RECENT CHANGES IN SHEEP AND CATTLE POPULATIONS IN EASTERN NEW SOUTH WALES.

by

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The purpose of this study is to examine long-term changes in sheep and cattle populations in different parts of New South Wales, excluding the Western Division and the coastal areas. In addition, reference will be made to factors which appear to have had a bearing on the changes which have taken place. It is intended to follow up this initial broad survey with examinations of small areas. This initial study has been undertaken partly to provide extension officers and others associated with the pastoral industries with information concerning long-term trends in stock numbers in their respective areas.

The figures on which the study is based are those collected annually by the New South Wales Bureau of Statistics and Economics. Sheep and cattle numbers on holdings as at March 31st each year have been obtained since 1932. In earlier years, livestock returns were collected as at June 30th.

The collection of livestock numbers at a single date in each year imposes some limitations on the data. For instance, a change from wool to fat lamb production in an area may lead to a reduction in sheep numbers on March 31st without there being any decline in carrying capacity. More commonly, such a change might result in a constant level of sheep numbers at March 31st, obscuring an increase in carrying capacity. Fat lambs, which are usually born in winter or early spring and sold before the following March, do not generally appear in livestock returns, although it is possible to obtain rough estimates of the number of fat lambs raised annually in each shire. A cursory examination of lambing figures suggests that in most shires where some switch from wool to fat lamb production has occurred, this factor would understate "true" sheep numbers by only five per cent. or less.

Another factor which tends to reduce the value of the data as an indication of carrying capacity is the probable decline in the proportion of fine-woolled merinos which may have taken place during the last twenty-five years. A recent C.S.I.R.O. experiment has shown that fine-woolled merinos eat considerably less feed per head than some of the British breeds. The published results disclose that the food eaten by 100 Lincolns would support 110 Corriedales, 140 Polwarths or 151 fine-woolled merinos in fat condition. Despite these two qualifications, it is believed that the figures of change in stock numbers give a reasonably accurate indication of broad changes in carrying capacity in New South Wales.

The smallest area for which long-term series of livestock populations can be obtained in New South Wales is the shire. Some shire boundaries have been changed slightly in recent years, but in most cases comparisons from 1927 onwards are possible. In order to eliminate trends in sheep populations which are the result of change-overs from or to cattle raising, shire totals have been worked out in terms of sheep equivalents, cattle figures being converted on the basis of one beast to eight sheep.

The shires outside the coastal areas have been subdivided into five groups:

Group I.—Shires where the number of sheep equivalents has averaged an increase of more than one per cent. per annum since 1927.

Group II.—Shires where sheep equivalents show a definitely increasing trend, but at a rate of less than one per cent. per annum.

Group III.—Shires with no definite trend.

Group IV.—Shires showing definite decreases averaging less than one per cent. per annum

Group V.—Shires showing declines averaging more than one per cent. per annum.

As a basis for grouping, five-year averages have been used. It has not been possible to make the division into the abovementioned groups completely mechanical. The main reason for this is that seasonal changes lead to large fluctuations in sheep and cattle numbers. The general principle applied was that changes of less than ten per cent. either way between the beginning and the end of the period could be the result of either seasonal conditions or statistical deficiencies. In those cases where there was a reversal in trends, the first and last five-year averages were used for classification. Where a large increase was observed within the first ten years and comparatively small increases afterwards (e.g., in the shire of Snowy River) the shire was placed in Group II and not Group I. It should be stressed, therefore, that the classification of shires as used here is to some extent the result of interpretation and is not wholly objective. Five-year averages for all shires examined are given in Appendix II so as to enable the reader to use different classifications for special purposes.

Almost half the shires fall within Group III, that is, they show no appreciable trend in sheep equivalents. Forty-seven out of a total of ninety-five shires examined show a definite tendency to increase or decline. Of this number, thirteen fall in Group I, eighteen in Group II, thirteen in Group IV, and three in Group V.

Changes in the area sown to wheat might be expected to influence sheep and cattle numbers. However, there is no evidence that changes in wheat acreages have been associated with significant changes in sheep and cattle numbers for the wheat belt as a whole, though there has been some tendency for declining wheat acreages to be associated with increasing stock numbers in the western area of the State (Plains and Riverina Divisions). The decline in sheep equivalents in Boolooroo and the rise in Bland shire is probably to some extent the result of changes in wheat acreages.

Shires with Declining Stock Numbers.

The accompanying map shows the group into which each shire has been placed. On the map, shires are numbered according to the percentage increases which have taken place in the number of sheep equivalents. Thus Shire 1 has shown the largest increase in the last twenty-five years, and Shire 95 the greatest decline.

The greatest concentration of shires with declining livestock populations is to be found in the south-western portion of the Riverina. It includes all shires in the Central Murray region with the exception of Waradgery and Berrigan, and also two shires north and east of the region, namely, Murrumbidgee and Urana. None of the shires fall within the south-west marginal wheat area of the State which is situated in Carathool, Lachlan and Bland shires.

With the exception of parts of the Murray and Urana shires, saltbush steppe is the predominant type of cover in the area. C. S. Christian and C. M. Donald of the C.S.I.R.O. have described the saltbush steppe as follows: "In characteristic form this one carries a treeless, open stand of shrub species of *Atriplex* (saltbush) and *Kochia* (bluebush). They are drought-resistant plants, well regarded as sheep feed. Unfortunately, this steppe has proved susceptible to over-grazing, because of the habit of the plants, their weak regeneration, and the low and erratic rainfall"[1]. While these comments were probably mainly intended to refer to the South Australian saltbush steppe zone which is much more extensive than the New South Wales saltbush steppe zone, they describe the latter equally well. N. C. W. Beadle, who has made a special study of vegetation cover and erosion in western New South Wales, attributes the decline in stock numbers and carrying capacity in this area to decreases in saltbush, increases in copper burr and widespread scalding. These are, of course, the effects of over-stocking in the past. Beadle shows that the decline in stock numbers in this area commenced as early as 1890. He uses as a basis of comparison stock returns to Pastures Protection Districts, the boundaries of which have not changed since 1890.

TABLE I[2].

*Stock Numbers in Three Pastures Protection Districts and Stock Numbers.**

Pastures Protection District.	1890-99.	1931-40.	Percentage Change.
	'000	'000	(Per cent.)
Deniliquin	1,474	971	— 34.1
Hay	1,634	1,313	— 19.6
Moulamein	748	634	— 15.2

*One beast = one horse = ten sheep.

These three Pastures Protection Districts contain the whole of the shires of Waradgery, Wakool, Murray and Windouran, and approximately one-half of Conargo, Murrumbidgee and Carrathool shires.

Annual figures show some differences for the various Pastures Protection Districts. In the case of the Deniliquin Pastures Protection District, the decline seems to have been fairly continuous, subject to seasonal conditions. The seasonal peaks in stock numbers show successive

[1] *The Australian Environment* (Melbourne: Commonwealth Scientific and Industrial Research Organisation, 2nd edition, 1950), p. 113.

[2] *The Vegetation and Pastures of Western New South Wales,* by N. C. W. Beadle, Department of Conservation, Sydney, p. 85, 1948.

declines since 1890 and a ten-year moving average shows a continuous decline. Stock numbers in the Hay Pastures Protection District show a large decline between 1890 and 1902, then a considerable increase until 1934, though not to 1890 levels, followed by further declines from 1934 on. The trend is similar for the Moulamein Pastures Protection District except that the 1934 peak was about fifteen per cent. above the 1890 figure.

During the last five years there has been a considerable increase in the number of sheep equivalents in all shires in this area except Murrumbidgee and Urana. This may be partly due to improved seasonal conditions, but the development of irrigation is probably responsible for the major part of this increase.

In the last fifteen years two irrigation districts—Wakool and Berriquin—have been established in this area. Wakool Irrigation District comprises a large part of Wakool shire and a portion of Murray shire. Water was first distributed to landholders in this district in 1936 and the whole project was completed by 1939. However, landholders in the area were relatively slow to take advantage of their water-rights; irrigation was not very widely practised until after World War II. The development of the Berriquin Irrigation District began in 1939 and was completed in 1945. This district embraces most of Berrigan and parts of Conargo and Jerilderie shires. Stock numbers in Berrigan shire responded immediately to the development of the irrigation district. Until 1939 stock numbers in Berrigan shire followed the same trend as in the other shires in the Central Murray region. They had dropped almost twenty per cent. in fifteen years. Since 1939 stock numbers in Berrigan have increased by 120 per cent.

Outside the main area discussed above, there are isolated shires where sheep and cattle seem to have shown declines. Some of these declines may be attributed to the high density of sheep equivalents per acre in the base period. Jindalee, for instance, carried an average of 168 sheep equivalents per 100 acres during 1927-31; this was about twenty per cent. above the average for this area. By 1947-1951 sheep numbers had fallen by thirteen per cent. and the density per 100 acres had declined to 130.1, which is still a little above the average for this type of country. A similar explanation seems to account for the drop in sheep and cattle numbers in Waugoola.

Shires with Increasing Stock Numbers.

The thick black line embracing most of the Central and Southern Tablelands, the South-West Slopes and parts of the Riverina marks the western and northern climatic boundary for subterranean clover, relying on rainfall. Subterranean clover is also used extensively in the Murrumbidgee Irrigation Area and, in recent years, in the Berriquin and Wakool Irrigation Districts. Of thirty-one shires with increasing livestock populations, twenty-six are wholly or partly within the area suitable for pasture improvement, with subterranean clover as the basic legume. Recent C.S.I.R.O. experiments have shown that subterranean clover can be grown successfully north of the area referred to, but for practical purposes the above line gives the northern boundary of the area in which pasture improvement with subterranean clover has been practised at all extensively.

To ascertain the influence of pasture improvement and other factors on sheep numbers, a multiple regression analysis was used. Area under sown grasses (other than paspalum) and initial stock density were two factors whose effects were examined. This analysis is discussed in Appendix I.

In the Tableland shires within the subterranean clover belt it was found that the two abovementioned factors accounted for approximately sixty per cent. of the changes in sheep equivalents. On the average, an increase of ten acres under sown grasses was associated with an increase of eleven sheep. In the shires within the subterranean clover belt west of the Tablelands, the relation between areas sown to grasses (other than paspalum) and changes in sheep numbers was negative, but statistically not significant. In both cases it was found that the higher the initial stocking rate, the lower the increase (or greater the decrease) in sheep equivalents over the period.

In some of the shires in this area, fat lamb production has increased considerably in the last twenty-five years. Declines in the percentage of merinos in the total number of sheep are a good indication of the increasing importance of fat lamb raising, as the main form of fat lamb production is from crossbred ewes run on improved pasture. Lyndhurst, Canobolas, Oberon, Tumbarumba and Tumut shires have shown substantial declines in the percentage of merinos. Declines in the proportion of merinos in the Tumut and Tumbarumba shires have been due partly to the growth of British breed studs in these shires in the last ten years. In the other shires in this area, merinos have been grazed on pastures which have been sown with subterranean clover and other species.

Increases in stock numbers in some shires outside the subterranean clover belt are due to well-known factors. In the case of Wade and Leeton shires these increases are the result of irrigation which has increased the sheep and cattle population by more than 100 per cent., despite diversion of land to other uses. The increase in Bland shire is the result of a switch away from pure grain farming to mixed farming or simple grazing. Over the last twenty-five years the number of holdings in Bland running sheep has increased by one-fifth, while the wheat acreage has declined by more than 50,000 acres. Increases in sheep equivalents in Coolamon and Narraburra shires may be attributed partly to the spread of skeleton weed.

APPENDIX I.

Statistical Analysis for Subterranean Clover Areas.

x_1 = Percentage of grazing land (i.e., total area of land in rural holding minus land under crop) sown to grasses other than paspalum in 1947. (This percentage does not differ very much from year to year. 1947 was chosen because it is the last year which will exert an influence for the whole five years on 1947-51 stock numbers.)

x_2 = Average number of sheep equivalents (1 beast = 8 sheep) per 100 acres of grazing land a the beginning of the period 1927-31.

y = % change in sheep density 1947/51-1927/31 (i.e., average number of sheep equivalents per 100 acres of grazing land in 1947-51 divided by x_2 minus 100).

The multiple regression analysis was conducted in two parts, one for the Tablelands shires, the other for shires west of the Tablelands, but within the subterranean clover belt. This division was used because the more rugged Tableland areas naturally support less stock per acre than the more gently sloped country further west, so that initial differences in stocking rates in these two areas would reflect permanent differences in carrying capacity while differences within the Tablelands and Western Slopes groups would tend more to reflect accidental or seasonal differences.

TABLELANDS SHIRES.

$y = 72.12 + 4.56x_1 - .876x_2.$
$R_{y \cdot x_1 x_2} = .771$ significant at 1 per cent. level.
$r_{y x_2 \cdot x_1} = -.697$ significant at 1 per cent. level.
$r_{y x_1 \cdot x_2} = .693$ significant at 1 per cent. level.

WESTERN SLOPES AND RIVERINA SHIRES.

$y = 86.22 - 1.46x_1 - .624x_2$
$R_{y \cdot x_1 x_2} = .802$ significant at 1 per cent. level.
$r_{y x_2 \cdot x_1} = -.788$ significant at 1 per cent. level.
$r_{y x_1 \cdot x_2} = -.291$ not significant at 10 per cent. level.

The existence of a negative relation between sown grass and increases in sheep equivalents in this area is not statistically significant. However, a possible explanation for such a relationship can be found. In 1947 (the year to which the figures relate) pasture improvement was the exception rather than the rule on the South-Western Slope and eastern Riverina shires. It is possible that more farmers would adopt pasture improvement practices in shires with declining livestock populations than in shires where sheep and cattle numbers had been stationary or expanding. This might account for the negative relationship.