

## BOOK REVIEW

*Geographical Information Systems: Principles and Applications.* D.J. Maguire, M.F. Goodchild, and D.W. Rhind (eds). Essex, England: Longman Scientific & Technical, 1991. Vol. 1, Principles, 649 pp. Vol. 2, Applications, 447 pp. \$295 Hardcover. (ISBN 0-582-05661-6) (Copublished in the United States with John Wiley & Sons, Inc., New York, (ISBN 0-470-21789-8).

Reviewed by E. Lynn Usery,  
Department of Geography,  
University of Wisconsin,  
Madison

Geographic Information Systems (GIS) have developed to a stage where production of a large reference compendium is not only feasible, as the editors state in their preface to this work, but necessary. This two-volume set is a milestone in the continuing development of GIS in three respects: first, it presents a comprehensive view of GIS as an emerging technology; second, it provides a reference work for researchers and practicing GIS professionals; and third, it attempts to develop the basis of GIS as a discipline. The stated aim of the book is to assemble a team of international experts to write a major reference work on GIS. Although there is a significant North American and European (particularly the United Kingdom) bias, the editors have accomplished this aim. With only a few flaws in the presentation, the work is a monumental achievement and will probably serve as the major GIS reference for some years to come.

The book is well organized into four sections: 1) an introductory overview with eight chapters examining the definitions, history, settings, and critique of GIS; 2) principles of GIS consisting of 26 chapters arranged into subsections concerning the nature of spatial

data, digital representation, functional, display, and operational issues; 3) applications of GIS with 22 chapters in four subsections concerning national and international programs, socio-economic, environmental, and management applications; and 4) an epilogue which briefly summarizes the main ideas and presents projections for the future. The editors tie the work together by providing an introductory article for each of the first three sections and by authoring the epilogue. The book contains a table of contents, preface, and list of contributors with affiliation and research interests repeated in each of the two volumes. While each article contains its own reference list, each volume contains a consolidated bibliography of some 60 pages, a six-page list of acronym definitions, an author index which includes page numbers where citations occur, and an extensive subject index. The repetition of the bibliography and indices allows each volume to be used independently but at the cost of the extra pages.

The book is a good, comprehensive work meeting the need in the GIS area for such a reference volume. It is similar in some respects to the *Manual of Photogrammetry* and the *Manual of Remote Sensing* published by the American Society for Photogrammetry and Remote Sensing, but unlike those manuals this book does not present a rigid, factual account of GIS. For example, one cannot use this book to learn how to program a quadtree data structure or how to use relational algebra to extract relevant geographical data attributes, as would be expected in a manual. The articles are more of a research approach, some with speculation and futurism. The book does provide an excellent overview of the general principles and applications of GIS, which is the intent. It

is aimed at advanced undergraduates, postgraduates, professionals, and research workers and succeeds at presenting the appropriate information to this target audience.

At the same time, GIS is an area where criticism has been scarce. This book is no different and the editors lament the fact that in the applications part of the work, no examples of GIS failures are included. The one chapter which does level criticism focuses on ideas of cartography's demise, the booster atmosphere surrounding GIS, and the declarations of success before implementation or experimentation. That GIS leads to improved spatial analysis is usually not questioned, but this aspect is the weakest of the system and true spatial analysis is incorporated in few if any GIS. Several chapters in this work echo this criticism as well as the limitations of GIS to handle three-dimensional and temporal data. Also, the chapter criticizes GIS researchers and practitioners who are quick to adopt new paradigms (currently object-orientation has captured the GIS collective imagination) and hail them as the solution to representation of geographic data before any implementation or experimentation has been performed.

The section on principles of GIS forms the core of this work and the editors' introduction identifies a small number of organizing principles which have emerged in GIS: raster versus vector, query versus product, and spatial analysis versus spatial information. The principles are organized by identifying key scientific questions of GIS which include the nature of spatial data, digital representation, functional, display, and operational issues.

The applications section is a good sampling of the possible types of GIS applications. Its limitation is that the breadth of the current and potential applications



cannot be effectively represented in a single volume.

In the epilogue the editors reflect on the ideas presented throughout the book and make some statements about the current status of GIS with a prognosis for the future. It examines the outstanding issues in the research agenda, projections to the year 2000, and how GIS fits in the bigger societal future. Briefly examining its history, the editors think GIS is converging upon a set of generic issues through the use of technology. These issues include data capture, data modeling, accuracy, data volume, spatial analysis, user interfaces, cost/benefit analysis, and impacts on organizations. An argument is made for geographic information science instead of the technology of GIS. While GIS was once seen only as access to maps, it is now viewed as access to the world represented by maps. Drawing a parallel to statistical packages, GIS is said to be at the stage of those packages in 1970. Statistics emerged as a discipline, will GIS do the same or will it follow the path of remote sensing and remain an interdisciplinary tool for all spatial scientists?

While GIS has many of the trappings of a discipline, including journals, trade press, conferences, textbooks, college classes and curricula, is there a fundamental set of problems for GIS to examine? Two views of GIS are put forward, one in which GIS follows the path of the quantitative revolution in geography in the 1960s. Today few geographers, particularly human geographers, are concerned with quantification. This view portrays GIS as the Edsel of electronic data processing. The second view projects continued convergence of ideas, disciplines, technologies, and a need for the various application areas to remain affiliated. The editors prefer the second view and

expound upon it in projections for GIS to the year 2000.

In summary, the book is a major step in developing a comprehensive view of GIS. While one may not agree with the statements in the introduction or the epilogue (and there is contradiction among the contributors), the editors are to be commended for the production of such a reference work. Flaws, such as inclusion of the subsection titles only in the table of contents and not in the subsections themselves, some cited references which do not appear in the reference list or in the consolidated bibliography, and a few isolated grammatical errors, are minor. One major problem is the color plates. Most are too small to be effective (with as many as eight per page), particularly in the applications section, and in some cases the graphics are completely illegible. This problem notwithstanding, the book is an excellent presentation of the framework of GIS principles and provides a reasonable survey of the major GIS application areas with a few detailed examples. The editors elicit major themes in their introductions and tie the 56 chapters together well. This work is likely to become required reference material for GIS students and practitioners; it certainly belongs on the bookshelf of every GIS researcher.

### *cartographic perspectives on the news*

Landsat commercialization will reach a major milestone on September 30, 1992, when taxpayer-subsidized operation of the program ends. Landsat is the United States Civil remote sensing satellite system operated by the Earth Observation Satellite Company (EOSAT). EOSAT announced it would assume opera-

tion costs for Landsat on October 1, saving the taxpayer \$19 million in Fiscal Year 1993. Landsat 6 will be completed and delivered to the government in October and NOAA has scheduled its launch for January 23, 1993.

The first Landsat was launched in 1972; since that time, an archive of over 2.7 million images have been created. These images are extremely valuable and useful for mapping, research, and monitoring the Earth's natural resources. The Landsat Thematic Mapper (TM) sensor collects data from a broad region of the electromagnetic spectrum that includes visible bands, near-infrared, shortwave-infrared, and thermal wavelengths. With Landsat's TM 30 x 30 meter resolution and large area coverage (100 x 100 miles), the sensor provides detailed information at relatively low cost per unit area, compared to aerial photography or other commercial satellite data. In addition, Landsat has repeat coverage every 16 days.

TM data is well suited for many environmental applications and is used to inventory and monitor world resources, wildlife habitats, marine environments and minerals. Carla Adams, at EOSAT, has compiled a brief description of case studies of environmental monitoring using Thematic Mapper data. Examples include the use of Landsat TM data to input information into a geographic information system by the Suwannee River Water Management District to help the regulatory and planning staff assess where land cover is changing and to locate areas where land use could harm surface water. Shoreline changes in the Aral Sea are being analyzed by comparing the 1977 MMS mosaic and 1987 mosaic. The United States National CoastWatch Program intends to use TM data to develop a comprehensive nationally standardized GIS to assess changes