

presentations is the last: Evidence of Our Tenure. Garrett Hardin would have been impressed—nowhere is the Tragedy of the Commons more evident than here. Of particular personal interest is the section by Karen Seto on the Urbanization of China's Pearl River Delta. The astonishing transformation in little more than a decade of this fertile area into the world's factory floor is shown in a pair of *Landsat-5* images that defy description. Just out of view (to the south) is the Hong Kong airport, the world's largest landfill project until the advent of The Palm and adjacent structures in Dubai (also shown in this book). Having watched the explosive growth of Dongguan since 2000, I can attest to

the mixed effects of rapid urbanization. Equally dramatic *Landsat-7* images document the tragic loss of the Iraqi marshes, the destruction of the Aral Sea, and the desiccation of Lake Chad. No one can look at these matchless images and remain unmoved.

In his epilogue, astronaut Sellers says this book is equivalent to a medical report on the health of the Earth: "...like a doctor gently warning his patient about early signs of problems due to overindulgence, the satellite data tell us clearly where we should be careful... Something must be done, and a good first step is to raise public awareness of the problem." To which I can only heartily agree. Much of what I have learned

in this remarkable book will find its way into my lectures and texts, and I can only thank the editors for the skill and balance demonstrated in their selection of contributors and topics. A clear appendix by Michael King on satellites and remote sensing wraps up this unique work.

Here is a call to action in the clearest sense. In a perfect world, every science educator would receive a copy of this book and pass its fundamental message along to his and her students. We have much to do!

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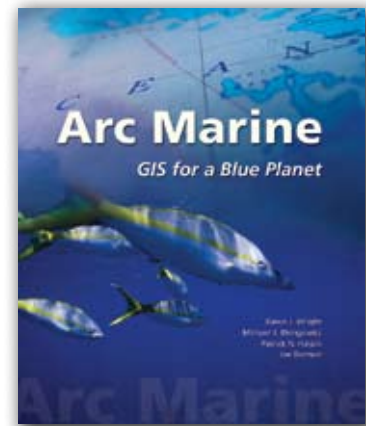
Arc Marine: GIS For a Blue Planet

By Dawn J. Wright, Michael J. Blongewicz, Patrick N. Halpin, and Joe Breman, ESRI Press, 2007, 216 pages, ISBN 978-1-58948-017-9, Softcover, \$47.95 US

REVIEWED BY PETER WADHAMS

This interesting and useful manual is meant to provide the background and context for a set of software that assists marine scientists to carry out GIS (Geographical Information System) analysis of multiple marine data sets. For most of its history, marine science suffered from the problem of data sparseness. When the shipborne oceanographic station (taking 12 hours or more for a shallow and deep cast using Nansen bottles) was the main means of gaining

knowledge about the nature of the ocean, knowledge grew very slowly. It was thought valid to create oceanographic atlases, to which every expedition would contribute new data, in the belief that data from different years and seasons could be combined to gradually build up a three-dimensional map of an unchanging ocean. Now we know better, but our recognition of the rapidly changing nature of the ocean has come about only because of the advent of a host of new oceanographic measurement techniques that generate data at unprecedented rates, both in space and time. Given that a typical oceanographic survey may involve the use of a large number of such techniques to map several different ocean parameters simultaneously, we are reaching the point of data overload, where instead of being



data sparse, the ocean becomes too data rich for us to fully understand the picture built up by the measurement systems and especially the relationships among different ocean parameters.

In terrestrial surveying, the GIS field grew up in order to map a variety of parameters layered on top of one another in a systematic spatio-temporal way that brings out correlations and enables us to make full use of the massive data-

generating facilities at our disposal. Now scientists are extending the GIS concept to the ocean, and ESRI has come up with a set of valuable software for carrying out these analyses for data from the seas. The book seeks to explain the concepts and show examples of how ocean GIS is done in practice, always aiming the reader back at the software.

The data model provides a structure for storing and analyzing marine data, but also helps the user to create three-dimensional scenes of the marine environment with many parameters represented. Chapters in the book deal with marine surveys and how the results are recorded; marine animal data applications (with humpback whales, loggerhead turtles, and harbor seals as examples) in which occurrence and migrations are related to environmental parameters; the implementation of the temporal dimension into spatial statistics; near-shore and coastal analyses where a host of correlations with seabed and coastal features adds to the complexity of marine system analysis; the formal development of model meshes; and the extension to multidimensional GIS. The book will be useful throughout the marine community—in governmental, industrial, military, and academic sectors—including providing a great aid to marine management. Potential users are bound to find analogies to their requirements in the wide range of cases considered in the book. Web sites where the GIS model is available for download are <http://dusk.geo.orst.edu/d/arcgis> and <http://support.esri.com/datamodels> (marine link).

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