidence before us, successful surface-sowing, with but few exceptions, has been carried out at low altitudes, while in Central Otago the same applies with regard to regeneration.

There are, then, but little data available, either from the evidence before us or from our own experience, as to the actual value of surface-sowing at above 1,500 ft. or 2,000 ft. altitude. Judging, however, from the favourable

results from surface-sowing in many localities, and considering that the conditions for plant-life and seed-germination of many slopes up to 3,000 ft.—or, indeed, 4,000 ft.— altitude are not very different from what they are at lower levels, it is reasonable to expect satisfactory results from the surface-sowing of such country. Also, there is the important fact that the sheep themselves, and other distributing factors, have led to the permanent settlement up to high altitudes of certain palatable plants such as Yorkshire fog (*Holcus lanatus*), fiorin (*Agrostis alba*), meadow-grass (*Poa pratensis*), and catsear (*Hypochoeris radicata*), to cite some of the more important. Now, what nature is doing unaided should surely be better carried out by the skill of man.

From the last paragraph it seems clear that a good case has been made out for the improvement of pasture by means of surface-sowing. How, then, should this be carried out? Now, as already explained, the mountain grasslands vary greatly in their composition. Generally, however, there is dominance of one or other of the tussocks, which, in order that they shall yield palatable food, and also in order to hinder them choking out better plants, must be burned. This burning of the tussock produces in the resulting ashes a seed-bed which otherwise is absent. Surface-sowing the tussock country after burning is then indicated; and if sheep could be driven over the ground after sowing in order to trample in the seed, so much the better. Unfortunately, this sowing after burning must be carried out in spring, a season probably not so favourable as the autumn—the natural seeding-time for most plants.

It has been pointed out that sheep themselves function to no small extent in distributing and sowing seeds. In autumn and late summer, when the pasture plants are in seed, mobs of sheep grazing on a part of a run where seeds are plentiful might with advantage be driven on to other parts of the run in order to carry on surface-sowing on their own account. The great spread of danthonia (*Danthonia pilosa*) in Marlborough is probably due in no small degree to the action of the sheep. Favourable and unfavourable opinions as to the method suggested above will occur to all practical sheep-farmers.

Surface-sowing, as suggested in the last two paragraphs, can only be carried out on land where there is sufficient tussock. Regrassing the depleted areas is another matter. In Central Otago on the hill-faces the original vegetation, as explained already, is altogether gone, and the ground is virtually bare. This bare ground varies in character from that where there is abundant and excellent mica-schist soil, covered probably with many scabweeds, to that where the underlying rock and stony debris is exposed—the case generally on extremely exposed ridges. An important distinction occurs between shady and sunny slopes—the former obviously the most suitable for regrassing. Then there are the gullies, where, even yet, in many places there is much valuable herbage.

At the present time the Department of Agriculture is carrying out a series of experiments in order to ascertain, first of all, if regrassing the extremely denuded country, at from 1,000 ft. to 2,000 ft. altitude, is possible, and, if so, to find out the best and cheapest methods for so doing. These experimental plots, as explained in the introduction to this report, we visited. We found the experiments designed with scrupulous care, and to us they seemed planned in the right direction. Until these experiments produce positive or negative results it seems to us premature to offer definite suggestions regarding regrassing the completely denuded areas. But the matter of their improvement receives further consideration under the next head.

As for the grasses and other plants to be used for surface-sowing, and having regard to recent work on palatability carried out by the Department of Agriculture, we consider the following to be the most suitable: Meadow-grass (*Poa pratensis*), cocksfoot (*Dactylis glomerata*), catsear (*Hypechoeris radicata*), white clover (*Trifolium repens*), suckling clover (*R. dubium*), fiorin (*Agrostis alba*), red-top (*A. vulgaris*), danthonia (*Danthonia pilosa*), Yorkshire fog (*Holcus lanatus*), Chewing's fescue (*Festuca rubra* var.), and possibly blue-grass (*Agropyron scabrum*), but the seed of this is not yet to be procured commercially. To the above might be added lucerne (*Medicago sativa*) and yarrow (*Achillea millefolium*).

(6.) *Spelling.*

Equally important as surface-sowing, and a corollary to it, is spelling the ground. Even without surface-sowing at all, spelling is a most powerful weapon in the hands of one wishing to improve his upland pastures. How can a pasture grazed year in and year out, even at the time of seeding, be expected to remain at its best? It must deteriorate. Witness in this regard the constant grazing for nearly seventy years of the mountain tussock-grasslands. No wonder they have deteriorated—the marvel is they are not worse!

Nowhere can the good effects of spelling be better shown than in the absolutely depleted lowlands of Central Otago. Here there are numerous small areas which have been enclosed by rabbit-proof netting for a number of years, such enclosures, except in one instance, having been made for purposes not connected at all with spelling. Within these enclosures, as seen by ourselves in the plantations at Galloway and Omarama, and in the Agricultural Department's experimental area near Clyde, there has been truly remarkable regeneration. A recent article in the *New Zealand Journal of Agriculture* (Vol. xx, pp. 82–94) deals specifically with these regenerated areas, and is illustrated with eleven photographs which bring out most clearly what nature will do on the very worst denuded lowland areas if stock and rabbits are eliminated. In one case, even in the presence of fairly heavy stocking by sheep, cattle, and horses, there was distinct regeneration, but in this case there was an irrigated area which generally kept the stock away from the regenerating portion. Of all these enclosed areas, that of the Cromwell Development Company is perhaps the most interesting. This has been kept free from rabbits for between five and six years. About two years ago the regenerated grassland was burned in the summer, but, all the same, at the present time there is a close covering of grasses. A very early arrival after shutting up a piece of land from stock and rabbits is blue-grass (*Agropyron scabrum*), which forms large tussocks. Other palatable species which were in are red clover (*Trifolium pratense*), rye-grass (*Lolium perenne*), tall blue-tussock (*Poa intermedia*), sorrel (*Rumex acetosella*), cocksfoot (*Dactylis glomerata*), plume-grass (*Dichelachne crinita*), and meadow-grass (*Poa pratensis*).

The exact time it takes to regenerate a piece of this lowland desert is not known: possibly three years will bring about a fair result. Even if so long a time is required, this is no excessive period for restoring absolutely worthless ground to an equal, or more likely a better, state of palatability than existed in any primitive pasture of Central Otago. How much more rapidly the pasture could be rejuvenated by surface-sowing, in addition to excluding rabbits and sheep, is abundantly demonstrated by the spelling of the Earnscleugh experimental area near Clyde. Leaving out of consideration that part of the hillside which has been cultivated, and considering only the steep slope where a certain amount of surface-sowing was carried out, some of it by first "scuffling" the ground, there is abundant evidence that cocksfoot, catsear, meadow-grass, and Yorkshire fog can be firmly established, and that, without sowing at all, blue-grass and tall blue-tussock will reappear in plenty on the darker faces, and to some extent even where fully exposed to sun and wind. On this area, too, without irrigation, the lucerne sown on the cultivated ground in 1911 has grown vigorously year by year, notwithstanding its extraordinary dry station; so, too, with the cocksfoot, the tall oat-grass (*Arrhanatherum elatum*), and the Chewing's fescue.

Coming next to those better-grassed pastures which make up the bulk of the pastoral lands, the evidence before us, and our own experience, lead us unhesitatingly to declare how necessary it is for the mountain pastures to be spelled. The seeding, and spreading by means of their creeping stems, of the palatable grasses is thereby greatly facilitated. A pasture which is not naturally regenerating is going back, and natural regeneration can only be induced by spelling. Hand in hand with such spelling comes in surface-sowing. It is next to useless to sow after burning the tussock, and not to spell the ground till such time as the seedlings are able to resist the attack of stock. This stands true, especially for a grass so palatable as cocksfoot.

Finally, it must be urged that nothing but the best seed be used. No good farmer dreams of using any but the best of seed on his agricultural land. On the mountain pastures seed of high germinating-power is even more essential. From the evidence given before us many failures in surface-sowing in the past must be attributed to the use of non-viable seed.

2. Concerning the Burning of Tussock.

(Part (8) of the Order of Reference.)

During comparatively recent years the question of burning tussock has led to much discussion. One section of the runholders favoured burning, while another section considered that burning should never be practised. Those opposed to burning made out a sufficiently strong case for the Lands Department to take action, so that in the present Acts are sections to the effect that burning tussock—the kinds are not defined—shall take place only in the late winter and early spring (July, August, and September), and that snow-grass is to be burnt under no circumstances. Stated briefly, the reasons for burning and the contrary are as follows:—

For burning: (1.) Unburnt tussock (poa and fescue) is unpalatable, so burning must be practised, as it favours the production of young, palatable leaves. (2.) Non-burning leads to a rank growth of the tussock with many dead leaves and stems which choke out the neighbouring palatable plants. (3.) Burning in early spring does no harm to the tussock. (4.) Burning owes its bad reputation to its having taken place at the wrong season of the year—*i.e.*, during hot, dry periods when the tussock may be killed outright. (5.) If burning is not practised, accidental fires at the wrong season of the year will sweep over the country and do irreparable damage.

Against burning: (1.) Constant burning weakens and gradually kills the tussocks. (2.) The presence of the tussocks is necessary for the protection of the ground-vegetation between them. (3.) The food supplied by the new growth after burning is only available for a comparatively short time. (4.) Burning destroys not merely the tussocks, but also the valuable palatable plants which grow between them. (5.) Burning leads to extension of bare ground and consequent erosion. To the above it might be added that burning leads also to the spread of unpalatable plants, a point already stressed.

Taking the evidence before us together with our personal experience, we are strongly of opinion, as far as evidence and experience go, that burning tussock is desirable. The following two reasons may be adduced in addition to those already cited in favour of burning: (1.) Even if poa-tussock or fescue-tussock is killed, and in consequence the ground becomes occupied by more palatable plants, burning is beneficial. Thus the danthonia pastures of Marlborough, and areas of meadow-grass (*Poa pratensis*) in many places, have replaced tussock after burning, greatly to the benefit of the pasture through its increase in palatability. (2.) Burning is a most valuable adjunct to surface-sowing.

Now, in supporting burning it must be understood that we are altogether opposed to *indiscriminate burning*. Burning, indeed, requires carrying out with the utmost discretion. First and foremost comes in the matter of climate: and in this regard it may be stated that the danger of damaging the pasture increases in proportion to an increase of dryness in the climate. Thus it is absolutely safe to burn near the forest area of the west, and most dangerous to burn in the extremely dry areas.

The matter of burning is indeed closely wrapped up in climate. It would be dangerous to propose any hard-and-fast rule regarding burning, as is done in the Land Act. Each district, and in some instances an individual run, should have its special rules regarding burning. In other words, the skilled sheep-farmer should know when to burn his run better than any other man.

But the above dictum must be modified by the fact that not sufficient is yet known regarding burning *per se*. Experiments are urgently demanded so as

to really learn what burning does with regard to the tussock itself and its accompanying plants. For instance, the following questions await an answer: How frequently can one and the same tussock be burnt? What amount of feed is produced after burning? To what extent and in what proportion do palatable and unpalatable plants come into new ground? Other questions suggest themselves, but the foregoing will suffice. Above all, adjacent sheep-stations where burning and non-burning is carried out require comparison, as also those on which different degrees of burning take place. These and other matters we suggest as subjects for investigation by the Department of Agriculture.

As to the circumstances under which burning should take place, we advise as follows: (1.) Burn when the tussock has become more or less choked out by its dead leaves and stems. (2.) Burn only in the early spring when the ground is damp. But here it must be remembered that spring comes in at different times on a mountain sheep-run. It is entirely a matter of aspect and altitude, and not of the season of the year as defined in the almanac. Thus there can be no hard-and-fast date for burning even on one and the same run. (3.) Burn snow-grass (*Danthonia flavescens*) with caution, and this rather for the purpose of providing tracks for the sheep and not food, for the large snow-tussocks make valuable shelter for stock, and in time of snow serve as food.

Equally if not more important than the right methods of burning are the circumstances under which burning should *not* take place. These are as follows: (1.) Do not burn on sunny faces in an extremely dry climate. (2.) Do not burn when the tussocks are greatly reduced in size. (3.) Avoid burning where it is likely to bring in an excess of unpalatable plants. (4.) Do not burn on greywacke mountains in the vicinity of shingle-slips, or where the soil is shallow and slips are readily made. (5.) Do not burn in a dry climate where rabbits are numerous and so provide food for these pests. (6.) Do not burn in the neighbourhood of rabbit-warrens. (7.) Do not burn near the sources of shingly rivers and bring about excess of shingle, which may raise the river-bed and bury well-grassed river-flats.

From what has been said regarding burning it is evident that the sections of the Land Act regarding this practice require greatly modifying.

(3.) Concerning Winter Feed.

(Part (6) of the Order of Reference.)

Generally speaking the summer country of the South Island sheep-runs is considerably understocked. This applies with its greatest force to the splendid summer country of the mica-schist mountains, where, even in the most depleted part of Central Otago, there are extensive pastures of tall blue-tussock (*Poa intermedia*), a grass of fair palatability even if not burnt. On the greywacke mountains of Canterbury and Marlborough the amount of summer feed is considerably less owing to the extensive areas occupied by shingle-slips. This understocking of the high country is altogether due to the much smaller carrying-capacity of the winter country. In order, then, to increase the carrying-capacity of the runs as a whole, the growing of much more winter feed than at present is essential.

At the present time in the high-country sheep-stations, with but few exceptions, there is no provision made for feeding sheep during winter, the only cultivation being the growing of a minimum of oats for chaff to feed the station-horses, or it may be the rams. This is not owing to the fact that it is impossible to grow oats or grass for hay, or even turnips. At an altitude of more than 3,000 ft. excellent chaff was grown for many years at Taradale and Molesworth. At Castle Hill (Canterbury) at 2,300 ft. altitude there are splendid paddocks of cocksfoot; also, good crops of turnips are grown yearly. Other examples of attention to winter feed could be cited, but such procedure is an exception.

One reason that stands in the way of winter feed being grown is the section in the Land Act by which a runholder can only grow crops by permission of the Land Board; and as this feed can be used only by the grower, it follows that he must not sell any of his produce. This latter restriction is adverse to

working certain runs, the owners of which, though unable to grow feed, would be glad to procure hay, &c., from a neighbouring run better fitted for cultivation. We feel accordingly that provision should be made to allow the sale of produce under certain circumstances. As for growing winter feed generally in high-country sheep-stations, far more could be done in this regard. In many places it is quite feasible to grow cocksfoot, red clover, and probably lucerne, and such in years of heavy snow would be invaluable; while, if considerable areas were cultivated in this manner, the carrying-capacity of the runs would be considerably increased. Cases of such increase of carrying-capacity have come before us in evidence. So, too, on many runs where at present no winter feed is grown even turnips can be produced. At present it is not the custom to grow winter feed—a large run may pay well enough without—but in these days of subdivision the growing of such feed must become imperative.

It is this growing of winter feed which is greatly assisting to make the small runs of Central Otago profitable and increasing their carrying-capacity. There, where depletion rules, cultivation is absolutely necessary on the lower ground. Here, happily, lucerne can be grown in its greatest luxuriance by aid of irrigation, and even in fair abundance (say, two hay crops a year), by methods of dry farming. (See photographs appended to this report, together with their explanation.)

PART III.—IRRIGATION.

(Part (7) of the Order of Reference.)

Your Commission finds, both from observation and evidence, that the available water-supply within those areas where the rainfall is especially low is not at present being used nearly to the best advantage; further, that in addition to the data already in the possession of the Government, it is desirable that expert inquiry should be made into the sources of supply of water for irrigation conservation areas, together with the economical and modern methods of construction of races, and the approximate acreage of areas in Central Otago, North Otago, the Mackenzie country, and other portions of Canterbury (especially the driest parts of the Canterbury Plains), and Marlborough which could be profitably irrigated. In the past mining was the primary industry of Central Otago, but to-day mining has been superseded by agricultural and pastoral operations necessitating the more profitable use of the existing water-supply not actually required for mining. Recent experience shows that the time has arrived when, owing to the altered conditions, a complete revision of the law relating to water-rights is imperative.

Your Commission therefore recommends in this connection that a Royal Commission of those well versed in the question be set up at the earliest possible moment to take evidence in regard to all the water-rights in Central Otago, and to make recommendations to the Government with a view to framing legislation which will deal equitably with both miners and farmers and suit the changed conditions.

Wherever water-races constructed for mining purposes, but no longer used, are found to be suitable for carrying water for irrigation the present owners should receive fair value.

Irrigation of land in the drier portions of Central Otago has been carried out with more or less success for the past thirty-five years, and in every case it has given satisfactory results. This is especially the case in the most arid situations and during the hottest and driest summers.

As it is essential that the huge areas of practically barren country in Central Otago should be brought into a state of productivity with as little delay as possible, your Commission recommends that the Government move most energetically in this direction and with the utmost speed.

As irrigation on an extensive scale is practically in its infancy in the Dominion, and except in Central Otago very little has been done, experiments might be carried out with great advantage not only in Central Otago, as already

suggested in our "Miscellaneous Recommendations," but in Canterbury and Marlborough, in order to demonstrate the economic value of water when applied to the soil in all districts where sufficient rain cannot always be relied upon.

Besides gravitation schemes from conservation dams, there is ample scope for the establishment of pumping plants along the banks of the Kawarau and Clutha Rivers. Although the foregoing method is more expensive than procuring a water-supply by gravitation, it will no doubt be necessary in the future to augment the gravitation supplies.

Although the irrigation scheme in Poolburn (Ida) Valley is not yet in full operation, sufficient has been done to demonstrate to the farmers the truly enormous possibilities of the district when this scheme is completed. Armed with the knowledge derived from our examination of the Poolburn Valley scheme, we were impressed with the suitability for irrigation of vast tracts of land in the Manuherikia Valley, which are not commanded by the race now in course of construction, but which must ultimately be brought under a more comprehensive scheme. In conclusion, we must state that the potentialities of the Manuherikia and Upper Clutha Valleys, as demonstrated at the present time by smiling orchards and green pastures, when irrigation is practised cannot be overestimated.

PART IV.—MISCELLANEOUS RECOMMENDATIONS.

Your Commission makes the following recommendations in addition to those already embodied in this report:—

1. That on the expiry of pastoral runs on the Blue Mountains situated in the Glenkenich, Rankleburn, and Crookston Survey Districts suitable areas of these runs be set aside for afforestation purposes.

2. That, as the planting of shelter-belts on open country is necessary in order to afford not only shelter and protection for stock, but also firewood, fencing, and other purposes, it is therefore recommended that settlers wishing to plant portions of their holdings shall, on application to the Forestry Department, be supplied with the proper trees for that particular part of the country, and shall receive instruction as to the best methods of planting and suitable location for such work. Also, the planting of waste areas is recommended, such as abandoned mining tailings, sand-drifts, waste land of little value for agricultural or pastoral purposes, and river-beds where such planting is deemed advantageous.

3. From the evidence obtained it is certain that the kea is responsible for the destruction annually of large numbers of sheep; therefore we recommend that the destruction of the kea should be encouraged as much as possible.

4. That section 235 of the Land Act, 1908, relative to the prevention of the growth and spread of noxious weeds, particularly sweetbrier (*Rosa rubiginosa*), blackberry (*Rubus fruiticosus*), and St. John's wort (*Hypericum perforatum*), should apply to the leases of all pastoral land, and the Lands Department should take steps to enforce this condition of the lease.

5. In cases where freehold land necessary for the working of the adjoining or adjacent high pastoral lands is let to the tenant of such land by the non-resident owner the Crown should take steps under the compulsory clauses of the Act to acquire such land and add it to the lease of the pastoral land, in terms of section 59, Land for Settlements Act, 1908.

6. The members of your Commission having inspected the various experimental areas instituted by the Department of Agriculture in Central Otago, and recognizing the importance of this work, strongly urge that further experiments in both irrigation and dry-farming methods be carried out on the areas set apart at Galloway Flat for this purpose.

7. That the present Fencing Act be amended in regard to the height, mesh, and gauge of rabbit-proof netting, and that netting 36 by 1½ by 17 is considered sufficient.

8. That, since the erection of rabbit-proof boundary-fences on rabbit-infested country is desirable, on the serving of due notice by an owner or

occupier on an adjoining landholder it shall be made compulsory that such a fence be erected. In case of dispute the matter must be referred to a Magistrate in the usual manner.

9. That, owing to the rabbit pest being one of the chief factors in connection with deterioration and depletion of vast areas, it is strongly recommended, with the view of exterminating the pest, that experiments be carried out ascertaining whether it is possible to render ferrets immune by inoculation from what is known as "distemper." Also that an investigation should be made regarding the disease which from time to time affects the rabbit in parts of Marlborough.

10. That an exhaustive survey of lucerne-growing be made in the lands referred to in this report, with a view to obtaining definite knowledge as to the best method of lucerne-cultivation for each district and of the most suitable varieties to be grown.

11. That the Department of Agriculture make an authoritative list of the popular names to be used for all economic pasture-plants and weeds, and that those names be scrupulously used in all Government publications and all schools and other educational establishments dealing with agricultural matters.

This concludes the report of your Commissioners.

In witness whereof we have hereunder set our hands and seals, this twenty-fourth day of June, in the year of our Lord one thousand nine hundred and twenty.

ROBT. T. SADD, Chairman.
W. B. BUCKHURST.
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