Seasonal Sunshine in Great Britain.

By CHAS. HARDING.

NEVER before has the good effect of sunshine on health been so fully recognised as it is now; the great benefit derived from sunshine by individuals of all ages, whether strong and robust, or weak and delicate, is being brought home to us in many ways. The records of sunshine by Campbell-Stokes' self-registering instruments are very satisfactory so far as registration is concerned, but compared with other meteorological elements such as pressure, temperature, and rainfall, they are of more recent date. Sunshine records were practically commenced in about 1881, but by ordinary observers they have been somewhat tardily used.

The "Book of Normals" published by the Meteorological Office, giving monthly normals for stations for the 35 years from 1881 to 1915, supplies the principal facts for comparisons here made. These on examination are found to contain comparatively few complete records for the 35 years; the majority of the stations are for shorter periods and are worked up to the 35-year period by comparison with adjacent stations. For the most part, only those stations are taken which have observations of sunshine for the complete period, so that the comparisons are more trustworthy than they would otherwise be.

Dealing first with the annual results, and comparing the records for the year in different parts of Great Britain, it is found that in Scotland there are five stations which yield an average annual duration of sunshine amounting to 3.41 hours a day; the most is 3.80 hours a day at Aberdeen; the least, 2.97 hours a day at Glasgow. In the south of England, taking Southampton, Falmouth, and Plymouth, the average annual duration is 4.65 hours a day, ranging from 4.56 hours at Plymouth to 4.82 hours at Falmouth. The excess in the south of England over Scotland amounts, on the average, to 1.24 hours a day for the year.

Comparing eastern and western districts, the stations in the eastern districts of England give an annual duration of 4.19 hours a day, while the western stations give 4.17 hours a day.

The central or Midland counties give an annual average duration of 3.90 hours a day—two of the three stations taken are Oxford and Cirencester, which give 4.13 hours a day, the agreement for the year and for the several seasons being remarkably similar.

Dealing with quarterly results of sunshine, dividing the year as generally recognised in meteorology, the winter quarter being represented by December, January, and February, and the summer quarter by June, July, and August. In the north of Scotland, as shown by the Orkneys and the Hebrides, there is little difference between the spring and summer sunshine; indeed, in the Orkneys the duration of sunshine is rather greater in the spring, the relative amounts being 4.60 hours a day in spring and 4.54 hours a day in the summer. For Scotland as a whole the average daily sunshine for the four quarters, starting with winter, is 1.34, 4.64, 5.02, and 2.60 hours; for the south of England the corresponding seasonal values are 2.08

hours a day, 5.78, 6.94, and 3.78 hours. The greatest gain for any season in the south of England is 1.92 hours a day in the summer season, and the least gain is 0.74 hours a day in the winter.

In the east of England the seasonal daily values are 1.85 hours in the winter, and in the following seasons 5.23, 6.26, and 3.40 hours; in the western district of England the corresponding values are 1.68 hours a day in the winter, followed in the other seasons by 5.46, 6.26, and 3.25 hours. The average daily duration of sunshine is thus less in the winter and autumn in the western district, including St. Ann's Head and Douglas in the Isle of Man, than in the eastern, absolutely the same in summer in both districts, but more in the western district in the spring.

In the central or Midland counties the seasonal sunshine records give for the winter 1.68 hours a day, and for the following seasons 4.88, 5.87, and 3.13 hours; these are less than for the east of England in all seasons, and are less than in the western districts except for the winter, when the two districts are in absolute agreement.

A later "Book of Normals" published by the Meteorological Office gives the weekly, monthly, quarterly, and seasonal normals for districts for periods ending with 1915. In all seasons the least sunshine occurs in the north of Scotland and the most in the English Channel. Comparing south-east England with south-west England and South Wales, the average sunshine for the year in south-east England is 4.49 hours a day, and in south-west England and south Wales, including the so-called Cornish Riviera, it is 4.28 hours. In the winter, south-east England has an average daily sunshine of 1.92 hours, and in south-west England and south Wales the value is 1.91 hours a day; in spring the hours of sunshine for the two districts are respectively 5.50 and 5.36; in summer 6.88 and 6.41, and in autumn 3.46 and 3.31 hours. In each season, therefore, the value for the eastern district is above that of the western.

The amounts of sunshine vary considerably in different years and in different seasons. A record of 40 years' sunshine at Oxford, from 1881-1920, shows that the highest total in any year is 1810 hours in 1899, and the least, 1158 hours in 1888. In the winter months the amounts range from 106 hours in February 1899 to 5 hours in December 1890; in spring from 294 hours in May 1909 to 62 hours in March 1916; in summer from 310 hours in July 1911 to 99 hours in July 1913; in autumn from 223 hours in September 1911 to 30 hours in November 1888.

For the corresponding 40 years at Greenwich Observatory the maximum hours of sunshine in any year is 1778 in 1911, and the least in any year is 1069 hours in 1888. The year 1921 had sunshine for 1761 hours, but this is after the 40-year period. In the years 1892-96 the records at Greenwich are doubtful, owing to the development of cloudiness in the glass sphere of the sunshine recorder, the glass having deteriorated; this suggests the need of great care at other stations at home and abroad. In the winter months the amounts

range from 106 hours in February 1914 to 2 hours in December 1890; in spring from 326 hours in May 1909 to 46 hours in March 1888; in summer from 335 hours in July 1911 to 95 hours in August 1913; in autumn from 234 hours in September 1911 to 23 hours in November 1912.

In the abnormal summer of 1911, in the 18 weeks from the commencement of June to the end of September, there were 15 weeks with an excess of sunshine in England E., Midland Counties, England S.E., and England S.W.; 14 weeks in England N.E. and N.W.; 13 weeks in Scotland W. and in the English Channel. July was exceptionally bright; in the south of England the excess of sunshine was very great, averaging about 5 hours a day more than usual at some stations. Eastbourne and Hastings had 160 per cent. of the average; Greenwich and Kew Observatory, 161; Brighton, 163; Plymouth, 169; Torquay, 172; and Tunbridge Wells, 180 per cent. At Greenwich the duration was 335 hours, which is 110 hours more than the average; this was the brightest July since the commencement of sunshine records. The duration of bright sunshine at Greenwich for the four months June to September was 1053 hours, a higher total than in any previous year on record. In 1911 the duration of sunshine at Greenwich was 1778 hours; at Westminster, 1592 hours; and at Bunhill Row, in the heart of the City, 1444 hours, showing clearly the loss of sunshine in the metropolis; the loss is usually proportionately greater in the winter than in the summer. The duration of sunshine at Greenwich for the summer season June to August in 1911 was 819 hours, and the mean temperature for the three months was $66^{\circ}\cdot 1$, about 5° in excess of the normal.

The following shows the difference between a good and bad season for sunshine: The year 1903 was about the wettest year on record, certainly the wettest at Greenwich Observatory for the last hundred years. The summer rainfall at Greenwich, June to August, was 16.16 inches, and the duration of bright sunshine 560 hours; whereas in 1911 the duration of bright sunshine was 819 hours. Last year, 1925, was a dull and comparatively sunless summer; the total duration of sunshine in the three summer months was 587 hours, and the total rainfall was 6.10 inches. The year 1924 also had a dull summer; the total sunshine at Greenwich was 589 hours, and the rainfall was 8.49 inches.

These summers were remarkably dull in comparison with 1911 and 1921.

However desirable it may seem to decide which part of England enjoys the longest duration of sunshine, it is not easy to determine the most sunny region, although the following results seem to give a preference to south-east England. The published records of the Meteorological Office available for 35 years, which enable a trustworthy comparison to be made, give results for fewer stations than seem desirable, and in years to come, as the periods increase, results will become more satisfactory.

The highest average annual duration of sunshine at any station for the period of 35 years, 1881 to 1915, is 4.92 hours a day at St. Leonards, in England S.E.; and the station with the next highest average annual duration is Falmouth, in the Cornish Riviera, with 4.82 hours a day. The seasonal values for the two stations are: St. Leonards in the winter 2.25 hours a day, and in the following seasons 6.01, 7.34, and 4.03 hours; at Falmouth in the winter 2.21 hours a day, and in the following seasons 6.01, 7.15, and 3.90 hours; St. Leonards having most sunshine at all seasons except in the spring, when the duration of bright sunshine is the same in both places.

Records for less than 35 years given in the Meteorological Office normals show that, after weighting with other stations near, Felixstowe in England E., with 11 years' observations, ranks highest for the year, with 5.04 hours a day, and with a summer average of 7.84 hours a day. Worthing, with 17 years' observations, has an annual average of 4.98 hours a day and a summer average of 7.42 hours a day. Eastbourne, with observations for 30 years, has an average annual duration of 4.88 hours a day and a summer average of 7.37 hours. All of these have a higher daily average sunshine than the Cornish Riviera.

A rough summary of sunshine observations such as that here given is far from satisfactory, and is drawn up for the most part on published data readily to hand. Without doubt there are many considerations of greater importance to the Meteorological Office and to the general public, but since there has been a great accumulation of sunshine observations over Great Britain in recent years, an official discussion bringing the normals up-to-date would be of considerable scientific interest and would, without doubt, be heartily welcomed.

News and Views.

GENERAL approval from scientific men and naturalists the world over will be extended to the Society for the Preservation of the Fauna of the Empire in its active propaganda against the indiscriminate and wholesale destruction of wild game as a means for the extermination of tsetse flies, and, therefore, of the diseases, both of human beings and stock, which they are the means of transmitting. Certain proposals to throw open game reserves in Zululand led to a deputation from the Society, headed by Dr. P. Chalmers Mitchell, to the High Commissioner for the Union of South Africa, to protest against this measure, and a report of its proceedings, together with a memorandum on the subject, printed in the December

number of the Society's journal, will be read with great interest and sympathy. The Society urges that the indiscriminate slaughter of big game does not necessarily lead to the extermination of the tsetse flies, but may have the result of leading the flies to seek other and smaller hosts, still more difficult to control, or failing a suitable wild host, to attack man himself. The danger to the human population would, therefore, be increased rather than decreased, and, in the Mwanza district of the Tanganyika Territory, where wholesale game destruction due to military operations was followed by a serious epidemic of sleeping sickness, there would appear to be evidence in support of this view. The Society urges strongly