the coal direct into the furnaces of steam boilers. Such methods offer the attraction that they permit the recovery of by-products that are lost with direct firing, and it is, therefore, disappointing to find that the committee's conclusions are adverse. They conclude that, in the present state of knowledge, the direct burning of coal under steam boilers forms the cheapest method of generating electricity on a large scale from coal, even when the indirect processes are credited with the revenue obtainable from the sale of the recovered by-products. What is still more unfortunate—from the point of view of those who hope for an increased supply of home-produced liquid fuel, as well as cheaper electricity from capital power stations with gas-fired boilers—they make out that the advantage of direct firing increases with rising costs of coal and labor.—The London *Times*.

NOTES ON METEOROLOGY AND CLIMATOLOGY

RAINFALL (AND SNOWFALL) OF THE UNITED STATES[1]

THE Weather Bureau has just issued a reprint from the *Monthly Weather Review* entitled "Seasonal distribution of precipitation and its frequency and intensity in the United States,"[2] by Joseph B. Kincer. Three reviews and abstracts are included in the reprint: "Some characteristics of the rainfall of the United States,"[3] by R. DeC. Ward; "New seasonal precipitation factor of interest to geographers and agriculturalists,"[4] by R. M. Harper; and "The snowfall of the United States,"[5] by R. DeC. Ward. Since these three papers are easily available, this note will cover only Mr. Kincer's article and the graphs added to the reviews of Professor Ward's two papers.

Here are published, for the first time, reliable and detailed maps of the average rainfall of the whole United States for each month. The topographic (hachured) base-map used shows at once the close dependence of rainfall on topography as it affects precipitation of moisture from the prevailing westerly winds. We have long known of the marked spring and early summer rainfall maximum in the prairies and Great Plains; but these monthly maps give us almost a moving picture of the wave of rainfall which spreads northward and westward as the warm southerly winds blow in day after day from the Gulf of Mexico. From its February position across east Texas, northwest Arkansas and southern Illinois, the 3-inch monthly rainfall line in March has moved westward into Oklahoma, central Missouri and northern Illinois; in April, to central Texas, central Oklahoma, eastern Kansas and central Iowa; in May, to the 101st meridian in south Texas, across the Panhandle into northeastern New Mexico, through western Kansas, west central Nebraska, the Dakotas and northern Minnesota, and in June still farther westward in the central and northern Great Plains—in Montana even to the Rockies. By June in the southern Plains and by July in the northren Plains the spring-time flood of moist air has spent itself, and the rainfall lines are beginning to retreat—eastward as the summer passes, and southward as the coldness of the oncoming winter renders much precipitation impossible. The four maps of precipitation by seasons summarize this same movement of the isohyets. With such a series of maps before one it is obvious that the Gulf of Mexico and the open country to the north and northwest allow our prairies and plains to be so productive.

If the conditions year after year were like those shown on these maps of average rainfall, we should not have been experiencing or

[1] *Cf.* notes on this subject in SCIENCE, July 19, 1918, N. S., Vol. XLVIII., pp. 69–72 (snow, SCIENCE, February 11, 1916, N. S., Vol. XLIII., pp. 212–214).

[2] September and October, 1919, Vol. 47, pp. 624–633, 695–696, 7 graphs, 30 maps—13 in text and 17 full-page lithographs. (For copies, apply to "Chief, U. S. Weather Bureau, Washington, D. C.")

[3] *Scientific Monthly*, September, 1919, Vol. 9, pp. 210–223.

[4] SCIENCE, August 30, 1918, N. S., Vol. XLVIII., pp. 208–211.

[5] *Scientific Monthly*, November, 1919, Vol. 9, pp. 397–415, map.

reading of the great droughts, recently ended, which were at their worst in west Texas and the northern Great Plains. The flood of warm, moist air from the Gulf is variable in size and duration. These variations are felt most near its western and northwestern limits, where farmers have learned to look on partial crop failures as normal. This variability, which is the most important aspect of rainfall, aside from the average amount, is clearly brought out by Mr. Kincer in a number of graphs and maps. In drought years as well as in years of plenty, farmers are inclined to believe in stories of progressively decreasing or increasing rainfall: comparisons of rainfall averages by successive 20-year periods show, however, that in this region there is no perceptible progressive change in rainfall.

In years of decreasing rainfall, real-estate agents for the semi-arid lands of western Kansas explain to prospective buyers that although the total rainfall is decreasing, the decrease is mostly confined to the washing and flooding downpours, and that the proportion of rains of beneficial amount is increasing. They are discussing another essential element which must be considered in comprehensive rainfall discussions. Mr. Kincer presents maps showing the average annual number of days with precipitation 0.01 to 0.25 inch, 0.26 to 1.00 inch, and 2.00 inches or more. Further details of rainfall intensity are given on maps showing the average annual number of days with precipitation more than 1.00 inch in an hour, and the maximum precipitation in 24 hours. Two more maps which might be called "drouth maps" show the percentage of years with 30 consecutive days or more without 0.25 inch of rainfall in twenty-four hours from March 1 to September 30, and the greatest number of consecutive days without 0.25 inch of rainfall from March 1 to September 30. These are all based on the rainfall data for the 20-year period, 1895–1914.

There are three snow maps presented. A large one shows the average annual snowfall of the United States, 1895–1914, drawn on a topographic base-map with close attention to the effects of altitude and exposure. The other two maps show the average annual number of days (1) with measurable snowfall, and (2) with snow cover. In the eastern United States (except near the Atlantic) the line of one day with snow cover (the average of several days in one winter, with no days in several years) is near the 33d parallel of latitude; that of 30 days with snow cover lies close to the 39th parallel; that of 60 days near the 42d; that of 90 days near the 43d, and that of 120 from near the 44th in the East to the 47th in Minnesota. As a broad generalization, the number of days with snowfall is about half the number of days with snow cover.

The publication of these interesting precipitation maps with the discussion makes us hope that still another year will not pass before the issue of the long-expected precipitation section of the Atlas of American Agriculture, with its colored maps, carefully made graphs and detailed discussion. Still later, the folio on temperature and the other climatic elements are to come.

CHARLES F. BROOKS

WASHINGTON, D. C.

SPECIAL ARTICLES

INTERSEXES IN DROSOPHILA SIMULANS

ON the first day of January, 1920, a stock of *Drosophila simulans* Sturtevant[1] from Rochester, Minn., was found to contain intersexual individuals. Over 200 such intersexual specimens from this stock and derivatives of it have now been examined. About a dozen of them have been dissected and about the same number have been cleared in KOH and examined in balsam. All these specimens apparently belong to a single type. Male and female parts are both present, as will appear from the following table.

The intersexes are sterile, inasmuch as their gonads are almost, if not quite, absent. Their sexual behavior seems to agree best with that of the normal females. They are courted by males, but mating has not been seen.

[1] For a description of this species see *Psyche* (1919), 26, p. 153.