BOOK REVIEWS

A Definitive System for Analysis of Grizzly Bear Habitat and Other Wilderness Resources. By John J. Craighead, J. S. Sumner, and G. B. Scaggs. Wildlife-Wildlands Institute Monogr. 1, University of Montana Foundation, Missoula. 1982. xxiv, 279pp., 105 figs. (14 in color), 96 tables, color frontispiece. $25.00 (paper).

Information about wildlife and habitats has been gathered remotely since the invention of the binoculars and camera. Radio-location telemetry and high-altitude photography were the popular tools for remote sensing in the 1960's and early 1970's. In the late 1970's and 1980's, however, more sophisticated methods of monitoring reflectance data began appearing. Landsat digital data and the associated technology have been used to inventory and classify vegetative associates of wildlife habitats since the middle 1970's.

Craighead and coauthors have applied Landsat technology to the problems of identifying habitat on an extensive basis for the wide-ranging grizzly bear. The work is an outgrowth of their concern for, and long experience with, the grizzly bear in the Yellowstone ecosystem (Craighead, Varney, and Craighead, A population analysis of the Yellowstone grizzly bears, For. and Conserv. Exp. Stn. Bull. 40., Sch. For., Univ. Montana, Missoula, 1974). That earlier publication is reprinted as an appendix to this current effort and the controversy surrounding it was recently summarized by Chase (Atlantic Monthly 251[2]:63–73, 1983).

The stated objectives of this research were to: (1) clearly define grizzly bear habitat requirements, (2) analyze the food habits of grizzly bears, and (3) devise a rapid, relatively inexpensive method for analyzing large expanses of remote wilderness. These objectives are approached in 5 chapters.

Chapter I provides a generalized overview of the project, discusses components of prime grizzly bear habitat based upon the authors' extensive experience with the species, and describes the primary (Lincoln–Scapegoat Wilderness Area) and secondary (Danaher and Slategoat) study areas. Chapter II provides an exhaustive vegetation/landform description of those altitudinal zones used by grizzly bears in the primary study area. This effort is the ground-truthing exercise for the classification of the Landsat digital data.

Food habits and preferences of grizzly bears are described in Chapter III. The food habits analysis concentrates specifically on the vegetative portion (about half) of the diet. Food abundance and preference data are calculated as raw percentages (as are all data in the work). From these data the authors determined that the plant energy resource of the subalpine zone was 3–4× greater than that for the alpine zone. Comparable data were not available for the temperate zone as bear scats were not collected there. Based upon plant abundance and diversity (species richness), the temperate zone was felt to be equally as important to bears as the subalpine sites. The authors concluded, however, that all 3 zones are essential to maintain bears in an area and that loss of 1 would lead to "edaphic extinction."

The process of developing an ecospectral vegetation classification is described in Chapter IV. Using the ground-truth information from Chapter II, the digital data are clustered to conform to known vegetation at training sites. The resultant spectral signature values were extrapolated to the secondary study areas and the accuracy of this extrapolation evaluated for the 10 vegetation types classified in the 2nd generation mapping; an 89% accuracy on the Scapegoat compared to 75% on the Danaher and Slategoat extrapolations. A major portion of this error in extrapolation was attributed to inconsistencies between the human and remote classification of ecotonal pixils that were more frequent in the secondary sites. The percentage abundances of selected bear foods within each spectral class were then multiplied by the area coverage of that class to derive habitat ratings of the classified digital data. The authors thereby conclude that a resource manager can quantify grizzly bear habitat for sites ranging from 1 acre (0.47 ha) to 1,000 mi^2 (2,590 km^2). In turn, they caution that extrapolations are only effective within a vegetative type, that extrapolation is limited to the Landsat scene of the training exercise, and that the major limitations in the technique are not in Landsat resolution, but rather in the thoroughness and accuracy of the ground truthing. Although familiar to experienced users, these latter points are basic in any introduction to Landsat analysis.

Chapter V discusses potential applications of multispectral imagery classification to wilderness resource monitoring and provides an overview of the current status of the grizzly bear, problems impeding its survival, and recommendations for its preservation. Final statements discuss applications to the national parks and the value of those parks. To this extent, the study really is as much, or more, a park study than a bear study.

Like most field ecologists, I am inherently skeptical of anything that proclaims to be a definitive answer, not excluding this volume. The weak link in the study is the integration of grizzly bear habitat requirements with the remotely classified vegetative communities. The effort is based upon zonal classification of vegetation that grossly represents what is known about grizzly bear habitat. However, a habitat (by definition) requires that an animal be present. The authors' approach could assume presence fairly reliably on the primary study area classification, but extrapolation throughout a scene could be highly misleading. The current approach ignores the minimum area requirements for a bear, along with potentially relevant interspersion and juxtaposition of

vegetative types within a bear's range. The authors tested the accuracy (which was quite good) of the vegetative classification, but the ultimate test should be how accurately they can predict grizzly bear occurrence or density.

A more definitive approach would have restricted the vegetative classification to grizzly bear home ranges (available from telemetry studies). This approach would have permitted a more detailed classification due to a greater intensity of ground truthing on a smaller area, plus minimum area criteria for grizzly bear occupation. In addition, the analysis may have distinguished similar absolute values (numbers of classified pixils) among home ranges that could represent criteria that bears actually use in selecting a habitat. The resultant merit of the approach would not be in accurately classifying vegetation within grizzly bear habitats, but rather in identifying sites (in tests) where grizzly bears are present vs. sites outside known home ranges of bears. Even 50% accuracy in these tests would be a monumental breakthrough in grizzly bear management and protection. Perhaps, and hopefully, this approach is the next phase in the extensive research program.

Landsat technology is now 10 years old. This work is based upon Landsat I, launched in 1972. The 4th satellite in this Earth Resources Observational System was launched in 1982. The early pixil resolution of 0.45 ha is now less than 0.1 ha and a thematic mapper accompanies the multispectral scanner giving reflectance data in 3 additional (near infrared, including thermal infrared) bands. Nonetheless, this is the most intensive application of Landsat technology to a wildlife resource that has been followed through to the publication of results. Thus, it must be viewed as a milestone in resource inventory of wildlife habitats. The flash of color-coded vegetation mapping and the vision of our mythical giant bear fighting for survival in the nation's most scenic wilderness reserve can only enhance such an image. Unfortunately, the price of $25.00 plus $1.09 postage for a research report using early Landsat technology will likely tarnish this image for those interested in remote sensing more than bears.—**Fritz L. Knopf,** Denver Wildlife Research Center, 1300 Blue Spruce Drive, Fort Collins, CO 80524-2098.

Hibernation and Torpor in Mammals and Birds. By Charles P. Lyman, John S. Willis, Andre Malan, and Lawrence C. H. Wang. Academic Press, New York, N.Y. 1982. 317pp. $37.50.

This book is an extensive review of our current understanding of this area of environmental physiology. The authors have emphasized recent investigations, concentrating on the biochemical aspects of hibernation. The complexity of torpor is again revealed. The reader is informed that hibernation is not a simple event or even 1 event, but a collection of physiologic changes directed toward survival. Even though mammals and birds attain similar ends, the means are, at times, quite dissimilar.

The book is organized into 14 chapters. The authors have discussed the current knowledge in an orderly fashion beginning with "Why bother to hibernate?," moving through the different stages in the hibernation cycle and ending with a short presentation of "Recent theories of hibernation." Each chapter is followed by a list of references.

C. P. Lyman authored the majority of the text. He presents the classic data collected during the 1950's and 1960's as well as more recent studies on the overall phenomenon of torpor. Topics include physiologic states of entrance, deep torpor, and arousal. Separate chapters concentrate on the animal's responses and interaction with their environment.

J. S. Willis discusses the biochemical responses involved in torpor. Chapters include "The mystery of periodic arousal" and "Intermediary metabolism in hibernation." In a 3rd chapter, Willis addresses the enzymatic and ionic alterations present in cold adaptation of hibernators.

Andre Malan and L. C. H. Wang each have contributed 1 chapter. Malan presents acid–base regulation during hibernation. L. C. H. Wang's extensive chapter deals with the endocrine changes evidenced throughout the hibernators' yearly cycle.

New students and established investigators will appreciate this book. For some it will serve as a starting point, whereas for others it presents a concise review of literature concerning the physiologic aspects of hibernation and torpor.—**S. W. Jack,** Virginia–Maryland Regional College of Veterinary Medicine, University of Maryland College Park, College Park, MD 20742.

Observations of Wildlife. By Sir Peter Scott, illus. by the author. Cornell University Press, Ithaca, N.Y. 1980. 112pp., with forword by The Duke of Edinburgh. $19.95 (cloth).

The book is 22 × 28 cm bound in brown buckram-like covers with gold lettering lengthwise on the spine and a blind stamp of a pintail duck on the front cover. The pages are glossy white allowing sharp accents to Scott's numerous (36) black-and-white drawings. Included are 38 color and 36 black-and-white plates of the author's paintings. Acknowledgments, Foreword, and Preface precede the 4-chapter main section, which in turn is followed by an epilogue and an index.

The author regards his book as a patchwork quilt and that is an apt description, but what a beautiful and skillfully constructed piece. The opening sentence in the Preface starts with these 6 words, "This is a book of pictures . . . ," and I will treat it as such. This is not to imply that the text is anemic; on the contrary, it is an astute assessment of wildlife con-