SECTION III.

PHYSIOGRAPHY.

§ 1. General Description of Australia.

1. **Geographical Position.**—The Australian Commonwealth, which includes the island continent of Australia proper and the island of Tasmania, is situated in the Southern Hemisphere, and comprises in all an area of about 2,974,581 square miles, the mainland alone containing about 2,948,366 square miles. Bounded on the west and east by the Indian and Pacific Oceans respectively, it lies between longitudes 113° 9′ E. and 153° 39′ E., while its northern and southern limits are the parallels of latitude 10° 41′ S. and 39° 8′ S., or, including Tasmania, 43° 39′ S. On its north are the Timor and Arafura Seas and Torres Strait, on its south the Southern Ocean and Bass Strait.[1]

Tropical and Temperate Regions. Of the total area of Australia the lesser portion lies within the tropics. Assuming, as is usual, that the latitude of the Tropic of Capricorn is 23° 30′ S.[2], the areas within the tropical and temperate zones are approximately as follows :—

AREAS OF TROPICAL AND TEMPERATE REGIONS

OF STATES WITHIN TROPICS.

Areas.	Queensland.	Western Australia.	Northern Territory.	Total.
	Sq. miles.	Sq. miles.	Sq. miles.	Sq. miles.
Within Tropical Zone	359,000	364,000	426,320	1,149,320
Within Temperate Zone	311,500	611,920	97,300	1,020,720
Ratio of Tropical part to whole State ...	0.535	0.373	0.814	0.530
Ratio of Temperate part to whole State ...	0.465	0.627	0.186	0.470

Thus the tropical part is roughly about one-half (0.530) of the three territories mentioned above, or about five-thirteenths of the whole Commonwealth (0.386). See hereafter Meteorology 3.

2. **Area of Australia compared with that of other Countries.**—That the area of Australia is greater than that of the United States of America, that it is four-fifths of that of Canada, that it is nearly one-fourth of the area of the whole of the British Empire, that it is nearly three-fourths of the whole area of Europe, that it is more than 25 times as large as any one of the following, viz., the United Kingdom, Hungary, Italy, the Transvaal, and Ecuador, are facts which are not always adequately realised. It is this great size, taken together with the fact of the limited population, that gives to the problems of Australian development their unique character, and its clear comprehension is essential in any attempt to understand those problems.

1. The extreme points are "Steep Point" on the west, "Cape Byron" on the east, "Cape York" on the north, "Wilson's Promontory" on the south, or, if Tasmania be included, "South East Cape." The limits, according to the 1903-4 edition of "A Statistical Account of Australia and New Zealand," p. 2, and, according to Volume XXV. of the "Encyclopædia Britannica," tenth edition, p. 787, are respectively 113° 5′ E., 153° 16′ E., 10° 39′ S., and 39° 11½′ S., but these figures are obviously defective. A similar inaccuracy appears in the XI. edition of the Encyclopædia.

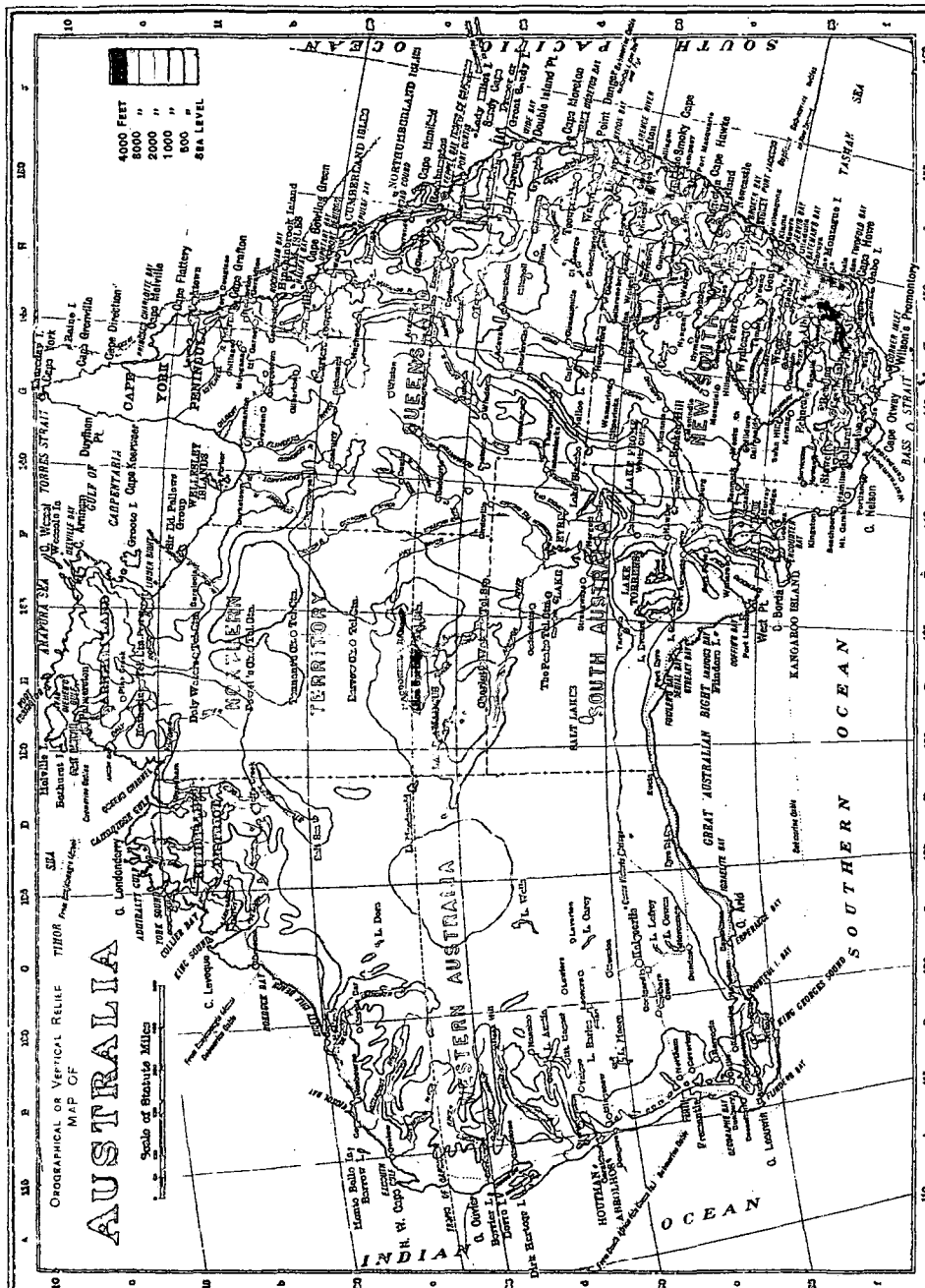
2. Its correct value for 1916 is 23° 27′ 0″.76, and it decreases about 0″.47 per annum.

The relative magnitudes may be appreciated by a reference to the following table, which shews how large Australia is compared with the countries referred to, or *vice versa*. Thus, to take line 1, we see that Europe is about $1\frac{3}{10}$ times (1.29549) as large as Australia, or that Australia is about three-quarters (more accurately 0.77) of the area of Europe.

SIZE OF AUSTRALIA IN COMPARISON WITH THAT OF OTHER COUNTRIES.

Commonwealth of Australia ... 2,974,581 square miles.

Country.	Area.	Australian Commonw'lth in comparison with—	In comparison with Australian C'wealth.
Continents—	Sq. miles.		
Europe	3,853,547	0.77	1.29549
Asia	16,820,644	0.18	5.65479
Africa	12,115,568	0.25	4.70303
North and Central America and West Indies ...	8,560,254	0.35	2.87780
South America	7,448,953	0.40	2.50420
Australasia and Polynesia	3,462,554	0.86	1.16505
Total, exclusive of Arctic and Antarctic Conts.	52,261,520	0.06	17.56937
Europe—			
Russia (inclusive of Poland, Ciscaucasia & Finland)	2,122,998	1.40	0.71371
Austria-Hungary (incl. of Bosnia & Herzegovina)	261,259	11.39	0.08763
Germany	208,780	14.25	0.07018
France	207,054	14.37	0.06969
Spain	194,778	15.27	0.06548
Sweden	172,963	17.20	0.05814
Norway	124,643	23.86	0.04190
United Kingdom	121,633	24.45	0.04089
Italy	110,632	26.89	0.03719
Denmark (inclusive of Iceland)	55,338	53.73	0.01861
Rumania	53,489	55.61	0.01798
Greece	41,933	70.94	0.01409
Bulgaria	39,529	68.65	0.01329
Portugal	35,490	83.82	0.01193
Servia	33,891	87.76	0.01139
Switzerland	15,976	186.22	0.00537
Netherlands	12,582	236.42	0.00423
Belgium	11,373	261.78	0.00382
Albania	11,317	262.84	0.00380
Turkey	10,882	273.34	0.00366
Montenegro	5,603	530.88	0.00188
Luxemburg	998	2941.18	0.00034
Andorra	175	16997.61	0.00006
Malta	118	25423.76	0.00004
Liechtenstein	65	45793.55	0.00002
San Marino	38	78278.45	0.00001
Monaco	8	371822.63	...
Gibraltar	2	1487290.50	...
Total, Europe	3,853,547	0.77	1.29549
Asia—			
Russia (inclus. of Transcaucasia, Siberia, Steppes, Transcaspia, Turkestan and inland waters) ...	6,641,587	0.45	2.23278
China and Dependencies...	3,913,560	0.76	1.31567
British India...	1,093,074	2.72	0.36747
Independent Arabia	966,700	3.08	0.32499
Feudatory Indian States...	709,555	4.19	0.23854
Turkey (including Samos)	699,522	4.25	0.23516
Persia	628,000	4.74	0.21112
Dutch East Indies	584,611	5.09	0.19654
Japan (and Dependencies)	263,084	11.31	0.08844



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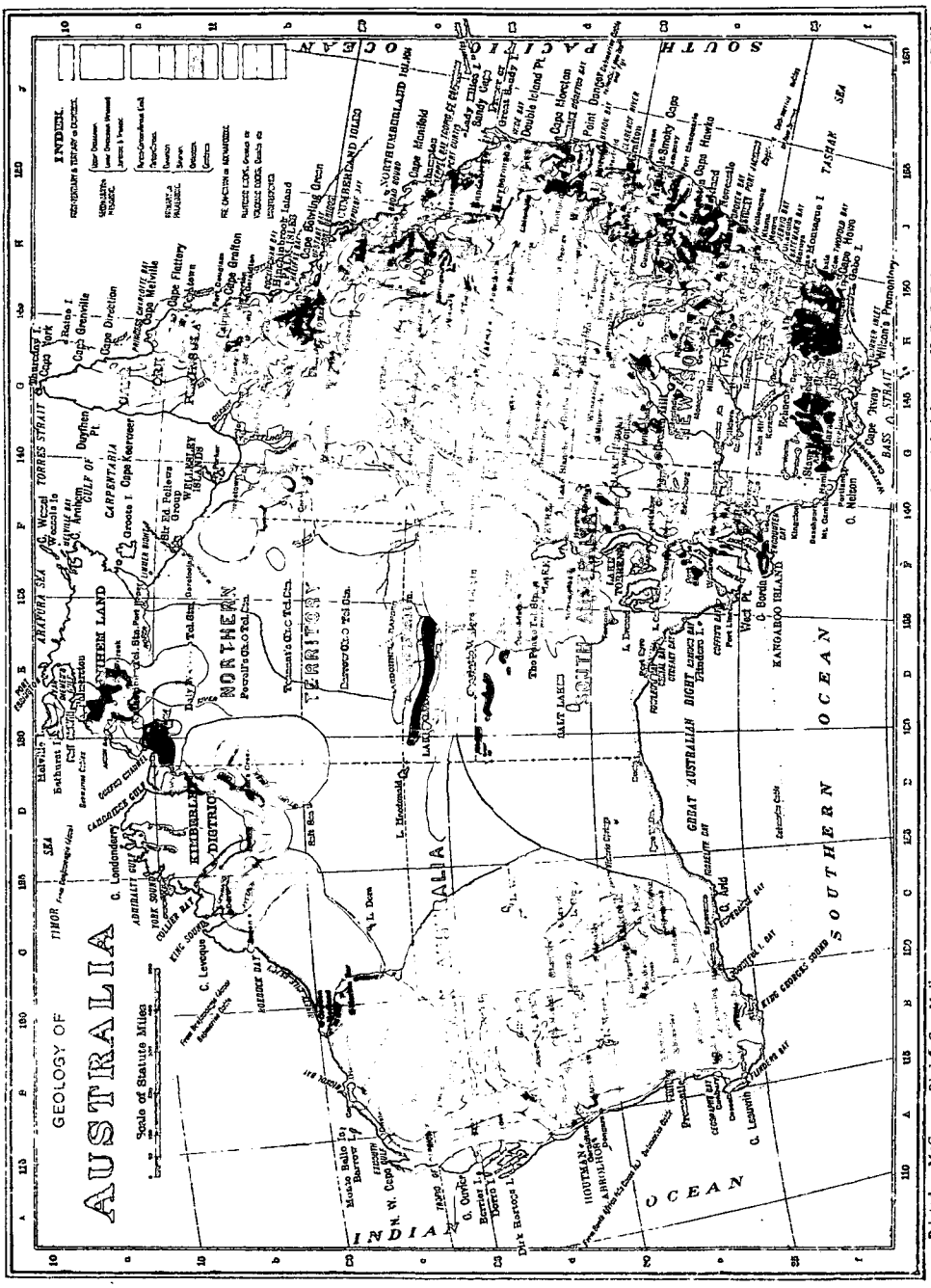

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Country.	Area.	Australian Commonwe'lth in comparison with—	In comparison with Australian C'wealth.
ASIA (continued)—	Sq. Miles.		
Afghanistan	250,000	11.90	0.08405
Siam	195,000	15.25	0.06555
Philippine Islands (inclusive of Sulu Archipelago)	120,000	23.60	0.04236
Laos	111,940	26.57	0.03763
Bokhara	83,000	35.83	0.02790
Omán	82,000	36.27	0.02757
British Borneo and Sarawak	73,106	40.68	0.02457
Cambodia	67,724	43.92	0.02277
Annam	61,718	48.20	0.02075
Nepál	54,000	55.10	0.01815
Tonking	46,223	64.35	0.01554
Federated Malay States	27,506	108.14	0.00925
Ceylon	25,332	117.42	0.00852
Malay Protectorate	24,600	120.91	0.00827
Khiva	24,000	123.94	0.00807
Cochin China	21,988	135.28	0.00739
Bhután	20,000	148.73	0.00672
Aden and Dependencies	9,005	330.32	0.00303
Timor, etc. (Portuguese Indian Archipelago)	7,330	406.50	0.00246
Brunei	4,000	743.64	0.00134
Cyprus	3,584	833.33	0.00120
Kiauchau (Neutral Zone)	2,500	1189.83	0.00084
Goa, Damaõ, and Diu	1,638	1818.18	0.00055
Straits Settlements	1,600	1851.85	0.00054
Sokotra and Kuria Muria Islands	1,382	2152.22	0.00046
Hong Kong and Dependencies	405	7344.64	0.00013
Kwang Chan Wan	386	7706.17	0.00013
Wei-hai-wei	285	10623.50	0.00009
Bahrein Islands	250	11898.32	0.00008
Kiauchau (German)	200	14872.90	0.00007
French India (Pondicherry, etc.)	198	15023.14	0.00007
Labuan	29	102571.76	0.00001
Italian Concession, Tientsin	18	165254.50	0.00001
Macao, etc.	4	743643.25	...
Total, Asia	16,820,644	0.18	5.65479
Africa—			
French Sahara	1,544,000	1.93	0.51907
French Equatorial Africa	1,003,600	2.96	0.33739
Soudan	984,520	3.02	0.33098
Belgian Congo	909,654	3.27	0.30582
French Military District of the Niger	534,124	5.57	0.17956
Angola	484,800	6.14	0.16298
Union of South Africa	473,100	6.28	0.15905
Rhodesia	438,575	6.78	0.14744
Tripoli and Benghezi	406,000	7.33	0.13649
German East Africa	384,180	7.74	0.12915
Abyssinia	350,000	8.50	0.11766
Egypt	350,000	8.50	0.11766
Mauretania	344,967	8.62	0.11597
Algeria (including Algerian Sahara)	343,500	8.66	0.11548
Nigeria and Protectorate	336,000	8.85	0.11296
German South-west Africa	322,450	9.23	0.10840
Senegambia and Niger	302,136	9.84	0.10157
Portuguese East Africa	293,400	10.14	0.09864
Bechuanaland Protectorate	275,000	10.82	0.09245
British East Africa Protectorate	246,822	12.05	0.08298
Madagascar	226,016	13.16	0.07598
Morocco	219,000	13.58	0.07362
Kamerun	191,130	15.56	0.06425

Country.	Area.	Australian Commonw'lth in comparison with—	In comparison with Australian C'wealth.
AFRICA (continued)—	Sq. miles.		
Italian Somaliland	139,430	21.34	0.04687
Ivory Coast	125,538	23.69	0.04220
Uganda Protectorate	121,437	24.49	0.04082
French Guinea	92,249	32.25	0.03101
Gold Coast Protectorate (with North. Territories)	80,000	37.18	0.02689
Senegal	73,973	40.21	0.02487
Rio de Oro, etc.	73,000	40.75	0.02454
British Somaliland	68,000	43.74	0.02286
Tunis	50,000	59.49	0.01681
French Somali Coast	46,320	64.21	0.01557
Eritrea	45,800	64.95	0.01540
Liberia	40,000	74.36	0.01345
Nyassaland Protectorate	39,315	75.66	0.01322
Dahomey	37,527	79.26	0.01261
Togoland	33,700	88.26	0.01133
Sierra Leone and Protectorate	31,000	95.95	0.01042
Portuguese Guinea	13,940	213.22	0.00469
Spanish Guinea (Rio Muni, etc.)	12,000	247.88	0.00403
Basutoland	11,716	253.89	0.00393
Swaziland	6,536	455.10	0.00219
Gambia and Protectorate	4,504	660.43	0.00151
Cape Verde Islands	1,480	2000.00	0.00050
Zanzibar	1,020	2941.18	0.00034
Réunion	965	3082.47	0.00032
Fernando Po, etc.	814	3654.28	0.00027
Mauritius and Dependencies	809	3676.86	0.00027
Comoro Islands	694	4286.14	0.00023
St. Thomas and Prince Islands	360	8262.73	0.00012
Seychelles	156	19067.82	0.00005
Mayotte, etc.	143	20801.27	0.00005
Spanish North and West Africa	87	34190.59	0.00003
St. Helena	47	63288.95	0.00002
Ascension	34	87487.65	0.00001
Total, Africa	12,115,568	0.25	4.07303
North and Central America and West Indies—			
Canada	3,729,665	0.80	1.25385
United States (exclusive of Alaska, etc.)	2,973,890	1.00	0.99976
Mexico	785,881	3.78	0.26420
Alaska	590,884	5.03	0.19864
Newfoundland and Labrador	162,734	18.28	0.05471
Nicaragua	49,200	60.46	0.01654
Guatemala	48,290	61.61	0.01623
*Greenland	46,740	63.65	0.01571
Honduras	44,275	67.18	0.01488
Cuba	44,164	67.35	0.01484
Costa Rica	23,000	129.32	0.00773
San Domingo	18,045	164.74	0.00607
Haiti	10,204	291.55	0.00343
British Honduras	8,598	345.96	0.00289
Salvador	7,225	411.52	0.00243
Bahamas	4,404	675.43	0.00148
Jamaica	4,207	707.05	0.00141
Porto Rico	3,606	824.90	0.00121
Trinidad and Tobago	1,868	1592.39	0.00063
Leeward Islands	715	4160.25	0.00024
Guadeloupe and Dependencies	687	4329.81	0.00023
Windward Islands	517	5753.54	0.00017

* Danish colony only. Total area has been estimated as between 827,000 and 850,000 square miles.

Country.	Area.	Australian Commonwe'lth in comparison with—	*In comparison with Australian C'wealth.*
N. & C. AMERICA & W. INDIES (continued)—	Sq. miles.		
Curaçao and Dependencies	403	7381.09	0.00014
Martinique	381	7807.30	0.00013
Turks and Caicos Islands	166	1792.18	0.00005
Barbados	166	17925.18	0.00005
Danish West Indies	138	21554.94	0.00005
St. Pierre and Miquelon	93	31984.74	0.00003
Cayman Islands	89	33422.26	0.00003
Bermudas	19	156556.89	...
Total, N. and C. America and W. Indies ...	8,560,254	0.35	2.87780
South America—			
Brazil (inclusive of Acré)...	3,364,564	0.88	1.13110
Argentine Republic	1,153,119	2.58	0.38766
Peru	722,461	4.12	0.24288
Bolivia	514,155	5.79	0.17285
Colombia (exclusive of Panama)	440,846	6.75	0.14820
Venezuela	398,594	7.46	0.13400
Chile	292,580	10.17	0.09836
Paraguay	165,000	18.03	0.05546
Ecuador	116,000	25.64	0.03900
British Guiana	89,480	33.24	0.03008
Uruguay	72,153	41.22	0.02426
Dutch Guiana	46,060	64.60	0.01548
French Guiana	34,061	87.33	0.01145
Panamá	32,380	91.86	0.01088
Falkland Islands	6,500	456.62	0.00219
South Georgia	1,000	2974.58	0.00034
Total, South America	7,448,953	0.40	2.50420
Australasia and Polynesia—			
Commonwealth of Australia	2,974,581	1.00	1.00000
Dutch New Guinea	151,789	19.60	0.05103
New Zealand and Dependencies	104,751	28.39	0.03522
Papua	90,540	32.85	0.03044
Kaiser Wilhelm Land	70,000	42.50	0.02353
Bismarck Archipelago	20,000	148.73	0.00672
British Solomon Islands	14,800	204.36	0.00497
New Caledonia and Dependencies	8,548	347.99	0.00287
Fiji	7,435	400.08	0.00250
Hawaii	6,449	460.83	0.00217
German Solomon Islands, etc.	5,160	576.46	0.00173
New Hebrides	5,100	583.25	0.00171
French Establishments in Oceania	1,520	1960.78	0.00051
German Samoa	1,000	2974.58	0.00034
Tonga	390	7627.13	0.00013
Guam	213	13965.17	0.00007
Gilbert Islands	166	17919.16	0.00006
Samoa (U.S.A. part)	102	29162.56	0.00003
Norfolk Island	10	297458.10	...
Total, Australasia and Polynesia ...	3,462,554	0.86	1.16505
British Empire...	12,857,334	0.23	4.32240

3. Relative Size of Political Subdivisions.—As already stated, Australia consists of six States and the Northern and Federal Territories. The areas of these, in relation to one another and to the total of Australia, are shewn in the following table :—

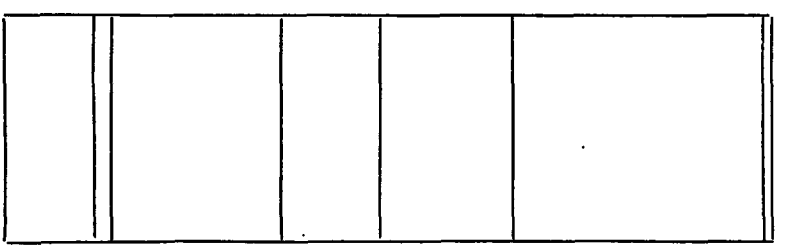
RELATIVE SIZE OF STATES AND COMMONWEALTH.

State.	Area.	Ratio which the Area of each State and Territory bears to that of other States, Territories and Commonwealth.							
		N.S.W.	Vic.	Q'land.	S.A.	W.A.	Tas.	N. Ter.	C'wlth.
	Sq. miles.								
New South Wales	309,460	1.000	3.522	0.462	0.814	0.317	11.806	0.591	0.104
Victoria ...	87,884	0.284	1.000	0.131	0.231	0.090	3.352	0.168	0.030
Queensland ...	670,500	2.166	7.629	1.000	1.764	0.687	25.577	1.280	0.225
South Australia	380,070	1.228	4.325	0.567	1.000	0.389	14.498	0.726	0.128
West. Australia	975,920	3.153	11.105	1.455	2.568	1.000	37.228	1.864	0.328
Tasmania ...	26,215	0.085	0.298	0.039	0.069	0.027	1.000	0.050	0.009
North. Territory	523,620	1.691	5.958	0.781	1.378	0.537	19.974	1.000	0.176
Federal Territory	912	0.003	0.010	0.001	0.003	0.001	0.034	0.002	0.000[1]
Commonwealth	2,974,581	9.610	33.847	4.436	7.827	3.048	113.469	5.681	1.000

1. The correct decimal is 0.0003.

Thus, looking at the top line, New South Wales is seen to be over three-and-a-half times as large as Victoria (3.522) and less than one-half the size of Queensland (0.462); or again, looking at the bottom line, the Commonwealth is shewn to be more than nine-and-a-half times as large as New South Wales (9.610), and nearly thirty-four times as large as Victoria (33.847).

These relative magnitudes are shewn in the small diagram below. It may be added that Papua (or British New Guinea), with its area of 90,540 square miles, is 0.030 of the area of the Commonwealth. The comparatively small size of the Federal Territory prevents its being shewn in this diagram.



	N.S.W.	V.	Qld.	S.A.	N.T.	W.A.	Tas.
% of total	10	3	22	13	18	33	1

4. Coastal Configuration.—There are no striking features in the configuration of the coast; the most remarkable indentations are the Gulf of Carpentaria on the north and the Great Australian Bight on the south. The York Peninsula on the extreme north is the only other remarkable feature in the outline. In Year Book No. 1, an enumeration of the features of the coast-line of Australia was given (see pp. 60 to 68).

(i.) *Coast-line.* The lengths of coast-line, exclusive of minor indentations, both each State and of the whole continent, are shewn in the following table:—

SQUARE MILES OF TERRITORY PER MILE OF COAST LINE.

STATES AND CONTINENT.

State.	Coast-line.	Area ÷ Coast-line.	State.	Coast-line.	Area ÷ Coast-line.
	Miles.	Sq. miles.		Miles.	Sq. miles.
New South Wales[1]	700	443	South Australia ...	1,540	247
Victoria	680	129	Western Australia	4,350	224
Queensland ...	3,000	223	Continent[2] ...	11,310	261
Northern Territory	1,040	503	Tasmania ...	900	29

1. Including Federal Territory. 2. Area 2,948,366 square miles.

For the entire Commonwealth this gives a coast-line of 12,210 miles, and an average of 244 square miles for one mile of coast line. According to Strelbitski, Europe has only 75 square miles of area to each mile of coast line, and, according to recent figures, England and Wales have only one-third of this, viz., 25 square miles.

(ii.) *Historical Significance of Coastal Names.* It is interesting to trace the voyages of some of the early navigators by the names bestowed by them on various coastal features—thus Dutch names are found on various points of the Western Australian coast, in Nuyt's Archipelago, in the Northern Territory and in the Gulf of Carpentaria; Captain Cook can be followed along the coasts of New South Wales and Queensland; Flinders' track is easily recognised from Sydney southwards, as far as Cape Catastrophe, by the numerous Lincolnshire names bestowed by him; and the French navigators of the end of the eighteenth and the beginning of the nineteenth century have left their names all along the Western Australian, South Australian, and Tasmanian coasts.

5. **Geographical Features of Australia.**—In each preceding issue of this Year Book, fairly complete information has been given concerning some special geographical element. Thus No. 1 Year Book, pp. 60-68, contains an enumeration of Coastal features. No, 2, pp. 66-67, deals with Hydrology, No. 3, pp. 59-72, with Orography, No. 4, pp. 59-82, with the Lakes of Australia, No. 5, pp. 51-80, with the Islands of Australia, No. 6, pp. 55-66, with the Mineral Springs of Australia, and No. 7, pp. 56-58, with the Salient Features in the Geological History of Australia, with special reference to changes of climate. This practically completes the description of the ordinary physical features. An orographical or vertical relief map of Australia will be found on p. 49.

§ 2. The Fauna of Australia.

An authoritative article describing in some detail the principal features of the Fauna of Australia was given in Year Books No. 1 (see pp. 103 to 109) and No. 2 (see pp. 111 to 117), while a synoptical statement appeared in No. 3 (see pp. 73 to 76). Considerations of space will, however, preclude the inclusion in this issue of more than a passing reference to the subject.

§ 3. The Flora of Australia.

In Year Books No. 1 (see pp. 109 to 114) and No. 2 (see pp. 117 to 122) a fairly complete though brief account was given of the Flora of Australia, and in Year Book No. 3 similar information in a greatly condensed form will be found on pp. 76 to 78. Space in this issue will not permit of more than a mere reference to preceding volumes.

A special article dealing with Australian fodder plants, contributed by J. H. Maiden, Esq., F.L.S., Government Botanist of New South Wales, and Director of the Botanic Gardens, Sydney, appeared in Official Year Book No. VI., pp. 1190-6. In § 7 will be found a special article on the grasses and saltbushes of Australia, contributed by E. Breakwell, B.A., B.Sc., Agrostologist at the Botanic Gardens, Sydney.

§ 4. Seismology in Australia.

A brief statement regarding the position of seismology and seismological record in Australia appears in Year Book No. 4, pp. 82 and 83.

Barisàl Guns. Reference may be made here to an interesting pamphlet published by Dr. J. Burton Cleland, in which the author sums up the available information regarding the peculiar explosive or booming noises heard at times in Australia as well as in other parts of the world. As far as inland Australia, at all events, is concerned, it seems clear that the explosions are of earth origin, and are probably due to the sudden sundering of immense rock masses, either as a result of climatic influences, or through folding movements in the earth's crust.

§ 5. The Geology of Australia.

1. **General.**—Independent and authoritative sketches of the geology of each State were given in Year Books No. 1 (see pp. 73 to 103) and No. 2 (see pp. 78 to 111). Want of space has precluded the insertion of these sketches in the present issue of the Year Book, and it has not been considered possible to give anything like a sufficient account of the geology of Australia by presenting here a mere condensation of these sketches. Reference must, therefore, be made to either Year Book No. 1 or No. 2, *ut supra*.

2. **Geological Map of Australia.**—The map of the Geology of Australia on page 50, shews the geographical distribution of the more important geological systems and formations.

§ 6. Climate and Meteorology of Australia.[1]

1. **Introductory.**—In preceding Year Books some account was given of the history of Australian meteorology, including reference to the development of magnetic observations and the equipment for the determination of various climatological records. (See Year Book No. 3, pp. 79, 80.) In Year Book No. 4, pp. 84 and 87, will be found a short sketch of the creation and organisation of the Commonwealth Bureau of Meteorology and a resumé of the subjects dealt with at the Meteorological Conference of 1907. Space will not permit of the inclusion of this matter in the present issue.

2. **Meteorological Publications.**—The following publications are issued daily from the Central Meteorological Bureau, viz.:—(i.) Weather charts. (ii.) Rainfall maps. (iii.) Bulletins, Victorian and Interstate, shewing pressure, temperature, wind, rain, cloud extent, and weather. Similar publications are also issued from the divisional offices in each of the State Capitals.

The Bulletins of Climatology are as follow:—No. 1.—A general discussion of the climate and meteorology of Australia, illustrated by one map and diagrams. No. 2.—A discussion of the rainfall over Australia during the ten years (1897-1906) compared with the normal, illustrated by one map. No. 3.—Notes and statistics of the remarkable flood rains over south-eastern Australia during the winter of 1909, illustrated

1. Prepared from data supplied by the Commonwealth Meteorologist, H. A. Hunt, Esquire, F.R.Met.Soc.

by five maps and diagrams. No. 4.—A discussion of the monthly and seasonal rainfall over Australia, illustrated by one map and diagram. No. 5.—An investigation into the possibility of forecasting the approximate winter rainfall for Northern Victoria, illustrated by two diagrams. No. 6.—The physiography of the proposed Federal Territory at Canberra, illustrated by a relief map and 21 plates. No. 7.—On the climate of the Yass-Canberra district, illustrated by one map. No. 8.—Physiography of Eastern Australia, with 28 text illustrations. No. 9.—The climate of Australia, with charts and diagrams, prepared for the Federal Handbook of Australia.

Commencing with January 1910, the "Australian Monthly Weather Report," containing statistical records from representative selected stations, with rain maps and diagrams, etc., is being published. Complete rainfall and other climatological data are published in annual volumes of meteorological statistics for each State separately.

The first text book of Australian meteorology, "Climate and Weather of Australia," was published in 1913.

3. **General Description of Australia.**—In the general description of Australia, page 47, it is pointed out that a considerable portion (0.530) of three divisions of the Australian Commonwealth is north of the tropic of Capricorn, that is to say, within the States of Queensland and Western Australia, and the Northern Territory, no less than 1,149,320[1] square miles belong to the tropical zone, and 1,020,720 to the temperate zone. The whole area of the Commonwealth within the temperate zone, however, is 1,825,261[2] square miles, thus the tropical part is about 0.386, or about five-thirteenths of the whole, or the "temperate" region is half as large again as the "tropical" (more accurately 1.591). By reason of its insular geographical position, and the absence of striking physical features, Australia is, on the whole, less subject to extremes of weather than are regions of similar area in other parts of the globe; and latitude for latitude Australia is, on the whole, more temperate.

The altitudes of the surface of Australia range up to a little over 7300 feet, hence its climate embraces a great many features, from the characteristically tropical to what is essentially alpine, a fact indicated in some measure by the name Australian Alps given to the southern portion of the great Dividing Range.

While on the coast the rainfall is often abundant and the atmosphere moist, in some portions of the interior the rainfall is very limited, and the atmosphere dry. The distribution of forest, as might be expected, and its climatic influence, is consequently very variable. In the interior there are on the one hand fine belts of trees, on the other there are large areas which are treeless, and where the air is hot and parched in summer. Again, on the coast, even as far south as latitude 35°, the vegetation is tropical in its luxuriance, and also somewhat so in character. Climatologically, therefore, Australia may be said to present a great variety of features. The various climatological characteristics will be referred to in detail.

4. **Meteorological Divisions.**— The Commonwealth Meteorologist has divided Australia, for climatological and meteorological purposes, into five divisions. The boundaries between these may be thus defined :—(*a*) Between divisions I. and II., the boundary between South and Western Australia, viz., the 129th meridian of east longitude ; (*b*) between divisions II. and III., starting at the Gulf of Carpentaria, along the Norman River to Normanton, thence a straight line to Wilcannia on the Darling River, New South Wales ; (*c*) between divisions II. and IV., from Wilcannia along the Darling River to its junction with the Murray ; (*d*) between divisions II. and V., from the junction of the Darling and Murray Rivers, along the latter to Encounter Bay ; (*e*) between divisions III. and IV., starting at Wilcannia, along the Darling, Barwon, and Dumaresq Rivers to the Great Dividing Range, and along that range and along the

1. In the article "Australia" in the Encyclopædia Britannica, Vol. II., p. 946 (XI. Edition), this area is given as 1,145,000 square miles.

2. Given as 1,801,700 square miles in the work above quoted, where, however, the statistics are said "*to refer only to the continental States of the Federation, not to Tasmania.*"

watershed between the Clarence and Richmond Rivers to Evans Head on the east coast of Australia; (*f*) between divisions IV. and V., from the junction of the Darling and Murray Rivers along the latter to its junction with the Murrumbidgee, along the Murrumbidgee to the Tumut River, and along the Tumut River to Tumut, thence a straight line to Cape Howe; (*g*) division V. includes Tasmania.

The population included within these boundaries at the Census of the 3rd April, 1911, was approximately as follows:—

Division	I.	II.	III.	IV.	V.
Population	282,000	429,000	607,000	1,540,000	1,597,000

In these divisions the order in which the capitals occur is as follows:—(i.) Perth, (ii.) Adelaide, (iii.) Brisbane, (iv.) Sydney, (v.) Melbourne, (vi.) Hobart; and for that reason the climatological and meteorological statistics will be set forth in the indicated order in this publication.

Special Climatological Stations. The latitudes, longitudes, and altitudes of special stations, the climatological features of which are graphically represented hereinafter, are as follows:—

SPECIAL CLIMATOLOGICAL STATIONS.

Locality.	Height above Sea Level.	Latitude. S.		Longitude. E.		Locality.	Height above Sea Level.	Latitude. S.		Longitude. E.	
	Feet.	deg.	min.	deg.	min.		Feet.	deg.	min.	deg	min.
Perth	197	31	57	115	50	Darwin ...	97	12	28	130	51
Adelaide ...	140	34	56	138	35	Daly Waters ...	691	16	16	133	23
Brisbane ...	137	27	28	153	2	Alice Springs ...	1926	23	38	133	37
Sydney	146	33	52	151	12	Dubbo ...	870	32	18	148	35
Melbourne ...	115	37	49	144	58	Laverton ...	1530	28	40	122	23
Hobart	177	42	53	147	20	Coolgardie ...	1402	30	57	121	10

5. **Temperatures.**—In respect of Australian temperatures generally it may be pointed out that the isotherm for 70° Fahrenheit extends in South America and South Africa as far south as latitude 33°, while in Australia it reaches only as far south as latitude 30°, thus shewing that, on the whole, Australia has a more temperate climate when compared latitude for latitude with places in the Southern Hemisphere.

The comparison is even more favourable when the Northern Hemisphere is included in the comparison, for in the United States the 70° isotherm extends in several of the western States as far north as latitude 41°. In Europe the same isotherm reaches almost to the southern shores of Spain, passing, however, afterwards along the northern shores of Africa till it reaches the Red Sea, when it bends northward along the eastern shore of the Mediterranean till it reaches Syria. In Asia nearly the whole of the land area south of latitude 40° N. has a higher isothermal value than 70°.

The extreme range of shade temperatures in summer and winter in a very large part of Australia amounts to probably only 81°. In Siberia, in Asia, the similar range is no less than 171°, and in North America 153°, or approximately double the Australian range.

Along the northern shores of the Australian continent the temperatures are very equable. At Darwin, for example, the difference in the means for the hottest and coldest months is only 8.6°, and the extreme readings for the year, that is, the highest maximum in the hottest month and the lowest reading in the coldest month, shew a difference of under 50°.

Coming southward the extreme range of temperature increases gradually on the coast, and in a more pronounced way inland.

The detailed temperature results for the several capitals of the States of Australia are shewn in the Climatological Tables hereinafter.

(i.) *Hottest and Coldest Parts.* A comparison of the temperatures recorded at coast and inland stations shews that, in Australia as in other continents, the range increases with increasing distance from the coast.

In the interior of Australia, and during exceptionally dry summers, the temperature occasionally reaches or exceeds 120° in the shade, and during the dry winters the major portion of the country to the south of the tropics is subject to ground frosts. An exact knowledge of temperature disposition cannot be determined until the interior becomes more settled, but from data procurable, it would appear that the hottest area of the continent is situated in the northern part of Western Australia about the Marble Bar and Nullagine goldfields, where the maximum shade temperature during the summer sometimes exceeds 100° for days, and even weeks, continuously. The coldest part of the Commonwealth is the extreme south-east of New South Wales and extreme east of Victoria, namely, the region of the Australian Alps. Here, the temperature seldom, if ever, reaches 100° even in the hottest of seasons.

In Tasmania, although occasionally hot winds may cross the Straits and cause the temperature to rise to 100° in the low-lying parts, yet the island as a whole enjoys a most moderate and equable range of temperature throughout the year.

(ii.) *Monthly Maximum and Minimum Temperatures.* The mean monthly maximum and minimum temperatures can be best shewn by means of graphs, which exhibit the nature of the fluctuation of each for the entire year. In the diagram (on page 67) for nine representative places in Australia, the upper heavy curves shew the mean maximum, the lower heavy curves the mean minimum temperatures based upon daily observations. On the same diagram the thin curves shew the relative humidities (see next paragraph).

6. **Relative Humidity.**— Next after temperature the degree of humidity may be regarded as of great importance as an element of climate; and the characteristic differences of relative humidity between the various capitals of Australia call for special remark. For six representative places the variations of humidity are shewn on the graph on page 67, which gives results based upon daily observations of the dry and wet bulb thermometers. Hitherto difficulties have been experienced in many parts of Australia in obtaining satisfactory observations for a continuous period of any length. For this reason it has been thought expedient to refer to the record of humidity at first order stations only, where the results are thoroughly reliable. Throughout, the degree of humidity given will be what is known as *relative humidity*, that is, the percentage of aqueous vapour actually existing to the total possible if the atmosphere were saturated.

The detailed humidity results for the several State capitals are given in the Climatological Tables hereinafter. From these, it is seen that, in respect of relative humidity, Sydney has the first place, while Melbourne, Hobart, Brisbane, Perth, and Adelaide follow in the order stated, Adelaide being the driest. The graphs on page 67 shew the annual variations in humidity. It will be observed that the *relative* humidity is ordinarily but not invariably great when the temperature is low.

7. **Evaporation.**—The rate and quantity of evaporation in any territory is influenced by the prevailing temperature, and by atmospheric humidity, pressure and movement. In Australia the question is of perhaps more than ordinary importance; since in its drier regions water has often to be conserved in "tanks"[1] and dams. The magnitude of the economic loss by evaporation will be appreciated from the records on pages 68 and 76 to 81, which shew that the yearly amount varies from about 33½ inches at Hobart to 97 inches at Alice Springs in the centre of the Continent.

(i.) *Monthly Evaporation Curves.* The curves shewing the mean monthly evaporation in various parts of the Commonwealth will disclose how characteristically different are the amounts for the several months in different localities. The evaporation for characteristic places is shewn on diagram shewing also rainfalls (see page 68).

1. In Australia artificial storage ponds or reservoirs are called "tanks."

(ii.) *Loss by Evaporation.* In the interior of Australia the possible evaporation is greater than the actual rainfall. Since, therefore, the loss by evaporation depends largely on the exposed area, tanks and dams so designed that the surface shall be a minimum are advantageous. Similarly, the more protected from the direct rays of the sun and from winds, by means of suitable tree planting, the less will be the loss by evaporation: these matters are of more than ordinary concern in the drier districts of Australia.

8. **Rainfall.**—As even a casual reference to climatological maps, indicating the distribution of rainfall and prevailing direction of wind, would clearly shew, the rainfall of any region is determined mainly by the direction and route of the prevailing winds, by the varying temperatures of the earth's surface over which they blow, and by the physiographical features generally.

Australia lies within the zone of the south-east trade and prevailing westerly winds. The southern limit of the south-east trade strikes the eastern shores at about 30° south latitude. Hence, we find that, with very few exceptions, the heaviest rains of the Australian continent are precipitated along the Pacific slopes to the north of that latitude, the varying quantities being more or less regulated by the differences in elevation of the shores and of the chain of mountains, upon which the rain-laden winds blow, from the New South Wales northern border to Thursday Island. The converse effect is exemplified on the north-west coast of Western Australia from the summer south-east trade winds. Here the prevailing winds, blowing from the interior of the continent instead of from the ocean, result in the lightest coastal rain in Australia.

The westerly winds, which skirt the southern shores, are responsible for the very reliable, although generally light, rains enjoyed by the south-western portion of Western Australia, by the south-eastern agricultural areas of South Australia, by a great part of Victoria, and by the whole of Tasmania.

(i.) *Factors determining Distribution and Intensity of Rainfall.*

(ii.) *Time of Rainfall.*

In preceding Year Books (see No. 6, pp. 72, 73, 74) some notes were given of the various factors governing the distribution, intensity and period of Australian rainfall.

(iii.) *Wettest and Driest Regions.* The wettest known part of Australia is on the north-east coast of Queensland, between Port Douglas and Cardwell, where three stations situated on, or adjacent to, the Johnstone and Russell Rivers have an average annual rainfall of between 150 and 166 inches. The maximum and minimum falls there are:—Goondi, 241.53 in 1894 and 76.24 inches in 1902, or a range of 165.29 inches; Innisfail, 211.24 in 1894 and 69.87 inches in 1902, or a range of 141.37 inches; Harvey's Creek, 238.45 in 1901 and 80.47 inches in 1902, or a range of 157.98 inches.

On four occasions more than 200 inches have been recorded at Goondi, the last of these being in 1910, when 204.82 inches were registered. The record at this station covers a period of 29 years.

Harvey's Creek in the shorter period of 18 years has twice exceeded 200 inches, the total for 1910 being 201.28 inches.

The driest known part of the continent is about the Lake Eyre district in South Australia (the only part of the continent below sea level), where the annual average is but 5 inches, and where the fall rarely exceeds 10 inches for the twelve months.

The inland districts of Western Australia have until recent years been regarded as the driest part of Australia, but authentic observations taken during the past decade at settled districts in the east of that State shew that the annual average is from 10 to 12 inches.

(iv.) *Quantities and Distribution of Rainfall generally.* The departure from the normal rainfall increases greatly and progressively from the southern to the northern shores of the continent, and similarly also at all parts of the continent, subject to

capricious monsoonal rains, as the comparisons hereunder will shew. The general distribution is best seen from the map on page 73, shewing the areas subject to average annual rainfalls lying between certain limits. The areas enjoying varying quantities of rainfall determined from the latest available information are shewn in the following table:—

DISTRIBUTION OF AVERAGE RAINFALL.

Average Annual Rainfall.	N.S.W.	Victoria.	Queensland.	South Aust.	Northe'n Territ'y.	Western Aust.	Tasmania. *	Commonwealth. *
	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.	sqr. mls.
Under 10 inches	44,997	nil	91,012	317,600	138,190	513,653	nil	1,105,452
10—15 ,,	77,268	19,912	87,489	33,405	141,570	232,815	nil	592,459
15—20 ,,	57,639	12,626	112,738	14,190	62,920	89,922	937	350,972
20—30 ,,	77,202	29,317	213,779	13,827	93,470	95,404	7,559	530,558
30—40 ,,	30,700	14,029	69,880	984	40,690	40,750	4,588	201,621
Over 40 ,,	22,566	12,000	95,602	64	46,780	3,376	10,101	190,489
Total area ...	310,372	87,884	670,500	380,070	523,620	975,920	26,215	2,974,581

* Over 3030 square miles no records available.

Referring first to the capital cities, the complete records of which are given on the following page, it is seen that Sydney with a normal rainfall of 48.51 inches occupies the chief place, Brisbane, Perth, Melbourne, Hobart and Adelaide following in that order, Adelaide with 20.88 inches being the driest. The extreme range from the wettest to the driest year is greatest at Brisbane (72.09 inches) and least at Adelaide (19.48 inches).

In order to shew how the rainfall is distributed throughout the year in various parts of the continent, the figures of representative towns have been selected. (See map on page 74.) Darwin, typical of the Northern Territory, shews that in that region nearly the whole of the rainfall occurs in the summer months, while little or nothing falls in the middle of the year. The figures of Perth, as representing the south-western part of the continent, are the reverse, for while the summer months are dry, the winter ones are very wet. In Melbourne and Hobart the rain is fairly well distributed throughout the twelve months, with a maximum in October in the former, and in November in the latter. The records at Alice Springs and Daly Waters indicate that in the central parts of Australia the wettest months are in the summer and autumn. In Queensland, as in the Northern Territory, the heaviest rains fall in the summer months, but good averages are also maintained during the other seasons.

On the coast of New South Wales, the first six months of the year are the wettest, with slight excesses in April and July; the averages during the last six months are fair and moderately uniform. In general it may be said that one-fourth of the area of the continent, principally in the eastern and northern parts, enjoys an annual average rainfall of from 20 to 50 inches, the remaining three-fourths receiving generally from about 10 to 15 inches.

(v.) *Curves of Rainfall and Evaporation.* The relative amounts of rainfall and evaporation at different times through the year are best seen by referring to the graphs for a number of characteristic places. (See page 68.) It will be recognised at once how large is the evaporation when water is fully exposed to the direct rays of the sun, and to wind, etc.

(vi.) *Tables of Rainfall.* The table of rainfall for a long period of years for each of the various Australian capitals affords information as to the variability of the fall in successive years, and the list of the more remarkable falls furnishes information as to what may be expected on particular occasions.

RAINFALL AT THE AUSTRALIAN CAPITALS, 1840 to 1914.

Year.	Perth.			Adelaide.			Brisbane.			Sydney.			Melbourne.			Hobart.		
	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.	Amount.	No. of Days.	10 Years' Means.
	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.	in.		in.
1840	...	...	...	24.23	99	...	29.32	...	...	58.52	150	...	22.57	...	...	...	...	...
1	...	...	...	17.96	93	...	49.31	...	...	76.31	142	...	30.18	...	...	13.95	...	...
2	...	...	...	20.32	122	...	28.81	...	...	48.32	138	...	31.16	...	...	23.60	...	...
3	...	...	...	17.19	104	...	51.67	...	...	62.78	168	...	21.54	...	...	13.43	...	...
4	...	...	...	16.88	136	...	63.20	...	...	70.66	156	...	30.74	...	...	26.25	...	...
5	...	...	...	18.83	125	...	39.99	...	...	62.01	133	...	23.93	...	...	16.68	...	...
6	...	...	...	26.89	114	...	31.41	...	41.83	43.83	139	...	30.53	...	...	21.96	...	...
7	...	...	...	27.61	109	...	...	...	(7 yr.)	42.81	142	...	30.18	...	...	14.46	...	...
8	...	...	...	19.74	114	21.07	42.59	...	...	59.17	155	58.27	33.15	...	28.22	23.62	...	19.24
9	...	...	...	25.44	110	(9 yr.)	...	...	...	21.49	140	(9 yr.)	44.25	...	(9 yr.)	33.52	...	(8 yr.)
1850	...	...	...	19.56	84	...	...	...	...	44.88	157	...	26.98	...	...	14.51	...	...
1	...	...	...	30.86	128	...	...	...	...	35.14	142	...	...	...	...	17.98	...	...
2	...	...	...	27.44	118	...	...	...	...	43.79	143	...	...	...	...	23.62	...	...
3	...	...	...	27.08	128	...	...	...	...	46.12	130	...	...	...	...	14.52	...	...
4	...	...	...	15.35	105	...	...	...	...	29.29	136	...	...	...	...	30.54	...	...
5	...	...	...	23.15	124	...	...	...	...	52.86	138	...	28.21	...	...	18.25	...	...
6	...	...	...	24.93	118	...	...	...	...	43.31	116	...	29.76	134	...	22.73	151	...
7	...	...	...	22.15	105	...	...	...	...	50.95	135	...	28.90	138	...	17.14	113	...
8	...	...	...	21.55	107	23.75	43.00	...	...	39.60	129	40.75	26.01	158	...	33.07	129	22.59
9	...	...	...	14.85	95	...	35.00	...	...	42.01	137	...	21.82	156	...	23.31	...	...
1860	...	...	...	19.67	119	...	54.63	144	...	82.76	180	...	25.38	133	...	21.05	...	...
1	...	...	...	24.04	147	...	69.45	155	...	59.36	157	...	29.16	159	...	28.19	...	...
2	...	...	...	21.85	119	...	28.27	98	...	23.99	108	...	22.08	139	...	21.72	...	...
3	...	...	...	23.68	145	...	68.83	146	...	47.08	152	...	36.42	165	...	40.67	...	...
4	...	...	...	19.75	121	...	47.00	114	...	69.12	185	...	27.40	144	...	28.11	...	...
5	...	...	...	15.51	108	...	24.11	52	...	36.15	140	...	15.94	119	...	23.07	...	...
6	...	...	...	20.11	116	...	51.18	142	...	36.91	156	...	22.41	107	...	23.55	...	...
7	...	...	...	19.05	112	...	61.04	112	...	59.56	140	...	25.79	133	...	22.27	...	...
8	...	...	...	19.99	113	19.85	35.98	110	47.55	42.98	161	49.99	18.27	120	24.47	18.08	...	25.00
9	...	...	...	14.74	117	...	54.39	114	...	48.00	150	...	24.58	129	...	23.87	...	...
1870	...	...	...	23.84	119	...	79.06	154	...	64.47	179	...	33.77	129	...	27.53	...	...
1	...	...	...	23.25	137	...	45.45	119	...	52.27	141	...	30.17	125	...	18.25	131	...
2	...	...	...	22.66	146	...	49.22	131	...	37.12	161	...	32.52	136	...	31.76	160	...
3	...	...	...	21.00	139	...	62.02	138	...	73.40	176	...	25.61	134	...	23.43	157	...
4	...	...	...	17.23	127	...	38.71	135	...	63.60	173	...	28.10	134	...	24.09	138	...
5	...	...	...	29.21	157	...	67.03	162	...	46.25	153	...	32.87	158	...	29.25	181	...
6	28.73	100	...	13.43	110	...	53.42	130	...	45.69	156	...	24.04	134	...	23.63	...	...
7	20.48	103	...	24.95	135	...	30.28	119	...	59.66	147	...	24.10	124	...	20.82	...	...
8	39.72	143	29.64	22.08	112	21.24	56.33	134	53.59	49.77	129	54.03	25.36	116	28.11	29.76	...	25.24
9	41.34	106	(3 yr.)	20.69	130	...	67.30	157	...	63.19	167	...	19.28	127	...	21.07	...	...
1880	31.79	116	...	22.48	142	...	49.12	134	...	29.51	142	...	28.48	147	...	...	...	...
1	24.78	101	...	18.02	135	...	29.39	117	...	40.99	163	...	24.08	134	...	...	...	...
2	35.68	109	...	15.70	134	...	42.62	121	...	42.28	112	...	22.40	131	...	30.69	...	...
3	39.65	122	...	26.76	161	...	32.22	114	...	46.92	157	...	23.71	130	...	24.05	160	...
4	31.96	92	...	18.74	138	...	43.49	136	...	44.04	159	...	25.85	128	...	21.55	171	...
5	33.44	110	...	15.89	133	...	26.85	112	...	39.91	145	...	26.94	123	...	28.29	176	...
6	28.90	89	...	14.42	141	...	53.66	152	...	39.43	152	...	24.00	128	...	21.39	189	...
7	37.52	105	...	25.70	164	...	81.54	242	...	60.16	190	...	32.39	153	...	24.21	174	...
8	27.83	117	33.29	14.55	131	19.30	33.08	143	45.93	23.01	132	42.94	19.42	123	24.66	18.45	151	23.71
9	39.96	123	...	30.87	143	...	49.36	155	...	57.16	186	...	27.14	125	...	30.80	180	(8 yr.)
1890	46.73	126	...	25.78	139	...	73.02	162	...	81.42	184	...	24.24	140	...	27.51	173	...
1	30.33	93	...	14.01	113	...	41.68	143	...	55.30	200	...	26.73	126	...	23.25	160	...
2	31.23	122	...	21.53	137	...	64.98	146	...	69.26	189	...	24.96	124	...	18.62	...	...
3	40.12	145	...	21.49	129	...	88.26	147	...	49.90	209	...	26.80	140	...	27.46	146	...
4	23.72	103	...	20.78	134	...	44.02	143	...	38.22	198	...	22.60	138	...	27.39	151	...
5	33.01	123	...	21.28	130	...	59.11	105	...	31.86	170	...	17.04	131	...	25.40	119	...
6	31.50	103	...	15.17	121	...	44.97	121	...	42.40	157	...	25.16	124	...	21.61	136	...
7	27.17	106	...	15.42	119	...	42.53	115	...	42.52	136	...	25.85	117	...	20.45	153	...
8	31.76	118	33.55	20.75	116	20.71	60.06	131	56.80	43.17	143	51.12	15.61	102	23.61	20.40	164	24.29
9	32.40	107	...	18.84	119	...	38.85	141	...	55.90	174	...	28.87	116	...	20.68	170	...
1900	36.61	124	...	21.68	133	...	34.41	110	...	66.54	170	...	28.09	139	...	19.14	135	...
1	36.75	122	...	18.01	124	...	38.48	110	...	40.10	149	...	27.45	113	...	25.11	147	...
2	27.06	93	...	16.02	123	...	16.17	87	...	43.07	180	...	23.08	102	...	21.85	151	...
3	35.69	140	...	25.47	134	...	49.27	136	...	38.62	173	...	28.43	130	...	25.86	139	...
4	34.35	125	...	20.31	117	...	33.23	124	...	45.93	158	...	29.72	128	...	22.41	139	...
5	34.61	116	...	22.28	131	...	36.76	108	...	35.03	145	...	25.64	129	...	32.09	168	...
6	32.37	121	...	26.51	127	...	42.85	125	...	31.89	160	...	22.29	114	...	23.31	155	...
7	40.12	132	...	17.78	125	...	31.46	119	...	31.32	132	...	22.26	102	...	25.92	167	...
8	30.52	106	34.05	24.56	125	21.15	44.01	125	36.55	45.65	167	43.41	17.72	130	25.36	16.50	149	23.29
9	39.11	107	...	27.69	138	...	34.06	111	...	32.45	177	...	25.86	171	...	27.29	170	...
1910	37.02	135	...	24.62	116	...	49.00	133	...	46.91	160	...	24.61	167	...	25.22	205	...
1	23.38	108	...	15.99	127	...	35.15	128	...	50.24	155	...	36.61	168	...	26.78	193	...
2	27.85	123	...	19.57	116	...	41.32	114	...	47.51	172	...	20.37	157	...	23.14	181	...
3	38.28	141	...	18.16	102	...	40.79	115	...	57.70	141	...	21.17	157	...	19.36	165	...
4	20.21	128	...	11.39	91	...	33.99	141	...	56.42	149	...	18.57	129	...	15.42	154	...
Aver.	...	...	32.91	...	...	20.88	...	...	46.41	...	...	48.51	...	...	26.02	...	...	23.39
No. of Yrs.			(39)			(75)			(65)			(75)			(71)			(72)

NOTE.—The above average Rainfall figures for Brisbane, Sydney, and Melbourne differ slightly from the mean annual falls given in the Climatological Tables on pp. 77-79, which are for a less number of years.

9. **Remarkable Falls of Rain.**—The following are the more remarkable falls of rain in the States of New South Wales, Queensland, Western Australia, and South Australia, which have occurred within a period of twenty-four hours:—

HEAVY RAINFALLS, NEW SOUTH WALES, UP TO 1914, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Anthony	28 Mar., 1887	17.14	Maitland W. ...	9 Mar., 1893	14.79
,, ...	15 Jan., 1890	13.13	Major's Creek ...	14 Feb., 1898	12.32
Araluen	15 Feb., 1898	13.36	Marrickville ...	9 Mar., 1913	10.40
Berry	13 Jan., 1911	12.05	Morpeth	9 ,, 1893	21.52
Billambil	14 Mar., 1894	12.94	Mount Kembla ...	13 Jan., 1911	18.25
Bomaderry... ...	13 Jan., 1911	13.03	Mt. Pleasant ...	24 Mar., 1914	10.30
Broger's Creek ...	14 Feb., 1898	20.05	Nepean Tunnel ...	14 Feb., 1898	12.30
,, ,, ...	19 July, 1910	12.22	Nowra	13 Jan., 1911	13.00
,, ,, ...	13 Jan., 1911	20.83	Padstow Park ...	9 Mar., 1913	10.64
Bulli Mountain ...	13 Feb., 1898	17.14	Prospect	28 May, 1889	12.37
Camden Haven ...	22 Jan., 1895	12.23	Richmond ...	28 ,, ,,	12.18
Castle Hill... ...	28 May, 1889	13.49	Rosemount ...	23 Mar., 1914	12.62
Colombo Lyttleton ...	5 Mar., 1893	12.17	Rooty Hill ...	27 May, 1889	11.85
Comboyne	18 May, 1914	10.68	Taree	28 Feb., 1892	12.24
Condong	27 Mar., 1887	18.66	Terara	26 ,, 1873	12.57
Cordeaux River ...	14 Feb., 1898	22.58	Tomago	9 Mar., 1893	13.76
,, ,, ...	13 Jan., 1911	14.52	Tongarra Farm ...	14 Feb., 1898	15.12
Dapto West ...	14 Feb., 1898	12.05	Towamba	5 Mar., 1893	20.00
Dunheved	28 May, 1889	12.40	The Hill(Shell Harb.)	24 Mar., 1914	12.00
Holy Flat	12 Mar., 1887	12.00	Sherwood	17 June, 1914	10.00
,, ,, ...	28 Feb., 1892	12.24	Stockyard Mt. ...	24 Mar., 1914	10.72
Jamberoo	23 Mar., 1914	10.22	South Head		
,, ...	24 ,, ,,	11.28	(near Sydney)...	29 Apr., 1841	20.12
Katoomba	7 Apr., 1913	10.50	,, ,, ...	16 Oct., 1844	20.41
Kembla Heights ...	13 Jan., 1911	17.46	Unanderra ...	24 Mar., 1914	11.68
Leconfield	9 Mar., 1893	14.53	Wollongong ...	24 ,, ,,	12.50
Madden's Creek ...	13 Jan., 1911	18.68			

HEAVY RAINFALLS, QUEENSLAND, UP TO 1914, INCLUSIVE.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Allomba (Cairns) ...	30 Jan., 1913	13.50	Cairns	11 Feb., 1911	15.17
Anglesey	26 Dec., 1909	18.20	,, ...	2 Apr., ,,	20.16
Atherton (Cairns) ...	31 Jan., 1913	16.69	,, ...	31 Jan., 1913	13.94
Ayr	20 Sep., 1890	14.58	Cape Grafton ...	5 Mar., 1896	13.37
Babinda (Cairns) ...	31 Jan., 1913	12.79	Cardwell	30 Dec., 1889	12.00
,, ,, ...	1 Feb., 1913	20.51	,, ...	23 Mar., 1890	12.00
Banyan (Cardwell) ...	31 Jan., 1913	13.79	,, ...	18 ,, 1904	18.24
Barrine (Cairns) ...	31 ,, 1913	13.34	,, ...	3 Apr., 1911	12.84
Bloomsbury ...	14 Feb., 1893	17.40	Clare	26 Jan., 1896	15.30
,, ...	10 Jan., 1901	16.62	Coen	17 Feb., 1914	12.03
Bowen	13 Feb., 1893	14.65	Collaroy	30 Jan., 1896	14.25
Brisbane	21 Jan., 1887	18.31	Cooktown	22 ,, 1903	12.49
Bromby Park (Bowen)	14 Feb., 1893	13.28	,, ...	23 ,, 1914	13.98
Brookfield ...	14 Mar., 1908	14.95	Cooran	1 Feb., 1893	13.62
Buderim Mountain ...	11 Jan., 1898	26.20	,, ...	26 Dec., 1908	14.08
Bundaberg ...	16 ,, 1913	16.94	Cooroy	9 June, 1893	13.60
Burketown ...	15 ,, 1891	13.58	,, ...	10 Jan., 1898	13.50
,, ...	12 Mar., 1903	14.52	Crohamhurst		
Burnett Head			(Blackall Range)	2 Feb., 1893	35.71
(Bundaberg) ...	16 Jan., 1913	15.22	,, ,, ...	9 June, ,,	13.31
Bustard Head ...	17 ,, 1913	14.93	,, ,, ...	9 Jan., 1898	19.55
Cairns	11 Feb., 1889	14.74	,, ,, ...	6 Mar. ,,	16.01
,, ...	21 Apr., ,,	12.40	,, ,, ...	26 Dec., 1909	13.85
,, ...	5 ,, 1891	14.08			

HEAVY RAINFALLS, QUEENSLAND—Continued.

Name of Town or Locality.	Date.	Amnt.
		ins.
Crow's Nest ...	2 Aug., 1908	11.17
Croydon	29 Jan., 1908	15.00
Cryna (Beaudesert) ...	21 „ 1887	14.00
Dungeness ...	16 Mar., 1893	22.17
„	17 Apr., 1894	14.00
Dunira	9 Jan., 1898	18.45
„	6 Mar., „	15.95
Eddington(Cloncurry)	23 Jan., 1891	10.33
Emu Park... ...	18 „ 1913	12.75
Enoggera Railway ...	14 Mar., 1908	12.14
Ernest Junction ...	„ „	13.00
Fairymead Plantation (Bundaberg) ...	16 Jan., 1913	15.32
Flat Top Island ...	22 Dec., 1909	12.96
Floraville	6 Jan., 1897	10.79
„	11 Mar., 1903	12.86
Flying Fish Point ...	7 Apr., 1912	16.06
„ „ ...	31 Jan., 1913	16.10
Gatcombe Head (Gladstone) ...	18 Jan., 1913	12.88
Gin Gin	16 „ 1905	13.61
„	16 „ 1913	12.27
Gladstone	18 Feb., 1888	12.37
„	31 Jan., 1893	14.62
„	4 Feb., 1911	18.83
Glen Boughton ...	5 Apr., 1894	18.50
„ „ ...	31 Jan., 1913	14.92
Glen Prairie ...	18 Apr., 1904	12.18
Gold Creek Reservoir	14 Mar., 1908	12.50
Goldsborough (Cairns)	31 Jan., 1913	19.92
„ „	1 Feb., 1913	12.22
Goodwood(Bund'berg)	16 Jan., 1913	13.07
Goondi Mill (Innisfail)	6 Apr., 1894	15.69
„ „	18 Apr., 1899	14.78
„ „	24 Jan., 1900	13.30
„ „	29 Dec., 1903	17.83
„ „	10 Feb., 1911	17.68
„ „	31 Mar., „	12.38
„ „	1 Apr., „	13.60
„ „	6 Apr., 1912	15.55
Goondi	30 Jan., 1913	24.10
Granada (formerly Donaldson) ...	27 Jan., 1891	11.29
„ „ ...	8 „ 1911	13.50
„ „ ...	9 „ „	14.30
Halifax	5 Feb., 1899	15.37
„	6 Jan., 1901	15.68
„	8 Apr., 1912	12.75
Hambledon Mill ...	13 Jan., 1909	13.80
„ „ ...	2 „ 1911	18.61
„ „ ...	10 Feb., „	13.97
„ „ ...	30 Mar., „	13.04
„ „ ...	31 „ „	14.95
„ „ ...	1 Apr., „	19.62
„ „ ...	30 Jan., 1913	17.32
Harvey Creek ...	8 Mar., 1899	17.72
„ „ ...	25 Jan., 1900	12.53
„ „ ...	25 May, 1901	14.00
„ „ ...	14 Mar., 1903	12.10
Harvey Creek ...	11 Jan., 1905	16.96
„ „ ...	28 „ 1906	12.29
„ „ ...	14 „ 1909	14.40
„ „ ...	3 „ 1911	27.75
„ „ ...	11 Feb., „	12.88
„ „ ...	1 Apr., „	13.61
„ „ ...	2 „ „	16.46
„ „ ...	31 Jan., 1913	24.72
Haughton Valley ...	26 Jan., 1896	18.10
Herberton ...	31 Jan., 1913	14.00
Hillcrest (Mooloolah)	26 Dec., 1909	13.35
Holmwood (Woodf'd)	2 Feb., 1893	16.19
„ „	10 Jan., 1898	12.40
Homebush ...	3 Feb., „	12.04
Howard	15 Jan., 1905	19.55
Ingham	18 „ 1894	12.60
„	6 „ 1901	13.59
„	25 Dec., 1903	12.30
Inkerman... ...	21 Sep., 1890	12.93
Inneshowen (Johnstone River)	30 Dec., 1889	14.01
Innisfail (formerly Geraldton) ...	11 Feb., 1889	17.13
„ „ ...	31 Dec., „	12.45
„ „ ...	6 Apr., 1894	16.02
„ „ ...	18 „ 1899	13.20
„ „ ...	24 Jan., 1900	15.22
„ „ ...	29 Dec., 1903	21.22
„ „ ...	11 Feb., 1911	14.48
„ „ ...	1 Apr., 1911	12.35
„ „ ...	2 „ „	15.00
„ „ ...	7 „ 1912	20.50
„ „ ...	8 „ „	12.15
„ „ ...	31 Jan., 1913	20.91
Invicta (Kolan R.) ...	16 Jan., 1913	14.58
Isis Junction ...	6 Mar., 1898	13.60
Kamerunga (Cairns)	20 Jan., 1892	13.61
„ „ ...	6 Apr., 1894	14.04
„ „ ...	5 „ 1895	12.31
„ „ ...	11 Feb., 1911	13.07
„ „ ...	1 Apr., „	14.20
„ „ ...	2 „ „	21.00
„ „ ...	31 Jan., 1913	16.00
Kulara (Cairns) ...	31 „ „	12.69
Kuranda (Cairns) ...	6 Mar., 1899	14.12
„ „ ...	20 Apr., 1903	14.16
„ „ ...	14 Jan., 1909	12.37
„ „ ...	11 Feb., 1911	16.30
„ „ ...	17 Mar., „	15.10
„ „ ...	31 „ „	18.60
„ „ ...	1 Apr., „	24.30
„ „ ...	2 „ „	28.80
„ „ ...	31 Jan., 1913	16.34
Lake Nash ...	10 Jan., 1895	10.25
„ ...	20 Mar., 1901	10.02
Landsborough ..	2 Feb., 1893	15.15
„ ...	9 June, „	12.80

HEAVY RAINFALLS, QUEENSLAND—Continued.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Landsborough ...	26 Dec., 1909	14.00	Palmwoods ...	7 Mar., 1898	13.02
Low Island ...	10 Mar., 1904	15.07	,, ...	25 Dec., 1909	17.75
,, ...	31 ,, 1911	14.70	Peachester ...	26 ,, ,,	14.91
,, ...	1 Apr., ,,	15.30	Pialba(Maryborough)	16 Jan., 1913	17.22
Lucinda	17 Feb., 1906	13.35	Pittsworth ...	11 Mar., 1890	14.68
,, ...	10 Mar., 1906	14.60	Plane Creek (Mackay)	26 Feb., 1913	27.73
Lytton	21 Jan., 1887	12.85	Point Archer ...	23 Jan., 1914	13.47
Mackay	23 Dec., 1909	13.96	Port Douglas ...	5 Mar., 1887	13.00
Sugar Experimental Farm, Mackay ...	23 Dec., 1909	12.00	,, ,, ...	10 ,, 1904	16.34
Macnade Mill ...	18 Jan., 1894	12.56	,, ,, ...	11 Jan., 1905	14.68
,, ...	17 Apr., ,,	14.26	,, ,, ...	17 Mar., 1911	16.10
,, ...	5 Feb., 1899	15.20	,, ,, ...	1 Apr., ,,	31.53
,, ...	6 Jan., 1901	23.33	Ravenswood ...	24 Mar., 1890	17.00
,, ...	7 Mar., 1914	12.44	Redcliffe	21 Jan., 1887	14.00
Maleny	26 Dec., 1909	14.76	,, ...	16 Feb., 1893	17.35
Mapleton	14 Mar., 1908	14.29	Rosedale	6 Mar., 1898	12.60
,, ...	26 Dec., 1909	15.72	,, ...	16 Jan., 1913	18.90
Marlborough ...	17 Feb., 1888	14.24	Sandgate	16 Feb., 1893	14.03
Milton	14 Mar., 1908	12.24	Somerset	28 Jan., 1903	12.02
Mirani	12 Jan., 1901	16.59	St. Helens (Mackay)	24 Feb., 1888	12.00
MiriamVale(B'd'berg)	17 ,, 1913	15.80	St. Lawrence ...	17 Feb., 1888	12.10
Mt. Molloy ...	31 Mar., 1911	20.00	,, ,, ...	30 Jan., 1896	15.00
,, ...	1 Apr., ,,	20.00	Tewantin	30 Mar., 1904	12.30
,, ...	2 ,, ,,	20.00	The Hollow (Mackay)	23 Feb., 1888	15.12
Mooloolah	13 Mar., 1892	21.53	Thornborough ...	20 Apr., 1903	18.07
,, ...	2 Feb., 1893	19.11	Townsville ...	24 Jan., 1892	19.20
,, ...	6 Mar., 1898	14.43	,, ...	28 Dec., 1903	15.00
Mount Crosby ...	14 Mar., 1908	14.00	Victoria Mill ...	6 Jan., 1901	16.67
Mount Cuthbert ...	8 Jan., 1911	18.00	Walsh River ...	1 Apr., 1911	13.70
Mourilyan ...	14 Jan., 1909	13.00	Woodford	2 Feb., 1893	14.93
,, ...	3 ,, 1911	12.70	Woodlands (Yeppoon)	25 Mar., 1890	14.25
,, ...	11 Feb., ,,	17.40	,, ,, ...	31 Jan., 1893	23.07
,, ...	1 Apr., ,,	13.20	,, ,, ...	9 Feb., 1896	13.97
,, ...	7 ,, 1912	18.97	,, ,, ...	7 Jan., 1898	14.50
,, ...	31 Jan., 1913	15.05	Woody Island ...	16 ,, 1913	12.66
Mundoolun ...	21 Jan., 1887	17.95	Woombye	26 Dec., 1909	13.42
Musgrave	6 Apr., 1894	13.71	Yandina	1 Feb., 1893	20.08
Nambour	9 Jan., 1898	21.00	,, ...	9 June, ,,	12.70
,, ...	7 Mar., ,,	13.28	,, ...	9 Jan., 1898	19.25
,, ...	27 Dec., 1909	16.80	,, ...	7 Mar., ,,	13.52
Nerang	15 June 1892	12.35	,, ...	28 Dec., 1909	15.80
North Kolan (Bundaberg) ...	6 Jan., 1913	12.90	Yarrabah	11 Feb., 1911	12.00
North Pine ...	16 Feb., 1893	14.97	,, ...	2 Apr., ,,	30.65
Nundah	14 Mar., 1908	12.00	Yeppoon	31 Jan., 1893	20.05
Oxenford	14 Mar., 1908	15.65	,, ...	8 ,, 1898	18.05
Palmwoods ...	4 Feb., 1893	12.30	,, ...	3 Feb., 1906	14.90
,, ...	10 Jan., 1898	15.85	,, ...	,, 1911	14.92
			,, ...	18 Jan., 1913	13.00
			,, ...	8 Oct., 1914	21.70

NOTE.—In Queensland falls of 12 or more inches on coast or 10 or more inches inland are taken.

HEAVY RAINFALLS, WESTERN AUSTRALIA, UP TO 1914, INCLUSIVE.

		ins.			ins.
Alice Downs ...	20 Jan., 1914	8.12	Cossack	3 Apr., 1898	12.82
,, ...	21 ,, ,,	5.33	,, ...	16 ,, 1900	13.23
,, ...	22 ,, ,,	4.04	Croydon	3 Mar., 1903	12.00
Balla Balla ...	21 Mar., 1899	14.40	Cocos Island ...	29 Nov., ,,	14.38
Boodarie	21 ,, ,,	14.53	Derby	29 Dec., 1898	13.09

HEAVY RAINFALLS, WESTERN AUSTRALIA—Continued.

Name of Town or Locality.	Date.	Amnt.	Name of Town or Locality.	Date.	Amnt.
		ins.			ins.
Derby	30 Dec., 1898	7.14	Whim Creek ...	20 Mar., 1899	8.89
Fortescue	3 May, 1890	23.36	,, ...	21 ,, ,,	18.17
Kerdiadary ...	7 Feb., 1901	12.00	Woodstock ...	21 ,, 1912	13.00
Meda	9 Jan., 1914	2.87	Wyndham ...	27 Jan., 1890	11.60
,, ...	10 ,, ,,	8.72	,, ...	11 ,, 1903	9.98
Obagama	28 Feb., 1910	12.00	,, ...	12 ,, ,,	6.64
Point Torment ...	17 Dec., 1906	11.86	,, ...	13 ,, ,,	4.20
Thangoo	17-19 Feb.'96	24.18	Yeeda	28 Dec., 1898	8.42
Whim Creek ...	2 Apr., 1898	7.08	,, ...	29 ,, ,,	6.88
,, ...	3 ,, ,,	29.41	,, ...	30 ,, ,,	6.12

HEAVY RAINFALLS, NORTHERN TERRITORY, UP TO 1914, INCLUSIVE.

		ins.			ins.
Borroloola	14 Mar., 1899	14.00	Lake Nash ...	21 Mar., 1901	10.25
Brock's Creek ...	4 Jan., 1914	10.68	Pine Creek ...	8 Jan., 1897	10.35
Burrundie... ...	4 ,, ,,	11.61	Darwin	7 Jan., 1897	11.67

10. **Snowfall.**—Light snow has been known to fall even as far north, occasionally, as latitude 31° S., and from the western to the eastern shores of the continent. During exceptional seasons it has fallen simultaneously over two-thirds of the State of New South Wales, and has extended at times along the whole of the Great Dividing Range, from its southern extremity in Victoria as far north as Toowoomba in Queensland. During the winter snow covers the ground to a great extent on the Australian Alps for several months, where also the temperature falls below zero Fahrenheit during the night, and in the ravines around Kosciusko and similar localities the snow never entirely disappears.

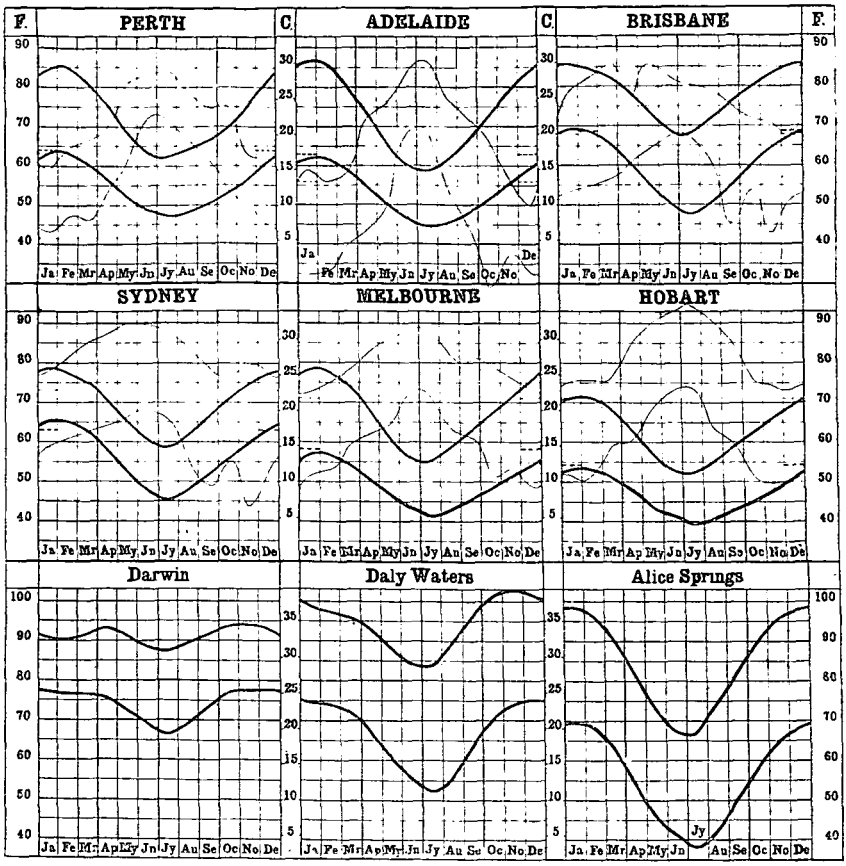
The antarctic "V"-shaped disturbances are always associated with our most pronounced and extensive snowfalls. The depressions on such occasions are very steep in the vertical area, and the apexes are unusually sharp-pointed and protrude into very low latitudes, sometimes even to the tropics.

11. **Hail.**—Hail falls throughout Australia most frequently along the southern shores of the continent in the winter, and over south-eastern Australia during the summer months. The size of the hailstones generally increases with distance from the coast, a fact which lends strong support to the theory that hail is brought about by ascending currents. Rarely does a summer pass without some station experiencing a fall of stones exceeding in size an ordinary hen-egg, and many riddled sheets of light-gauge galvanised iron bear evidence of the weight and penetrating power of the stones.

Hail storms occur most frequently in Australia when the barometric readings indicate a flat and unstable condition of pressure. They are almost invariably associated with tornadoes or tornadic tendencies, and on the east coast the clouds from which the stones fall are generally of a remarkable sepia-coloured tint.

12. **Barometric Pressures.**—The mean annual barometric pressure (corrected to sea-level and standard gravity) in Australia varies from 29.80 inches on the north coast to 29.92 inches over the central and 30.03 inches in the southern parts of the continent.

GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN MAXIMUM AND MINIMUM TEMPERATURE AND HUMIDITY IN SEVERAL PARTS OF THE COMMONWEALTH OF AUSTRALIA.



EXPLANATION OF THE GRAPHS OF TEMPERATURE AND HUMIDITY.—In the above graphs, in which the heavy lines denote 'temperature' and the thin lines 'humidity,' the fluctuations of mean temperature and mean humidity are shewn throughout the year. These curves are plotted from the data given in the Climatological Tables hereinafter. The temperatures are shewn in degrees Fahrenheit, the inner columns giving the corresponding values in Centigrade degrees. Humidities have not been obtained for Darwin, Daly Waters, and Alice Springs.

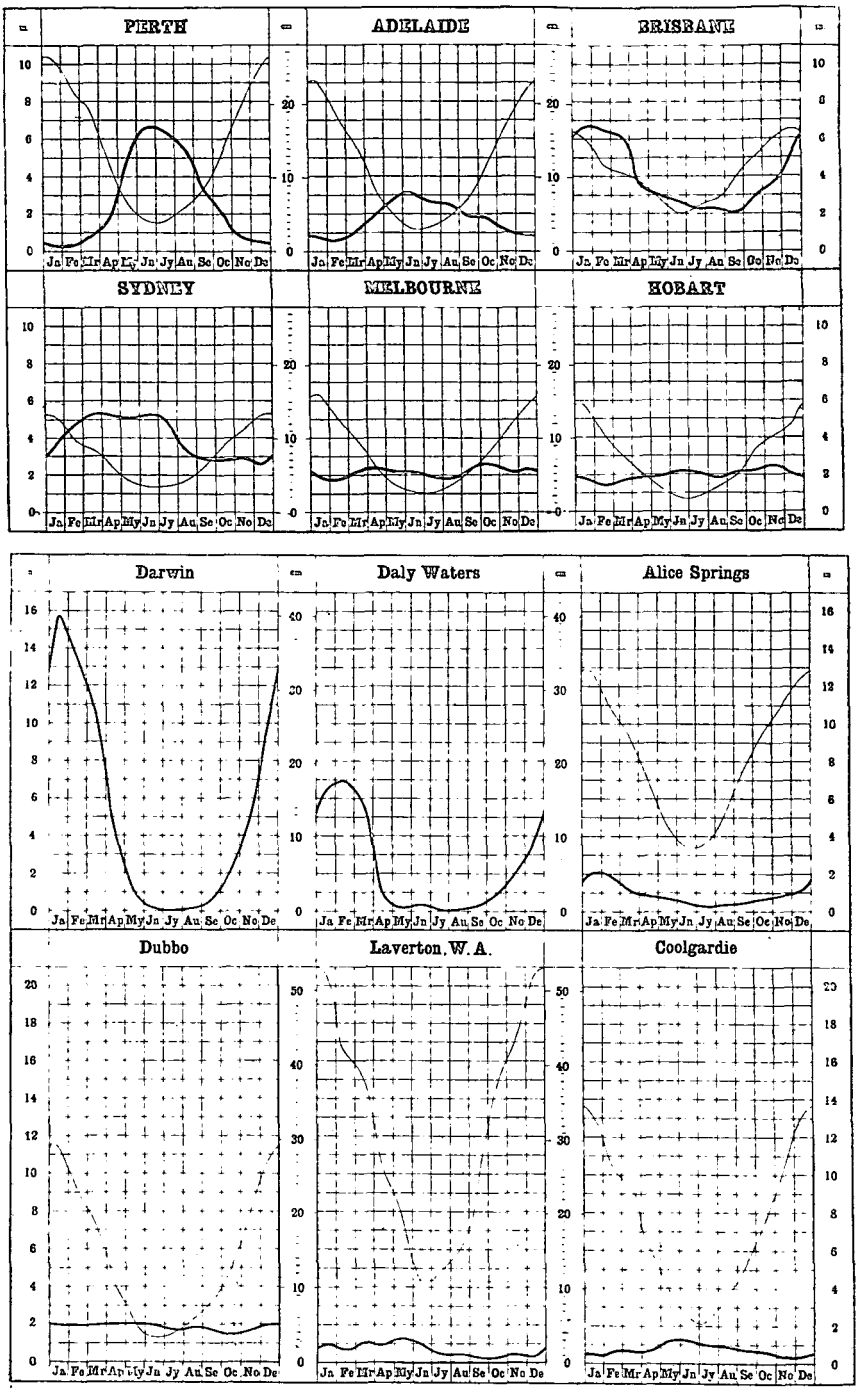
For the thin lines the degree numbers represent relative humidities, or the percentages of actual saturation on the total for the respective temperatures.

The upper temperature line represents the mean of the maximum, and the lower line the mean of the minimum results; thus the curves also shew the progression of the range between maximum and minimum temperatures throughout the year. The humidity curves shew the highest and lowest values of the mean monthly humidity at 9 a.m. recorded during a series of years.

INTERPRETATION OF THE GRAPHS.—The curves denote mean monthly values. Thus, taking for example, the temperature graphs for Perth, the mean readings of the maximum and minimum temperatures for a number of years on 1st January would give respectively about 83° Fahr. and 62° Fahr. Thus the mean range of temperature on that date is the difference, viz., 21°. Similarly, observations about 1st June would give respectively about 66° Fahr. and 51° Fahr., or a range of 15°.

In a similar manner it will be seen that the greatest mean humidity, say for March, is about 66° and the least mean humidity for the month 47°; in other words, at Perth, the degree of saturation of the atmosphere by aqueous vapour for the month of March ranges between 66 % and 47 %.

GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN RAINFALL AND MEAN EVAPORATION IN SEVERAL PARTS OF THE COMMONWEALTH OF AUSTRALIA.



(For Explanation see next page.)

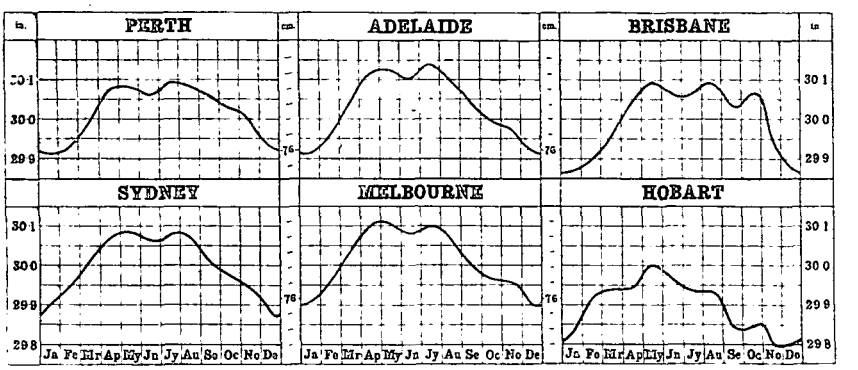
EXPLANATION OF THE GRAPHS OF RAINFALL AND EVAPORATION.—On the preceding graphs thick lines denote rainfall and thin lines evaporation, and shew the fluctuation of the mean rate of fall *per month* throughout the year. The results, plotted from the Climatological Tables hereinafter, are shewn in inches (see the outer columns), and the corresponding metric scale (centimetres) is shewn in the two inner columns. The evaporation is not given for Darwin and Daly Waters.

INTERPRETATION OF THE GRAPHS.—The distance for any date from the zero line to the curve, represents the average number of inches, reckoned as per month, of rainfall at that date. Thus, taking the curves for Adelaide, on the 1st January the rain falls on the average at the rate of about four-fifths of an inch per month, or, say, at the rate of about 9½ inches per year. In the middle of June it falls at the rate of nearly 3 inches per month, or, say, at the rate of about 36 inches per year. At Dubbo the evaporation is at the rate of nearly 11¼ inches per month about the middle of January, and only about 1½ inches at the middle of June.

TABLE SHEWING MEAN ANNUAL RAINFALL AND EVAPORATION IN INCHES OF THE PLACES SHEWN ON PRECEDING PAGE, AND REPRESENTED BY THE GRAPHS.

—	Rainfall.	Evaporation.	—	Rainfall.	Evaporation.
Perth ...	32.91	66.33	Darwin... ...	61.23	—
Adelaide ...	20.88	54.26	Daly Waters ...	26.55	—
Brisbane ...	46.65	50.17	Alice Springs...	10.86	96.10
Sydney ...	48.51	37.14	Dubbo ...	23.79	—
Melbourne ...	25.32	38.59	Laverton, W.A.	9.30	145.19
Hobart ...	23.39	33.29	Coolgardie ...	9.21	97.03

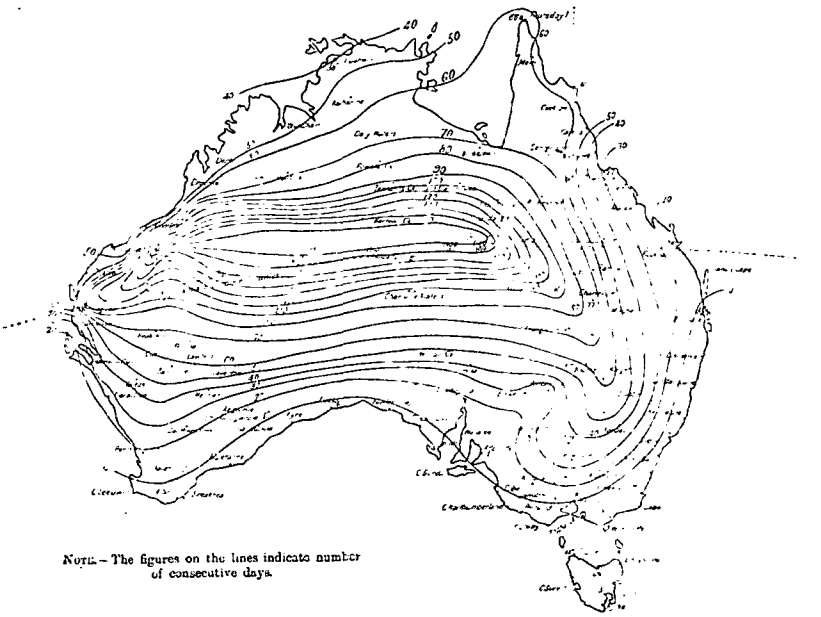
GRAPHS SHEWING ANNUAL FLUCTUATIONS OF MEAN BAROMETRIC PRESSURE FOR THE CAPITALS OF THE SEVERAL STATES OF THE COMMONWEALTH OF AUSTRALIA.



EXPLANATION OF THE GRAPHS OF BAROMETRIC PRESSURE.—On the above graphs the lines representing the yearly fluctuation of barometric pressure at the State capital cities are means for long periods, and are plotted from the Climatological Tables given hereinafter. The pressures are shewn in inches on about 2½ times the natural scale, and the corresponding pressures in centimetres are also shewn in the two inner columns, in which each division represents one millimetre.

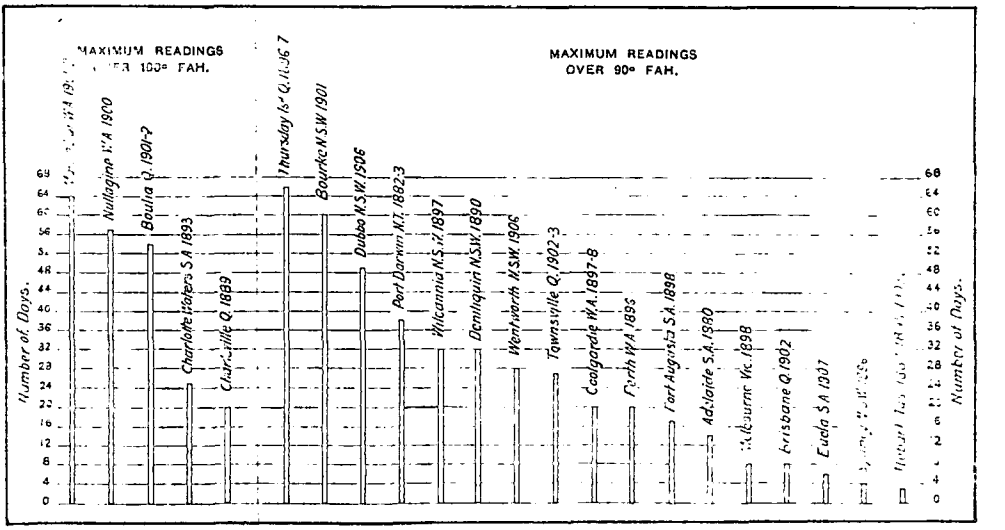
INTERPRETATION OF THE BAROMETRIC GRAPHS.—Taking the Brisbane graph for purposes of illustration, it will be seen that the mean pressure on 1st January is about 29.87 inches, and there are maxima in the middle of May and August of about 30.09 inches, and in October of about 30.07 inches.

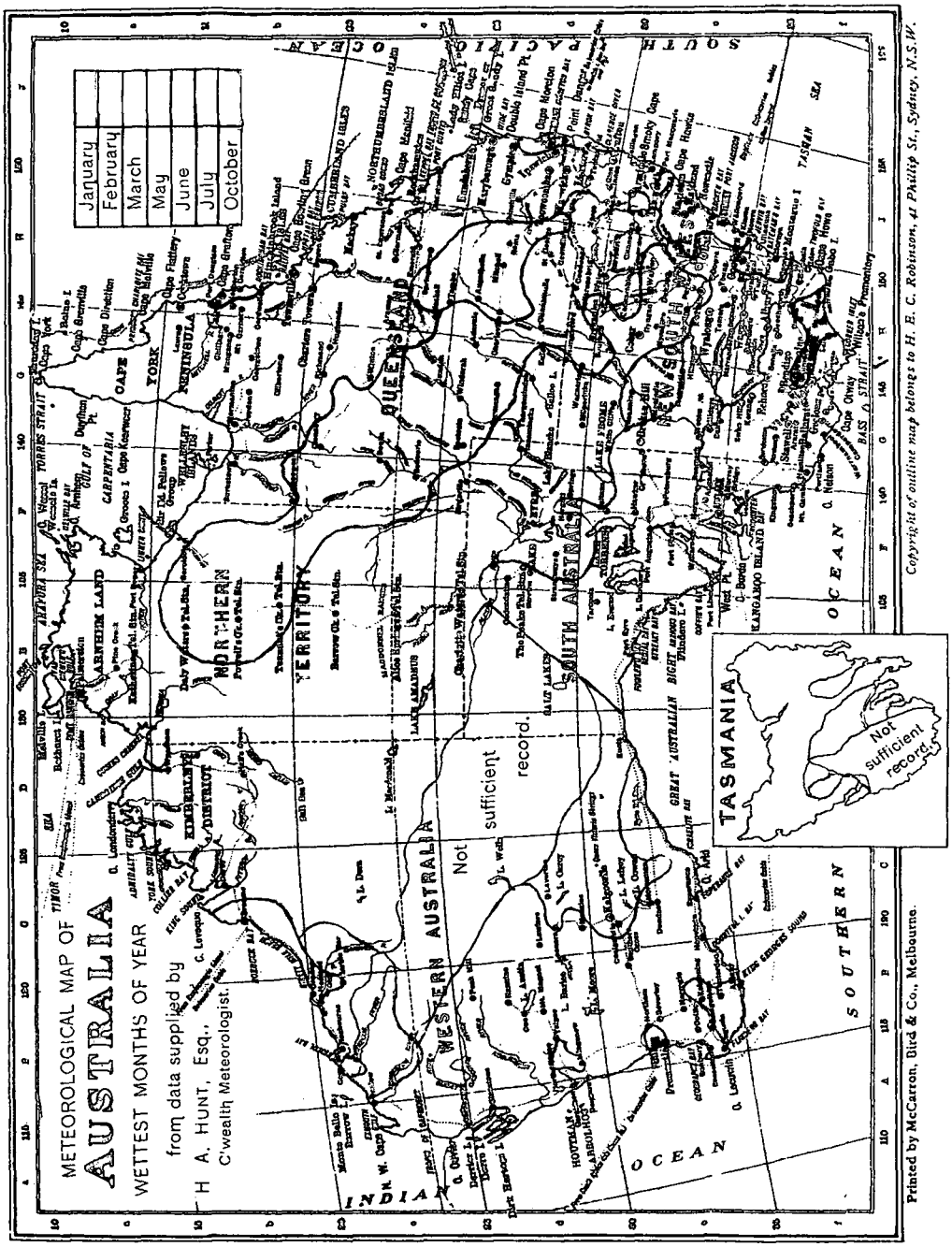
Chart indicating the area affected and period of duration of the Longest Heat Waves when the Maximum Temperature for consecutive 24 hours reached or exceeded 90° Fah.



NOTE.—The figures on the lines indicate number of consecutive days.

Diagram showing the greatest number of consecutive days on which the Temperature in the shade was over 100° and also over 90° at the places indicated.





METEOROLOGICAL SUB-DIVISIONS.

WEST AUSTRALIA.

No.
1. East Kimberley.
2. West Kimberley.
3. North-West.
4. Gascoyne.
5. South-West.
6. Eucla.
7. Eastern.

SOUTH AUSTRALIA.

8. Northern Territory.
9. Far North and N.W.
10. West.
11. Upper North.
12. North-East.
13. Lower North.
14. Central.
15. Murray Valley.
16. South-East.

QUEENSLAND.

17. Peninsular.
18. Gulf.
19. Far West.
20. Central.
21. Nth-East Coast.
22. Central Coast.
23. South-East Coast.
24. Darling Downs.
25. Maranoa.
26. South-West.

NEW SOUTH WALES.

27. Western.
28. North-West Plain.
29. North-West Slope.
30. Northern Tableland
31. North Coast.
32. Hunter & Manning.
33. Central Tableland.
33a. Metropolitan.
34. Cent. Westn. Slope.
35. Cent. Westn. Plain.
36. Riverina.
37. South-West Slope.
38. Southern Tableland
39. South Coast.

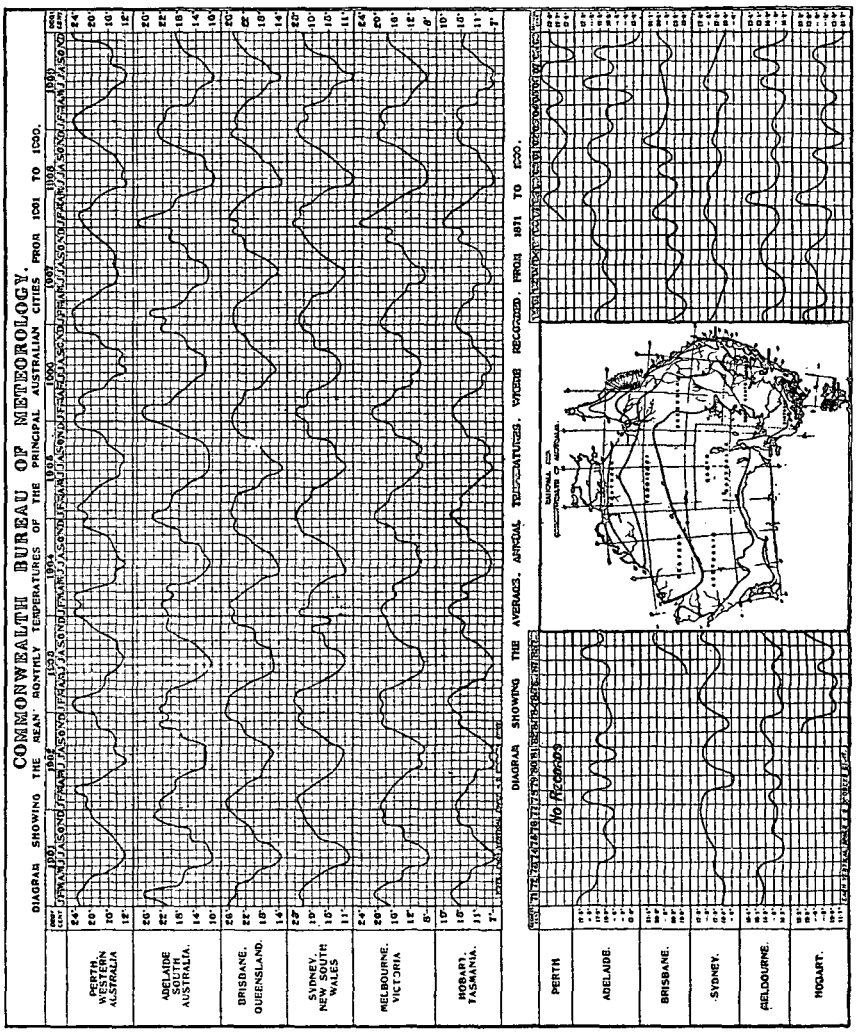
VICTORIA.

40. Gippsland.
41. North-East.
42. Central.
43. North Central.
44. Northern Country.
45. Mallee.
46. Wimmera.
47. Western.

TASMANIA.

48. Northern.
49. W. Coast Mt. Region
50. Central Plateau.
51. Midland.
52. East Coast.
53. Derwent.
54. South-Eastern.

The above are the meteorological sub-divisions adopted by H. A. HUNT, Esq., C'wealth. Meteorologist.

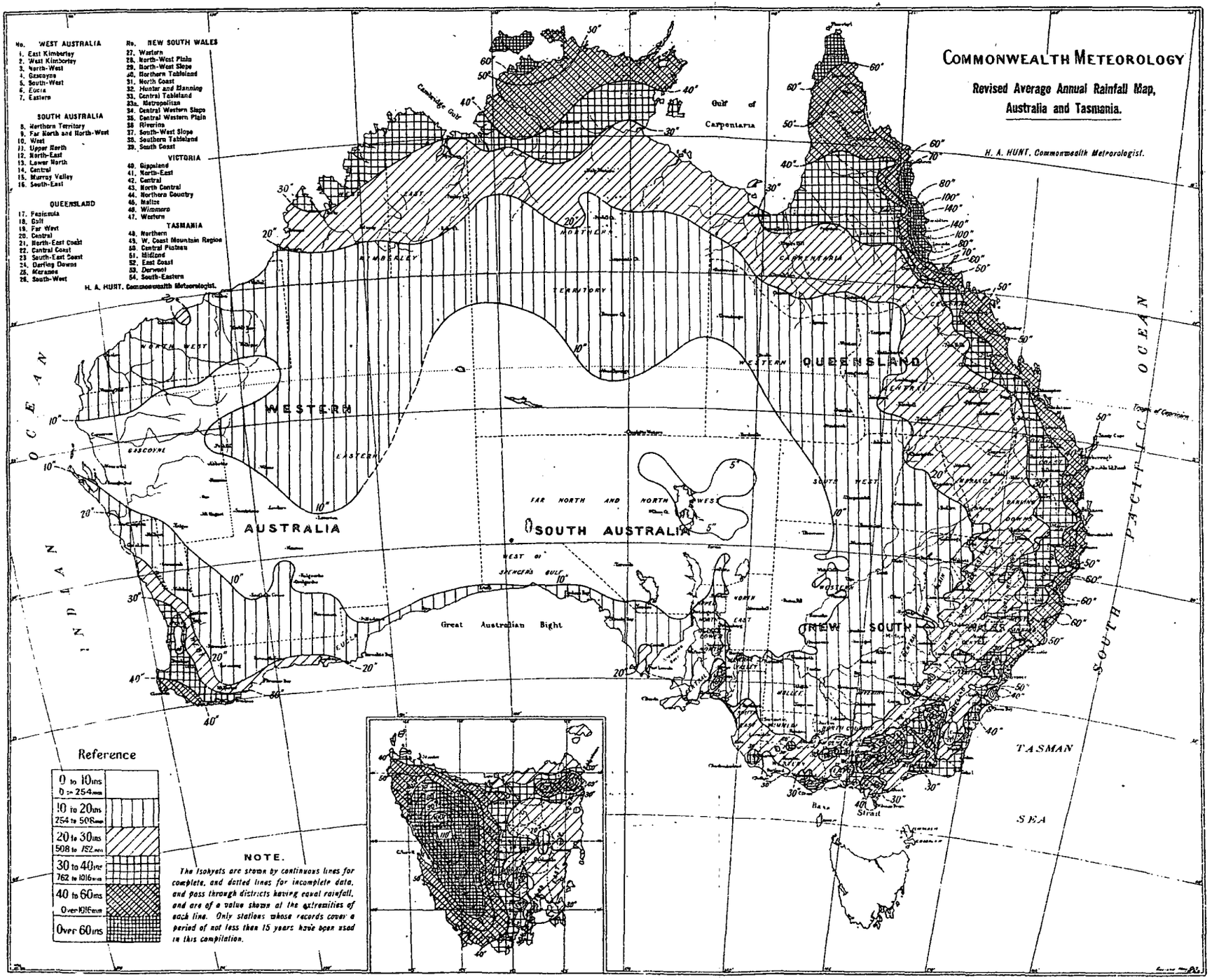


EXPLANATION OF GRAPH.

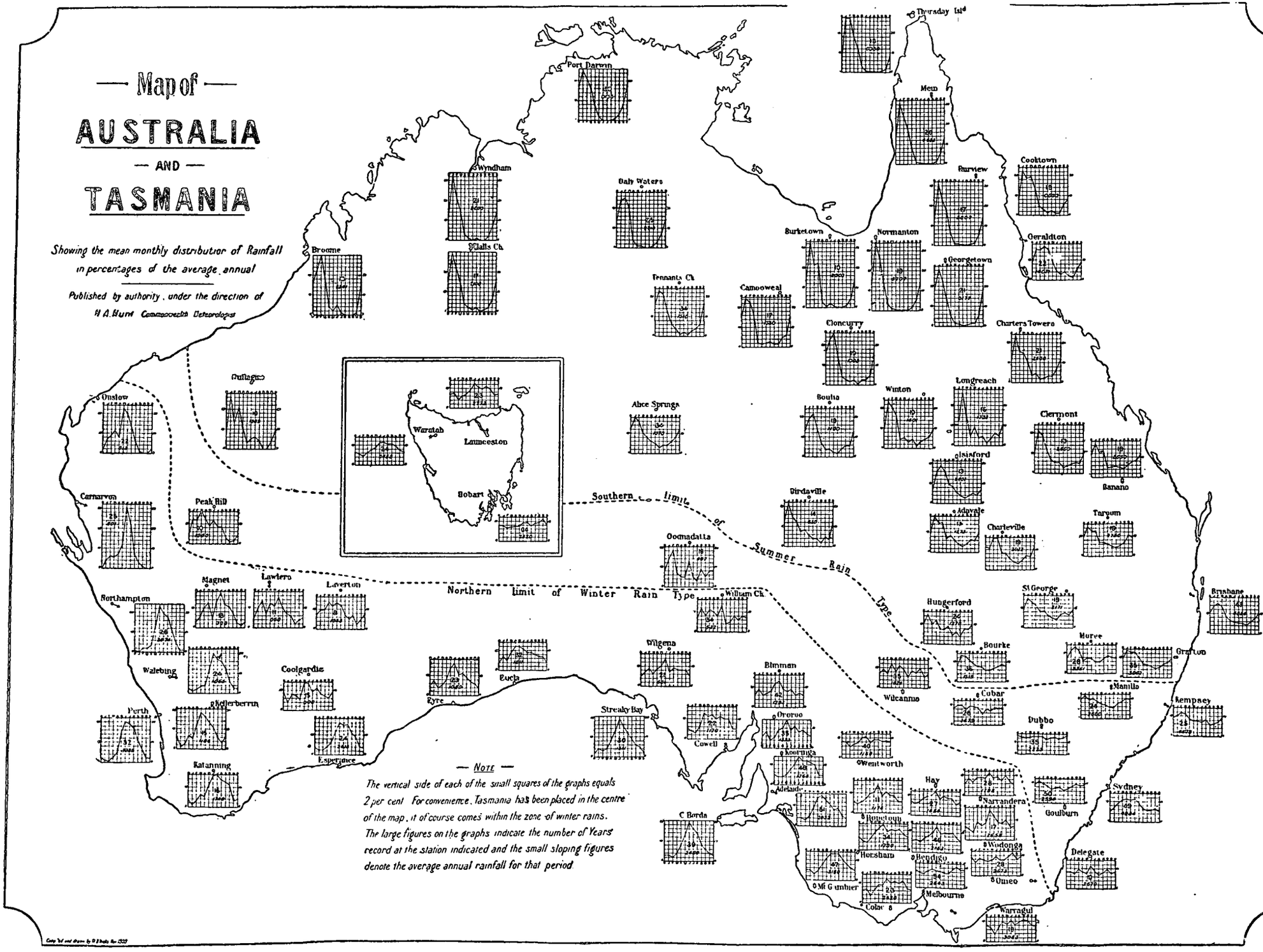
The six continuous curves on the upper part of the diagram shew the fluctuations of mean monthly temperatures of the Australian capitals from 1901 to 1909. The base of each small square denotes one month, and the vertical side 2° Centigrade or 3.6° Fahrenheit.

The six curves in lower portion of the diagram similarly shew the fluctuations of the mean annual temperatures, from 1871 in the case of Adelaide, Sydney and Melbourne, from 1883, 1887 and 1897 in the case respectively of Hobart, Brisbane and Perth. The base of each rectangle represents one year, and the vertical side 0.3° Centigrade or 0.54° Fahrenheit.

The map shews the areas affected by given amounts of annual rainfall, and is elsewhere given.



By authority, McCarron, Bird & Co., Printers, Melbourne.


— Map of —
AUSTRALIA
— AND —
TASMANIA
Showing the mean monthly distribution of Rainfall in percentages of the average annual
Published by authority, under the direction of H.A. Hunt Commonwealth Meteorologist
Thursday Isl
Port Darwin
Mein
Wyndham
Daly Waters
Cooktown
Burketown
Normanton
Geraldton
Broome
Wolfe Ck
Fennants Ck
Camooweal
Georgetown
Cloncurry
Charters Towers
Dunlagine
Onslow
Abee Springs
Boulia
Winton
Longreach
Clermont
Isisford
Banana
Warratah
Launceston
Hobart
Carnarvon
Peak Hill
Birdsville
Adavale
Charleville
Targum
Southern limit of Summer Rain Type
Oodnadatta
Northern limit of Winter Rain Type
William Ck
Hungerford
St George
Brisbane
Northampton
Magnet
Lawlers
Laverton
Bourke
Moree
Grafton
Walebing
Coolgardie
Wilgena
Bimman
Wilcannia
Cobar
Manilla
Kempsey
Perth
Kalgoorlie
Eucla
Eyre
Streaky Bay
Cowell
Ororoo
Pubbo
Esperance
Katanning
Wentworth
Hay
Narrandera
Sydney
Goulburn
Adelaide
Hopetoun
Wodonga
Delegate
C Borda
Horsham
Bendigo
Umeo
Mt Gambier
Melbourne
Colac
Warragul
— Note —
The vertical side of each of the small squares of the graphs equals 2 per cent. For convenience, Tasmania has been placed in the centre of the map, it of course comes within the zone of winter rains. The large figures on the graphs indicate the number of Years' record at the station indicated and the small sloping figures denote the average annual rainfall for that period.

In January the mean pressure ranges from 29.70 inches in the northern and central areas to 29.91 inches in the southern. The July mean pressure ranges from 29.90 inches at Darwin to 30.12 inches at Alice Springs. Barometer readings, corrected to mean sea-level, have, under anticyclonic conditions in the interior of the continent, ranged from 30.81 inches to as low as 28.44 inches. This lowest record was registered at Townsville during a hurricane on the 9th March, 1903. The mean annual fluctuations of barometric pressure for the capitals of Australia are shewn on page 69.

13. **Wind.**—Notes on the distinctive wind currents in Australia were given in preceding Year Books (see No. 6, page 83) and are here omitted to save space.

14. **Cyclones and Storms.**—The "elements" in Australia are ordinarily peaceful, and although severe cyclones have visited various parts, more especially coastal areas, such visitations are rare, and may be properly described as erratic.

During the winter months the southern shores of the continent are subject to cyclonic storms, evolved from the V-shaped depressions of the southern low-pressure belt. They are felt most severely over the south-western parts of Western Australia, to the south-east of South Australia, in Bass Straits, including the coast line of Victoria, and on the west coast of Tasmania. Apparently the more violent wind pressures from these cyclones are experienced in their northern half, that is, in that part of them which has a north-westerly to a south-westerly circulation.

Occasionally the north-east coast of Queensland is visited by hurricanes from the north-east tropics. During the first three months of the year these hurricanes appear to have their origin in the neighbourhood of the South Pacific Islands, their path being a parabolic curve of south-westerly direction. Only a small percentage, however, reach Australia, the majority recurving in their path to the east of New Caledonia.

Very severe cyclones, popularly known as "Willy Willies," are peculiar to the north-west coast of Western Australia from the months of December to March inclusive. They apparently originate in the ocean, in the vicinity of Cambridge Gulf, and travel in a south-westerly direction with continually increasing force, displaying their greatest energy near Cossack and Onslow, between latitudes 20° and 22° South. The winds in these storms, like those from the north-east tropics, are very violent and destructive, causing great havoc amongst the pearl-fishers. The greatest velocities are usually to be found in the south-eastern quadrant of the cyclones, with north-east to east winds. After leaving the north-west coast, these storms either travel southwards, following the coast-line, or cross the continent to the Great Australian Bight. When they take the latter course their track is marked by torrential rains, as much as 29.41 inches, for example, being recorded in 24 hours at Whim Creek from one such occurrence. Falls of 10 inches and over have frequently been recorded in the northern interior of Western Australia from similar storms.

Some further notes on severe cyclones and on "Southerly Bursters," a characteristic feature of the eastern part of Australia, will be found in previous issues of the Year Book (see No. 6, pp. 84, 85, 86).

15. **Influences affecting Australian Climate.**—Australian history does not cover a sufficient period, nor is the country sufficiently occupied, to ascertain whether or not the advance of settlement has materially affected the climate as a whole. Local changes therein, however, have taken place, a fact which suggests that settlement and the treatment of the land have a distinct effect on local conditions. For example, the mean temperature of Sydney shews a rise of two-tenths of a degree during the last twenty

years, a change probably brought about by the great growth of residential and manufacturing buildings within the city and in the surrounding suburbs during that period. Again, low-lying lands on the north coast of New South Wales, that originally were seldom subject to frosts, have, with the denudation of the surrounding hills from forests, experienced annual visitations, the probable explanation being that, through the absence of trees, the cold air of the high lands now flows, unchecked and untempered, down the sides of the hills to the valleys and lower lands.

(i.) *Influences of Forests on Climate.* As already indicated, forests doubtless exercise a great influence on local climate, and hence, to the extent that forestal undertakings will allow, the weather can be controlled by human agency. The direct action of forests is an equalising one; thus, especially in equatorial regions and during the warmest portion of the year, they considerably reduce the mean temperature of the air. They also reduce the diurnal extremes of their shade temperatures, by altering the extent of radiating surface, by evaporation, and by checking the movement of air. While decreasing evaporation from the ground, they increase the relative humidity. Vegetation greatly diminishes the rate of flow-off of rain, and the washing away of surface soil. Thus, when a region is protected by trees, steadier water supply is ensured, and the rainfall is better conserved. In regions of snowfall the supply of water to rivers is similarly regulated, and without this and the sheltering influence of ravines and "gullies," watercourses supplied mainly by melting snow would be subject to alternate periods of flooding and dryness. This is borne out in the inland rivers. Thus, the River Murray, which has never been known to run dry, derives its steadiness of flow mainly through the causes above indicated.

(ii.) *Direct Influences of Forest on Rainfall.* Whether forests have a direct influence on rainfall is a debatable question, some authorities alleging that precipitation is undoubtedly induced by forests, while others contend the opposite.

Sufficient evidence exists, however, to establish that, even if the rainfall has not increased, the beneficial effect of forest lands in tempering the effects of the climate is more than sufficient to disclose the importance of their protection and extension.

It is the rapid rate of evaporation, induced by both hot and cold winds, which injures crops and makes life uncomfortable on the plains. Whether the forest aids in increasing precipitation there may be doubt, but nobody can say that it does not check the winds and the rapid evaporation due to them.

Trees as wind-breaks have been successfully planted in central parts of the United States, and there is no reason why similar experiments should not be successful in many parts of our treeless interior. The belts should be planted at right angles to the direction of the prevailing parching winds, and if not more than half a mile apart will afford shelter to the enclosed areas.

In previous issues some notes on observations made in other countries were added (see Year Book No. 6, pp. 86 and 95).

16. **Comparison of Rainfalls and Temperatures.**—For the purpose of comparison the following lists of rainfalls and temperatures are given for various important cities throughout the world, for the site of the Federal capital, and for the capitals of the Australian States :—

COMPARISONS OF RAINFALLS AND TEMPERATURES
OF CITIES OF THE WORLD WITH THOSE OF AUSTRALIA.

Place.	Height above M.S.L.	Annual Rainfall.			Temperature.					
		Average.	Highest.	Lowest.	*Mean Summer.	†Mean Winter.	Highest on Record.	Lowest on Record.	Average Hottest Month.	Average Coldest Month.
	Ft.	Ins.	Ins.	Ins.	Fahr.	Fahr.	Fahr.	Fahr.	Fahr.	Fahr.
Amsterdam ...	6	27.29	40.59	17.60	63.2	36.8	90.0	4.1	64.4	35.4
Auckland ...	125	43.31	63.72	26.32	66.1	52.5	91.0	31.9	67.2	51.8
Athens	351	15.48	33.32	4.55	79.2	49.1	106.5	19.6	81.1	47.5
Bergen	146	89.10	102.80	73.50	56.8	34.5	88.5	4.8	57.9	33.6
Berlin	115	22.95	30.04	14.25	64.7	32.2	98.6	—13.0	66.0	30.0
Berne	1,877	36.30	58.23	24.69	62.2	30.1	91.4	— 3.6	64.4	28.0
Bombay	37	71.15	114.89	33.41	83.5	75.1	100.0	55.9	84.8	74.2
Breslau	482	22.00	28.01	16.45	63.9	30.0	100.0	—23.4	65.5	29.3
Brussels	328	28.35	41.18	17.73	62.6	36.0	95.5	— 4.4	63.7	34.5
Budapest... ...	500	25.20	35.28	16.79	68.6	30.2	98.6	— 5.1	70.4	28.2
Buenos Ayres ...	72	36.82	80.73	21.53	73.2	51.5	103.1	25.9	74.2	50.5
Calcutta	21	61.98	89.32	39.38	84.9	67.1	108.2	44.2	85.4	65.5
Capetown ...	40	25.50	36.72	17.71	68.1	54.7	102.0	34.0	68.8	53.9
Caracas	3,420	30.03	47.36	23.70	68.3	65.3	87.8	48.2	69.2	63.7
Chicago	823	33.54	45.85	24.52	69.2	25.4	103.0	—23.0	72.3	24.0
Christchurch ...	25	25.45	35.30	13.54	61.1	43.4	95.7	21.3	61.6	42.4
Christiania ...	82	22.52	31.73	16.26	61.0	24.4	95.0	—21.1	62.6	23.9
Colombo... ...	40	83.83	139.70	51.60	81.5	79.9	95.8	65.0	82.6	79.1
Constantinople ...	245	28.75	42.74	14.78	74.0	43.5	103.6	13.0	75.7	42.0
Copenhagen ...	46	22.33	28.78	13.94	60.7	32.1	90.5	—13.0	62.2	31.4
Dresden	115	26.80	34.49	17.72	62.9	32.4	93.4	—15.3	64.4	31.6
Dublin	47	27.66	35.56	16.60	59.4	42.0	87.2	13.3	60.5	41.7
Dunedin	300	37.06	53.90	22.15	57.3	43.1	94.0	23.0	57.9	42.0
Durban	260	40.79	71.27	27.24	75.6	64.4	110.6	41.1	76.7	63.8
Edinburgh ...	441	25.21	32.05	16.44	55.8	38.8	87.7	5.0	57.2	38.3
Geneva	1,328	33.48	46.89	21.14	64.4	33.7	...	...	66.2	32.2
Genoa	157	51.29	108.22	28.21	73.8	46.8	94.5	16.7	75.4	45.5
Glasgow	184	38.49	56.18	29.05	52.7	41.0	84.9	6.6	58.0	38.4
Greenwich ...	159	24.12	35.54	16.38	61.3	39.3	100.0	4.0	62.7	38.6
Hong Kong ...	110	84.10	119.72	45.83	81.3	60.3	97.0	32.0	81.8	58.1
Johannesburg ...	5,750	31.63	50.00	21.66	65.4	54.4	94.0	23.3	68.2	48.9
Leipzig	384	24.69	31.37	17.10	63.1	31.5	97.3	—14.8	64.8	30.6
Lisbon	312	29.18	52.79	17.32	69.6	51.3	94.1	32.5	70.2	49.3
London	18	24.04	38.20	18.23	61.2	39.3	100.0	9.4	62.8	38.7
Madras	22	49.06	88.41	18.45	86.7	76.0	113.0	57.5	87.6	75.3
Madrid	2,149	16.23	27.48	9.13	73.0	41.2	107.1	10.5	75.7	39.7
Marseilles ...	246	21.88	43.04	12.28	70.3	45.3	100.4	11.5	72.1	43.3
Moscow	526	18.94	29.28	12.07	63.4	14.7	99.5	—44.5	66.1	11.9
Naples	489	34.00	56.58	21.75	73.6	48.0	99.1	23.9	75.4	46.8
New York ...	314	42.47	59.68	28.78	72.1	31.7	100.0	— 6.0	74.5	30.3
Ottawa	294	33.40	44.44	26.36	67.2	14.1	98.5	—33.0	69.7	12.0
Paris	165	21.92	29.56	16.44	63.5	37.1	101.1	—14.1	65.8	36.1
Pekin	143	24.40	36.00	18.00	77.7	26.6	114.0	— 5.0	79.2	23.6
Quebec	296	40.46	47.57	32.12	63.5	12.4	95.5	—34.3	66.3	10.1
Rome	166	32.57	57.89	12.72	74.3	46.0	104.2	17.2	76.1	44.6
San Francisco ...	155	22.83	38.82	9.31	59.0	51.0	101.0	29.0	62.0	50.0
Shanghai ...	14	44.13	62.52	27.91	77.4	39.4	102.9	10.2	79.7	37.4
Singapore ...	8	91.99	158.68	32.71	81.2	78.6	94.2	63.4	81.5	78.3
Stockholm ...	146	18.31	25.46	11.78	59.7	27.0	91.8	—22.0	62.1	25.7
Petrograd ...	16	21.30	29.52	13.75	61.1	17.4	97.0	—38.2	63.7	15.2
Tokio	70	59.17	77.10	45.72	73.9	38.9	97.9	15.4	77.7	37.1
Trieste	85	42.94	63.14	26.57	73.9	41.3	99.5	14.0	76.3	39.9
Vienna	663	24.50	33.90	16.50	65.7	30.4	97.7	— 8.0	67.1	28.0
Vladivostock ...	55	19.54	33.60	9.39	63.9	11.0	95.7	—21.8	69.4	6.1
Washington ...	75	43.80	61.33	18.79	74.7	34.5	104.0	—15.0	76.8	32.9
Wellington (N.Z.)	110	49.70	67.68	30.02	61.7	48.4	98.0	30.0	62.4	47.5
Zurich	1,542	45.15	78.27	29.02	63.3	31.3	94.1	— 0.8	65.1	29.5
FEDERAL CAPITAL SITE.										
Canberra (Dist.) Queanbeyan ...	2,000 to 2,900	22.20	41.29	10.45	* 68.3	† 43.9	101.0	20.0	70.0	42.9
THE STATE CAPITALS.										
Perth	197	32.91	46.73	20.21	* 72.9	† 55.8	107.9	34.3	74.1	54.9
Adelaide... ...	140	20.88	30.87	11.39	73.1	52.9	116.3	32.0	74.1	51.5
Brisbane... ...	137	46.41	88.26	16.17	76.8	59.6	108.9	36.1	77.2	58.2
Sydney	146	48.51	92.76	21.49	70.9	53.9	108.5	35.9	71.6	52.4
Melbourne ...	115	26.02	44.25	15.61	66.5	50.0	111.2	27.0	67.4	48.5
Hobart	160	23.39	40.67	13.43	61.7	46.7	105.2	27.0	62.4	45.3

* Mean of the three hottest months. † Mean of the three coldest months.

17. **Climatological Tables.**—The means, averages, extremes, totals, etc., for a number of climatological elements have been determined from long series of observations at the Australian capitals. These are given in the following tables:—

CLIMATOLOGICAL DATA FOR PERTH, W.A.

LAT. 31° 57′ S., LONG. 115° 50′ E. HEIGHT ABOVE M.S.L. 197 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F. Min. Sea Level and Standard Gravity from 9 a.m. & 3 p.m. readings.	Wind. Greatest Number of Miles in one day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds. 9 a.m. & 3 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	30	17	17	17	17	16	17	18	18
January	29.912	797 27/98	0.70	11,396	S	10.42	1.3	2.7	13.9
February	29.928	650 6/08	0.66	10,089	S S E	8.71	1.1	2.9	11.6
March	29.988	651 6/13	0.57	10,257	S S E	7.75	0.9	3.3	11.6
April	30.074	955 25/00	0.43	8,654	S E	4.79	0.8	4.5	7.1
May	30.088	768 5/12	0.35	8,068	E N E	2.77	1.8	5.4	5.2
June	30.070	861 27/10	0.38	8,050	N N E	1.74	1.7	6.0	3.3
July	30.098	949 11/99	0.40	8,528	N N E	1.66	2.3	5.6	5.2
August	30.088	966 15/03	0.42	8,818	W	2.37	1.3	5.4	5.1
September	30.063	864 11/05	0.48	9,095	S W	3.37	1.5	5.2	5.5
October	30.034	686 15/98	0.54	9,991	S S W	5.30	1.1	5.2	5.3
November	29.994	777 18/97	0.60	10,256	S	7.70	0.9	4.0	7.5
December	29.932	672 31/98	0.66	11,018	S	9.75	1.5	3.2	10.9
Year Totals	—	—	—	—	—	66.33	16.2	—	92.2
Year Averages	30.022	—	0.51	9.519	S	—	—	4.4	—
Year Extremes	—	966 15/8/03	—	—	—	—	—	—	—

TEMPERATURE.

Month.	Mean Temperature. Mean Max.	Mean Temperature. Mean Min.	Mean Temperature. Mean	Extreme Shade Temperature. Highest.	Extreme Shade Temperature. Lowest.	Greatest Range.	Extreme Temperature. Highest in Sun.	Extreme Temperature. Lowest on Grass.	Sea water min. 3 ft. below surface
No. of yrs. over which observation extends	18	18	18	18	18	18	17	16	—
January	84.3	63.0	73.6	107.0 16/97	50.6 25/01	56.4	177.3 22/14	42.4 25/02	—
February	84.9	63.3	74.1	106.8 6/98	47.7 1/02	59.1	169.0 4/99	39.8 1/13	—
March	81.5	60.7	71.1	106.1 6/14	45.8 8/03	60.3	164.0 6/14	36.7 8/03	—
April	75.7	56.7	66.2	99.7 9/10	39.3 20/14	60.4	156.8 2/13	31.0 20/14	—
May	68.7	52.2	60.4	90.4 2/07	34.3 11/14	56.1	139.1 7/14	25.3 11/14	—
June	63.8	49.0	56.4	81.7 2/14	36.3 29/14	45.4	135.5 9/14	29.9 21/14	—
July	62.4	47.4	54.9	73.8 24/99	36.4 19/06	37.4	132.9 25/13	27.6 21/11	—
August	64.0	48.1	56.0	81.0 12/14	35.3 31/08	45.7	139.1 21/13	27.9 10/11	—
September	66.2	50.1	58.2	86.7 30/13	38.9 17/13	47.8	149.5 30/14	30.2 25/13	—
October	69.4	52.8	61.1	93.4 17/06	41.2 10/03	52.2	154.0 29/14	33.4 1/10	—
November	74.8	56.1	65.4	104.6 24/13	42.0 1/04	62.6	164.5 24/13	35.5 ‡	—
December	80.6	60.5	70.6	107.9 20/04	48.0 2/10	59.9	168.3 20/04	39.1 2/10	—
Year Averages	73.0	55.0	64.0	—	—	—	—	—	—
Year Extremes	—	—	—	107.9 20/12/04	34.3 11/5/14	73.6	177.3 22/1/14	25.3 11/5/14	—

‡ 6/1910 and 14/1912.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean Daily.	Humidity. Highest Mean.	Humidity. Lowest Mean.	Rainfall. Mean Monthly.	Rainfall. Mean No. of Days Rain.	Rainfall. Greatest Monthly.	Rainfall. Least Monthly.	Rainfall. Greatest in One Day.	Dew. Mean Amount of Dew.	Dew. Mean No. days Dew
No. of yrs. over which observation extends	18	18	18	39	39	39	39	39	—	18
January	51	59	43	0.32	3	2.17 1879	nil *	1.74 28/79	—	2.8
February	54	64	47	0.32	2	2.30 1883	nil †	0.90 10/83	—	2.7
March	57	66	46	0.69	4	4.50 1896	nil ‡	1.53 17/76	—	4.8
April	64	70	53	1.63	7	4.97 1882	0.05 ‖	2.62 30/04	—	8.9
May	73	81	61	4.71	13	12.13 1879	0.98 1903	2.80 20/79	—	12.7
June	78	83	72	6.54	16	12.11 1890	2.16 1877	2.65 16/00	—	12.3
July	78	84	72	6.41	17	10.90 1902	2.42 1876	3.00 4/91	—	12.7
August	74	79	67	5.58	18	10.33 1882	0.46 1902	2.79 7/03	—	11.2
September	68	75	62	3.29	14	7.72 1903	0.62 1914	1.73 23/09	—	9.2
October	63	75	54	2.07	11	7.87 1890	0.49 1892	1.38 15/10	—	6.0
November	56	63	50	0.78	6	2.12 1880	nil 1891	1.11 30/03	—	4.7
December	52	62	45	0.57	4	3.05 1888	nil 1886	1.72 1/88	—	3.4
Year Totals	—	—	—	32.91	115	—	—	—	—	91.4
Year Averages	62	—	—	—	—	—	—	—	—	—
Year Extremes	—	83	45	—	—	12.13 5/79	nil §	3.00 4/7/91	—	—

* 1888, 1894, 1897, and 1911. † 1885, 1891, 1896, 1903, and 1913. ‡ 1877, 1884, and 1886. ‖ 1890 and 1894. § January, February, March, November, and December, various years.

CLIMATOLOGICAL DATA FOR ADELAIDE, S.A.

LAT. 34° 56′ S., LONG. 138° 35′ E. HEIGHT ABOVE M.S.L. 140 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. & 3 p.m. readings.	Wind. Greatest Number of Miles in one day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m., 3 & 9 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	58	37	37	37	37	45	43	47	33
January	29.916	758 19/99	0.35	8,072	S x W	8.94	2.3	3.5	7.8
February	29.953	691 22/96	0.31	6,832	S	7.28	2.0	3.4	7.0
March	30.036	628 9/12	0.25	6,836	S x W	5.74	2.3	4.0	6.5
April	30.117	773 10/96	0.23	6,262	S W x S	3.37	1.7	5.0	3.8
May	30.128	760 9/80	0.21	6,190	N N E	1.99	1.7	5.7	1.7
June	30.105	750 12/78	0.25	6,592	N x E	1.23	2.1	6.1	1.3
July	30.134	674 25/82	0.25	6,808	N x W	1.29	1.6	5.8	1.5
August	30.102	773 31/97	0.28	7,231	N N W	1.87	2.2	5.6	2.1
September	30.043	720 2/87	0.31	7,368	W S W	2.83	2.4	5.2	2.8
October	30.000	768 28/98	0.35	7,998	S W	4.78	3.5	4.8	4.0
November	29.975	677 2/04	0.34	7,676	S S W	6.53	3.9	4.5	5.2
December	29.919	675 12/91	0.35	8,080	S S W	8.41	2.8	3.8	6.8
Year Totals	—	—	—	—	—	54.26	28.5	—	50.5
Year Averages	30.036	—	0.29	7,162	S W x S	—	—	4.6	—
Year Extremes	—	773*	—	—	—	—	—	—	—

* 10/4/96, and 31/8/97.

TEMPERATURE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Greatest Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	*Sea water mn. 3 ft. below surface.
No. of yrs. over which observation extends	58	58	58	58	58	58	37	54	38
January	86.5	61.7	74.1	116.3 26/58	45.1 21/84	71.2	180.0 18/82	36.5 14/79	70.8
February	86.1	62.0	74.0	113.6 12/99	46.4 13/05	67.2	170.5 10/00	36.7 24/78	70.9
March	80.9	59.0	69.9	108.0 12/61	44.8 —/57	63.2	174.0 17/83	33.8 27/80	68.2
April	73.3	54.6	64.0	98.0 10/66	39.6 15/59	58.4	155.0 1/83	30.3 27/08	64.0
May	65.4	50.0	57.7	88.3 5/66	36.9 †	51.4	148.2 12/79	25.9 10/91	59.1
June	60.2	46.6	53.4	76.0 23/65	32.5 27/76	43.5	138.8 18/79	22.9 12/13	54.7
July	58.7	44.4	51.5	74.0 11/06	32.0 24/08	42.0	134.5 26/90	23.3 25/11	52.2
August	62.0	45.9	53.9	85.0 31/11	32.3 17/59	52.7	140.0 31/92	23.5 7/88	53.3
September	66.2	47.8	57.0	90.7 23/82	32.7 4/58	58.0	160.5 23/82	26.2 15/08	56.5
October	72.6	51.4	62.0	102.2 24/14	36.0 —/57	66.2	158.8 19/82	28.5 7/96	60.7
November	78.8	55.4	67.1	113.5 21/65	40.8 2/09	72.7	166.9 20/78	31.5 2/09	65.2
December	83.4	58.9	71.2	114.2 14/76	43.0 ‡	71.2	175.7 7/99	32.5 4/84	68.6
Year Averages	72.9	53.1	63.0	—	—	—	—	—	62.0
Year Extremes	—	—	—	116.3 26/1/58	32.0 24/7/08	84.3	180.0 18/1/82	22.9 12/6/13	—

* Taken at Lighthouse at entrance to Port River. (Discontinued in 1912.) † 26/1895, and 24/1904. ‡ 16/61, and 4/06.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew
No. of yrs. over which observation extends	47	47	47	76	76	76	76	76	—	43
January	38	59	33	0.73	4	4.00 1850	nil *	2.30 2/89	—	4
February	41	56	33	0.62	4	2.67 1858	nil †	2.24 14/13	—	5
March	47	58	40	1.06	6	4.60 1878	nil ‡	3.50 5/78	—	11
April	56	72	44	1.86	9	6.78 1853	0.06 1910	3.15 5/60	—	14
May	68	76	49	2.70	14	7.75 1875	0.20 1891	2.75 1/53	—	16
June	78	84	69	3.03	15	7.80 1847	0.42 1886	1.45 2/49‖	—	16
July	76	87	69	2.62	17	5.38 1865	0.36 1889	1.75 10/65	—	17
August	69	77	54	2.47	16	6.24 1852	0.35 1914	2.23 19/51	—	16
September	63	72	44	1.94	14	4.64 1840	0.45 1896	1.42 25/93	—	16
October	51	67	29	1.73	11	3.83 1870	0.17 1914	2.24 16/08	—	12
November	44	57	37	1.16	8	3.55 1851	0.04 1885	1.88 28/58	—	6
December	39	50	33	0.96	5	3.98 1861	nil 1904	2.42 23/13	—	4
Year Totals	—	—	—	20.88	123	—	—	—	—	137
Year Averages	53	—	—	—	—	—	—	—	—	—
Year Extremes	—	87	29	—	—	7.80 6/47	nil §	3.50 5/3/78	—	—

* 1848, 1849, 1878, and 1906. † 1848, 1860, etc. ‡ 1859, etc. § January, February, March and December, various years. ‖ and 25/84.

CLIMATOLOGICAL DATA FOR BRISBANE, QUEENSLAND.

LAT. 27° 28′ S., LONG. 153° 2′ E. HEIGHT ABOVE M.S.L. 137 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. & 3 p.m. readings.	Wind. Greatest Number of Miles in one day.	Wind. Total Miles.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Prevailing Direction.	Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds, 9 a.m. & 3 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	28	4	3	3	28	6	28	28	6
January	29.869	315 24/14	3,312	0.06	E	6.110	4.7	6.2	2.6
February	29.897	268 26/14	2,663	0.04	S E	4.601	4.8	6.3	1.8
March	29.951	197 12/14	2,387	0.03	S	4.196	3.2	6.0	3.2
April	30.042	209 10/13	2,249	0.03	S	3.751	2.9	5.1	9.2
May	30.093	149 15/13	2,161	0.02	S	2.840	2.6	4.9	8.4
June	30.066	170 20/11	2,198	0.03	S	2.052	1.8	4.9	6.8
July	30.064	165 1/13	2,016	0.02	S & W	2.350	2.2	3.9	13.5
August	30.093	212 27/14	2,034	0.02	S & S W	2.757	3.5	4.0	10.4
September	30.028	158 16/11	1,982	0.02	S & E	3.884	5.4	3.8	11.8
October	30.064	268 19/11	3,284*	0.06*	N E	4.984	6.5	4.4	9.0
November	29.960	199 19/13	2,877	0.05	N E & E	5.913	7.8	5.2	6.4
December	29.884	295 21/13	3,192	0.06	N E & E	6.492	8.5	5.6	4.2
Year Totals	—	—	—	—	—	49.930	53.9	—	87.3
Year Averages	30.001	—	2,530	0.04	S'ly to E'ly	—	—	5.0	—
Year Extremes	—	315 24/1/14	—	—	—	—	—	—	—

* Mean for 4 years.

TEMPERATURE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Greatest Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Sea water mn. 3 ft. below surface.
No. of yrs. over which observation extends.	28	28	28	28	28	28	28	28	—
January	85.5	68.9	77.2	108.9 14/02	58.8 4/93	50.1	164.4 2/13	49.9 4/93	—
February	84.5	68.5	76.5	101.9 11/04	58.7 *	43.2	165.2 6/02	49.3 9/89	—
March	82.3	66.5	74.4	96.8 16/88	52.4 29/13	44.4	160.0 1/87	45.4 29/13	—
April	79.2	61.7	70.5	95.2 †	48.6 17/00	46.6	150.1 ¶	37.0 17/00	—
May	73.5	55.4	64.5	88.8 18/97	41.3 24/99	47.5	147.0 1/05	29.8 8/97	—
June	69.2	50.8	60.0	81.5 6/06	36.3 29/08	45.2	133.9 6/06	25.4 23/88	—
July	68.2	48.1	58.2	83.4 28/98	36.1 ‡	47.3	134.4 29/89	23.9 11/90	—
August	71.3	49.8	60.6	87.5 28/07	37.4 6/87	50.1	140.7 30/88	27.1. 9/99	—
September	75.8	54.6	65.2	95.2 16/12	40.7 1/96	54.5	155.5 26/03	30.4 1/89	—
October	79.8	59.8	69.8	101.4 18/93	43.3 3/99	58.1	156.5 31/89	34.9 8/89	—
November	83.0	64.1	73.6	106.1 18/13	48.5 2/05	57.6	162.3 7/89	38.8 1/05	—
December	85.6	67.5	76.6	105.9 26/93	56.4 13/12	49.5	159.5 23/89	49.1 3/94	—
Year Averages	78.2	59.6	68.9	—	—	—	—	—	—
Year Extremes	—	—	—	108.9 14/1/02	36.1 ‖	72.8	165.2 6/2/10	23.9 11/7/90	—

* 10-11/04. † 9/96 and 5/03. ‡ 12/94 and 2/96. ‖ 12/7/94 and 2/7/96. ¶ 1/08 and 6/13.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew
No. of yrs. over which observation extends	28	28	28	63	55	63	63	—	—	28
January	65	79	53	6.59	14	27.72 1895	0.61 1882	18.31 21/87	—	2.9
February	69	82	55	6.55	14	40.39 1893	0.77 1904	8.36 16/93	—	3.0
March	72	85	56	6.18	16	34.04 1870	0.58 1868	11.18 14/08	—	5.4
April	72	79	60	3.64	12	15.28 1867	0.05 1897	3.93 20/92	—	9.3
May	74	85	64	2.98	10	13.85 1876	0.00 1846	5.62 9/79	—	10.0
June	75	82	67	2.68	8	14.03 1873	0.02 1895	6.01 9/93	—	7.5
July	74	80	67	2.32	8	8.46 1889	0.00 1841	3.54 ‡	—	8.5
August	71	80	62	2.28	7	14.67 1879	0.00 *	4.89 12/87	—	6.9
September	65	76	47	2.04	9	5.43 1886	0.10 1907	2.46 2/94	—	6.5
October	61	72	52	2.75	10	9.99 1882	0.14 1900	1.95 20/89	—	4.9
November	59	71	45	3.57	10	10.43 1846	0.00 1842	4.46 16/86	—	1.7
December	61	67	52	5.07	12	13.99 1910	0.35 1865	6.60 28/71	—	1.7
Year Totals	—	—	—	46.65	130	—	—	—	—	68.3
Year Averages	68	—	—	—	—	—	—	—	—	—
Year Extremes	—	85	47	—	—	40.39 2/1893	0.00 †	18.31 21/1/87	—	—

— signifies no record kept.

* 1862, 1869, 1880. † 5/1846, 7/1841, 8/1862, 1869, 1880, 11/1842. ‡ 15/76, 16/89.

CLIMATOLOGICAL DATA FOR SYDNEY, N.S.W.

LAT. 33° 52′ S., LONG. 151° 12′ E. HEIGHT ABOVE M.S.L. 146 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 24 hourly readings.	Wind.				Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds.	No. of Clear Days.
		Greatest Number of Miles in one day.	Mean Hourly Pressure. (lbs.)	Total Miles.	Prevailing Direction.				
No. of yrs. over which observation extends	55	48	48	48	56	35	55	53	51
January	29.902	721 1/71	0.37	8,292	N E	5.15	4.7	5.8	1.8
February	29.945	871 12/69	0.34	7,156	N E	3.99	4.2	6.1	1.1
March	30.013	943 20/70	0.25	6,871	N E	3.37	4.3	5.6	1.6
April	30.069	803 6/82	0.23	6,300	N E	2.45	3.9	5.1	2.5
May	30.083	758 6/98	0.23	6,443	W	1.62	3.5	4.9	2.9
June	30.065	712 7/00	0.29	7,145	W	1.36	2.2	4.8	3.2
July	30.078	930 17/79	0.29	7,300	W	1.43	2.5	4.4	3.9
August	30.070	756 22/72	0.27	7,014	W	1.75	3.3	4.1	4.3
September	30.006	964 6/74	0.31	7,264	W	2.57	4.1	4.4	3.6
October	29.972	926 4/72	0.34	7,887	N E	3.69	4.9	5.0	2.2
November	29.940	720 13/68	0.35	7,757	N E	4.46	5.5	5.6	1.4
December	29.881	938 3/84	0.36	8,174	N E	5.30	5.6	5.6	1.8
Year Totals ...	—	—	—	—	—	37.14	48.7	—	30.3
Year Averages ...	30.002	—	0.30	7,300	N E	—	—	5.1	—
Year Extremes ...	—	964 6/9/74	—	—	—	—	—	—	—

TEMPERATURE.

Month.	Mean Temperature.			Extreme Shade Temperature.				Greatest Range.	Extreme Temperature.				*Sea water mn. 3 ft. below surface.
	Mean Max.	Mean Min.	Mean	Highest.		Lowest.			Highest in Sun.		Lowest on Grass.		
No. of yrs. over which observation extends	56	56	56	56		56		56	55		55		54
January	78.4	64.9	71.6	108.5	13/96	51.2	14/65	57.3	160.9	13/96	44.2	18/97	71.5
February	77.3	64.9	71.1	101.0	19/66	49.3	28/63	51.7	162.1	16/98	43.4	25/91	72.0
March	75.4	63.0	69.3	103.6	3/69	48.8	14/86	53.8	172.3	4/89	39.9	17/13	71.1
April	71.1	58.2	64.7	89.0	4/09	44.6	27/64	44.4	144.1	10/77	33.3	24/09	68.4
May	65.0	52.1	58.5	83.5	1/59	40.2	22/59	43.3	129.7	1/96	30.1	5/09	64.2
June	60.5	48.2	54.3	74.7	24/72	38.1	29/62	36.6	123.0	14/78	28.1	24/11	59.9
July	58.9	45.7	52.4	74.9	17/71	35.9	12/90	39.0	144.3	15/98	24.0	4/93	57.3
August	62.3	47.6	54.9	82.0	31/84	36.8	3/72	45.2	149.0	30/78	26.1	4/09	57.7
September	66.4	51.4	59.0	91.1	24/07	40.8	18/64	50.3	142.2	12/78	30.1	17/05	60.3
October	71.2	55.9	63.5	99.7	19/98	43.3	2/99	56.4	151.9	31/14	32.7	9/05	63.4
November	74.4	59.7	67.1	102.7	21/78	45.8	1/05	56.9	158.5	28/99	36.0	6/06	67.1
December	77.3	62.8	70.1	107.5	31/04	49.3	2/59	58.2	171.5	4/88	41.5	6/09	69.7
Year Averages ...	69.9	56.2	63.0	—		—		—	—		—		65.2
Year Extremes ...	—	—	—	108.5	13/1/96	35.9	12/7/90	72.6	172.3	4/3/89	24.0	4/7/93	—

* Taken at Fort Denison.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity.			Rainfall.								Dew.	
	Mean 9 a.m.	Highest Mean.	Lowest Mean.	Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.		Least Monthly.		Greatest in One Day.		Mean Amount of Dew.	Mean No. days Dew
No. of yrs. over which observation extends	56	56	56	56	56	56		56		56		55	55
January	70	78	58	3.52	14.2	15.26	1911	0.42	1888	7.08	13/11	0.002	1.3
February	72	81	60	4.62	14.2	18.56	1873	0.34	1902	8.90	25/73	0.004	2.1
March	75	85	63	5.31	15.2	18.70	1870	0.42	1876	6.52	9/13	0.008	3.5
April	77	87	63	5.25	13.2	24.49	1861	0.06	1868	7.52	29/60	0.017	5.8
May	77	90	66	5.06	15.5	20.87	1889	0.21	1885	8.36	28/89	0.022	6.5
June	79	89	68	5.24	13.0	16.30	1885	0.19	1902	5.17	16/84	0.018	5.5
July	77	88	66	4.91	12.6	13.21	1900	0.12	1862	5.72	28/08	0.016	5.5
August	74	84	56	3.19	11.4	14.89	1899	0.04	1885	5.33	2/60	0.014	5.0
September	69	79	49	2.86	12.2	14.05	1879	0.08	1882	5.69	10/79	0.008	3.6
October	68	77	55	2.84	12.7	10.81	1902	0.21	1867	6.37	13/02	0.007	3.2
November	67	79	44	2.87	12.5	9.88	1865	0.19	1910	4.23	19/00	0.004	2.3
December	67	77	52	2.63	12.8	8.47	1910	0.23	1913	4.75	13/10	0.003	1.6
Year Totals ...	—	—	—	48.30	159.5	—		—		—		0.123	45.9
Year Averages ...	73	—	—	—	—	—		—		—		—	—
Year Extremes ...	—	90	44	—	—	24.49	4/1861	0.04	8/1885	8.90	25/2/73	—	—

CLIMATOLOGICAL DATA FOR MELBOURNE, VICTORIA.

LAT. 37° 49′ S., LONG. 144° 58′ E. HEIGHT ABOVE M.S.L. 115 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F., Mn. Sea Level and Standard Gravity from 9 a.m., 3 & 9 p.m. readings.	Wind. Greatest Number of Miles in one day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds. 9 a.m. & 3 p.m.	No. of Clear Days.
No. of yrs. over which observation extends	57	48	48	48	48	42	7	57	7
January	29.914	583 10/97	0.29	7,301	S W, S E	6.39	1.7	5.1	9.0
February	29.963	566 8/68	0.27	6,347	S W, S E	5.04	2.3	5.0	8.4
March	30.034	677 9/81	0.22	6,313	S W, S E	3.90	2.2	5.5	5.3
April	30.100	597 7/68	0.19	5,697	S W, N W	2.35	1.0	5.9	4.1
May	30.108	693 12/65	0.19	5,894	N W, N E	1.46	0.2	6.5	2.7
June	30.085	761 13/76	0.24	6,387	N W, N E	1.09	1.0	6.7	2.0
July	30.099	755 8/74	0.22	6,350	N W, N E	1.05	1.2	6.3	3.7
August	30.069	637 14/75	0.25	6,813	N W, N E	1.48	1.0	6.3	1.9
September	30.000	617 11/72	0.28	6,993	N W, S W	2.26	1.7	6.1	3.0
October	29.970	899 5/66	0.29	7,277	S W, N W	3.32	2.5	5.9	5.4
November	29.953	734 13/66	0.28	7,000	S W, S E	4.52	2.8	5.9	4.0
December	29.897	655 1/75	0.30	7,439	S W, S E	5.73	2.1	5.5	4.2
Year Totals	—	—	—	—	—	38.59	19.7	—	53.7
Year Averages	—	—	0.25	6,651	S W, N W	—	—	5.9	—
Year Extremes	30.016	899 5/10/66	—	—	—	—	—	—	—

TEMPERATURE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Greatest Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Sea water mn. 3 ft. below surface
No. of yrs. over which observation extends	59	59	59	59	59	59	55	53	—
January	78.2	56.6	67.4	111.2 14/62	42.0 28/85	69.2	178.5 14/62	30.2 28/85	—
February	77.9	56.8	67.4	109.5 7/01	40.3 9/65	69.2	167.5 15/70	30.9 6/91	—
March	74.5	54.7	64.6	105.5 2/93	37.1 17/84	68.4	164.5 1/68	28.9 *	—
April	68.5	50.7	59.6	94.0 6/65	34.8 24/88	59.2	152.0 8/61	25.0 23/97	—
May	61.4	46.7	54.0	83.7 7/05	31.3 26/95	52.4	142.6 2/59	23.2 21/97	—
June	56.8	43.9	50.4	72.2 1/07	28.0 11/66	44.2	129.0 11/61	20.4 17/95	—
July	55.4	41.5	48.5	68.4 24/78	27.0 21/69	41.4	125.8 27/80	20.5 12/03	—
August	58.8	43.3	51.0	77.0 20/85	28.3 11/63	48.7	137.4 29/69	21.3 14/02	—
September	62.5	45.4	53.9	82.3 30/07	31.1 16/08	51.2	142.1 20/67	24.7 13/07	—
October	67.1	48.1	57.6	98.4 24/14	32.1 3/71	66.3	154.3 28/68	25.9 3/71	—
November	71.5	51.1	61.3	105.7 27/94	36.5 2/96	69.2	159.6 29/65	24.6 2/96	—
December	75.3	54.0	64.6	110.7 15/76	40.0 4/70	70.7	170.3 20/69	33.2 10/04	—
Year Averages	67.3	49.4	58.4	—	—	—	—	—	—
Year Extremes	—	—	—	111.2 14/1/62	27.0 21/7/69	84.2	178.5 14/1/62	20.4 17/6/95	—

* 17/1884 and 20/1897.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean Daily.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew
No. of yrs. over which observation extends	57	57	57	59	59	59	59	56	—	7
January	64	73	52	1.82	7	5.68 1904	0.04 1878	2.97 9/97	—	1.8
February	64	75	52	1.70	7	6.24 1904	0.03 1870	2.14 7/04	—	2.3
March	67	78	59	2.22	9	7.50 1911	0.18 1859	3.05 15/78	—	5.7
April	73	83	62	2.30	11	6.71 1901	0.33 1908	2.28 22/01	—	8.0
May	78	86	64	2.17	13	4.31 1862	0.45 1901	1.85 7/91	—	7.2
June	80	88	72	2.09	13	4.51 1859	0.73 1877	1.74 21/04	—	9.2
July	79	88	72	1.84	13	7.02 1891	0.57 1902	2.71 12/91	—	10.8
August	74	81	63	1.79	14	3.59 1909	0.48 1903	1.87 17/81	—	8.0
September	71	81	61	2.31	14	5.87 1870	0.52 1907	2.62 12/80	—	7.3
October	70	79	52	2.58	13	7.61 1869	0.29 1914	3.00 17/69	—	7.8
November	66	75	53	2.19	10	5.05 1881	0.25 1895	2.57 16/76	—	1.9
December	64	75	49	2.31	9	7.18 1863	0.11 1904	2.62 28/07	—	1.5
Year Totals	—	—	—	25.32	133	—	—	—	—	71.5
Year Averages	71	—	—	—	—	—	—	—	—	—
Year Extremes	—	88	49	—	—	7.61 10/69	0.03 2/70	3.05 15/3/78	—	—

— signifies no record kept.

CLIMATOLOGICAL DATA FOR HOBART, TASMANIA.

LAT. 42° 53′ S., LONG. 147° 20′ E. HEIGHT ABOVE M.S.L. 160 FT.

BAROMETER, WIND, EVAPORATION, LIGHTNING, CLOUDS, AND CLEAR DAYS.

Month.	Bar. corrected to 32° F. Mn. Sea Level and Standard Gravity from 9 a.m. & 3 p.m. readings.	Wind. Greatest Number of Miles in one day.	Wind. Mean Hourly Pressure. (lbs.)	Wind. Total Miles.	Wind. Prevailing Direction.	Mean Amount of Evaporation.	No. of Days Lightning.	Mean Amount of Clouds.	No. of Clear Days.
No. of yrs. over which observation extends	30	4	4	4	10	5	7	52	8
January	29.826	420 8/14	0.19	5,918	N W & S E	5.78	0.4	5.8	4.0
February	29.920	393 19/13	0.11	4,127	S E & N	4.17	1.0	5.9	3.1
March	29.941	315 28/11	0.10	4,308	N & S E	3.03	1.1	5.8	2.2
April	29.944	413 9/11	0.13	4,764	N to N W	2.06	0.7	6.0	2.0
May	29.998	346 31/14	0.10	4,263	N to N W	1.29	0.4	6.0	2.2
June	29.967	415 17/12	0.10	4,129	N to N W	0.74	1.1	6.0	2.1
July	29.934	396 17/11	0.09	4,158	N to N W	0.81	0.4	5.7	3.3
August	29.932	459 30/11	0.15	5,201	N to N W	1.32	1.1	5.9	2.5
September	29.846	435 4/13	0.18	5,510	N to N W	1.94	0.7	6.1	2.0
October	29.844	461 8/12	0.17	5,657	N	3.39	0.9	6.3	2.1
November	29.800	418 16/11	0.18	5,567	N & S E	4.16	0.7	6.3	2.0
December	29.804	359 9/12	0.17	5,634	N W & S E	4.77	1.7	6.1	1.2
Year Totals	—	—	—	59,236	—	33.46	10.2	—	28.6
Year Averages	29.896	—	0.14	—	N	—	—	6.0	—
Year Extremes	—	461 8/10/12	—	—	—	—	—	—	—

TEMPERATURE.

Month.	Mean Temperature. Mean Max.	Mean Min.	Mean	Extreme Shade Temperature. Highest.	Lowest.	Greatest Range.	Extreme Temperature. Highest in Sun.	Lowest on Grass.	Sea water min. 3 ft. below surface
No. of yrs. over which observation extends	44	44	44	68	68	68	27	48	—
January	71.7	53.0	62.4	105.0 1/00	40.3 *	64.7	160.0 †	30.6 19/97	—
February	71.6	53.1	62.4	104.4 12/99	39.0 20/87	65.4	165.0 24/98	28.3 –/87	—
March	68.1	50.7	59.4	98.8 5/46	36.0 31/05	62.8	150.0 3/05	27.5 30/02	—
April	62.8	47.6	55.2	90.0 2/56	30.0 25/56	60.0	142.0 18/93	25.0 –/86	—
May	57.3	43.5	50.4	77.5 1/41	29.2 20/02	48.3	128.0 ‡	20.0 19/02	—
June	52.7	40.9	46.8	75.0 7/74	28.0 22/79	47.0	122.0 12/94	21.0 6/87	—
July	51.7	39.0	45.3	72.0 22/77	27.0 18/66	45.0	118.7 19/96	18.7 16/86	—
August	54.9	40.9	47.9	77.0 3/76	30.0 10/73	47.0	129.0 1887	20.1 7/09	—
September	58.6	42.9	50.8	80.0 9/72	30.0 12/41	50.0	138.0 23/93	22.7 –/86	—
October	62.8	45.4	54.1	92.0 24/14	32.0 12/89	60.0	156.0 9/93	23.8 §	—
November	66.4	48.3	57.3	98.0 20/88	35.2 5/13	62.8	154.0 19/92	26.0 1/08	—
December	69.6	51.1	60.3	105.2 30/97	38.0 3/06	67.2	156.0 18/05	27.2 –/86	—
Year Averages	62.4	46.4	54.4	—	—	—	—	—	—
Year Extremes	—	—	—	105.2 30/12/97	27.0 18/7/66	78.2	165.0 24/2/98	18.7 16/7/86	—

* 3/72 and 2/06. † 5/86 and 13/05. ‡ 1888 and 1892. § 1/86. 1899.

HUMIDITY, RAINFALL, AND DEW.

Month.	Humidity. Mean 9 a.m.	Highest Mean.	Lowest Mean.	Rainfall. Mean Monthly.	Mean No. of Days Rain.	Greatest Monthly.	Least Monthly.	Greatest in One Day.	Dew. Mean Amount of Dew.	Mean No. days Dew
No. of yrs. over which observation extends	35	35	35	72	71	72	72	48	—	5
January	62	75	51	1.77	9	5.91 1893	0.03 1841	2.59 30/05	—	1.4
February	64	76	51	1.42	8	9.15 1854	0.07 1847	4.50* 25/54	—	1.2
March	68	76	59	1.65	10	7.60 1854	0.02 1843	2.06 14/11	—	3.2
April	75	85	60	1.83	11	6.50 1909	0.07 1904	5.02 20/09	—	8.8
May	80	90	68	1.87	12	6.37 1905	0.10 1843	3.22 14/58	—	12.6
June	83	94	73	2.18	13	8.15 1889	0.22 1852	4.11 14/89	—	5.4
July	83	97	74	2.10	14	5.98 1849	0.30 1850	2.00 27/78	—	7.6
August	80	92	64	1.81	13	10.16 1858	0.23 1854	4.35 12/58	—	5.4
September	73	87	60	2.12	14	7.14 1844	0.39 1847	3.50 29/44	—	2.8
October	67	75	51	2.21	15	6.67 1906	0.26 1850	2.58 4/06	—	2.6
November	63	74	50	2.50	14	8.92 1849	0.16 1868	3.97 6/49	—	1.4
December	60	73	51	1.93	11	9.00 1875	0.11 1842	2.27 27/07	—	1.6
Year Totals	—	—	—	23.39	144	—	—	—	—	54.0
Year Averages	71	—	—	—	—	—	—	—	—	—
Year Extremes	—	97	50	—	—	10.16 8/1858	0/02 3/1843	5.02 20/4/09	—	—

* 4.18, 26/54 also.

§ 7. The Grasses and Saltbushes of Australia.[1]

1. Grasses.

1. **Value of Native Grasses to the Pastoral Industry.**—The native grasses of Australia are famous throughout the world, not only for their fattening and wool-producing qualities, but also for their remarkable ability to withstand the effects of drought. It is upon the excellence of the native grass pasture, coupled with the indigenous saltbushes and other edible fodder plants that the success of the great pastoral industries of the Commonwealth primarily depends. Moreover, while it is true that in the progress of the development of most countries, the pastoral industry tends to become overshadowed in importance by other industries, and while it is also true that dry-farming methods can extend the area of cultivation far beyond what was thought possible a few years ago, nevertheless the excellence of Australian pastoral products, particularly as regards wool and mutton, renders it probable that the pastoral industry will for long retain its position as one of the chief sources of Australia's wealth.

In this connection, also, the fact must not be lost sight of that no cultivated plants have as yet been, or are likely to be, found which can replace, with their drought-resisting qualities, the native grasses, saltbushes, and edible fodder plants.

2. **Dairying and Introduced Grasses.**—Besides the wealth produced from wool-growing and sheep and cattle-raising, there must be also considered that derived from dairying. This industry is confined chiefly to the coastal belt and highlands of Australia. In New South Wales, Victoria, South Australia, Western Australia and Tasmania, well-known introduced grasses like Cocksfoot, Perennial Rye, Timothy, *Phalaris bulbosa* and many others, find on the coasts and tablelands a climate pre-eminently adapted to their requirements. Under a fair rainfall and not too hot conditions they may be said in such localities to be superior to the native grasses which they have replaced. A new introduced plant is occasionally found which proves a boon to certain districts when laid down to cultivation. Particularly is this the case with *Paspalum* on the northern rivers of New South Wales, Rhodes grass for light and hot soils, Strawberry Clover for Gippsland, Victoria, and Egyptian Clover for South Australia. The history of *Paspalum* reads almost like a romance. Introduced from the hot moist climate of South America it found most congenial surroundings in the coastal districts of New South Wales, and what were once villages on the northern rivers are now thriving townships.

In most of the dairying districts of Queensland, however, native grasses still hold pride of place. A hot summer and at times precarious rainfall prove too much for introduced grasses, and although such exotic dry country grasses as Rhodes are making headway, it is doubtful if the results produced can come up to those from the native grasses.

3. **Distribution of the Native Grasses.**—The distribution of the native grasses of Australia may be said, generally speaking, to be more dependent on climatic conditions than on soil considerations. Australia possesses three distinct rain zones, viz., a summer rain zone extending from the Northern Territory and embracing the north-western portion of Western Australia, Queensland, and the northern and north-western portion of New South Wales, a neutral rain zone, extending over the middle portions of the continent, and a winter rain zone, which embraces the Riverina portion of New South Wales, practically the whole of Victoria and Tasmania, and the southern portions of South Australia and Western Australia. In considering the grasses in these places, we find that the dominant species are those best adapted to the climatic conditions. For example, out of 54 different species of the genus *Panicum*, 27 are found in the Northern Territory, 30 in Queensland, 20 in New South Wales, and only 5, 8 and 6 in Victoria, South Australia and Western Australia respectively. The *Panics* are summer

1. Contributed by E. Breakwell, Esq., B.A., B.Sc., Agrostologist, Botanic Gardens, Sydney.

grasses and are best adapted to hot summer conditions. On the other hand, the *Agrostis* species are typical winter grasses, and we accordingly find them most common in Tasmania (11 species), South Australia (6 species), Western Australia (6 species), Victoria (12 species), southern portion of New South Wales (8 species), while they are practically absent in the Northern Territory (0 species), and in Queensland (2 species).

Some very cosmopolitan grasses are the *Danthonias, Eragrostis, Themedas* and *Stipas*. The rareness of the lastnamed genus in the Northern Territory is probably due to the fact that the more vigorous growing grasses crowd them out. As a rule the grasses growing in the summer rain zone lend themselves to greater variety and bulk of feed than those of the winter rain belt. For example, Queensland, the Northern Territory and the northern parts of New South Wales may be considered typical cattle country, owing to the variety and vigorous nature of the grasses, although typical sheep grasses are of course abundant in the way of smaller grasses growing amongst the larger ones. Such strong growing grasses as *Panicums, Astreblas, Andropogons, Erianthus* and *Aristidas*, of which there are many species and which freely intermingle with each other, often dominate the situation.

4. **Dominant Genera.**—Of a total of 433 species in Australia, 210 are confined to New South Wales.* Using Bentham's figures, out of a total of 346 native species in Australia† 144 are confined to the Northern Territory, 164 to Queensland, 149 to New South Wales, 93 to Victoria, 68 to South Australia, 89 to Western Australia, and 62 to Tasmania. Although, as seen by the figures brought up to date in New South Wales, the numbers are now greater in each State, they are conclusive enough to show that the bulk of the grass flora is found in the States of New South Wales, Queensland and the Northern Territory.

The dominant genera, i.e., grasses which provide the bulk of herbage in each State are as follows:—

NORTHERN AUSTRALIA.—*Panicum, Xerochloa, Rottboelia, Ischæmum, Ectrosia, Chloris, Eragrostis, Erianthus, Diplachne, Andropogon, Aristida, Themeda, Triodia and Eriachne.*

QUEENSLAND.—*Panicum, Astrebla, Ischæmum, Aristida, Erianthus, Andropogon, Themeda, Chloris, Eragrostis, Sporobolus and Eriachne.*

NEW SOUTH WALES.—*Panicum, Cynodon, Chloris, Danthonia, Eragrostis, Sporobolus, Aristida, Stipa, Andropogon, Themeda, Astrebla, Pappophorum and Sorghum.*

VICTORIA.—*Danthonia, Eragrostis, Poa, Glyceria, Sporobolus, Stipa, Agropyron, Themeda, Agrostis and Panicum.*

SOUTH AUSTRALIA.—*Danthonia, Themeda, Eragrostis, Poa, Chloris, Agrostis, Cynodon, Glyceria, Stipa, Andropogon and Pappophorum.*

WESTERN AUSTRALIA.—*Panicum, Neurachne, Stipa, Andropogon, Themeda, Danthonia, Agrostis, Poa, Dichelachne and Agrostis.*

TASMANIA.—*Agrostis, Danthonia, Poa, Stipa, Amphipogon, Hierochloe, Microlæna and Tetrarrhena.*

5. **The Most Important Native Grasses.**—(i.) The *Mitchell* grasses (*Astrebla* species) may be said to hold perhaps the highest reputation of all the native grasses. They are very common on the black and red soils in the interior of New South Wales, Queensland, and the Northern Territory. The leaf is abundant and relished by stock of all kinds, while the seed is also nutritious. They provide feed in warm situations practically throughout the year. At present the Mitchell grasses are considered so valuable that the seed is a marketable commodity.

* Unpublished Census of New South Wales plants (Maiden and Betche).
† Bentham's Australian Flora.

(ii.) The *Andropogons*, including *Andropogon sericeus* (Queensland Blue grass), *A. intermedius* (Rare Blue grass), *A. bombycinus* (Silky heads), *A. refractus* and *A. pertusus* (Pitted Blue grass) are very common in New South Wales and Queensland, and less common in the Northern Territory. Queensland Blue is highly spoken of by all pastoralists for its succulence and perennial qualities. Rare Blue appears to like moist situations better, and in such localities usually provides a greater bulk of feed than does Queensland Blue. The common Queensland Blue grass also grows in the Northern Territory, but the *Andropogons* in that locality, *e.g.*, *A. procerus*, *A. annulatus*, and *A. exaltatus* are more of the vigorous tall-growing kind, although probably as palatable as our own. The seed of Queensland Blue is also a marketable commodity; it is of such fluffy nature, however, that hand-sowing must be resorted to if required to bring it under cultivation.

(iii.) The *Panic* grasses are extremely common and variable. They are mostly quick-growing summer grasses, succulent, palatable, and free seeders. If given a free chance to seed they become a valuable asset to grazing country. Some of the more important are:—

Panicum decompositum (Australian or Native Millet). This is a very wide-leaved succulent grass, and extremely drought-resisting, It is common to most of the States and appears to be very dominant in moist black or red soils.

Panicum queenslandicum, Domin (Coolah grass). This grass is very common in the pastures of the Northern Territory, Queensland, and New South Wales, and is characterised by its extreme powers of drought-resistance. This grass closely resembles *P. trachyrachis* another drought-resistant species, but much less common.

Panicum flavidum, Retz, and *P. globoideum*, Domin, growing in warm, moist situations, are also valuable pasture grasses in the Northern Territory, Queensland, and New South Wales. They are extremely free seeders.

Valuable *Panic* grasses confined to the Northern Territory are *P. piligerum*, *P. argenteum*, and *P. prostratum*. Some cosmopolitan good *Panic* grasses are *P. leucophœum* (Cotton Panic), *P. sanguinale* (Summer grass), *P. effusum*, and *P. prolutum*.

(iv.) The *Eragrostis* grasses are very cosmopolitan and may be found right throughout the Commonwealth. Some, like *E. Brownii*, *E. leptostachya* and *E. leptocarpa*, grow in favourable situations on the coast and tablelands, and provide a fair amount of feed. Others, like *E. laniflora*, *E. speciosa*, and *E. lacunaria*, are adapted to hot, sandy situations, and are small and wiry. The root system of some of these shews their adaptation to hot conditions, for even in the mature root, a sheathing case of sand and hairs is present as a protection against burning and evaporation.

(v.) The *Danthonias* provide a great quantity of winter feed in the cooler parts of the continent. They are commonly known as White Top or Wallaby grasses. Able to stand a good deal of stocking and very palatable, some of the finest sheep in the State of New South Wales are grown on *Danthonia* pastures in Yass district. The *Danthonias* are particularly valuable for shallow or poor soils, and in these situations have been turned to such good account that the seed is now a marketable commodity.

(vi.) The *Couch* grass (*Cynodon dactylon*) association in New South Wales is well-known to all dairymen. Many poor clay soils would be in a bad way as regards pasturage were it not for this fine little fighting grass. In sandstone country on the coast a common grass association is *Couch, Eragrostis leptostachya*, and *Sporobolus*.

(vii.) The *Themeda* grasses, better known as Kangaroo grasses, will be found growing in nearly every conceivable situation throughout the Commonwealth. The commonest is *Themeda Forskalii*, previously known as *Anthistiria ciliata*, and there is no doubt that this grass provides excellent feed in the interior. Owing to its shy seeding habits, however, and its sensitiveness to stocking, it is rapidly dying out in many situations, and is becoming more common on protected areas, such as railway enclosures, than elsewhere. Its one time congener, *Iseilema membranacea*, previously called *Anthistiria membranacea*

is well known to the pastoralist of Queensland, northern New South Wales, and the Northern Territory, as Landsborough grass. Although smaller than the ordinary Kangaroo grass it will stand heavier stocking, and is considered more palatable.

(viii.) The *Erianthus* grasses, and particularly *E. fulvus*, commonly known as Sugar grass or Brown Top, are also considered very valuable grasses in the interior of New South Wales, Queensland, and the Northern Territory. Indeed, from the point of view of drought-resistance and permanence, it would be difficult on the black soils to replace the Sugar grass with a better.

There are many other genera, of which there may be only one or two species, widely distributed over the continent and providing a large quantity of feed. Some of the more valuable are:—*Lappago racemosa* (Burr grass), *Neurachne mitchelliana* (Mulga grass), *Dactyloctenium aegyptiacum* (Crowfoot grass), *Eriochloa polystachya* (Early Spring grass), and *Diplachne fusca* (Swamp grass).

(ix.) *Sheep Grasses.* The *Chloris*, Windmill, or Star grasses are amongst the most valuable sheep grasses. *Chloris acicularis*, *C. truncata*, *C. ventricosa*, and *C. barbata* are the commonest and best. The last named is considered so valuable, resembling the introduced *Rhodes* grass very much, that the seed is a marketable commodity.

(x.) *The Stipas.* These are commonly called Spear grasses. They are very common in Western Australia, South Australia, Victoria, and the Riverina district in New South Wales. In many situations, such as rocky slopes, these grasses are valuable, providing feed for sheep for the greater part of the year, but it is to be regretted that during a good season these Spear grasses, particularly *S. setacea*, *S. scabra* and *S. semibarbata*, become very troublesome. The growth becomes too rapid for the sheep and the grasses develop seed. These seeds are extremely sharp pointed and provided with a twisted awn which is sensitive to hygroscopic conditions. The result is that they are able to work their way into the organs of the sheep, and particularly affect the eyes. "Spear-grass" country is not looked on favourably by pastoralists. Fortunately, in good country it is possible, by judicious management, for the good grasses to overcome the *Stipas*.

(xi.) The *Aristidas*, commonly known as Wire grasses, are also widely distributed, and possess an inferior value only. *A. leptopoda* and *A. Behriana* are the only ones providing an average amount of feed in the interior.

In the colder mountainous districts the *Poa* and *Agrostis* species provide the bulk of the feed. The grasses found on the southern mountain heights of New South Wales remind one very much of similar grasses in Europe.

6. **The Future of Native Grasses.**—The future of our pastoral wealth depends on the maintenance of our native grasses. At present the three principal enemies of our pastures are rabbits, droughts, and over-stocking. The rabbit evil on level country, thanks to wire-netting, and a vigorous offensive on the burrows, is being checked. The effects of drought will be probably minimised in the future by anticipatory measures, such as the conservation of fodder, the construction of large dams, and cross-country railways to allow of speedy agistment. At present, the actual deleterious effect of droughts on the native grasses lies in the eating and killing-out of the better varieties, an evil aggravated, of course, during drought periods by slowness of growth and non-seeding habits.

7. **Over-stocking.**—Over-stocking during drought periods should be avoided, but over-stocking in normal periods is to be deplored. Evidence exists on every hand that many of our large holdings are being over-stocked, *i.e.*, that the stock are being carried on the paddocks in such numbers, and to such an extent that the good grasses are not allowed to seed, but become depastured and replaced by introduced or noxious herbage. Miles of country in the interior (that once had a profitable carrying capacity) are now covered with thistles and other useless herbage. The spread of Barley grass (*Hordeum murinum*), Barren Fescue (*Festuca bromoides*), the useless Bromes (*Bromus maximus*,

B. mollis, etc.), and other valueless or even noxious agricultural grasses in New South Wales, has also been remarkable. Less than twenty years ago they were varieties in many places, now they have taken almost complete possession of the pastures, but, as the law of the survival of the fittest indicates that present conditions in many localities are more favourable for these than for the native grasses, it follows that, unless the latter are nursed and encouraged, the useless introduced grasses and weeds will predominate where at one time the natural herbage thrived. It is natural that a grazier should desire to produce from his land the largest amount of wealth he can, by stocking to the fullest capacity, but satisfactory financial results cannot be maintained by doing so. The deterioration which a pasture undergoes by continued overstocking must result in a considerably lessened carrying capacity, and, although exact data are not available, the loss thus incurred to the Commonwealth must be considerable,

8. **Conservation of Pastures.**—The problem of conserving and restoring native pastures, has, in many localities, been met by thoughtful graziers gathering the seed of the good grasses, and scattering it on the loose soil of their runs during the rainy season. Although the vitality of native grass seed is fairly low, it is particularly characterised by the length of time it can stay in the ground and then germinate under satisfactory conditions. The black soils are particularly adapted for this method of treatment.

9. **Division and Resting of Pastures.**—It is clear, however, that the main success in checking deterioration will be ensured by dividing pastures and resting them from time to time. Many beneficial results have been secured by resting pastures, and if the process is continued at periodic intervals a good stand of grass is secured over a large area, and the carrying capacity increased enormously.

Most graziers divide their areas into paddocks, but in many cases these are far too large. The larger the paddocks the greater the trampling, and the more the best grasses are picked out, eaten down, and prevented from seeding. In an area of 12,000 acres, say, eight paddocks would not be too many. Once a good stand of grass is obtained in paddocks of limited area, judicious handling of such paddocks will produce a maintenance of the pastures for an indefinite period.

10. **Native *v.* Introduced Grasses.**—The introduction of ex-Australian grasses can only be advocated for those districts where the climatic conditions are similar to those of the countries whence introduced. Such country is mostly confined to the coast and tablelands of Australia and to Tasmania. Owing to the high vitality of the seed and the improvement which has taken place under many years of cultivation these grasses have replaced the native in many parts. Such grasses as *Paspalum*, Rhodes, Perennial Rye, Cocksfoot, Timothy, and Tall Fescue are largely grown, while the newer but valuable grasses like *Phalaris bulbosa, Bromus inermis*, and Prairie are slowly growing in popularity.

11. **Cultivation of Native Grasses.**—Up to the present the placing of native grasses under cultivation has not been carried out commercially. The difficulties which have to be contended with are as follow:—(*a*) The uncertain vitality of wild seed, (*b*) the scarcity and high price of native grass seed on the market, (*c*) the large area of native pastures, giving sufficient feed for practical requirements. When the cultivation of native grasses becomes an accomplished fact, it will be on the inland slopes and those areas where closer settlement prevails.

12. **Improvement of Native Grasses under Cultivation.**—That a great improvement takes place in the native grasses when cultivated is well seen by experiments carried out at State Experiment Farms. Succulence and bulk are considerably increased, even in a very short time. Particularly has this been noticed in such grasses as Mitchell grass, Queensland Blue grass, the Panic grasses, and Brown Top or Sugar

grass (*Erianthus fulvus*). When we consider that it is only after many years of cultivation that the present improvement in our introduced grasses has resulted, the striking improvement of the native grasses under cultivation in such a short time is distinctly encouraging. It is probable that good seeding habits, bulk, etc., will be improved by selection. The value of such experimental work cannot be over-estimated since, as before pointed out, it will be extremely difficult, if not impossible, to replace our native grasses of the interior with better plants. The pastoral industry of Australia is such a valuable asset that every means should be taken not only to conserve the native pastures as much as possible, but to work and aim at increasing their present carrying capacity.

2. Saltbushes.

1. **General.**—The saltbushes belong to the botanical order *Chenopodiaceae*. They are all plants adapted to alkaline soils, and grow thickly in the interior. Their adaptability to the hot and dry situations of Australia is shewn in the succulent nature of the leaves, in the more or less hairy investiture, and in the deep-rooting system. The edible saltbushes practically belong to the four genera, viz., *Atriplex*, of which the Old Man saltbush is representative; *Kochia*, or cottony saltbushes; *Rhagodia*, red-berried saltbush; and *Enchylaena*, Barrier or Spiny saltbushes.

2. **Value of Saltbushes.**—The value of saltbushes lies particularly in their drought-resistance, which stands out prominently when other grasses and herbage fail. They also grow in arid districts where the rainfall is extremely small, and where grasses are few in number and sparsely scattered. Although saltbushes are not appreciated to any extent when grasses and other herbage are plentiful, during drought periods they are readily and even greedily eaten by stock.

The free-seeding and rapid growing habits of the saltbushes are particularly advantageous in allowing them to quickly revive after heavy stocking during drought periods, all the more so, as in normal seasons, when the grasses and herbage are plentiful, they are not eaten to any great extent.

3. **Fodder Value of Saltbushes.**—In this connection some useful experiments were carried out at the State of New South Wales Experiment Farm, at Coolabah, in 1906 and 1907. The result of these experiments gives a definite idea of the value of saltbush as a fodder, and its effect on the texture of the wool. The report of a prominent pastoralist on these experiments is as follows:—"I had the sheep in the yard and had a good look at them. They have altered very much since they were taken to the farm, and have also altered since last year; the wool has grown smaller in the fibre, and shews a shorter and weaker staple without any increase in quality to make up for the loss in weight. They have not grown the frame they would, running on natural pastures, I cannot understand why they have produced such a black yolky tip, quite as good a tip as you see on sheep reared in a cooler climate. I can give no reason why sheep fed on natural grasses and herbage shew a white tip inclined to be fuzzy, while these sheep, fed only on saltbush, shew a good tip. Although they have not grown a really profitable fleece, nor produced the carcase of more highly-fed sheep, the experiment proves that sheep can be kept alive on saltbush only, for a considerable time, possibly for long enough to tide over a severe period of dry weather, and probably at less cost than by expensive means of artificial feeding. The experiment has also shewn that saltbush can be grown at little cost—at a less cost than any other fodder—in a very dry time, and is practically drought-resisting." It might be remarked that these experiments were carried over a period of twenty-one months, during which time the sheep were entirely fed on saltbush.

4. **Distribution of Saltbushes.**—The principal saltbush genera are distributed as follows:—

(i.) ***Atriplex.*** Northern Territory, 4 species; Queensland, 8 species; New South Wales, 14 species; Victoria, 10 species; South Australia, 18 species; Western Australia, 12 species; and Tasmania, 4 species.

(ii.) ***Kochia.*** Northern Territory, 1 species; Queensland, 3 species; New South Wales, 11 species; Victoria, 6 species; South Australia, 10 species; and Western Australia, 6 species.

(iii.) ***Rhagodia.*** Queensland, 5 species; New South Wales, 7 species; Victoria, 5 species; South Australia, 6 species; and Western Australia, 5 species.

It is to be noted that the more arid districts, like the west of New South Wales, and South Australia, are better provided with saltbushes than the Northern Territory with its heavy rainfall; this is as it should be.

5. **Some of the More Important Saltbushes.**— ***Atriplex nummularia, Lindl*** (Old-Man saltbush). This is very common in Queensland, Victoria, New South Wales, and South Australia. It grows to a height of 10 feet, and is thus better protected from the ravages of drought and over-stocking than most saltbushes. It grows very rapidly and is considered palatable.

Atriplex leptocarpa, F.v.M. (Creeping saltbush). This is very common on the red and black soils. It is a rapid grower and a free seeder.

Atriplex semibaccata, R. Br. (Half-buried saltbush.) Has a very spreading and prostrate habit, and it thus protects both the soil and itself. A free seeder. This is one of the saltbushes successfully introduced into California, America, and is highly spoken of. Two cuttings of 20 tons each were obtained each season from an acre.

A. vesicaria, Hew, and ***A. halimoides, Lindl,*** although less common than the aforesaid, are considered more palatable. Unfortunately, their palatability and their annual habits tend to cause them to diminish under heavy stocking.

Other valuable saltbushes very common in South Australia and Western Anstralia are *A. stipitata, Benth.*, *A. rhagodiodes, F. v. M.*, *A. muelleri, Benth.*, and *A. spongiosa.*

The ***Kochias*** are much smaller than the ***Atriplex*** genus, with a finer leaf, and also, as a rule, hairier, while some are spiny. All are valuable as stand-bys in times of drought, and the commonest are *K. ciliata, F. v. M.*, *K. villosa, Lindl.*, *K. eriantha, F. v. M.* (South Australia), and *K. appressa, Benth.* (Western Australia).

The ***Rhagodias*** are less common in the interior than the ***Atriplexes.*** They will also grow in situations, as the coast and tablelands, where the others will not thrive. One of the best adapted to interior conditions is ***Rhagodia hastata, R. Br.***, so called from its hastate or sword-shaped leaves. This saltbush has been proved to grow readily from cuttings, endures adverse conditions, and attains a great size in a year. It can be recommended as a hedge plant. Other good ***Rhagodias***, and also found in the interior, are *R. nutans, R. Br.*, and *R. linifolia R. Br.* Some other particularly drought-resistant saltbushes which provide feed under adverse conditions are ***Enchylaena tomentosa, R. Br.*** (the Barrier saltbush), and the ***Scleroloenas***, including ***Scleroloena diacantha, Benth.***, and *S. paradoxa, R. Br.*

6. **Cultivation of Saltbushes.**—The cultivation of saltbushes, like that of native grasses, is not yet carried on commercially. Experiments shew, however, that they will grow readily from seed, cuttings, or roots. On a big area where turning over for cultivation is impracticable, much might be done in ploughing a few furrows here and there, and planting three or four seeds in a hole during suitable seasons. By protecting the the young seedlings from stock for twelve months they should then be ready for grazing. The bulk of feed produced in normal seasons can be used as hay, which is an excellent stand-by during drought periods. Chemical analysis shews that the nutritive content of saltbushes is particularly high, and it seems an anomaly that, if it pays California to import seed and grow it profitably, there should be as little as there is under cultivation in Australia.