The Future of Animal Production in New Zealand

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THE future of animal production in New Zealand is likely to be determined by many complex factors. It is scarcely possible to consider all the relevant details in an address such as this and many of them will be covered by later speakers in this symposium. It does seem to me, however, that certain broad issues will be decisive determinants and I propose to confine myself to these, without in any way suggesting that other factors may not profoundly modify the economic climate within which these developments proceed.

It should hardly be necessary to stress to this Society the dominating position of the animal industry in the New Zealand economy. Over 90 per cent of the gross value of farm production comprises animal products, and the percentage is still higher in terms of exports. New Zealand is poor in mineral resources and, were it not for the ability of the animal industries of this country to compete and sell their products on world markets, New Zealand would have virtually no foreign exchange to purchase imports of raw materials or consumer goods. The animal industries are in very truth the backbone of New Zealand and we must guard that in pursuing other political objectives, however desirable in themselves, we do not imperil the competitive ability of the farming industries.

What then are these broad issues affecting the future of animal production? As I see it they may be conveniently grouped under three broad headings:—

(a) Future effective demand for animal products.

(b) The potential for increased production of animal products in New Zealand.

(c) The conditions necessary to realize our potential for increased production.

Most of you, in the last few years, must have read some of the spate of literature on the problem of world population and food resources. This discussion on the concepts of Malthus in the modern setting has led to sharp differences of opinion. One school contends that Malthus was right, after all, and that the world faces starvation, while the opposing school contends that all is well and that science applied to the problem of food production will meet all our requirements. Sir Charles Galton Darwin, in his recent book "The Next Million Years," states the Malthusian point of view clearly; "There is nothing unreasonable in saying that the food production of the world could be doubled or trebled; but it is rather hard to see how it could be raised more than 10 times on the present methods of agriculture.

If the population is doubled in a century, it is only three and a half centuries before it will be 10 times its present number, and this would exhaust what I have estimated as the possibilities of the existing systems of agriculture. To summarise the Malthusian doctrine, there can never be more people than there is food for. There will not be less, because man, like every other animal, tends to increase in numbers."

The impact of modern insecticides and modern medical attention in controlling disease, thus lowering the mortality rate without any corresponding reduction in birth rate, poses a problem which we ignore

at our peril. All of us as scientists must join in the heart searching of A. V. Hill in his presidential address to the British Association in 1952 on "The Ethical Dilemma of Science," or the more dramatic rendering of the same theme by Vogt in "Road to Survival."

Present world population is estimated at approximately 2,350,000,000 people, and if present rates of population growth continue it is estimated that it will almost double to 4,163,0000,000* by 2000 A.D. Whether these estimates are accurate or not is of little moment for the immediate purposes of this discussion. The main inference to be drawn is that the need for food in the foreseeable future is likely to exceed the available supply.

This, however, must be clearly distinguished from the existence of effective demand. Surpluses of food-stuffs are produced only because they can be exchanged for other goods or services which the producer wants. Those in need of food must therefore produce surpluses of goods or services for which the producer in New Zealand can exchange his surplus production. In general the animal products produced in New Zealand sell at too high a price to meet an effective demand in those areas where the need is greatest. Animal products are expensive foods and, as in the past, effective demand is likely to continue to centre in those countries already enjoying a high standard of living. It appears likely that the United Kingdom will continue as a major market for most of our produce, but the possibility cannot be discounted that continuing growth of population may provide other useful outlets, such as, U.S.A. and even Australia.

One factor affecting demand which cannot be ignored is the continued development of margarine and synthetic fibres as competitors to butter and wool. Margarine production, last year, for a group of major countries, was approximately double the pre-war level. In the United Kingdom average production of margarine in the quinquennium 1934-1938 was 180,000 tons and by 1951 this had risen to 446,000 tons. The growth of margarine production has been fostered by the scarcity and high price of butter and, particularly in U.S.A., by the easing of restrictions on methods of manufacture, including colouring. Referring to the United Kingdom market, the Annual Report of the New Zealand Dairy Board (1953) says: "With both derationing and removal of subsidies in prospect, developments in 1954 will have a more than usual significance. The difference in retail prices will be rather more than 2s per pound, and the market may prove highly competitive."

World production of apparel wool on a clean scoured basis has increased by approximately 10 per cent since 1938. During this period there has been a phenomenal increase in the variety and production of synthetic fibres. Since 1938 production of rayon has approximately doubled, while production of the true synthetics has increased from 2 million lb. to 250 million lb. It is estimated that production in U.S.A. alone will reach 1,000 million lb. by 1960 and 4,000 million lb., or more than twice the present world production of wool, by 1975. These figures are of particular interest because the U.S.A. is the world's largest consumer of wool. Well over two-thirds of her needs are supplied by imports and, after the United Kingdom, she is traditionally the most important buyer of New Zealand wool. It is therefore of some interest to look at the impact of these man-made fibres on wool consumption in U.S.A.

In 1938 consumption of wool in U.S.A. was 284 million lb., or 7.9 per cent of the total fibre consumption, and in 1951, 490 million lb., or 7.1 per cent. The impact of the new fibres has fallen on cotton, which fell from 81 to 71 per cent, and on silk, which fell from 1.5 to 0.1 per cent of the total consumption.

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* Increase at 1.15% per annum—the estimated world rate, 1920-1947. (Stamp—"Land for To-morrow.")

I do not believe that these new fibres represent a serious threat to wool at their present stage of development. Large funds are, however, being spent on research for their improvement. In my opinion the sheep industry should take immediate steps to greatly increase the current volume of research on all phases of their own product and its utilization so that they may be in the best possible position to meet competition in the future.

While the threat of substitutes occupies much of current thinking on the question of future markets, it is probably of less significance than other imponderables, such as the ability of U.S.A. and the United Kingdom to sustain full employment, the absence of barriers to the free flow of trade, the convertibility of sterling and other matters of a politico-economic nature.

Covering, as they do, a relatively narrow range of products, New Zealand must always remain sensitive to trends in the world markets and our export industries must be organised in such a way that they can rapidly respond to changes in consumer requirements. I see no reason, however, for pessimism about future effective demand for our main products in world markets.

The second major issue which I raised was the potential for expansion of production in New Zealand, and I think we can get some guide to this by looking briefly at the progress made in the last 50 years. The total area in grass to-day is approximately 31 million acres, and just over another million acres is devoted to arable crops, making a total of slightly over 32 million acres of effective farm land. In 1901 approximately 30 million acres were in grass or crops, so that the area farmed has increased by just over 2 million acres or 7 per cent in the last 50 years. In addition to this apparent increase, however, considerable areas of low-producing tussock grassland have been converted to high-producing sown pasture.

While the farmed area has increased by only 7 per cent in the last 50 years, it has doubled in carrying capacity per acre due to the widespread adoption of top-dressing with phosphates and lime, the use of pedigree strains of grasses and clovers, and improved management techniques. Not only are these 1954 pastures carrying twice as many stock per acre, but the stock are better fed and hence higher producing. Average production per cow has increased by nearly 90 per cent and average production per sheep by 75 per cent.

In total, therefore, the output of livestock products has increased fourfold, i.e., carrying capacity has been doubled, output per stock unit nearly doubled, and there has been a 7 per cent increase in area. This four-fold increase in livestock output has not been uniformly spread over all phases of the livestock industry. Dairy production has increased over ten-fold, beef and fat-lamb production eight-fold, while wool and mutton production has approximately doubled. During the same period the volume of cash cropping declined by over 30 per cent.

Let us look more closely at these figures. The big increases in farm production have been in dairying, fat-lamb and beef production—dairying and fat-lamb almost confined to the ploughable lowland areas and beef production reliant on it for fattening. Mutton and wool to which our hill pastures make a major contribution have only doubled in the same period. In other words the expansion in production in the last 50 years has come largely from our ploughable lowland areas which represent only 30 per cent of our total area of grassland. On these lowland areas production has increased much more than fourfold: on them we have applied our skill as grassland farmers and scientifically exploited our capacity to produce grass, and the produce has been fairly won. We have increased fertility in the process so that we can proceed to still higher levels—much higher levels of production.

The hills, however, have scarcely felt the impact of the techniques we have so successfully applied on the lowlands. Remember that, even

excluding the tussock grasslands of the South Island, the area of sown hill-country equals that of the lowlands. Nearly all these hill pastures were sown before improved strains of grasses and clovers were available, and only the fringe of them had been top-dressed prior to the advent of aerial top-dressing.

In the 20 years 1925-1945 several of the East Coast counties of the North Island were either stationary or declining in average carrying capacity, but since 1945 there appears to have been a substantial improvement and only two counties (Matakaoa and Akitio) fall in this group in the period 1927-1952. In 1927 the average carrying capacity of East Coast counties, such as Uawa (1.98) and Waikohu (1.74), was equal to that of Otorohanga (1.82) and Matamata (1.73). The adoption of top-dressing and improved pasture management has converted the Waikato into some of the highest carrying capacity country in New Zealand, while the counties north of Gisborne with their hilly topography and poor access have shown at best only a slight increase (—9 per cent in Matakaoa to +15 per cent in Uawa).

There is no technical reason why the revolution which has taken place on the ploughable lands should not be re-enacted on the hill lands of the North Island, though economic factors may restrict it to a lower level of intensity. Aerial top-dressing has already given a substantial token of its possibilities; no less than 1,376,118 acres were aerially top-dressed last season with 144,000 tons of fertilizer and most of this went on the hill-country.

Considerable expansion of aerial top-dressing may be expected, and together with other means of top-dressing, the hills may be expected to make a major contribution to increased stock carrying capacity. Experiments carried out by the Grasslands Division of the Department of Scientific and Industrial Research at Te Awa have indicated that top-dressing and oversowing with clover seed, coupled with closer subdivision, can double production on this class of hill-country in 3-4 years. While this is possible on much of the easy hill-country, it would be misleading to suggest that it is possible on all hill-country. There are considerable areas where lime as well as phosphate is required, and these areas are unlikely to show the same quick response even if top-dressed with lime as well as phosphate. The recent demonstration of widespread molybdenum response on some of these lime responsive soils, however, may enhance the possibility of raising their production rapidly by top-dressing and oversowing.

The 12 million acres of tussock grassland in the South Island presents a much more difficult problem of improvement than the sown country of the North Island. Much is subject to severe limitations of rainfall or elevation, and considerable areas have already suffered accelerated erosion through burning, overstocking and rabbits. A second generation of pioneers like R. K. Ireland at Ribbonwood, however, have shown that large areas of tussock country can be substantially increased in carrying capacity by phosphate and clovers. The transformation at Ribbonwood is dramatic and over a period of years wool output has been doubled and, in addition, a herd of black cattle is now being grazed. Indications are that, in areas below 2,500 feet and with a rainfall over 30 inches, very considerable increases in production are possible.

To an increasing extent irrigation may be expected to contribute to increased production in the areas of moderate to low rainfall. In the South Island there are 2-3 million acres of light gravelly plains and shallow soils over gravel where production could be markedly increased by irrigation. At present only 126,000 acres of this 2 million is irrigated. Work by the Department of Agriculture at Winchmore has demonstrated the capabilities of this light plains land under irrigation. Pro-

duction on the dairy farm there is comparable with that on the average Waikato farm; the experimental fat-lamb farm is wintering 7 ewes—at least 4 times the average on adjoining unirrigated areas.

Even without irrigation Lincoln College has demonstrated at Ashley Dene that the carrying capacity of much of this land can be economically doubled by the introduction of subterranean clover coupled with light dressings of lime and phosphate. Their experiment, conducted over 6 years, raised the carrying capacity from ¾ to 1 ewe per acre to an average of 2.2 ewes in the last 3 years of the experiment.

On the ploughable lands of the North Island very large increases in production are possible. Farm surveys carried out in the Whangarei County show that the top 10 per cent of farmers on a given soil type carry 64 per cent more stock than the average farmer, and in general these stock are better fed and higher producing. Even these top 10 per cent of farmers, however, are by no means taking full advantage of present known techniques of pasture production and animal husbandry. A surprisingly small proportion of our grasslands have yet been sown with the new high-producing strains of grasses and clovers. It is doubtful whether 10 per cent of the ploughable grassland in the North Island has yet been sown with "certified seed." Sears, at Grasslands Division, has shown that it is possible to produce sufficient nutrients per acre to equal the production of over 400lb. of butterfat. The average for the Waipa County, however, is only 160-180lb. per acre, so there is still ample scope for doubling production per acre.

From time to time statements have been made regarding the large areas of unimproved land which are still available and suited for farming. Anyone who has travelled through the Rotorua-Taupo area or through North Auckland must be impressed by the large areas still in fern and scrub. In the Dominion as a whole available figures suggest that approximately 3¾ million acres of ploughable land is still in scrub or forest. This figure, however, overstates the reality. Over 1½ million acres of this area in the North Island consists of problem soils: the deep peats of the Waikato, the ironstone soils and sand podsols of North Auckland, soils over 2000ft. in elevation and other areas with severe limitations to productivity. Similarly in the South Island considerable areas of ploughable soils, such as the Pakahi, have severe limitations. The area actually suitable for conversion to grassland is probably about 1½ million acres, of which approximately one-third is Crown land.

Recent work on the peat soils of the Waikato by workers at the Rukuhia Soil Fertility Station give some hope that the problems associated with their utilization may bring these within the orbit of possible areas for development, just as the discovery of cobalt deficiency opened the way for settlement of the pumice country. There are other areas, such as the ironstone soils, which we may eventually learn to utilize economically. If we accept the tentative estimate of 1½ million acres this would represent an increase of just over 8 per cent in the present area of sown grassland, or nearly 5 per cent in the total area farmed; a little over half the increase that has been achieved in the past 50 years.

Over the past 20 years soil surveys have been carried out by the Department of Scientific and Industrial Research over the whole of the North Island, and the greater part of the South Island, and these can be used for assessing potential production. A detailed survey was carried out in the Whangarei County and it may be of some interest to look at the potential for that area, as shown in Table I. Our conservative estimate at that time was that carrying capacity could be increased 2½ times over 1940-41.

Table I: Land Use and Potential in Whangarei County.

Soil Rating	Area in Thousand Acres				Potential Carrying Capacity in Stock Units	
	Total	Bush	Scrub	Cultivated	Per Acre	Totals
1	53	8	34	11	—	—
2	109	34	25	50	2.25	169
3	193	38	36	119	2.75	426
4	65	5	20	40	3.25	195
5	144	7	52	84	3.75	510
6	89	6	10	70	4.25	340
7	9	1	1	7	4.75	38
	662*	99	178	381		1678
				Less 10% for gullies, etc.		167
						1511

* In addition there are 4,115 acres of urban areas, 4,841 acres of mangroves and 2,885 acres of sand dunes.

Stock units in 1940/41 were 599,400.

Stock units potential 1,511,000 or 2.5-fold 1940/41.

This estimate is based on not farming the area of 53,000 acres with a soil rating of 1: This should probably be in protective forest since much of it is steep land. Nor does the estimate involve utilizing any of the 99,000 acres at present in forest.

A similar detailed assessment for North Auckland indicates a potential carrying capacity of 7,849,000 stock units, while actual stock carried in 1948/49 totalled 3,011,000 units, i.e., a 2.6-fold increase is possible.

Less detailed assessments based on reconnaissance soil surveys for the Dominion as a whole are shown in Table II. and indicate that with present knowledge carrying capacity could be doubled. The pasture improvement and other measures necessary to achieve this doubling of carrying capacity would also lead to stock being better fed and hence higher producing, so that total production could be more than doubled.

Table II: Present and Potential Stock-carrying Capacity of New Zealand.

	Stock Units		Potential Increase
	1948/9	Potential	
North Island	27,698,117	54,023,000	1.95
South Island	12,963,098	34,252,000	2.64
TOTAL	40,661,215	88,275,000	2.17

I am confident that for the country as a whole we could and will double farm production and that with development of new techniques we may exceed that increase if farm production is attractive to labour and capital; but I find it difficult to visualize an increase for the country as a whole greater than 2½ or perhaps, greatly daring, 3 times our present production while we maintain our present pattern of livestock farming.

Turning now to the third major issue, the conditions necessary for this potential for increased production to be realized, we enter the politico-economic sphere in which there is undoubtedly considerable divergence of opinion and room for much argument.

Apart from seasonal fluctuations, the volume of livestock products increased at a remarkably uniform rate of 3.87 per cent per annum from 1901-2 to 1935-6. During this period the number of men (excluding Maoris) engaged in farming increased from 85,300 in 1901 to 144,500 in 1936. By 1951 the number of men engaged in farming had dropped to approximately 110,000*, a decrease of 34,000 since 1936. This reduction in the farm labour force has been reflected in a much slower rate of increase in the total volume of livestock output. The average annual rate of increase over the period 1935-6 to 1951-2 has been 1.42 per cent or considerably less than one-half of the average rate in the 34 years preceding 1935-6. If we end the period in 1949-50 so as to exclude the exceptionally good seasons following 1949/50 the average rate is reduced to 1.20 per cent per annum.

This slowing down in the average annual rate of increase was largely confined to the dairy industry where the change was much more dramatic.

Period.	Average Annual Percentage Increase in Output.
1901-2 to 1935-6	7.00
1935-6 to 1949-50	0.29
1935-6 to 1951-2	0.67

Even taking the most favourable view that the production level of 1951-52 was not influenced by "season," the percentage rate of increase since 1935-6 has been less than one-tenth of that achieved in the preceding 34 years. Since 1946-7 the number of cows in milk has shown a steady increase to record numbers and it is to be hoped that this increase will continue.

What was the cause of this fairly marked change in trend in the mid-thirties? Is it only coincidental that about this period there was a change in political philosophy with the emphasis on "security" in the form of guaranteed prices, on insulation of the N.Z. economy by encouragement of secondary industry and all the concomitant changes which these philosophies involved?

On present estimates New Zealand's population will increase to three millions by 1975 and to four millions by 1991 if present trends continue. Assuming steady terms of trade, farm output must increase at the same rate as population or our standard of living will fall, this calls for an increase in farm production of approximately 2 per cent per annum or an overall increase of 50 per cent in just over 20 years. By some means the rate of increase in livestock production must be increased to something more nearly approaching the rate prior to 1935. How is it to be achieved?

I don't propose to try and answer that question in the time available. But in my opinion the answers are political and economic and not technical. I believe we know how to increase production to the required level; what is imperative is the clear realization of the need at the national level. Farming must be made attractive to labour and capital if it is to fulfil the role which the national need demands.

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*N.B.—Maoris are excluded because numbers are not available for earlier censuses. If Maoris included, the number engaged in farming at the 1951 census becomes 119,172.

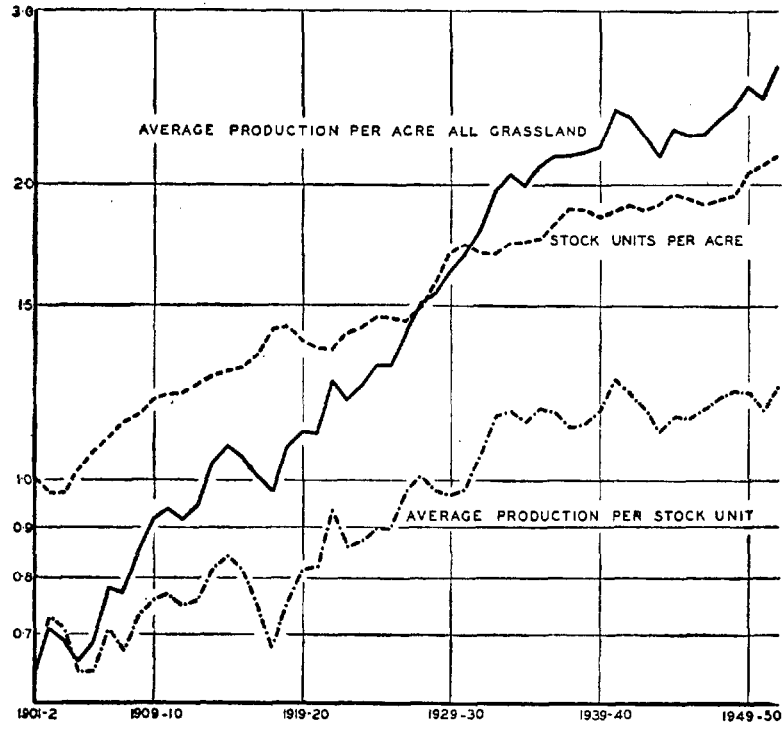

FIGURE 1: Volume of production per stock unit, and per acre of grassland, and carrying capacity in stock units per acre over the period 1901/2 to 1951/2. (Semi-log scale).

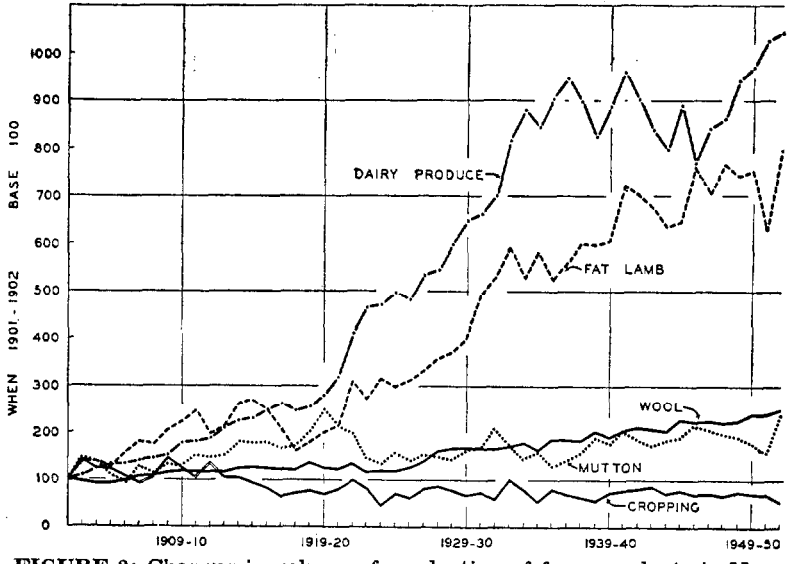

FIGURE 2: Changes in volume of production of farm products in New Zealand when 1901-2 is taken as base 100. Beef production is not shown but follows much the same trend as fat lamb.

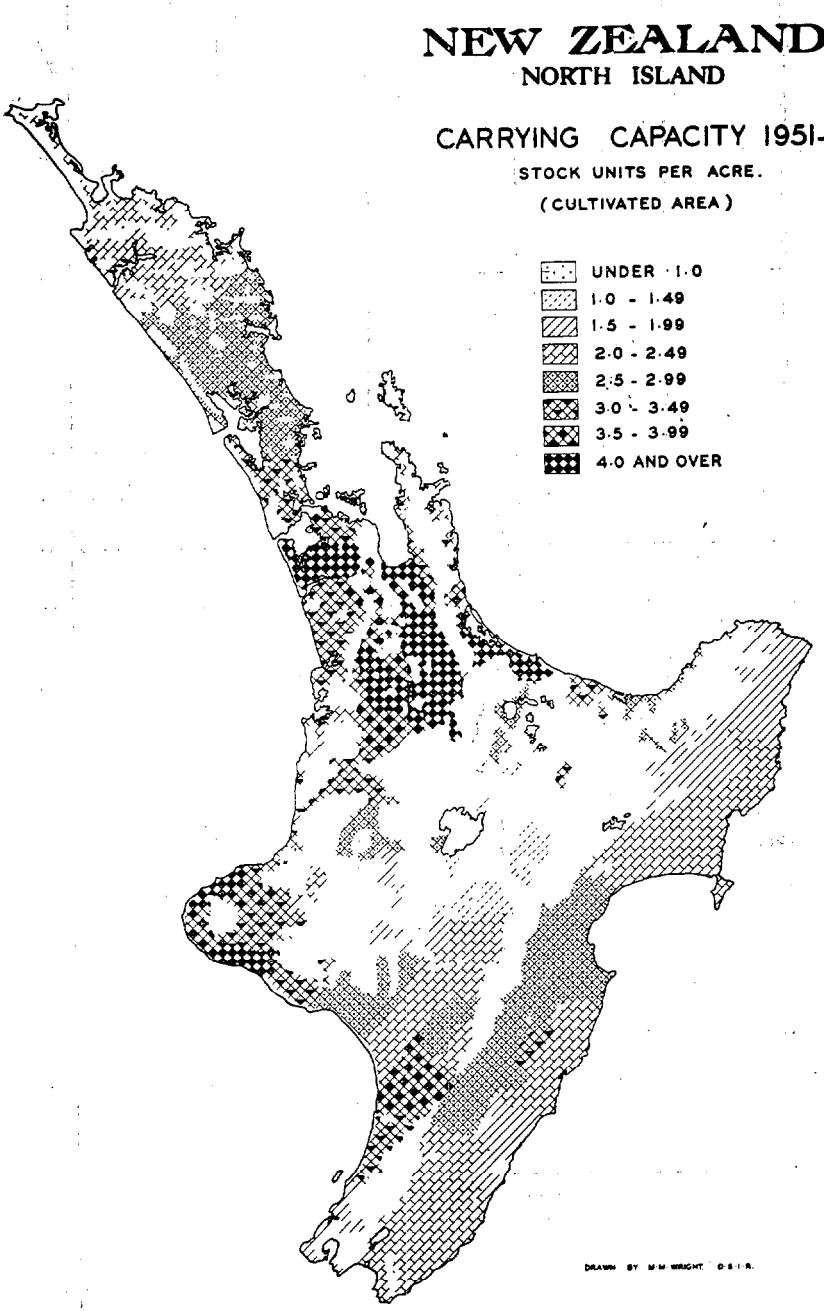
NEW ZEALAND
NORTH ISLAND
CARRYING CAPACITY 1951-2
STOCK UNITS PER ACRE.
(CULTIVATED AREA)
UNDER 1·0
1·0 - 1·49
1·5 - 1·99
2·0 - 2·49
2·5 - 2·99
3·0 - 3·49
3·5 - 3·99
4·0 AND OVER
DRAWN BY M.M. WRIGHT D.S.I.R.

Figure 3.

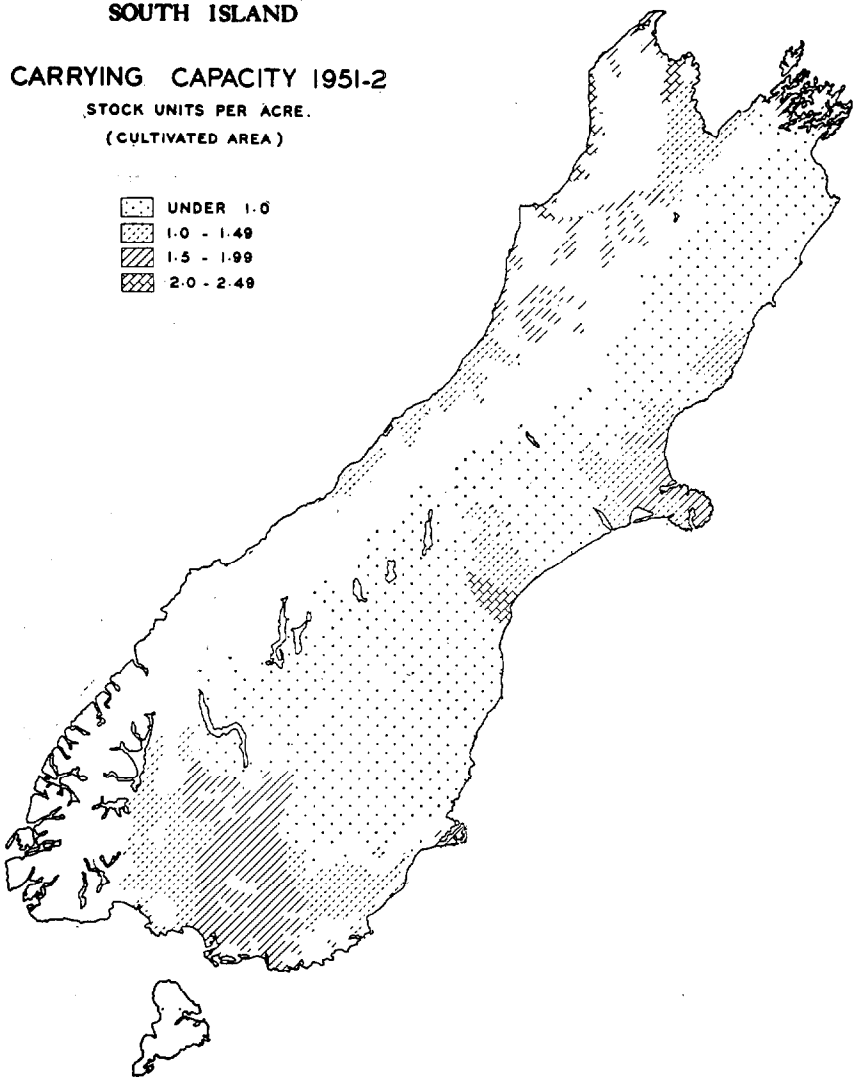

Figure 4.

FIGURES 3 and 4: Average carrying capacity in stock units per acre on a county basis 1951-2. A stock unit approximately equals a breeding ewe. All stock in a county have been converted to stock units and the total stock units divided by the area in grass (including tussock) plus forage crops. Only the area in grass and crops in each county is hatched. (Drawn by Miss M. Wright, D.S.I.R.).

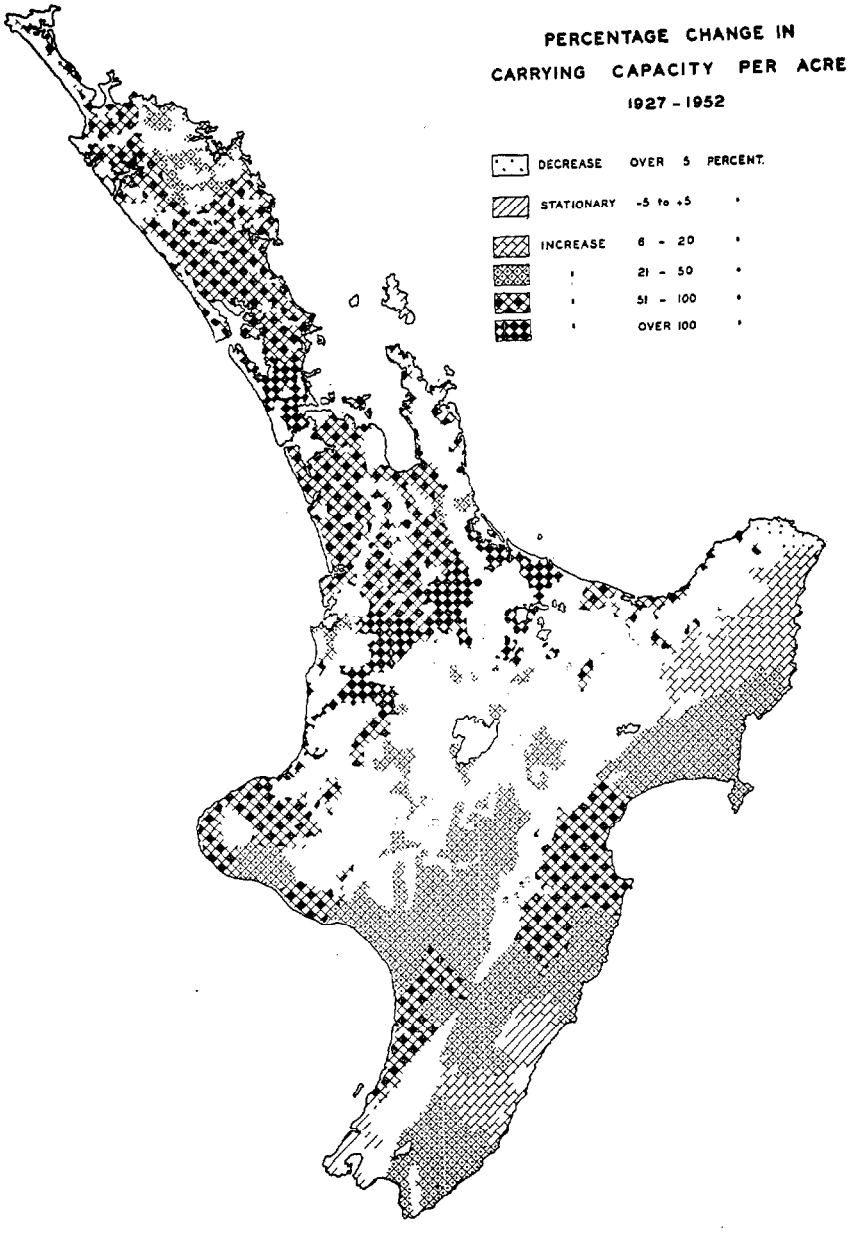
NEW ZEALAND
NORTH ISLAND
PERCENTAGE CHANGE IN
CARRYING CAPACITY PER ACRE
1927 - 1952
DECREASE OVER 5 PERCENT.
STATIONARY -5 to +5 "
INCREASE 6 - 20 "
" 21 - 50 "
" 51 - 100 "
" OVER 100 "

Figure 5.

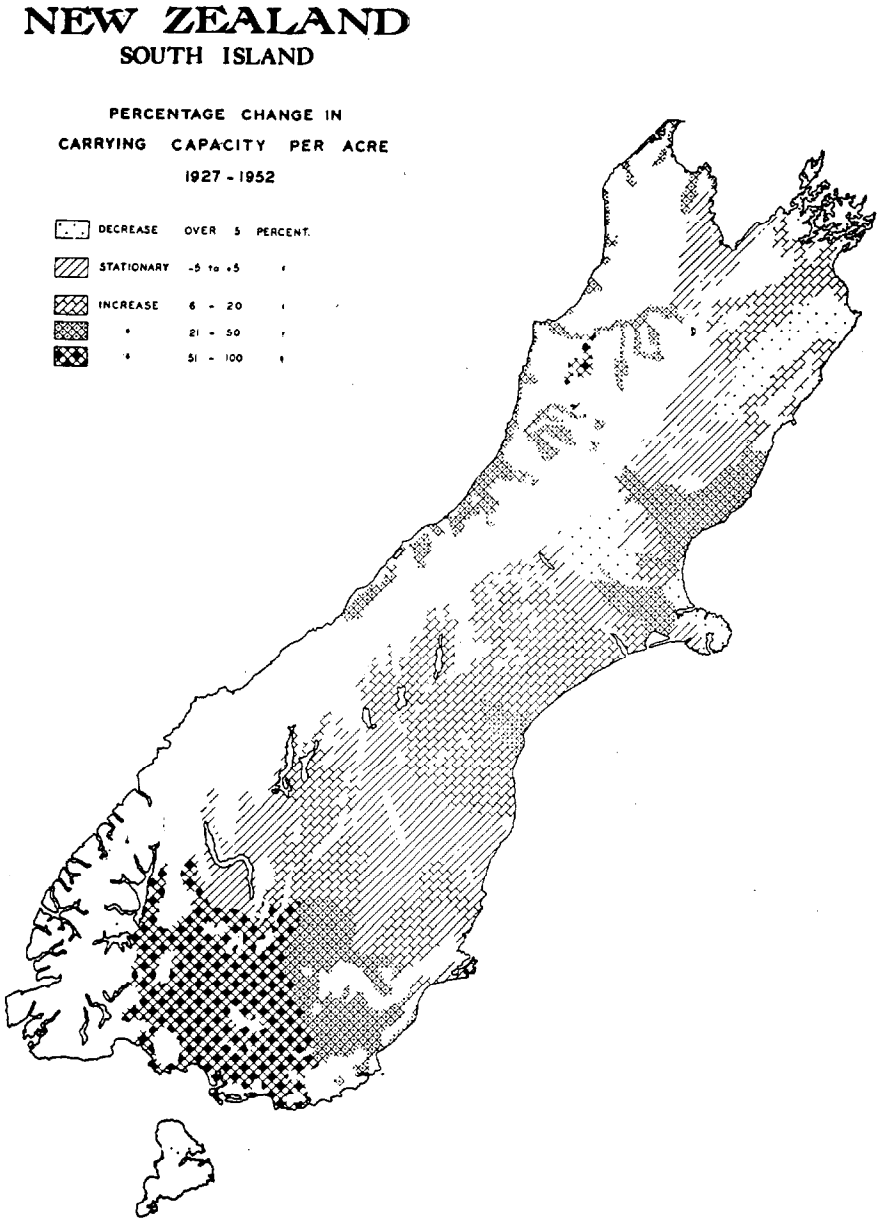

Figure 6.

FIGURES 5 and 6: Percentage change in carrying capacity per acre over the 25-year period 1927 to 1952, on a county basis. Average carrying capacity in 1927 was calculated as for Fig. 3 and 4 and the percentage increase to 1951-2 calculated. Only the area in each county in grass and crops is hatched. (Drawn by Miss M. Wright, D.S.I.R.).

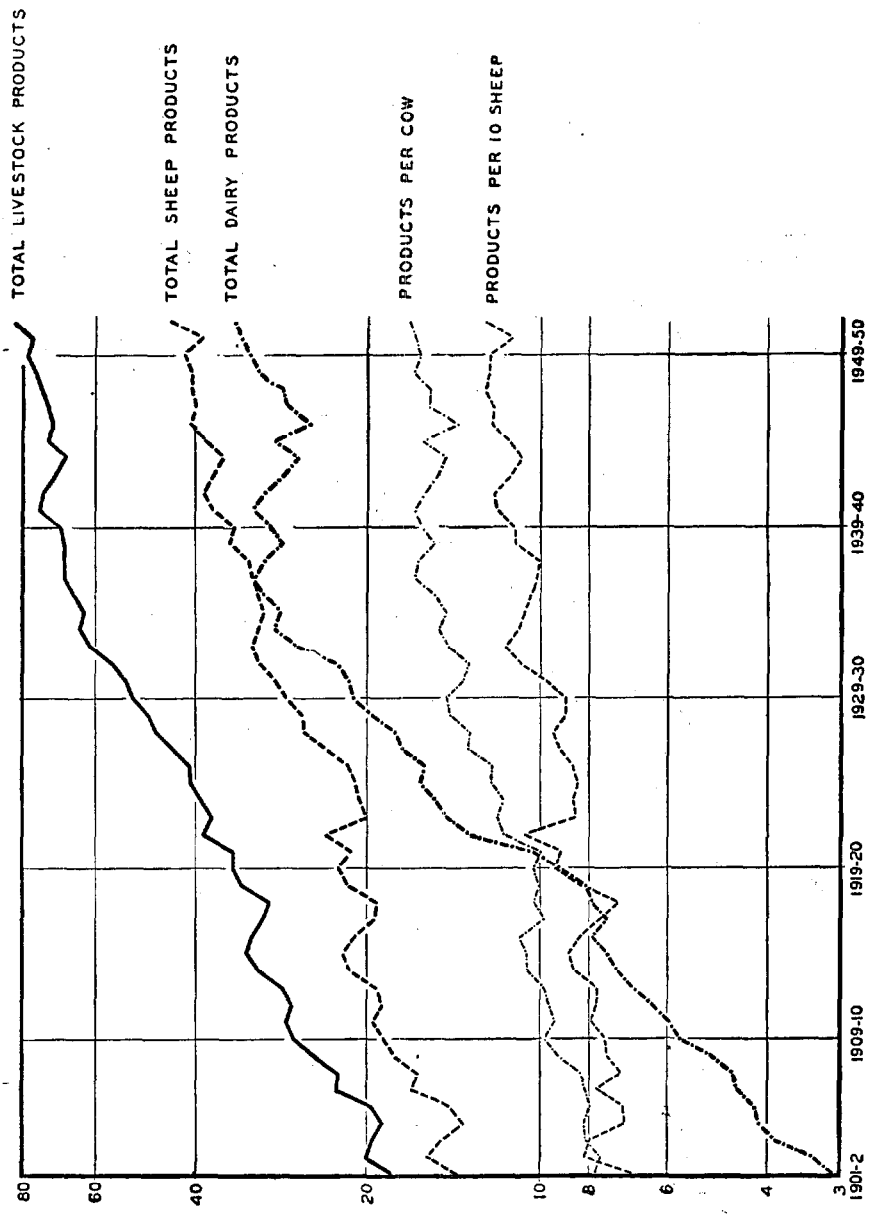

FIGURE 7: Growth in volume of production of livestock products in New Zealand over the period since 1901-2, showing the relative contributions of the dairy and sheep industries. Over the period 1901-2 to 1935-6 dairy production increased at an average rate of 7 per cent per annum, but over the period 1935-6 to 1951-2 the average rate of increase dropped to 0.67 per cent per annum.