BIRDS, BEASTS, AND FISHES OF NORTH WALES.[1]

DESPITE its unrivalled scenic attractions and its popularity as a health resort, North Wales has until recently received scant attention from zoologists, references to the district in standard works on British vertebrates being comparatively few, and often erroneous. The need of a comprehensive local fauna dealing with the district has long been felt. But it was recognised that there was no one man who was able to do the work. It could only be accomplished by the cooperation of a large number of naturalists resident in Wales and non-resident. For although comparatively little has been written about the vertebrate fauna of North Wales (and a good deal of that little quite recently), a good many observers, both residents and visitors, have been working steadily at it for some years. It remained to collect, sift, and arrange the facts they had got together. Mr. Forrest came forward and undertook this arduous work, and he obtained the practical assistance of a number of naturalists (a list of whom appears in the book), who readily placed their stores of information at his disposal. He has also examined what little literature (dating some way back) there was on the subject. This information he was able to supplement from his own observations, made during many short visits to the Principality. The result has been an excellent handbook to the vertebrate fauna of North Wales.

The introduction comprises some account of the former zoologists of North Wales, with portraits; a bibliography; a short account of the physical features of the country; some account of bird migration, wherein the routes are carefully traced, not an easy matter in a mountainous country; and a note on the Welsh names. Two conclusions reluctantly force themselves upon us after a perusal of this work. One is that North Wales is not a natural faunal district. West and east differ too greatly. Speaking of the rugged mass of mountains which stretches almost uninterruptedly from the Menai Straits to the Dovey estuary, the author himself says that the importance of this mountain barrier in limiting the distribution of species can hardly be over-estimated. In a very large number of instances, species are confined to the eastern side of this barrier. The truth of this is particularly evident in regard to many woodland birds and fresh-water fishes. The second conclusion is that the vertebrate fauna of a district like this (which, although its actual area is small, is so diversified in its physical aspect) is too big a subject for one octavo volume, bulky almost to clumsiness as this volume is.

The work shows signs of being cramped, and there is evidence that the vast amount of information at the author's disposal has been unduly condensed, and that the material has lost in the process. This is not of too great importance, or wholly a drawback. For it is distinctly an advantage to have a fauna containing all the main facts in one volume, and, despite its fatness, we may call it a handbook to the vertebrate fauna of North Wales, if it is not a history of it; and the way is still left open to anyone who may be able and willing to write a "Birds" of any of the North Welsh counties. How fascinating such a book, dealing fully with the bird-life, would be only those who know Wales in the spring and early summer can tell. But even in the present work we should have been glad of more details. The life-histories as observed in North Wales could have been fuller with advantage. We do not notice that the habit of the merlin of breeding on the sea coast in other districts besides Anglesey is alluded to, or the fact of the overflow population of great jackdaw haunts nesting in crowds in rabbit burrows on a hillside; and many other points might have been touched upon. More exact details of the *local* nests of the buzzard built in trees would have been welcome. Nor is the distribution of birds in the breeding season so exact and full (safeguarding rare birds being understood) as might be. More details of the position of breeding stations of rock birds might have been given; and in the introduction a few pages might well have been devoted to a description of some of the more notable sea-bird stations.

This fauna is to a great extent pioneer work, and

Photo] Puffins on St. Tudwal's. From "The Vertebrate Fauna of North Wales." [*H. E. Forrest.*

[1] "The Vertebrate Fauna of North Wales." By H. E. Forrest. Pp. lxxiv+537; with 28 plates and a map. (London: Witherby and Co., 1907.) Price 17*s.* 6*d.* net.

the author points out that there is a great deal of work still to be done, especially among the reptiles and the marine fishes. There are blanks, too, in the general record that it has been impossible to fill owing to the lack of resident observers. The records from Snowdonia and the central moorlands, for example, are derived almost entirely from the observations of naturalists who have visited those districts from time to time, and there are few or no winter records from these districts. The author proposes to publish additional records in the form of a supplement. We might suggest instead of this a new edition in two or more volumes, with more space and greater detail and the *authority* for the statements, which should always be given in a compilation.

Mr. Forrest has carried out a difficult and laborious task so well that we feel he might well undertake a work which would be monumental as a history of the vertebrate fauna of the most interesting (from that point of view) part of these islands. It was not to be expected that many of the rare stray avian visitors which straggle to our shores would penetrate so far as Wales. Nor are its shores patrolled day after day, in season and out, by men with guns on the look-out for a rarity, as are parts of our east and south coast. Two hundred and seventy-two species of birds are enumerated. But it is in its breeding species that the richness of the North Wales avifauna consists. The author states that 143 species have been known to breed in the district. They do not all do so now; but it has a list of 126 annual breeders, although its total area is not much more than half that of Yorkshire, which, despite great diversity of physical features, can only claim three less.

Treating of the Welsh names, which are dealt with very fully, the author states that his aim has been to include only those which are actually used by the people of the district; "'book' names are excluded." We cannot, however, regard some of the names given as other than book names. The honey buzzard, for instance, seems far too rare to have a genuine Welsh name: the same may perhaps be urged in the case of the black-tailed godwit, and there seems no reason why it should be called "black plover." Again, if the Welsh locally distinguished the Arctic from the common tern at all, there seems no reason why they should have pitched upon a word meaning Arctic or northern unless they had been influenced by books. Nor can we agree with the author (while giving full weight to his authorities) in rendering barcud as kite. Bergut or bearcoot is the name for an eagle among the Kirgiz Tartars, and the buzzard is really an eagle, while the kite is not. Moreover, we have, according to Eugene Rolland, barged and barguet for the buzzard in Breton and Breton Armoricaine, but no name like it for the kite in those branches of the Celtic language. The bird of which Giraldus Cambrensis and his companions heard the sweet notes between Carnarvon and Bangor was not in all probability a golden oriole. Giraldus says "of a bird, which some said was a woodpecker, and others, more correctly, an aureolus." He was not the last to mistake a green woodpecker for an oriole. The misprints are so few that there is no sheet of *errata et corrigenda*. Had there been, perhaps the unfortunate blunder about the buzzard would not have gone uncorrected. The statements that it rears two broods in the year, and will lay again if robbed of its first clutch of eggs, are, of course, the opposite of the facts. A map of so diversified a district is doubtless a serious and troublesome matter, but the one given in this volume is on so small a scale, and the names are printed in so small a type, that it is almost useless to eyes that read ordinary small print without difficulty.

THE WATER PROBLEM IN AGRICULTURE.[1]

THE increasing use of artificial manures and of improved tillage implements has rendered possible an increase in the amount of produce obtained from a given area of land, and attention has during the past few years been directed to another factor, the water supply, which at present limits crop production in a number of cases. The amount of water actually transpired through the crop depends on too many circumstances to be stated with precision, but it may be roughly estimated at 300 lb. or more for every pound of dry matter produced, so that if two tons of dry matter is produced per acre, at least 600 tons of water, equal to 6 inches of rain, will be used in transpiration, quite apart from what is lost by evaporation, percolation, &c. A crop of this size is by no means excessive; indeed, in some types of intense cultivation three times as much produce would be aimed at. Even in England the problem is often serious; it is far more so in countries where the rainfall is deficient during the whole or part of the growing season.

In order that a large proportion of the rain-water should remain near the surface of the soil within reach of the plant roots, it is obviously necessary to reduce loss by percolation and evaporation. The practical man in dry districts has succeeded in evolving methods which go some way to doing this. The methods and implements used by the Madras cultivators are described by Mr. H. C. Sampson in the Agricultural Journal of India. In some districts recourse is had to deep ploughing with a heavy plough, followed by a lighter plough, and then when the crop is up the land is hoed. In other districts the plough is the only tillage implement. But in practically all cases the plan is to stir the surface of the soil after a rain, and to keep the top soil loose during the growth of the crop. The methods adopted in the arid regions of the United States are described in the Transvaal Agricultural Journal (April, 1908) by Mr. Macdonald, and in the Journal of Agriculture of South Australia (March, 1908) by Mr. Strawbridge, who was sent with the express purpose of reporting thereon. They include deep ploughing, followed by harrowing, so as to get the soil into a fine state; the harrowing is, as a rule, repeated after each rain. When the crop is up the surface soil is frequently stirred. It seems definitely established that when the top layer of soil is in a loose condition it retains water better than if it is compact, but the loose condition must be maintained by constant stirring.

The gain in water content may probably be ascribed to decreased evaporation, for water evaporates less freely from loose than from compact soil. The explanation usually given is that the movement of water in soils (apart from the gravitational flow) is a surface-tension effect akin to the rise of water in capillary tubes, and is therefore facilitated when the spaces between the particles are diminished, and impeded when the spaces are kept large. Frequent stirring of the soil, which prevents it becoming compact, reduces the capillary movement of water to the surface, and consequently lessens the evaporation. This hypothesis explains a good deal, but unfortunately it has not been very fully developed; there is little doubt that if some physicist would take the matter up he could obtain results of great importance to agricultural science and practice.

[1] (1) The Agricultural Journal of India, vol. iii., part 1. (1908.)
(2) Memoirs of the Department of Agriculture in India, vol. i., No. 6, "The Loss of Water from Soil during Dry Weather," by J. W. Leather.
(3) The Transvaal Agricultural Journal, April, 1908.
(4) The Journal of the Department of Agriculture of South Australia, March and May, 1908.