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The Red-cockaded Woodpecker: Surviving in a Fire-Maintained Ecosystem.—Richard N. Conner, D. Craig Rudolph, and Jeffrey R. Walters. 2001. University of Texas Press, Austin, Texas. xix + 363 pp., 72 text figures, 8 text tables. ISBN 0-292-71234-0. $60.00 (cloth).

This is a comprehensive treatise on an endangered species that covers both the species' biology and its conservation and recovery. Organized in textbook fashion, the volume includes a review of the most important aspects of Red-cockaded Woodpecker (*Picoides borealis*) ecology and conservation. The 12 chapters cover this species' taxonomy, morphology, distribution, cooperative breeding system, foraging ecology, habitat requirements, habitat management, reasons for endangered species status, and prospects for the future. Overall I found the book to be well organized, clearly worded, and written in a style that is both readable and informative. The tables and figures are simple, pertinent, and easy to comprehend. Although there are three authors, the writing styles are seamlessly interwoven so as not to detract from the readability of the book. All three authors are highly regarded in the field of Red-cockaded Woodpecker biology and management, and their collective insights add immeasurably to the book.

The Red-cockaded Woodpecker is particularly fascinating because it is a cooperative breeder that places its nest cavities in live trees, in an ecosystem that burns several times per decade. Social behavior and population biology are well described so that the reader gains an appreciation of how cooperative breeding, a vital, overarching aspect of the species' ecology, impacts its distribution and long-term probability of persistence. The authors emphasize the importance of fire in maintaining the ecosystems on which the bird depends, and devote an entire chapter to this important concept. The subject of cavity trees occupies a separate chapter, which is understandable given that the availability of cavities is a crucial habitat requirement. The main management themes of the book include protecting cavities, ensuring the availability of trees suitable for cavity construction, controlling hardwood encroachment, preferably by prescribing fire; translocating birds in cases of the loss of a breeder and to create new groups, and managing timber.

Conservation efforts on behalf of this species have been equally fascinating, and they have entailed innovations that are well described in this book. One such innovation was the invention of artificial cavity construction (cavity inserts and drilled cavities that can be installed quickly and are readily accepted by the bird). Another was the novel approach of developing safe-harbor agreements with private landowners. Credit is given to the many hard-working, conscientious, and talented professionals that are endeavoring to protect this species and provide for its long-term viability. This book beautifully illustrates how research findings dealing with the ecology of a species can be instrumental in crafting and guiding management strategies for conservation efforts.

The book begins by describing the longleaf pine ecosystem with which the Red-cockaded Woodpecker is closely affiliated, and documenting the drastic decline of this habitat from its historical extent. This substantial reduction in preferred pine habitat resulted in a concomitant decline both in the numbers and distribution of the Red-cockaded Woodpecker, culminating in its designation as a federal endangered species in 1968.

After describing in general terms the habitat of the species, the book continues with a concise description of the species' taxonomy, evolution, and morphology. A well-organized discussion of the current and past distribution and population levels makes clear what problems the species has faced, such as the availability

of large, live pine trees in which the bird can construct its nest cavity. Red-cockaded Woodpeckers use cavities year round for roosting and during the breeding season for nesting. As the birds do not share roost cavities, it is essential that there are sufficient cavities to accommodate each member of the group. A lack of suitably large trees can render an area unsuitable and has had a dramatic negative impact on reproduction, population size, and distribution.

The chapter on foraging behavior describes foraging preferences and intersexual differences that are manifested by males foraging higher on the tree trunks and more on the branches than females. Foraging requirements of this species are adequately detailed, as well as the interactions of the birds with the southern pine beetle (*Dendroctonus frontalis*). Irruptions of this beetle can provide a useful food resource for Red-cockaded Woodpeckers, especially during the breeding season when adults, larvae, and pupae are taken as food. The downside to southern pine beetle epidemics is that cavity trees can be lost from beetle activity, as happened on the Sam Houston National Forest in the mid-1980s, when more than 300 cavity trees were killed. The foraging information sets the stage for a subsequent chapter on the reasons for population decline, which include loss of nesting and foraging habitat.

In the chapter on the causes of population decline, the authors relate the declines evidenced in this species to specific features of its population dynamics and ecology. They pose an interesting question in asking why the Red-cockaded Woodpecker was so much more susceptible to changes in habitat conditions than were other species occupying the same habitats. The authors present a credible argument that much of the remaining forest lacked essential resources, thereby making it unacceptable habitat. The loss of suitable cavity trees was a particularly devastating change in the habitat conditions. This loss, along with encroachment by midstory vegetation, resulting in cavity abandonment and cavity usurpation, especially by Pileated Woodpeckers (*Dryocopus pileatus*), led to the reduction in numbers and distribution of Red-cockaded Woodpeckers. The authors do a commendable job of explaining how the absence of natural fire contributes to the woodpecker's decline. For example, they note that without sufficient frequency of fire, fires that do occur may burn more severely because of the increased fuel load, potentially damaging cavity trees. Recent cavities that were constructed lower in the trees than historical cavities, primarily because they were built in younger trees, are more susceptible to fire damage. Further, the authors state that despite growing evidence that good foraging habitat can improve survivorship and reproductive success, the loss of such habitat appears to be less associated with population declines than the encroachment of midstory vegetation and the increasing isolation of woodpecker populations. These chapters tie in beautifully with the chapter on the legal status and management of the bird.

The authors craft available scientific information into a cohesive recovery approach that they refer to as the "new management strategy," which consists of both a short-term and long-term approach. The short-term approach is predicated on the idea that establishment and maintenance of a territory is dependent on the availability of trees for high-quality cavities. This is one of the few areas of the book where I fear the authors have gone a bit astray, not in their belief that cavities are absolutely essential to the bird, but in placing so much emphasis on this one aspect of the species' management. The authors focus so strongly on creation and protection of cavity trees that readers could come away believing that cavity maintenance is the solution to the Red-cockaded Woodpecker's problems. For example, the possibility of improving productivity and survivorship by maintaining foraging habitat seems to be overshadowed by the cavity issue. A more careful reading reveals that the authors are indeed concerned with providing for high-quality foraging as part of a long-term management strategy, rather than relying solely on short-term, emergency measures to provide and protect cavities. Even so, I would have liked to see more discussion of the importance of foraging habitat. The evidence provided in the book supports the authors' long-term approach for conserving the species after it has recovered, by maintaining healthy pine ecosystems using a two-pronged strategy. This approach incorporates growing-season burns and appropriate timber management to maintain forests with a range of tree ages, including well-distributed old trees.

Because of its status as an endangered species, the Red-cockaded Woodpecker has a certain degree of protection. To comply with the regulations that implement the Endangered Species Act of 1973, as amended, federal agencies and other interested landowners have developed various guidelines and management plans, with the stated objective of helping to ensure the long-term viability of the species. The authors had a daunting task explaining the legal subtleties of landowners' (public and private) efforts to comply with the ESA and the challenge facing the USFWS in developing a recovery plan. The section dealing with the history of management is replete with stories of court battles and legal maneuvering by various parties to either enhance or avoid the actions deemed necessary to protect this species. The evolution of the legal battles that were entwined with various management scenarios could have been confusing, but were handled in a well-designed, straightforward approach, which emphasized that the road to recovering this species has not been easy or without its pitfalls. Rarely has the public been exposed to such behind-the-scenes legal battles on a conservation issue. The authors are to be commended for carefully and, in my opinion, objectively laying out what has been done on private lands and by each of the public landowners, such as the Forest Service and military. The chapter on extinction, legal status, and history of management, along with the last chapter that addresses the uncertain future of the species, are the highlights of this book.

One of the few shortcomings of the book is the minimal discussion of population viability analysis and metapopulation theory as it applies to the long-term recoverability of the Red-cockaded Woodpecker. Regardless of this limitation, the book is written in a style designed for a wide audience, emphasizing the general public. Thanks to the clarity and thoroughness of the

various chapters, any interested person, even someone with no previous knowledge of the Red-cockaded Woodpecker, can comfortably read all components of the book. This account will improve the general public's appreciation of the magnitude of risks facing this endangered species, and the complexities engendered in efforts to conserve it. I believe this book would be a welcome addition to the library of anyone interested in the conservation and management of endangered species. As the authors so poignantly note in the last chapter, clearly this captivating species is facing an uncertain future.—KATHLEEN E. FRANZREB, Southern Appalachian Mountains Cooperative Ecosystems Studies Unit, USDA Southern Research Station, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, TN 37901-1071, e-mail: franzreb@utk.edu