

## Biotic Interactions as Nature's Ornaments: A View from the Tropics

**The Ornaments of Life: Coevolution and Conservation in the Tropics.** Theodore H. Fleming and W. John Kress. University of Chicago Press, 2013. 616 pp., illus. \$50.00 (ISBN 9780226253411 paper).

We tend to think of *ornaments* as useless structures—as artifacts existing merely for admiration or refinement. To the naive eye, nature appears to have plenty that exist without specific function. Sometimes these ornaments seem to be a result of a preexisting, functional structure, now devoid of any apparent purpose. To the keen eyes of natural historians Theodore H. Fleming (a biologist specializing in plant–animal mutualisms) and W. John Kress (a research botanist and curator at the Smithsonian Institution National Museum of Natural History), an ornament can have key roles within the life history of an organism. These expert observers of nature have distilled their rigorous research into *The Ornaments of Life: Coevolution and Conservation in the Tropics*, supporting their argument with myriad examples and case studies, along with a solid knowledge of tropical forests worldwide. Their book delves beyond the aesthetics of ornaments into their fundamental biological roles. It focuses on the ecological functions that are hidden within nature's beauty and the pervasive coevolutionary processes that not only generate these ornaments but that are also crucial to their persistence.

The authors discuss plant–animal biotic interactions as the fundamental ornaments of tropical forests: No species survives without interacting with other species, and this ecological principle has created amazing examples of biological elegance. Think of *Heliconia* flowers and their hermit hummingbird pollinators or the colorful and bizarre

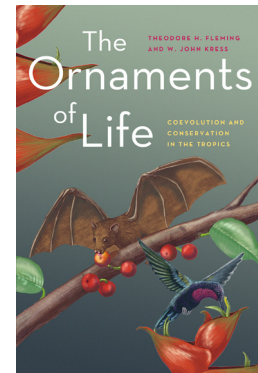
cotingids that interact with many tropical laurels and palms. Biotic interactions are biodiversity's wireframe, and Fleming and Kress carefully dissect their structure and coevolution.

These ornaments are clearly much more than bizarre species and stunning interactions, however. A difficult challenge in conservation biology is to preserve biotic interactions so that the full functionality of ecosystems is preserved, and in the tropics, drivers of global change operate very quickly. Emerging pathogens, deforestation, overhunting and poaching, and selective logging can cause a loss of habitat and biodiversity that may not extirpate the species but will frequently terminate its interactions.

The book's first section—about one-third of its text—is dedicated to exploring macroecological, patterned interactions of pollination and seed dispersal. The authors characterize flowers and fruits as resources and discuss the demographic and genetic consequences for both plants and animals. These chapters are thoroughly presented, but I did miss a more detailed treatment of lizards and fish as frugivores and seed dispersers. However, I agree with the authors that birds and mammals “account for the vast majority of vertebrate pollination and frugivory mutualisms today and undoubtedly have done so throughout the Cenozoic” (p. 3).

*The Ornaments of Life* offers a magisterial perspective of the ecological intricacies and genetic consequences of these mutualisms and their outcomes. Fleming and Kress bridge the pollination stage nicely with the outcomes of seed dispersal and consider the effectiveness of interactions, dispersal distances, and genetic consequences. They rely on this detailed and documented description to discuss the empty forest syndrome—when the forest has lost its ornaments but is still the habitat for those remaining mutualistic animals, in

such low abundance that their ecological services are nullified.



Later in the book, the authors examine the potential for plant–animal mutualisms to drive speciation and macroevolution in both plants and animals, and they illustrate this message with more than 60 photos of hummingbirds, cracids, bats, cotingids, toucans, monkeys, flowers, and fruits. After admiring the color plates, a reader soon lacks the willingness to argue against the idea that these ornaments had a key role in the diversification of tropical life. Tests were conducted, as well, for speciation patterns in core families, which supports the idea that these mutualisms, especially pollination, had a central relevance to speciation within up to 37 families (approximately 17 percent of the tropical plant families).

Fleming and Kress identify a core of plant families that appear to be pivotal in maintaining tropical diversity through coevolved interactions with their animal mutualists. They claim that diversification of these families (e.g., Ericaceae, Cactaceae, Heliconiaceae, and Myrtaceae with vertebrate pollinators; Burseraceae, Moraceae, Melastomataceae, and Rubiaceae with vertebrate frugivores) has driven the diversification of major vertebrate taxa (e.g., hummingbirds, honeyeaters, cotingids, trogons,

bowerbirds, phyllostomid and pteropodid bats, haplorhine primates). Furthermore, the authors suggest that the high speciation rates in some of these animal groups, in turn, increased plant speciation rates. It can certainly be argued that highly diversified interactions involving these families of plants with major pollinator and frugivore taxa have had tremendous relevance in driving coevolved diversification in the tropics.

The authors later expand and refine their argument by exploring phylogenetic and biogeographic patterns to conclude that codiversification occurred but with high asymmetry. Most animal families were younger than their core plant families, and this was especially true for seed dispersal mutualisms, in which the animal families (tanagers, birds of paradise, phyllostomid bats) radiated within the last 15 million years—much more recently than their major plant families. This opens fascinating questions about the rate and mode of coevolution in highly diversified assemblages of mutualists.

Fleming and Kress then focus on two mutualisms, pollination and frugivory, by providing a thorough review of the nuts and bolts of these interactions and how the ornaments become crucial to the functioning of tropical ecosystems. There is a general trend for pollination interactions to show greater specificity than seed dispersal interactions do, rendering pollination mutualisms more vulnerable to the extinction of their partners. The authors explain that both types of interaction are fundamental to the life of each partner organism, because the outcomes during the consecutive stages of pollination and dispersal are so deeply integrated within the life cycle of the plants and the life histories of the animals. Every trait of each partner organism is thoroughly discussed to underscore its functional importance in determining mutualistic outcomes.

*The Ornaments of Life* is accessible material for undergraduate or graduate students. The highly readable text is superbly edited and illustrated with tables and elegant color plates. Background information from the

Neotropics is most prevalent, which reflects the expertise of the authors, but the paleotropical areas are also widely covered. Its breadth and depth of scholarship makes the book especially valuable to research faculty, but anyone surveying the current research on tropical plant–animal interactions will enjoy this in-depth analysis of the ecological underpinnings of these fascinating mutualisms.

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doi:10.1093/biosci/biu081

## HOW TO COEXIST WITH PREDATORS

**The Predator Paradox: Ending the War with Wolves, Bears, Cougars, and Coyotes.** John Shivik. Beacon Press, 2014. 208 pp., illus. \$26.95 (ISBN 9780807084960 cloth).

**W**ildlife management tends toward being a hidebound, tradition-oriented endeavor, its origins going back to our beginnings, when we were not only hunters but prey ourselves. The predator paradox stems from those beginnings, and John Shivik's new book of that same title considers and elaborates on this. The bottom line: We both love and fear these species.

Shivik is one of the better writers for a generalized audience that I have run across in the wildlife field. His career includes being leader of the National Wildlife Research Center Predator Research Facility, funded by the US Department of Agriculture's Wildlife Services, Utah State University, and the Utah Division of Wildlife Resources. Although non-lethal management of predators is

its focus, his book provides insight into our relationships with these large mammals, which are deeply rooted in our present-day society and can be applied to many facets of wildlife management. Anyone interested in wildlife conservation should read this book. The research illustrates an interaction of scientific inquiry with human creativity and morals. It also discusses efforts by agencies and organizations to preserve themselves, regardless of what might be the more appropriate approach to wildlife management. Shivik's experiences and personal views buttress the message of the book to good effect. It is well referenced for those who wish to further their knowledge, with scientific literature and publications intended for the general public both listed.

Shivik delves extensively into how society deals with predators, commenting on the organizations that ostensibly support predator conservation, as well as on those that do not. The US Department of Agriculture's Wildlife Services, which provides extensive support for predator research, conveniently ignores predator conservation out of concern for the potential loss of support from ranchers and other stakeholders—an example of how tradition influences management. Shivik is critical of certain environmental organizations and animal protection groups that are quick to criticize from afar without fully understanding the problems that the ranching interests are confronting. Conservation organizations that solicit donations from individuals living away from the predators under the pretense of “saving” them may not be helping improve wildlife management or reduce the killing of predators if there is no understanding of the rancher's perspective.

The author's insight into the ranching community leads us to certain unexpected realizations—namely, that ranchers typically have a close affinity not only for their livestock but for wildlife and that the financial aspects of their calling are not the main reasons for which they choose to stay in the business. I know a rancher living