

and the more fundamental methods of chemical analysis. No description is given of a modern type of calcimeter such as that of Collin's, but only of the two Passon's calcimeters in which the sources of error still remain. Again, ecologists might reasonably hope to find in these pages an account of either the electrical or colorimetric methods for determining the hydrogen-ion concentration of soil solutions, or of the colorimetric determination of nitrates.

It is particularly in respect to physical and chemical methods, of which the details are often widely scattered in non-botanical literature, that the biological investigator needs most guidance. The elucidation of ecological problems is becoming every day more a question of the investigation of the chemical and physical properties of the environment as they affect the different species directly, and their relationships to one another.

The second part of the volume is devoted to a consideration of the plant community, and is a helpful summary of the recent work on the extensive side of the subject. Here are dealt with such aspects as frequency and the methods of its determination, the occurrence of "constants" and characteristic species, the life forms of plants as classified by Raunkaier, the chief plant formations and the important subject of cartography.

Prof. Rübél's considerable experience in the Swiss Survey lends especial value to his pertinent discussions of the various statistical methods. The results so obtained are often by no means free from the personal equation, and hence often have a spurious appearance of accuracy to which attention is rightly drawn. The classification of plant formations is, in essentials, that put forward by Brockman and Rübél in 1912, based largely on the physiognomy of the dominant species. The chief change is the creation of a new class termed *Saxideserta* for stony deserts in which cryptogamic vegetation predominates.

Ecology, from the very complexity of the problems with which it deals, must cull its methods from all branches of science, and if we have criticised omissions it is not without a due appreciation of the magnitude of the author's task and of the encyclopædic knowledge requisite to its ideal performance.

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### Avian Minstrelsy.

*Songs of the Birds.* By Prof. Walter Garstang. Pp. 101. (London: John Lane, The Bodley Head, Ltd., 1922). 6s. net.

IN his "Songs of the Birds" Prof. Garstang has given us an unusual but agreeable mixture of science and verse. His introductory essay on avian

song is a contribution to the science of the subject which deserves serious consideration. His attempts to set down on paper representations of the songs of different species are also interesting, although opinions will probably differ as to whether he has greatly succeeded where others have failed. Finally, there are the author's own verses about the songsters, often incorporating his representations of their own music; but these, together with the little sketches from Mr. J. A. Shepherd's humorous pencil, scarcely fall within the scope of a notice in these pages.

Prof. Garstang starts from the assumption that "birds are not automatic musical boxes, but sound-lovers, who cultivate the pursuit of sound combinations as an art, as truly as we have cultivated our arts of a similarly æsthetic character. This art becomes to many of them a real object of life, no less real than the pursuit of food or the maintenance of a family." He also, following Warde Fowler, places bird song on the æsthetic level of the rude music of primitive man. The songs of birds, he tells us, "are in each generation an expression of the whole joy of life at its climax of achievement and well being," and he holds that it is wrong to regard them as essentially love lyrics. These views are a welcome reaction from the too mechanical conceptions that are common, but there is at the same time some danger of their leading towards too anthropomorphic ways of thinking.

Much ingenuity has been expended at various times, and with indifferent success, on the attempt to translate birds' songs into human speech or musical notation. Prof. Garstang obviously approaches this vexed question with a knowledge of music and a sense of poetry, and his endeavours to place the matter on a firmer footing are, at the least, interesting and instructive. As "the bird is a minstrel, not a musician," and as "timbre and resonance, rather than musical pitch, constitute the dominating features of a bird's sounds," the author has adopted a syllabic notation. His view is that "the secret of representation lies not in punctilious imitation of every sound (which is unattainable), but in accuracy of phrasing combined with a fair approximation to the succession of dominant vowels and consonants." As we have said, however, opinions are likely to differ as to whether the question is really solved, for the personal factor enters so largely into both the hearing of the songs themselves and the reading of the written symbols. The reader who has an ear may thus best judge for himself whether a useful advance in the means of studying and describing bird music has been achieved by such examples as the following representation of the song of the willow-warbler:

*Sip, sip, sip, see! Tee, tew, wee, tew!*  
*Witty, witty, wee-wee, weewee!*