The Biogeochemistry of Blue, Snow and Ross' Geese

By Harold C. Hanson and Robert L. Jones. 1976. Southern Illinois University Press, Carbondale. 281 pp., illus. U.S. $15.

The main aim of this book is to propose a new technique — feather mineral pattern analysis — for distinguishing different populations of wild geese, and for relating them to particular breeding and molting areas. The flight feathers of geese were analyzed to find the concentrations of 12 different mineral elements. Birds from the same area varied only slightly in their feather mineral patterns, but there were huge differences in mineral patterns between birds from different areas. It was thus possible to distinguish birds from different areas by analyzing their flight feathers. The different patterns were not genetically determined, but depended on the levels of various minerals present in food at the time of feather growth, and thus on the local soil and bedrock. This in itself is a remarkable finding, as it cuts across the traditional view that animals precisely regulate the composition of their tissues, with little variation among individuals. It raises the questions whether other tissues vary as much as feathers in their mineral contents, or whether feathers act as dumping grounds for surplus mineral? Either way, if geese from different areas can be distinguished, then so, presumably can other birds, and perhaps some other animals. The findings also emphasize the prospects of monitoring pollutant levels by feather analysis, as has already been done to good effect for mercury in Sweden. The authors give the term 'biogeochemistry' to this new type of study, and are justified in thinking that it will interest biochemists, physiologists, and nutritionists, as well as ecologists.

The authors' chief interest in the technique is in its management possibilities. They claim that it promises to supplement, or in some cases, replace banding, as a means of establishing the origins of migrant and wintering geese. It should allow finer discrimination between sub-populations, and thus give more resolution in management. Whether these claims are justified remains to be seen, but the allocation of birds shot in winter to particular breeding or molting areas will presumably depend on having all these areas 'typed' beforehand with respect to feather mineral patterns. This is in itself a huge job, though considerable progress has already been made.

The book is nicely presented and well illustrated with many diagrams, maps, and photographs. I found the text interesting and thought-provoking, but would have welcomed much more information on the variation in mineral patterns between different feathers on the same bird, between different individuals in the same molting area, and between sex and age groups and years. There was also the disturbing observation that the mere washing of feathers for long periods in water removed some considerable mineral content. Only when these aspects have been fully explored can one put proper confidence limits on the ability to discriminate birds from different areas. One can only hope that this innovative book will stimulate more work on the same lines.

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BOTANY

North American Species of *Lactarius*

By L. R. Hesler and A. H. Smith. 1979. University of Michigan Press, Ann Arbor. ix 841 pp., illus. Cloth U.S. $25.

Mushrooms of the genus *Lactarius* are among the most conspicuous and colorful species of fungi. Some are ardently sought for food. In nature they are extremely important partners in symbiotic (i.e., mycorrhizal) associations with various woody plants. These fungi typically produce medium- to large-sized mushroom fruitbodies which characteristically exude a latex when the mushroom is cut or broken.

Despite their large size and beauty, which has attracted considerable interest by amateurs and professionals, a critical study of the North American species has been slow to develop (e.g., 45% of the 197 species in this book have been newly described since 1959 and principally by Hesler and Smith). The authors emphasize that "There is more to be done than has been done. With the vast expanses of Canada still almost completely unsampled, no reasonably complete *Lactarius* flora for North America can be written." The common *L. deliciosus* and the western *L. rubrilacteus* (a species formerly reported from

North America as *L. sanguifluus*) were not reported from Canada although they surely occur here. Nevertheless, 46 species are reported from Canada (i.e., Nova Scotia, Quebec, Ontario and one species each from Manitoba and British Columbia).

The book contains 39 pages of methods for studying fresh and dried specimens, keys to the six subgenera and the species, species descriptions, 249 drawings of spores, cystidia and tissues, 154 excellent black-and-white photographs of various mushrooms, and three appendices. Appendix I contains descriptions of 29 species and varieties not yet found in North America but expected to be part of the flora (*Lactarius flavidus*, number 73, from Japan and *L. pusillus*, number 147, from Europe should have been listed here rather than in the flora). The inclusion of the extralimital species in the keys would have facilitated their recognition in our flora. Appendix II contains 37 "excluded and doubtful species." Appendix III prepared by R. L. Homola and N. S. Weber illustrates basidiospores of many species in scanning electron micrographs and drawings. Access to the pictures in Appendix III is cumbersome because they are not referred to in the species descriptions; however, 48 additional drawings of basidiospores (Figure 202–249) are cited in the species descriptions.

In discussing the distribution of species in North America, the continent is divided into four "mushroom provinces." One "extending from Alaska to Labrador" (i.e., Canada) is not included in the discussion "because we lack a significant sample of the *Lactarius* flora of that country" of 8 675 000 km^2. The distribution of the species in Canada is sometimes vague (e.g., "in Canada" on p. 324 but no specimens are cited). Specimens are cited by province and collector's number, a form which equates a report from Nova Scotia with one from Ontario, which is 20 times larger, covers 15° of latitude, and contains three major forest types. The distribution is sometimes misleading. For example, the range of *L. deceptivus* is given as southern Canada but specimens are cited from Parc Chibougamau, Quebec (about 49° N); however, these boreal forest collections by David Malloch were inserted in the manuscript at the last minute. Throughout the book there are confusing anomalies between distribution and the specimens cited (e.g., the distribution of *L. tomentosomarginatus* appears as Michigan but specimens are cited from Michigan, North Carolina, and Vermont).

This monograph, which is the biggest and best on the genus, will be a classic in mycological literature. The authors feel that it is a preliminary treatment but the foundation they have laid and the problems they pinpoint will facilitate further contributions. My comments have been, in part, directed toward stimulating interest in the Canadian flora. Despite the weak treatment of the Canadian flora (an irrelevant problem if the monograph were entitled *United States species of Lactarius*) this book will be indispensable in the study of our flora.

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Wildflowers of the North

By R. G. Bryan and M. E. Newton-White. 1978. Highway Book Shop, Cobalt, Ontario P0J 1C0. 215 pp., illus. $12.00.

North, to some, is a land of tundra, but to Bryan and Newton-White it is that part of Ontario and Quebec adjacent to Temagami and Lake Temiskaming. The flowers that are found there are, however, boreal species that are found over a wide range, and thus the book is of interest over a much wider territory.

The book is a combination of line drawings and hand printed text which blend together to give a most interesting presentation. This form of presentation makes the book a small coffee-table item, but it will also serve as an introduction to the flora of the region to both visitors and local residents. The about 380 species treated are described under the headings of growth habit, flowers, fruit, leaves, stem and root, and the habitat where they might be found, in a simple easily understood manner, but there is sufficient detail for recognition. Scientific names as well as both English and French names are given.

Included in the book are a short introduction, notes on plant propagation, an illustrated explanation of terms, a page on fun with flowers, and English, French and Latin indexes.

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