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## How Does Variation in Plant Resources Affect Herbivore Dynamics?: Review of Hunter et al., *Effects of Resource Distribution on Animal-Plant Interactions*

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up with alternatives to avoid the destruction of these forests, and with it, the disappearance of the critical services that they provide to mankind (one of which is, by the way, a rich biodiversity, of which migratory birds are just one component). Congressman Gerry Studds condenses this thought in the preface with just a few words: "An alliance to save life . . . must help economies grow without destroying natural resources—an alliance for sustainable development." A reasonable agenda for future research should therefore be heavily concentrated on understanding the effects of different land use practices on bird populations, and on developing the techniques that minimize damage while simultaneously providing opportunities for economic growth for local communities.

Fortunately, the scientific community has embraced this concept by enthusiastically participating in the Partners in Flight Program (PIF), a large-scale conservation effort that enlists broad support from both public and private agencies to conserve migratory birds. Because many consider this 1989 symposium to be one of the main catalysts for the launching of PIF, the symposium organizers deserve to be congratulated for helping to shape such a paramount effort.

The book ends with an article jointly authored by the Latin American participants at the symposium. Basically, they argue that any agenda for conservation must be jointly developed, but again, within the larger context of sustainable development. Considering that only 3 papers were first-authored by Latin Americans as opposed to 45 by scientists from the developed world, clearly much more effort is necessary to incorporate Latin American scientists into the development of such an agenda.

In summary, this is an excellent book that raises many critical questions and that will likely influence the way we look at migratory landbirds for years to come. Hopefully, we will have the wisdom to help find alternatives for development that incorporate biodiversity conservation as a cornerstone. Within this larger framework, a place for migratory birds will be assured forever.

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#### HOW DOES VARIATION IN PLANT RESOURCES AFFECT HERBIVORE DYNAMICS?

Hunter, Mark D., Takayuki Ohgushi and Peter W. Price (eds.). 1992. **Effects of resource distribution on animal-plant interactions**. Academic Press, San Diego, California. xi + 505 p. \$89.00, ISBN: 0-12-361955-6.

The book by Hunter et al. has two aims. The first is to focus more attention on the role of variation in resources, specifically plant resources, in the dynamics of herbivorous animals. The emphasis on plant variability in herbivore performance and dynamics, rather than on average patterns of plant resource availability, is timely. Emphasis to date has been on general patterns of resource use. However, knowledge of variation is required to predict outcomes of both ecological processes and evolutionary changes with environmental modification. Thus, I expect this book will be considered an important step on the road to such understanding.

The second stated aim of the book is to stimulate debate on the relative strengths of bottom-up vs. top-down effects in terrestrial foodwebs. An underlying goal appears to be to present the case for bottom-up regulation of herbivore populations and thus terrestrial foodwebs. For example, the editors say they wish to "reestablish the fundamental role of energy flow up through the system as the template upon which all species interactions . . . necessarily take place." Many of the chapters are cogent presentations of the bottom-up regulatory aspects of the effects of variation in plant quality and resource availability in herbivore performance and dynamics. Others, however, suggest the issue may be more complex than a simple dichotomy. I found the brief allusions to a third hypothesis, that neither "bottom-up" nor "top-down" regulation will be found to be general, both tantalizing and underrepresented. I think that more formal consideration of this "neutral" hypothesis, as well as more space for advocates of

the alternative "top-down" perspective, might stimulate more discussion directly. I particularly liked Jack Schultz's approach in this context. He makes the point that generalizations that exceed the facts available are counterproductive.

The 14 chapters are divided into four main sections. These sections are: (i) phenotypic and genotypic variation in interactions; (ii) herbivore reproduction and population dynamics in relation to resources; (iii) patterns in herbivore communities in relation to resources; and (iv) evolutionary responses to resources.

The first section approaches an issue that is being increasingly recognized as important and underexplored. Analyses of the genetic and environmental dimensions of biotic interactions are essential to our capacity to predict interaction outcome and evolution. MaryCarol Rossiter reviews the issue of population quality and maternal effects on the population dynamics of forest lepidoptera. Richard Ostfeld summarizes his work on responses of vertebrate herbivores to resource and habitat patchiness. And, Arthur Weis and Diane Campbell attempt to synthesize a framework for considering the consequences of plant genotypic variation for insect herbivores and for pollinators. I found the latter chapter especially intriguing. Yet, it was also clear that little has been done along these lines.

The second section covers a long-standing, fundamental issue in animal ecology: the role of food resources in the dynamics of herbivorous animals. Beverly Rathcke reviews connections between nectar distribution and pollinator behavior. Peter Price argues that plant resources form THE mechanistic basis for insect herbivore dynamics. Schultz suggests that plant tissue availability to insect herbivores includes variation due to natural enemy pressures, and challenges ecologists to keep their generalizations firmly grounded on fact. Takayuki Ohgushi summarizes his research on resource lim-

itation of an herbivorous ladybeetle. I think that at least two of these chapters (Price, Schultz) will generate the desired debate.

The third section, on resources in herbivore community organization, takes the central question of the book a step up in the organizational scheme. A striking feature of this section was its diversity. James Karr and colleagues examine the ideas of bottom-up vs. top-down regulation of vertebrate populations and conclude it probably isn't one or the other. Mark Hunter cleverly applies the keystone species concept to explain structuring of herbivore communities via their impacts on plant resources. David Roubik suggests resource use shifts by core species in space and time (= "loose niches") reflect the interchange of facultative mutualists expected in communities characterized by variable components. I found Hunter's idea, of feedback loops as sources of heterogeneity in trophic webs, with herbivores as a key loop in such heterogeneity, thought-provoking. Hunter was also one of the few authors to suggest possible feedbacks of herbivore interaction and variability onto the dynamics of plant resource populations.

The final section approaches evolutionary responses to resource distributions. Theodore Fleming asks how fruit- and nectar-feeding vertebrates track their food resources, concluding that important life history traits are influenced by patterns of variation in food resources for these species. Tamiji Inoue and Makato Kato, in examining morphological variation in bumble-bee traits, argue that the foraging strategy of a species is the sum of heterogeneous individual strategies. Mark Scriber and Robert Lederhouse hypothesize that the degree of local specialization of a polyphagous insect herbi-

vore is a function of phenological limits on generation time plus host plant quality. The latter chapter both synthesizes and extends ideas for understanding geographic and local variation in phytophagous insect diets.

In sum, the book presents multiple careful reviews of the bottom-up perspective for several types of herbivore populations. These should stimulate discussion and further comparative work. It also contains several gems in terms of creative ideas and potential tracks for future work. I think the book merits serious examination by all who are interested in the plant-insect interaction at the population and community levels. My main disappointment was the rarity with which the effects of herbivores and herbivore variation on their plant host population and community dynamics were discussed. Hunter and Price recognize this deficiency in their introductory chapter, and say: "... we know surprisingly little about the effects of variation among herbivore populations and individuals on plant ecology and evolution." I agree, although perhaps not as little as one would conclude from this collection. In sum, the book presents some unresolved issues, stimulating ideas, and multiple challenges for future discussion and research on the ecology of plant-animal interactions. It is likely that anyone interested in the issues of population limitation and regulation of herbivore community assemblage in terrestrial systems will find "meat for thought" here.

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#### TAKING US TO THE NEXT LEVEL OF WILDLIFE MANAGEMENT TEXTBOOKS

Morrison, Michael L., Bruce G. Marcot, and R. William Mann. 1992. **Wildlife-habitat relationships: concepts and applications**. The University of Wisconsin Press, Madison, Wisconsin. xix + 343 p. \$26.95, ISBN: 0-299-13200-5.

The value of habitat to longterm stability of wildlife populations has long motivated conservation agencies to purchase and manage land. Appropriately, policy decisions, such as how best to manage these habitats, are driven by human-oriented value decisions. A more thorough understanding of animal-oriented perspectives towards habitat value, superimposed on human value judgements, would aid the decision-making process. The book, *Wildlife-Habitat Relationships: Concepts and Applications*, is the most comprehensive attempt to date to insure that details of animal-perspectives toward wildlife-habitat relationships are properly documented and interpreted.

The authors' goal, to provide an advanced text dealing with documentation of wildlife-habitat relationships for upper-level undergraduates and graduate students with a background in wildlife biology and ecology, is most appropriate. The previous decade saw rapid growth in the number of text offerings

geared to introductory wildlife courses. As a teacher of just such a course who has evaluated many offerings, I believe that need has been properly addressed. In the fashion of applied wildlife management, it is time to move on to the next most limiting factor: textbooks for advanced coursework. To my knowledge, this book's coverage of analysis and interpretation of wildlife-habitat relationships is unique in the class of advanced wildlife textbooks.

Using the best index available to me, that is, their significant contributions to the reviewed-literature knowledge base, the authors are well qualified to cover "both the theoretical and applied aspects of wildlife-habitat relationships with an emphasis on the theoretical framework under which researchers should study such relationships." They are well-published in the areas of both specific analytical applications and reviews of the application and interpretation of standardized methodology.

I liked the general content and organization of the book. Each chapter begins with an introduction which clearly identifies the justification for and physical makeup of the chapter. By necessity, the literature reviewed is not inclusive of the entire literature base. However, the authors include an extensive selection of pertinent literature. As is appropriate to any