A Soil, Land-Use, and Erosion Survey of Parts of the Counties of Moira and Delatite, Victoria*

I. INTRODUCTION

> NOTE.-The investigations described in this Bulletin were undertaken by the Division of Soils at the request of the Soil Conservation Board of Victoria, which was desirous of obtaining information concerning the nature and distribution of soil erosion and its relation to soil type and land use in a representative section of north-eastern Victoria.

The purpose of these investigations has been to provide the soil conservation worker with certain basic information, which will enable him to study more efficiently the land use and farming methods in relation to erosion on individual farms. Consequently this Bulletin consists of a study of the soils, the nature and extent of soil erosion, the distribution of the catchment areas, an analysis of the climatic data, and a general outline of the present forms of agriculture. In fact the investigation provides the basis for stating and classifying the problems confronting the soil conservationist and the soil map provides the means of correlating his experiences in different parts of the area.

The total area covered by the survey was 650 square miles and included sixteen parishes, of which the four parishes of Dookie, Currawa, Gowangardie, and Caniambo amounting to 180 square miles were studied in detail. Larger areas would have been studied, but drought conditions during 1944-45 retarded work to such an extent that the size of the original project had to be reduced.

The locality plan (Fig. 1) shows the geographical position of the area surveyed in relation to the towns of Shepparton, Benalla, and Euroa and certain nearby districts-Shepparton Irrigation Area (Skene and Freedman 1944) and the Murray Valley Irrigation Area (Butler *et. al*. 1942)-whose soils have been surveyed and the relevant soil maps published. Within the area there is an interesting variety of soils, climate, topography, and agriculture. The soils range from red-brown earths in the north to podsolized soils in the south; the average annual rainfall varies from 18 to 30 inches and the elevation above sea level from 450 to 1,800 feet. The forms of agriculture include sheep grazing, wheat-growing, fat lamb raising, dairying, and horticulture. In fact the area is a good representative sample of the north-eastern part of Victoria and provides all the possible conditions for soil erosion which could be expected to occur in that part of the State.

II. CLIMATE†

The climate of the area has been studied in detail because such detail has been considered necessary for an investigation of erosion and land use. Furthermore, in the development of an adequate plan of soil conservation it is essential to know not only the main features of the climate, but also the details concerning variability and the times of the year when certain kinds of weather conducive to erosion can be expected. Consequently the objective has been to define as well as possible the main climatic factors of rainfall, temperature, and evaporation, and their possible variations from season to season, and also the probability of the occurrence of extreme conditions which may influence land use or cause damage by soil erosion.

The area surveyed lies between the latitudes of 36^0 15' and 36^0 45' S., and has, in common with most of south-eastern Australia inland from the main mountain range, a warm temperate climate with a maximum rainfall during the winter months. The summer is usually hot and dry, but each month has an average rainfall of more than 1 inch, owing to the occurrence in summer of heavy irregular rains of tropical origin. Rainfall is greater, more reliable, and less intense during the winter months, which constitute the effective rainfall period for agricultural purposes. The average annual rainfall varies from 18 inches in the north-western part of the area to 30 inches in the south-east.

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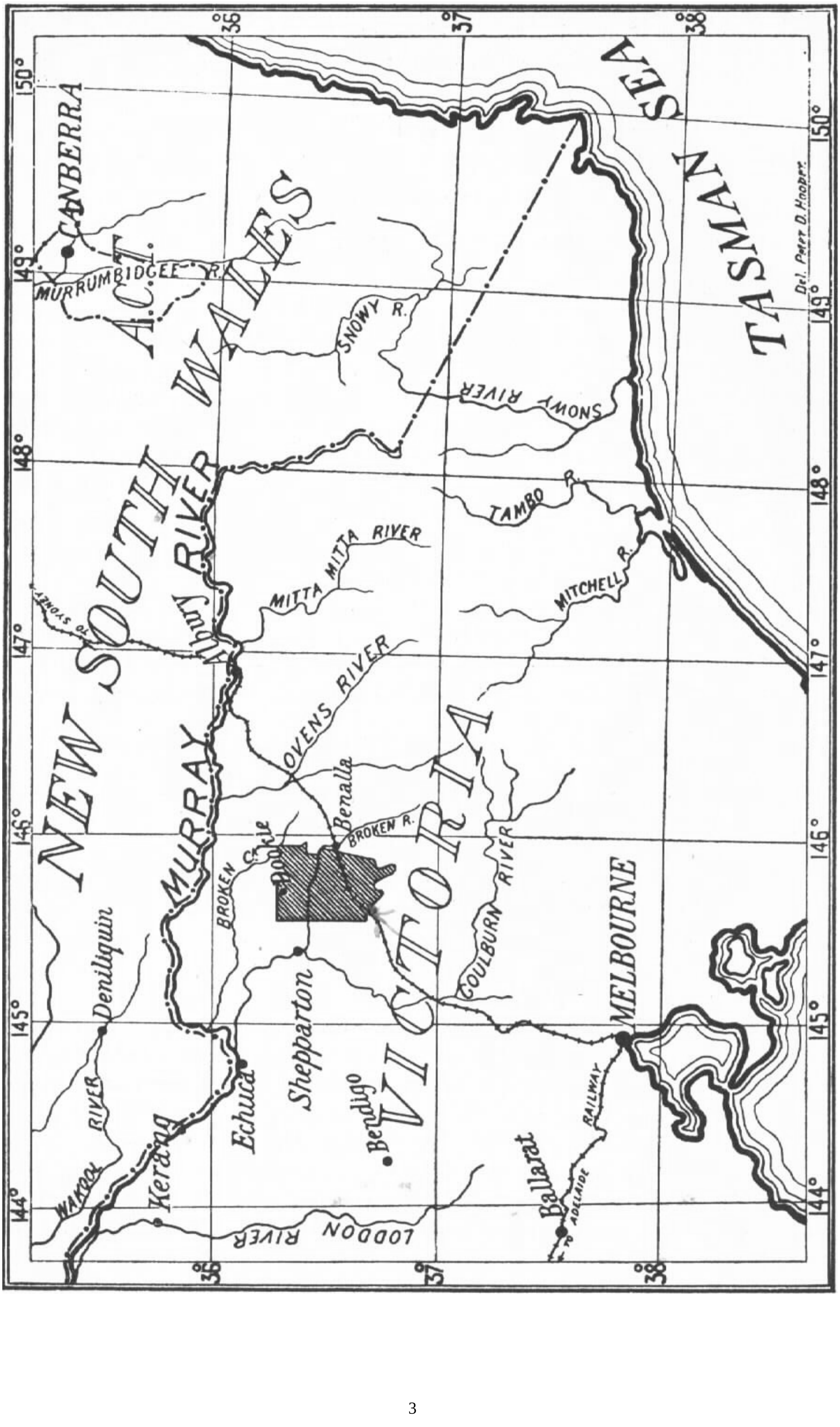
* Typescript received April 12, 1948

† Data used in this chapter were compiled from the records of the Commonwealth Meteorological Bureau

Fig 1 - Locality Plan

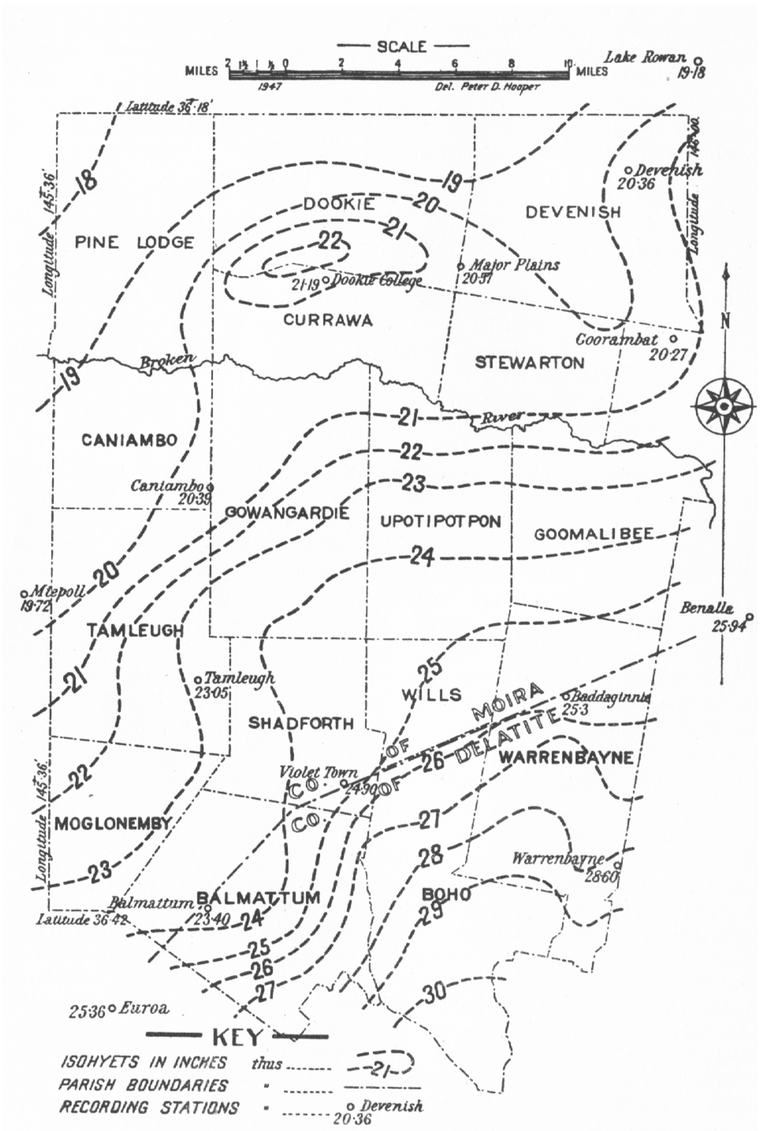


The average difference between summer and winter temperatures is only 26^0F, the average temperature of the hottest month being 72^0F, and that of the coldest month 46^0F. Maximum temperature during the summer can be high and there are usually several recordings over 100^oF each year, and in the winter frosts occur frequently. The summer climate is dominated by the sub-tropical high pressure belt, but there are frequent low pressure intrusions from the tropical regions. These tropical masses of warm, moist air often produce irregular heavy summer rains accompanied by thunder, local conditions providing convectional disturbance and cooling of the air mass necessary for precipitation. Occasionally these air masses produce steady widespread summer rain in south-eastern Australia. The winter rain is due to the normal west to east movement of moist air masses, which follow a path across southern Australia during that time of the year.

1. Rainfall

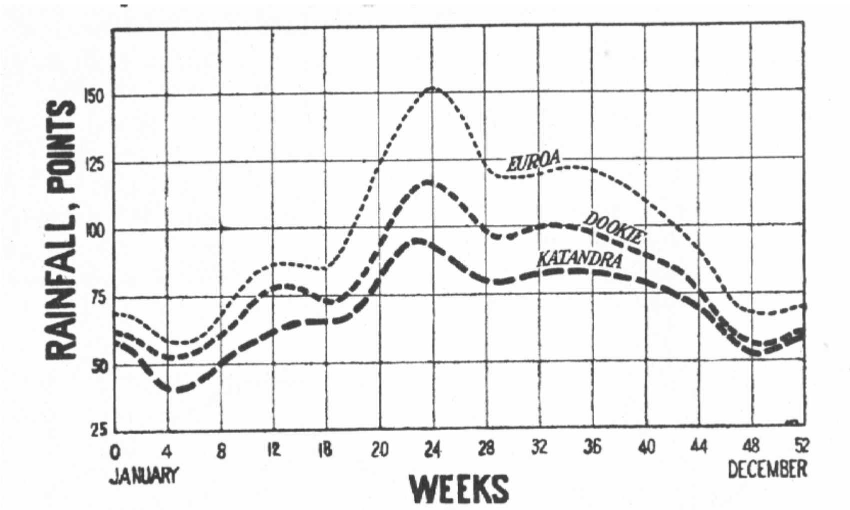
A map of the area showing the annual average isohyets (Fig. 2) has been compiled-from available data given for fifteen recording stations, together with private records from some of the landholders. The increase of rainfall from north-west to south-east is due to topographic variation, for the hills in the south-eastern part of the area are the foothills of the main dividing range which has a big effect on the climate of south-eastern Australia. Other minor topographic variations in the area have less effect. The central hills running from east to west through the parishes of Goomalibee, Upotipotpon, and Gowangardie have caused an extension westward of the 23 and 24 inch isohyets, while the hills in the vicinity of Dookie have caused a small local area of higher rainfall, particularly on the southern slopes.

Fig 2 - Rainfall map for part of Counties Moira and Delatite



The average distribution. of the rainfall throughout the year is shown by the curves for Katandra (18 in.), Dookie College (21 in.), and Euroa (25 in.) in Fig. 3, and although there are big differences between the average rainfall at these places, there is a distinct similarity in its seasonal distribution.

Fig 3 - Rainfall curves for Katandra, Dookie and Euroa

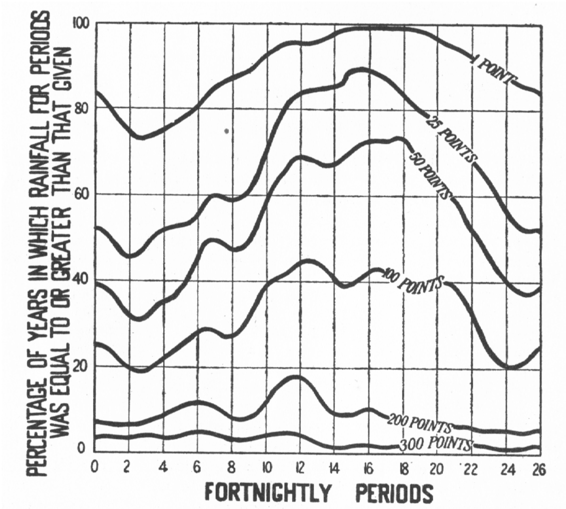


Dookie College is the only meteorological station within the area studied, and consequently its records have been used for detailed analysis of rainfall and temperature. At the end of 1944 there were rainfall records for 63 years and from them the average annual rainfall was found to be 21.19 inches. The distribution throughout the year is shown by the curve for the station in Fig. 3. There are four peaks occurring at periods 1, 7, 12, and 17 respectively, of which those occurring at 12 and 17 are known to be characteristic of the rainfall distribution for stations of similar latitude in south-eastern Australia. The other two are not so marked and. have shown up as a result of treating the rainfall figures on a two-weekly basis instead of in months. Their occurrence at times of the year when soil conditions are most conducive to erosion makes them important.

Period 1 Jan 1 - 14	Period 10 May 7 - 20	Period 19 Sept 10 - 23
Period 2 Jan 15 - 28	Period 11 May 21 - June 3	Period 20 Sept 24 - Oct 7
Period 3 Jan 29 - Feb 11	Period 12 June 4 - 17	Period 21 Oct 8 - 21
Period 4 Feb 12 - 25	Period 13 June 18 - July 1	Period 22 Oct 22 - Nov 4
Period 5 Feb 26 - Mar 11	Period 14 July 2 - 15	Period 23 Nov 5 - 18
Period 6 Mar 12 - 25	Period 15 July 16 - 29	Period 24 Nov 19 - Dec 2
Period 7 Mar 26 - Apr 8	Period 16 July 30 - Aug 12	Period 25 Dec 3 - 16
Period 8 Apr 9 - 22	Period 17 Aug 13 - 26	Period 26 Dec 17 - 31
Period 9 Apr 23 - May 6	Period 18 Aug 27 - Sept 9	

Annual rainfall and its average distribution through the year are useful for a general assessment of the climate, but for a more complete knowledge of the possible seasonal conditions which can occur, some indication of the rainfall reliability is necessary. The frequency distribution of total rainfall for each two-week period over the period of 63 years has enabled the compilation of Figure 4, which shows the percentage of years when the rainfall in each period has equalled or exceeded the figure given for each curve. For example, during period 2 (Jan. 15-28) it can be expected that the total rainfall will equal or exceed 1 point in 74 per cent of years, 25 points in 46 per cent, 50 points in 31 per cent, 100 points in 19 per cent, and 200 points in 6 per cent of years. These curves indicate the greater reliability of the winter rains in comparison with the summer rains for amounts of up to 100 points, but for the 100-point, and more particularly the 200-point and 300-point curves, there is an indication that the chances of such amounts are becoming more nearly equal throughout the year.

Fig 4 - Percentage of years in which rainfall in each two-week period equals or exceeds specified amounts (Dookie College).



The above analysis demonstrates the nature of the summer rain which does not occur in small amounts as frequently or as reliably as the winter rain, but rather in irregularly distributed large amounts. Even the 200-point curve shows that there is a greater chance of such rain during the late autumn and early winter (periods 6-7 and 10-13), and this is important in its possible effect on erosion. Another indication of the essential difference between the summer and winter rainfall is given by the figures under the heading "probability of zero rain" in Table 1, which show the chances of dry days occurring in each period of the year. Periods 2 and 3 are the driest for the year, the probability being 0.86 and 0.88 respectively, and this means that 86 and 88 days respectively out of every 100 days of these periods are dry or that 2 days of the fortnight in any one year can be expected to be wet (1 point of rain or more). This should be compared with period 13, having a probability of 0 - 6, or 5 wet days of that fortnight each year.

Table 1 - Probabilities of daily rainfalls in excess of indicated amounts (points) for each two-week period

Period	Probability of Zero Rain	1/5	1/10	1/20	1/50	1/100
1	0.84		8	26	70	125
2	0.86		5	18	51	90
3	0.88		3	16	47	86
4	0.86		7	24	63	108
5	0.85		7	24	66	115
6	0.83		8	24	61	107
7	0.80		15	40	95	159
8	0.79		13	30	66	107
9	0.79		10	24	55	89
10	0.72	5	18	39	82	133
11	0.68	7	21	43	84	130
12	0.61	10	23	42	79	119
13	0.58	11	26	47	88	131
14	0.63	7	19	35	66	109
15	0.60	8	18	32	59	88
16	0.56	10	23	41	75	110
17	0.62	8	19	33	60	89
18	0.59	10	22	40	75	113
19	0.65	7	17	32	62	95
20	0.70	6	18	37	76	118
21	0.71	6	19	39	79	123