A Tree is Just a Forest's Way of Making Another Forest

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the ecosystem- and landscape-focused approach of Eugene and Howard Odum. See the inside front-cover diagram in *Fundamentals of Ecology* (Odum and Barrett 2005) depicting the need to integrate these two approaches.

In chapter 10, which deals with population and the balance of nature, I became concerned about the balance in the level-of-organization approach when I read that many questions of community ecology will be explored "in the next eleven chapters." I think that succession, the subject of chapter 11, requires an understanding of both community and ecosystem development. However, I was pleased that chapters 12 and 13, dealing with community interactions such as biodiversity and food webs, were followed with chapters focusing on disturbance ecology (chapter 14), ecosystem ecology (chapters 15 and 16), and landscape ecology (an excellent chapter 17). Thus, the author does provide balance between schools of thought and equal discussion among levels of organization.

The book closes with four chapters on applied ecology: "How to Fish Sustainably" (chapter 18), "Why We Cannot Eliminate Pests" (chapter 19), "Endangered Species and Ecosystems" (chapter 20), and "Human Health and Human Impacts" (chapter 21). Krebs explains the ecological science behind these long-term, global-scale problems and points out that solutions will require the public's involvement and understanding. He optimistically concludes that if society does decide to address the issues with an integrative approach, solutions can be found.

Earlier in my career, I adopted various editions of G. Tyler Miller's outstanding environmental science book *Sustaining the Earth* (Brooks Cole, 2003; 6th ed.) for my introductory courses on environmental biology and environmental issues. I consider *The Ecological World View* to be the next generation of such venerable textbooks because it is written in a nontechnical language, yet it covers the history of ecology and its scientific methodology accurately and lucidly. Thus, the science of ecology is made accessible to those who would be concerned and informed environmentalists, regardless of their field of study. Few textbooks can accomplish this objective.

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A TREE IS JUST A FOREST'S WAY OF MAKING ANOTHER FOREST

Forest Genetics. Timothy L. White, W. Thomas Adams, and David B. Neale. CABI Publishing, 2007. 704 pp., illus. $100.00 (ISBN 9780851993485 paper).

Ten thousand years before Mendel's laws and modern genetics, humans began domesticating crop plants, thereby sowing the seeds of civilization. Nine thousand nine hundred years later, scientists began to apply genetics to the domestication of long-lived forest trees. White, Adams, and Neale, professors at the University of Florida, Oregon State University, and the University of California at Davis, respectively, provide a complete, up-to-date, and instructive overview of forest genetics in this long-awaited book. *Forest Genetics* offers three sections on conservation genetics, tree improvement, and woody plant biotechnology following an introductory section on basic principles of genetics. Books have been devoted exclusively to *Pinus,* or *Populus,* or *Eucalyptus,* but no book other than this one has brought together so many instructive examples on these and all other models of research in forest genetics around the world.

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I doubt that I would be venturing too far out on a limb in predicting nearly universal adoption of this book as the required text for a first course in forest genetics for advanced undergraduate and graduate students. The book might also be used to teach any one of three separate courses (i.e., tree improvement, conservation genetics, and woody plant biotechnology), and in anticipation of this, the authors suggest specific sets of chapters for each course.

Forest Genetics is written and structured to be useful to both students and forestry professionals. Its authors opted for putting important terms in boldface and defining them in context upon first use, thus avoiding the usual glossary of definitions without context. The page locations of definitions can be found conveniently in the index, thus preserving the ease of using a glossary. Abundant figures, tables, and boxes provide clear illustrations and examples of key points, and these are also indexed for ease of use. Sixty-six pages of carefully chosen references represent a scholarly resource in itself that students will appreciate.

This book may be as valuable to forestry and plant science faculty, who are responsible for subjects other than forest genetics, as it would be to forest geneticists. For example, if you have ever wondered how best to explain to your ecology students the confounding of genetic and environmental influences in phenotypic measurements, this book has a box that beautifully simplifies this lesson (box 6.1). If you have ever wished to see the properties of heritabilities neatly summarized, they are here (box 6.4). A box devoted to the "gene diversity analysis of population structure in *Pinus radiata*" explains, with data and references to the primary literature, why all five populations of this California native need to be conserved. With one glance at figure 3.7, I learned that the Taxodiaceae and the Cupressaceae are the only plant families in which both mitochondrial and chloroplast DNA are paternally inherited, and that the Pinaceae are distinguished by the unique combination of maternally inherited

mitochondria and paternally inherited chloroplasts.

If you have a latent interest in paleobotany, you will greatly enjoy the very readable chapter on evolutionary genetics, although you may wish, as I did, that it were longer. The longest of the book's four sections covers the subject of tree improvement. In seven chapters and 237 pages, the authors summarize and explain the practical side of forest genetics from its beginnings in the 1950s. "Today, tree improvement is so widespread in the world that a listing of programs would take many pages and would include all countries with substantial plantation programs and all tree species that are planted in any quantity." Like me, you may have listened to forest geneticists discussing breeding cycles and genetic gain without the understanding that you can easily acquire by reading *Forest Genetics*' summaries of the first-cycle, tree-improvement programs for *Gmelina arborea* in Costa Rica and for *Pinus taeda* in the southeastern United States. Photographs of a realized gain experiment with *Pinus radiata* in New Zealand show you what improvement looks like, but the authors also provide numerical examples of genetic gain calculations that deepen your understanding.

In a chapter on base populations, we learn why a company in South Africa would deploy a mix of *Eucalyptus* species and hybrids, or *Pinus patula* for its plantations of more than 400,000 hectares, whereas companies in Malaysia would choose to rapidly expand their investments in *Acacia*. In a chapter on genetic testing, we learn about mating designs, field designs, and test implementation. Data analysis in forest genetics is thoroughly treated, first in the section on basic principles with a chapter on quantitative genetics, and subsequently with a chapter on mixed models, variance components, and breeding values. In the latter, a case study of *Eucalyptus grandis* in Argentina is wonderfully instructive, showing students everything from editing and cleaning their data to interpretation of analyses. The final two chapters of the section on tree improvement cover first deployment of open-pollinated varieties, full-sib families and clones, and then advanced-generation breeding strategies.

The last section of *Forest Genetics* comprises 70 pages on structural, functional, and comparative genomics, marker-assisted selection and breeding, and genetic engineering. I was somewhat surprised not to see an estimate for the number of genes in *Populus trichocarpa* in a table summarizing such numbers for organisms on the basis of complete genome sequencing, but this is a minor detail. The final chapter on genetic engineering includes a single paragraph on genetically engineered disease resistance, which could also be criticized in part because "increased tolerance" to *Pyrenopeziza betulicola* was not what was actually reported by the Finnish authors of the cited study. The regulatory issues that are addressed at the end of the chapter in the last few pages of the book appear to be formidable. Except for China, where genetically engineered poplars are grown commercially, we learn that "there are almost no operational plantations of GE forest trees."

Forest Genetics lacks a final chapter of synthesis and prognostication. I would have liked such a chapter, and it is quite possible that students contemplating careers in forest genetics would have, as well. The outstanding performance of some exotic tree species in many parts of the world suggests that forest geneticists may be prompted by plantation foresters to pay more attention to the causes of genetic X environmental interactions in the future. But that is another book, and it would be wrong for me to conclude a review of this book on a negative note. This is an excellent book that should receive widespread adoption and use in the coming years.

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