

ecosystems. They are indeed “farmers of the forest,” as so aptly put by Kinnaird and O’Brien in the title of their book on the ecology and conservation of these birds.

Hornbills appeal not only to modern-day natural historians and biologists, but for centuries have figured prominently in indigenous cultures. They are revered as totems; hunted for food, feathers, and medicinal purposes; and are considered symbols of luck. Not only do they provide human societies with these services, but they also more importantly provide the very valuable ecosystem service of seed dispersal. They are great subjects to study plant and bird dispersal (much of their own dispersal behavior still remains a mystery) and the evolution of breeding behaviors such as monogamy. In spite of this, hornbills have not been the focus of many studies. This is likely due to their canopy-dwelling nature and their dense tropical-forest habitats, which make hornbills more difficult to study than other more accessible bird species. Even though they may be poorly known, understanding the ecology and conservation of hornbills is very important. Thus, I hope this book will highlight and bring attention to the interesting lives and conservation of these birds.

The authors focus primarily on Asian hornbills (with a few examples from African studies) in this book of nine chapters with accompanying figures, tables, sidebars, photographs, index, and references. Starting with hornbill evolution and ending with the future of Asian hornbills, each chapter takes us through some aspect of the ecology and conservation of these magnificent birds. In addition to summarizing other research in the field of hornbill biology, this book is well supplemented with much of the authors’ own research in Indonesia.

The first chapter is an overview of hornbills as a group and why we should invest our time in understanding their ecology and conservation. Though this chapter does contain general information on both African and Asian species, the subsequent chapters deal primarily with the Asian groups. The inclusion of a discussion here on the African genera, however, sets a nice stage for the focus on Asian birds and is important in providing the overall foundation for the book. The authors suggest that the focus on hornbills of Asia is, in part, due to their great diversification in Asia and increased conservation concern in Asian forests compared to African forests. Kinnaird and O’Brien are particularly well suited to write a book on Asian hornbills given their work in the field for nearly 15 years.

Chapter 2 discusses the evolution, taxonomy, and distribution of hornbills. Starting with the evolutionary history of hornbills, the book reviews three recent studies on hornbill phylogenies. Though there is not complete concurrence among these studies on the evolutionary history and relationships among hornbill species, the overall consensus is that the ancestral hornbill region was Africa. Following the appearance of the early ground-hornbill species (*Bucorvus*) in Africa, a bird sharing the characteristics of ground-hornbills and modern *Tockus* dispersed to Asia, where a frugivorous diet evolved and subsequent radiation and specialization occurred. Later, one of the more advanced Asian species reinvaded Africa, which then gave rise to the present African forest hornbills. A detailed description of species diversification in Asia is presented here. The chapter finishes with a basic summary on hornbill taxonomy and morphology.

Chapter 3 is more or less a summary of the kinds of habitats in which hornbills live. Referring to the “Asian hornbill realm,”

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**The Ecology and Conservation of Asian Hornbills: Farmers of the Forest.**—Margaret F. Kinnaird and Timothy G. O’Brien. 2007. University of Chicago Press, Chicago, Illinois. 315 pp. ISBN 0-226-43712-4. \$45.00 (cloth).

While hiking more than 15 years ago in the tropical lowland forests of Sumatra, a great hornbill (*Buceros bicornis*) flew over my head and landed nearby. The bird called loudly, announcing its arrival not only with its raucous call, but also with the dramatic whooshing sound of its wing beats. That was a time when Sumatran forests appeared essentially intact, and I know that today, I would probably be saddened by the changes that have occurred there over the last decade. Hornbills are awe-inspiring birds that have always reminded me of the old age of our tropical and subtropical forests. Every time I have seen or heard one, I have felt as if I were stepping back in time. Though they may seem ancient, these birds serve critical roles in current forest

there are interesting discussions of forest types occupied by hornbills and how forest structure and fruit production influence hornbill distribution and abundances. The final section here reviews the importance of El Niño events on Asian climate and the implications for hornbills. El Niño clearly has major impacts on fruiting events and may lead to sustained drought and increased fire frequency.

Chapter 4 deals with the feeding ecology of hornbills, which deserves special mention. This chapter provides an overview of hornbill diets and what it means to be strictly or mostly frugivorous. Essential information on fruit nutrition and which fruit types are most important for hornbills is presented. This is followed by a more interesting summary on diet overlap and resource partitioning. Fruit abundance and availability is discussed, especially in relation to bird abundances. The chapter concludes with a discussion of figs and revisits the controversial ideas of keystone species.

Chapters 5 and 6 cover the reproductive ecology and social system of hornbills. For some, the reproductive behavior and ecology is what is most fascinating about these birds. The fact that only albatrosses and large penguins invest more time in courtship, incubation, and chick rearing than hornbills is truly extraordinary. An investment of up to seven months per year for some species, combined with the unusual incarceration of females in nest cavities for much of the nesting cycle, make hornbill reproductive strategies among the most interesting in avian biology. Chapter 5 is a basic overview of hornbill breeding and courtship, ranging from timing of the breeding season to nest-site selection and finishing with female emergence and chick fledging. Chapter 6 revisits the ideas of social grouping and monogamy in hornbills. To start, the authors present four hypotheses (predation, microclimate, inter- and intraspecific competition, and mate fidelity) for the evolution of nest sealing. They build a convincing case that mate fidelity is the driving force for this rare behavior. A discussion of territoriality and cooperative breeding in hornbills finishes the chapter.

Chapter 7, my favorite chapter, highlights the importance of hornbills as seed dispersers. This aspect of hornbill ecology is likely to be the one most discussed in current ecological literature. With the increased awareness of the importance of ecosystem services provided by such guilds as frugivores, this is not surprising. Hornbills not only swallow fruits whole without damaging the seeds, they also in some cases promote seed germination by their gentle gut processing. Further, the larger and more frugivorous species typically have very large home ranges, leading to seeds distributed long distances from parent trees. This of course is the reason for the authors' very appropriate subtitle "Farmers of the Forest." This chapter also includes a very interesting discussion on ecologically functional populations (EFP). The ability to model the magnitude of ecosystem services (i.e., seed dispersal) and the potential impact of hornbill decline or disappearance on forest structure and composition is intriguing and very relevant to the subject of the book. The authors use their own data on two species spanning multiple years to estimate the EFPs.

The last two chapters (8 and 9) go into depth on conservation aspects of hornbill persistence and what the future may hold for these important birds. I was happy to see the authors keep the conservation focus throughout the book. Continued reminders are evident along the way that maintain the connection between the ecology and conservation of these birds. Rather than summarizing everything up in a final "conservation" chapter, the authors devote these two comprehensive chapters

to the subject. Chapter 8 provides an overview on the threats to hornbills, including the sources and drivers of habitat loss and hunting, reminding us that as these processes become more and more widespread, dispersal services are bound to decline. The final section of this chapter contains a predictive model including two case studies from Indonesia on how patterns of forest degradation threaten hornbill persistence. The final chapter reviews specific activities or programs designed to promote conservation of hornbills and their habitat in Asia. Using their detailed knowledge of Asian hornbill ecology, the authors conclude with a list of future priorities in hornbill research, management, and policy.

Kinnaird and O'Brien's book is well written and organized in a style that combines much of their own research with that of other hornbill studies. The sidebars add a nice element to the book's organization, giving the reader more detailed information on various studies, methodologies, and analyses. Photos by Tim Laman help the reader to better appreciate the magnificence of these birds. Not only do the photos reveal how truly remarkable-looking hornbills are, but they also provide wonderful glimpses into their canopy world. The book seems to be written for a combined group of bird enthusiasts and biologists interested not only in hornbill biology, but also in the ecological services provided by hornbills, and their interesting breeding behavior. The dialogue on Asian conservation status is well informed and adds greatly to the value of the book. Although many readers may find much of the information here a review on hornbill ecology, the authors do include some interesting and new research on ecosystem services provided by hornbills. For readers looking to get more specific information on individual hornbill species or more on African hornbills, read *The Hornbills* by Kemp (1995). Another hornbill book (*The Asian Hornbills: Ecology and Conservation*), edited by Poonswad and summarizing the 1996 proceedings from the Second International Asian Hornbill Workshop, includes a collection of research papers dealing with studies on hornbill population dynamics, conservation, breeding biology, behavior, and ecology (Poonswad 1998). The current book is a much more synthesized overview of hornbill research with a focus on conservation and seed dispersal, which easily sets it apart from the Poonswad book.

Though it would have been nice to see a more comprehensive book on hornbill ecology and conservation (including the African species), I certainly understand the need to bring specific and immediate attention to the Asian groups. Habitat conservation is of special concern in Asia, where the authors point out that nearly 30% of species are listed in the high-risk categories of vulnerable, endangered, or critically endangered and another 35% are listed as near threatened. Furthermore, the importance of this assemblage in the hornbill family is underscored by the fact that several species are endemic to either a single or a small group of islands.—KIMBERLY M. HOLBROOK, Integrative Ecology Group, Estación Biológica de Doñana—CSIC, Av. de María Luisa s/n Pabellón del Perú, 41013 Sevilla, SPAIN. E-mail: [kholbrook@ebd.csic.es](mailto:kholbrook@ebd.csic.es)

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