

flow of materials, minerals, money, energy, or whatever, is not new, as the author himself points out. What has been achieved in this book is the unification of all these instances into a single programme with a common measurable factor—the flow of energy. Thus we have a facility for studying old problems from new angles, and a source of sound arguments upon which to base necessary changes in many of man's habits. Professor Odum's book contains a highly readable introduction to the problems and methods of ecological studies, including a considerable bibliography of established and current research literature. Moreover, at a time of mounting concern over the future of man's partnership with nature, it provides the essence of what may be an ideal tool for a detailed qualitative and quantitative survey of that partnership.

D. I. McLAREN

Birds of Africa

African Birds of Prey. By Leslie Brown. Pp. 320+12 plates. (Collins: London, February 1971.) £2.25.

A Field Guide to the Birds of Southern Africa. By O. P. M. Prozesky. Pp. 350+40 plates. (Collins: London, January 1971.) £2.50.

LESLIE BROWN, a zoologist by training, has lived for many years in Africa and has made a special study of its birds of prey; he is also joint author of the standard work on the birds of prey of the world. With this authority he has now distilled some of his knowledge in an interesting and very readable book. In three introductory chapters he discusses the definition of a bird of prey, the behaviour and physical adaptations for predation, and the variety of birds of prey found in Africa—this last particularly in relation to the different types of habitat.

The next dozen chapters review, group by group (sometimes more by function than by strict taxonomy), the estimated 89 species of diurnal and 31 species of nocturnal raptors found in continental Africa as a whole. This takes us all the way from cuckoo-falcons to fishing-owls, with such chapter headings as "Large and spectacular eagles" and "A variety of middle-sized owls". There is a group entitled "Oddities" which contains the osprey, the vulturine fish-eagle (palm-nut vulture), the harrier-hawk, and—oddest of all—the secretary-bird. Without the tedium of a stereotyped treatment, suitable only for a work of reference, an account is given of the characteristics, distribution and habits of each species; personal experience of the birds is constantly cited.

After laying this foundation, the

author proceeds to the most important part of the book, a further nine chapters dealing with various biological problems that birds of prey present or exemplify. These are problems of ecology and distribution, of migration into and within Africa, of population dynamics and the effects of predation on other animals, of breeding seasons and cycles, and of relations with mankind. These matters are discussed in an interesting and often stimulating way. The book concludes with a valuable series of tables lucidly setting forth information about the abundance, distribution, habitats and food of each species.

Mr Prozesky's book provides a convenient conspectus of the nearly 900 bird species found south of the Zambesi. The text, desirably, follows the Peterson pattern which has become conventional for field-guides. The illustrations, of more than 400 species, fall substantially below the admittedly exacting Peterson level of artistry, but can for the most part be accepted as adequate for identification purposes.

A. LANDSBOROUGH THOMSON

Radiocarbon Dating

Radiocarbon Variations and Absolute Chronology. Edited by Ingrid U. Olsson. (Proceedings of the Twelfth Nobel Symposium held at the Institute of Physics at Uppsala University. Nobel Symposium No. 12.) Pp. 652. (Almqvist and Wiksell: Stockholm; Wiley-Interscience: New York and London, 1970.)

SINCE radiocarbon dating was first developed there has been a continued interest in the absolute accuracy of the method, and much effort has been expended, particularly during the past decade, in comparing radiocarbon with other systems of dating. The literature of the subject prior to this publication reveals a complex picture not easily understood by many users of radiocarbon dates and likely, in view of its complexity and the reported wide divergencies between radiocarbon and calendar dates in certain regions of time, to raise considerable doubts particularly in the mind of the archaeologist as to the validity of radiocarbon dates in general.

I would like to be able to report that this publication clarifies these problems completely for the general reader and user of radiocarbon dates but unfortunately this is not so. Despite this, however, it is the most comprehensive and up-to-date treatment of the subject at present available, and consequently all who are at all involved in using or producing radiocarbon dates will wish to acquire it or at least to ensure access to it.

It brings together under one cover

contributions from major workers in this field and there is much new work reported and much of great interest. Topics covered include the latest developments in those dating techniques which provide a means of comparison with the radiocarbon method: varve chronology, dendrochronology, pottery dating by thermoluminescence, ice core analysis, and of course the use of archaeological material of known age. In addition, there is equally full treatment of the many factors connected with the causes of the secular variations in radiocarbon activity including exchange rates in the various exchange reservoirs, the constancy of cosmic radiation as deduced from radiogenic isotopes in meteorites and on Earth and the effects of geomagnetic and heliomagnetic and climatic changes in the past.

Apart from the formal papers, the discussions are also recorded here although in condensed form. In places they are very illuminating. Thus, the editor states in the preface that she had "intended to publish most of the measurements on the radiocarbon content of the atmosphere in one figure . . . in such a way that this figure could be used for calibration purposes . . .". The reason why this was not possible emerges very clearly in the discussions. We learn, for example, that while there is fairly general agreement concerning the major long-term variations over the past seven millennia as deduced from measurements on dendrochronological material, the various laboratories are not in complete agreement as to the position and magnitude of the short-term fluctuations, and that while the majority were willing to pool their measurements in order to facilitate the editor's purpose, there was one notable exception (Professor Suess) who insisted that his calibration curve be published separately. Thus the chief shortcoming of the book from the point of view of the user of radiocarbon dates is that it does not provide a final definitive answer to the problem of converting radiocarbon dates to calendar years. Instead there are two separate diagrams: the calibration curve due to Suess which has appeared elsewhere, and the shape of which seems to have been arrived at intuitively rather than by any strict mathematical treatment of the data, and a diagram prepared by the editor on which the data of the other workers are plotted. Because this latter does not aim to compete with the other diagram by indicating a calibration curve, it serves principally to show how laboratories agree on the general trend of the large long-term variations and how they differ as to the position and magnitude of possible short-term fluctuations.

H. BARKER