

genera. By adjusting for differences of soil and precipitation, Gentry finds that African communities are as speciose as their South American cousins. Some of the reported floristic differences between the two continents may be illusory: he notes that many neotropical genera "masquerade" under different names in Africa.

Several authors emphasize the role of enhanced speciation in South America as opposed to extinction in Africa as a principal cause of species-richness differences. Terming the Pleistocene refugial theory intellectually barren, Paul Colinvaux offers a disturbance-vicariance hypothesis to explain elevated Amazonian species richness. Pleistocene cooling rather than desiccation resulted in creative intermingling of previously separated South American forest elements. Diversification was facilitated by large species ranges coupled with the isolating influence of lowland Amazonia's large and dynamic river system. According to Colinvaux, relatively limited lowland habitats of Africa would have favored extinction rather than speciation. Similarly, work on ant-plant relations by Doyle McKey and Diane W. Davidson suggests that relatively diverse physiography and climate in South America enhanced speciation. In addition to moisture differences between the two continents, Gentry invokes differences in reproductive ecology as potential speciation factors. Some African seed dispersers, such as elephants, contributed to long-distance dispersal and gene flow and limit the possibility of reproductive isolation. In South America, pollination systems exhibit a greater degree of host specificity and hence species radiation than they do in Africa.

The only shortcoming of this otherwise well balanced and timely collection is the complete omission of humans as biogeographical factors. Much of the biotic similarity exhibited between Africa and South America can be attributed to 500 years of human-mediated plant and animal dispersal and colonization. For the contributors to this volume, humans complicate rather than clarify the biogeographical picture. That there is no room for the role of people in "Biological Relationships between Africa and South America" underscores the fundamental difference between how biologists and geographers view the scope of biogeography.—

ROBERT A. VOEKS

DIFFUSION AND USE OF GEOGRAPHIC INFORMATION TECHNOLOGIES. Edited by IAN MASSER and HARLAN J. ONSRUD. xii and 352 pp.; diags., refs., index. Dordrecht: Kluwer Academic Publishers, 1993. \$136.00. ISBN 0-7923-2190-1.

"Diffusion and Use of Geographic Information Technologies" is a collection of essays derived from a NATO advanced research workshop that is published in cooperation with the NATO Scientific Affairs Division. The

book has five sections, four of which are subdivided into chapters; each subdivided section begins with an overview that provides a context or summary for the chapters. The introduction, by editors Ian Masser and Harlan J. Onsrud, is a broad-ranging survey of the subject. The sectional topics and the authors of the overviews are listed here, but in the brief space of a review it is impossible to repeat the titles and authors of the individual chapters. Section 1 covers research methodology and interdisciplinary perspectives, with the overview by Gerard Rushton. Section 2 deals with assessing and modeling the diffusion of innovations in geographic information, with the overview by Erik Stubkjaer. Section 3 assesses cultural and institutional issues, with the overview by Peter A. Burrough and Ken Jones. Section 4 examines the mechanisms for facilitating the diffusion of GIS technology, with Rushton again contributing the overview. Section 5, prepared by the editors, deals with the future research agenda and is not subdivided into chapters.

The use of sectional groupings for the chapters effectively focuses readers' attention on the broad issues. With technical material, it is crucial to encourage readers to take various perspectives, lest one see only the trees and not the forest. The device chosen by the editors to broaden the focus works well for this content and offers even the casual reader a significant outline of the materials detailed in the chapters.

Content is international in scope: among the countries covered are Australia, Canada, Denmark, Germany, Greece, Italy, the Netherlands, Norway, Portugal, the United Kingdom, and the United States. The background of the contributors is interdisciplinary: geography, planning, environmental studies, human sciences, engineering, and communication and behavioral sciences. This diversity serves well to support the premise of the collection: "Research necessary to advance the utility of geographic information systems must extend far beyond concerns with technical issues. The search for formalisms and generalizable principles relative to the behavior and needs of individuals, organizations and institutions is just as important in enabling optimal use of geographic information innovations." Indeed, for international and interdisciplinary interaction to be successful, the focus must be on broad issues.

The individual contributions appear to be carefully crafted and adhere to the premise of the collection. One lesson of crucial importance comes through quite clearly: the manner in which technological tools are developed can cause unforeseen difficulties that hinder progress. For example, in the chapter on universal and national traditions of land information, Michael Wegener and Hartwig Junius highlight this problem with the example of similar but different base maps in the American and German systems. Observations such as this underscore the utility of international workshops in which resolution of scale and edge-matching problems may be discussed.

The essays in this collection are informative and accessible to a wide range of readers. The editors have integrated the diverse viewpoints and styles into a cohesive whole. One might wish for greater use of GIS in the book or for a perspective on GIS from the computer-science and mathematics communities, the medical community, or the library community. Overall, the collection admirably meets its stated premise. To include more might have resulted in a corresponding price increase, which would make the book even less accessible to individuals than it is likely to be at a list price of \$136. The book is important reading for students who are immersed in the technical aspects of GIS.—SANDRA LACH ARLINGHAUS

REACTIVE DATA STRUCTURES FOR GEOGRAPHIC INFORMATION SYSTEMS. By PETER J. M. VAN OOSTEROM. xxii and 204 pp.; maps, diags., bibliog., index. New York: Oxford University Press, 1993. \$37.50. ISBN 0-19-823320-5.

As is often the case when mathematical concepts are cast in real-world settings, the first efforts are static; later efforts try to capture the dynamic character of underlying processes by introducing change through time. "Reactive Data Structures for Geographic Information Systems" by Peter van Oosterom is an imaginative, provocative effort to capture the dynamics of mathematics and computer science that underlie the technology of geographic information systems (GIS).

A reactive data structure permits the efficient storage and retrieval of geometric objects at more than one geographic scale or level of detail; the conceptual basis for the data structure is a "reactive tree." Chapter 1 is a clear, amply illustrated introduction to GIS that considers crucial mathematical concerns at the outset, as it should, such as advantages and disadvantages of various metrics. Because the idea of a tree is central to the thesis of this book, Chapter 2 is an overview of known data structures, with specific emphasis on the quadtree that results from the recursive partition of two-dimensional space into four parts. Chapter 3 discusses a new geometric data structure and offers visual applications of how it is used in thematic mapping. Oosterom is adept at interweaving the known and the new. Chapter 4 continues this theme by offering two additional structures for storing large sets of geometric data. These two trees were tested with large data sets from the World Bank.

The maps produced using the "sphere-tree" and the "r-tree" are intriguing and are vaguely reminiscent of richly ornate Western European paintings of various periods: as with the art, Oosterom's approach is bold, innovative, and likely enduring. Readers prone to think that mathematics is merely a tool or a set of formulas are well advised to peruse this work, in which the science of computing exposes quite clearly the elegance of mathematics as art.