animal. They have been absolutely exterminated by hunting, trapping, or by the decrease of the food-supply which occurred in the years 1904–5." An interesting cause is the disappearance of the rabbit. In 1904–5 "some disease smote the rabbits, and they died off by thousands." "In consequence of their disappearance, the animals which fed on them—the fox (the wolf, which need not be counted), the marten, the chief food of which, however, is mice, and other animals—died from absolutely no other cause than starvation." The problem of the conservation of the water supply is curiously bound up with afforestation. For instance, it has been found necessary to conserve the timber on the east slopes of the Rockies in order to conserve the river-heads. "It was shown that the destruction of the timber meant the disappearance of the regular water supply of those provinces, the agricultural production of which is the pride and the hope of Canada."

A list of the committees shows the scope of the Commission. They are seven in number, viz.:—Fisheries, game, and fur-bearing animals; forests; lands; minerals; waters and water powers; public health; press and cooperating organisations. Their reports on the first year's work, the chairman's speech, and the discussions are of unusual interest. Recommendations to Government have already commenced. Such a scheme for the scientific control of the ultimate natural resources of a country must inevitably be adopted elsewhere.

It has, however, one serious deficiency as yet, the absence of any organisation for the preservation of those sites and objects that have no commercial value, but the scientific and artistic importance of which is very great. Such conservation could easily be worked in with the main business. The latest reports of the committees for this special purpose in Germany are to hand. There are official directions giving the least injurious method of picking flowers. Every district seems to be thoroughly looked after and studied by its committee. There are very interesting maps of the habitats of rare plants, and studies of typical fauna, such as that by Dr. Kuhlgatz, on the animal life of the moors in Neulinum. Reference to maps shows that the districts preserved are remarkably numerous. The movement is not merely governmental, but aims at enlisting the sympathetic cooperation of the people. The propaganda is now being extended to the schools, and Prof. Schaefer-Cassel has an eloquent address on the subject. Cases for the "pillory" are recorded, as, for instance, that of a man who in a few years annexed 900 specimens of *Cypripedium calceolus*. This flower, once found near Settle, in Yorkshire, and perhaps in one or two other sites, has now, I understand, disappeared from this country. The same fate will attend many a rare plant, butterfly, or bird, unless we, too, adopt some system of preservation. The *Wild Birds' Protection Act*, it is to be feared, is a dead-letter.

If we had a national commission for the protection of all "monuments of nature," including beauty spots, places interesting for historic or geological reasons, woods, valleys, and hills remarkable for some species of plant, animal, or insect, we should not be a "nation of shopkeepers." But is the United Kingdom too far exploited for a commission for the protection of its natural resources, including its natural history? There would be difficulties in the way, but surmountable difficulties. One very obvious fact presents itself at once—these places of beauty, these habitats of species (by no means useless for the ends of commerce, since they subserve the ends of science), are precisely those which defy culture and would never make it worth while. To make them into natural museums would be a work for which future generations would be more grateful than we can realise. The museum of brick and stone has its uses; zoos and botanical gardens are of no little value; but neither can compare, either for interest or for scientific study, with a reservation. Not only Germany, but Australia, is setting an example here. Dr. Conwentz's book, recently published in England, and an excellent article by Dr. Günther in the *Naturwissenschaftliche Wochenschrift* of August 7 last, give a luminous exposition of the principle and its results.

In time perhaps the world will be full of such spots, where nature may have her Sabbaths and preserve her most interesting children, among whom, last but not least, will be aboriginal varieties of man himself. Is there not a reservation for the tribes of Central Australia?

A. E. CRAWLEY.

AGRICULTURE IN THE DRY REGIONS OF THE BRITISH EMPIRE.[1]

THE ordinary farm crops on which the supply of food-stuffs depends seem to be produced best in regions where the rainfall varies between 20 and 35 inches per annum. Where the upper limit is exceeded in the British Islands, a good deal of pasture is found; on the other hand it is notable that the great wheat-producing districts, the eastern counties, are regions where the rainfall comes nearer to the lower limit. Special agricultural methods become necessary where there is less than 20 inches of rain, as is the case over large areas in Canada, Australia, India and South Africa. These methods fall into two groups: irrigation is required if there is less than 10 inches of rain, while special cultural operations, collectively known as "dry farming," are used when there is as much as 15 or more inches. Between 10 to 15 inches, sometimes the one and sometimes the other method proves the more economical.

"Dry-farming" methods are of great interest to the student of soil physics. Their object is to keep the rain water near the surface of the soil and to prevent loss by evaporation, by surface drainage, and, if possible, by percolation. A remarkable degree of success appears to be attained. An examination of the methods in vogue in different parts of the world shows that all have certain features in common. The land is ploughed up in a rough state and the subsoil compacted directly after harvest or before the rainy season, if there is one; in countries where the rain is unevenly distributed and torrential downpours occur, rather elaborate terracing is arranged to prevent any loss by running off the surface; any streams that form having to follow a sinuous course over the whole field, so that absorption may be as complete as possible. Directly the rain is over, the surface soil is thoroughly stirred, thereby losing a little water by evaporation, but forming a loose layer. The water is thus imprisoned between the compacted subsoil and the thin loose layer of surface soil. The greatest importance is everywhere attached to the maintenance of this loose layer on the top; cultivation is repeated as often as rain has fallen, or whenever for any other reason it is considered the layer has become compact. Incidentally this repeated cultivation has the effect of keeping down weeds, which, if unchecked, would use up a good deal of the water.

In the dry parts of Canada and the United States, where these methods are most highly developed, it is customary to take a crop—usually wheat—once in two years only, leaving the land fallow in the alternate year. It is considered that two-thirds or even more

[1] *Transvaal Agricultural Journal*, vol. viii., 1910.
Agricultural Journal of the Cape of Good Hope, vol. xxxvi., 1910.
"Water Requirements of Crops in India." By J. W. Leather. (Memoirs of the Department of Agriculture in India.)

of the year's rainfall may, under favourable conditions, be stored in the soil for the next year; thus, if only 15 inches fell each year, making a total of 30 inches in the two years, the wheat crop grown during the second year should have moisture available equivalent to 25 inches or more, on which, of course, it should do very well. Unfortunately, the rainfall does not necessarily remain near its average, but fluctuates considerably, and records are not available for many districts; it has occurred in districts where dry farming was considered a great success that the rainfall was, after all, about 20 inches, and ordinary cultivation would have been equally good.

However, the interesting problem is this: What is function of the compact subsoil and the loose surface layer? It is usual to suppose that the compactness of the subsoil facilitates the upward lift by surface tension of water from the permanent water table, but it would seem equally rational to suppose that the compact subsoil retards the percolation of the water. So far as the writer is aware, no crucial experiments have been made that show beyond doubt how far the upward movement of water by surface tension is a factor in ministering to the needs of the plant. That it takes place, of course, is not disputed, but its relative importance is unknown. The function of the loose layer on top, the "mulch," is not settled. It is commonly regarded as a break in the structure of the soil leading to a rupture of the "capillary films" of water. It may equally be a non-conducting layer shielding the mass of the soil from the sun's heat, and therefore lessening evaporation.

Until these problems are solved, little advance can be expected from the scientific point of view, although the practical man continues to effect improvements. The fundamental need seems to be a mathematical analysis showing how water will distribute itself over a mass of particles varying in diameter from below 0·002 mm. up to 0·1 mm., the bulk being below 0·01 mm., and how rapidly any disturbance in equilibrium will readjust itself. The pressing need of work in this direction may be gauged from a perusal of the Transvaal, the Cape, or the South Australian Agricultural Journals; in South Africa alone a considerable part of Cape Colony, the western halves of the Orange Free State and the Transvaal, the whole of the Bechuanaland Protectorate and a considerable portion of southern Rhodesia fall within the "dry lands" area. Some useful practical work may be expected from the newly established dry-land experiment station, but that will only intensify the necessity for a scientific study of the problem.

There is also need of work by the plant physiologist on the effect of insufficient water supply on plant growth. In Dr. Leather's paper data are given showing how much water is transpired by a plant in the production of one pound of dry matter, and on the basis of these figures a table is made out showing how much irrigation or rain water is needed to obtain crops of certain sizes. The values depend on the amount of food-stuff available; less water is needed per pound of dry matter produced in a rich soil than in a poor one. Although there is no direct causal relationship between transpiration and assimilation, the ratios obtained by different observers in various parts of the world are roughly of the same order; thus for barley the number of pounds of water transpired per pound of dry matter produced are:—

Lawes and Gilbert (Rothamsted, 1850)	257
Wollny	774
King (Wisconsin, 1894)	393
Leather (Pusa, 1910) on manured soil	480
,, ,, on unmanured soil	680

E. J. RUSSELL.

THE CAVENDISH LABORATORY.

THERE is no more pleasant way of spending a week-end than by re-visiting the University Town of Cambridge in term time to meet the old friends and comrades of years gone by, and it was a happy thought that induced the writer of the "History of the Cavendish Laboratory" to choose a Saturday for presenting an edition de luxe of the book to the Cavendish Professor of Experimental Physics.

Saturday, November 12, was a red letter day for all who are interested in the Cavendish Laboratory, for it was the occasion of the assembling of a number of distinguished persons to do honour to the "boy professor" of a quarter of a century ago, who has so amply justified the confidence of the Board of electors in appointing so young a man to a post of such importance. Clerk Maxwell and Rayleigh were not easy men to follow; the standard they had set was a high one, the Cavendish Laboratory had become a prominent institution dependent for maintaining its position and for its further development not only on the scientific reputation of its Director, but on his power to attract the ablest young men of the day.

How far Sir J. J. Thomson has done this was evidenced by the number of distinguished visitors to Saturday's ceremony, among whom we noted: Lady Thomson and her little daughter Joan, Mrs. Sidgwick, the Vice-Chancellor, the Bishop of Ely, the President of Queens' and many Masters of Colleges, Sir T. Clifford Allbutt, Sir Robert Ball, Profs. P. V. Bevan, R. H. Biffen, F. C. Burkitt, Sir George Darwin, Prof. Ewing, Dr. Wm. Garnett, Profs. W. M. Hicks, F. G. Hopkins, B. Hopkinson, Dr. J. N. Keynes, Sir Joseph Larmor, Profs. Liveing, Leahy, Alexander Macalister, Dr. J. E. Marr, Profs. H. F. Newall, W. J. Pope, J. H. Poynting, E. Rutherford, Dr. J. E. Sandys, Mr. Sidney Skinner, the Hon. R. J. Strutt Mr. H. M. Taylor, Mr. W. C. D. Whetham, Prof L. R. Wilberforce, Mr. C. T. R. Wilson, Prof. G. Sims Woodhead, and Prof. A. M. Worthington.

In the unavoidable absence of the Chancellor, the Vice-Chancellor presided, and declared his position a sinecure in that the speakers needed no introduction.

Dr. Glazebrook, in making the presentation, began by reading a message, contained in a letter to himself, from Lord Rayleigh, Chancellor of the University:

My interest in the Cavendish Laboratory began with—indeed preceded—its inception, and I had the privilege of the acquaintance of that great genius, the first professor, on whom fell, of course, a vast amount of work in connection with the building and equipment. The laboratory had hardly more than got to work when British science sustained an irreparable loss by the death of Maxwell. My interest then became a responsibility. During the five years from 1879 to 1884 the educational work was greatly developed under yourself and Dr. Shaw, and in research some good work was done. But I must not dwell upon what, no doubt, most of the present students look upon as the dark ages. For six-and-twenty years Sir Joseph Thomson has had the direction, and under him the Cavendish Laboratory has assumed the first place among physical laboratories. By his own researches, pursued with astonishing ardour and success, he has opened up a new world, and, what is in some respects a task even more difficult, he has inspired and trained a number of followers, among whom I am pleased to reckon my own son. Cambridge has every right to be proud of the Cavendish Laboratory, its professor, and his staff.

I will ask you to convey my congratulations to Sir J. J. Thomson. For the future one can wish nothing better than that it should resemble the past.