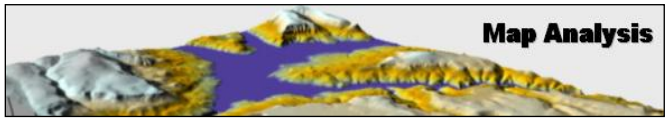
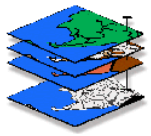
Beyond Mapping IV — GIS Modeling

Compilation of Beyond Mapping columns appearing in
GIS World magazine February 2007 to December 2013



written by Joseph K. Berry

posted by BASIS Press



Chronological and additional listings
with links to all Beyond Mapping columns

About the Online Compilation Series

About the Companion "Hands-On" Exercises

…more information posted at www.innovativegis.com/basis

Table of Contents

(click links below to access topics)

(Click for a printer-friendly .pdf version of this document)
(Click for Table of Contents for all four books in the series)

GIS Modeling: *Applying Map Analysis Tools and Techniques*

Description and Annotated Table of Contents

GIS Modeling: *Applying Map Analysis Tools and Techniques* *is a collection of selected works from Joe Berry's popular "Beyond Mapping" columns published in GeoWorld magazine from 2007-2013. This compilation extends earlier discussions of map analysis concepts, procedures, approaches, applications and issues affecting contemporary relevance and future potential.*

Geotechnology (the spatial triad of remote sensing (RS), GIS and GPS) has "taken to the net" and become routine in most workplaces and general users' computers, tablets and mobile devices. As a ubiquitous "technological tool," it has become an indispensible part of daily life and interwoven into the fabric of modern society.

Geotechnology's expression as an "analytical tool" is poised for a similar run and promises to forever change how people perceive geographic space and its intersection with numeric space to understand spatial relationships without the simplifying assumptions previously found in science and practice before the digital map. This transformative book is sure to alter experienced and novice readers' perceptions and paradigms of "what a map is (and isn't)" and how mapped data can be analyzed for startling new revelations of the world around us.

Topic 4 **Extending Spatial Statistics Procedures —** *Spatial Statistics relaxes the assumption that a "typical value" (e.g., average) is evenly distributed over a project area to characterize the continuous spatial distribution of field data, using such information to assess relationships within and among various map layers. This topic establishes the underlying concepts and procedures for developing spatial distributions, and then extends traditional nonspatial techniques into the spatial realm, such as generating maps of localized variations in Correlation and T-test.*

Topic 5 **Structuring GIS Modeling Approaches —** Grid-based *GIS Modeling*, in many respects, is an extended form of traditional mathematical modeling that manipulates matrices representing the spatial distribution of map variables. This topic examines the "map-ematical structure" for processing map layers, data-handling approaches, concerns surrounding precision and accuracy, and the similarities and differences among different types of GIS models.

Topic 6 **Education Outside the Traditional Lines —** GIS education has evolved significantly during four decades, with an early focus on training GIS specialists needed for transforming paper map information, procedures and mindsets into digital forms. More recently, education has broadened its focus to innovative solutions involving domain experts from a multitude of disciplines and incorporating rapidly evolving technological advances. This topic discusses the different perspectives of "the trailing 'S' in GIS" (Systems, Specialist, Science and Solutions), its impacts on GIS education and the probable increased emphasis on nontraditional GIS students in developing "spatial-reasoning" skills across campus.

Topic 7 **Spatial Data Mining in Geo-business —** Maps historically had minimal application in business operations, planning and decision making. However, with the advent of digital mapped data analysis/modeling, a more thorough understanding of spatial patterns and relationships are proving critical in successful marketing, financial, logistical and managerial actions. This topic links numerical and spatial distributions to uncover "unusual response" areas, identifies areas having relative similarity and clustering tendencies, and describes a Universal Database Key that promises to revolutionize database technology.

Topic 8 **GIS Modeling in Natural Resources —** Maps and mapping have long been a cornerstone of natural-resources management. However, map analysis/modeling capabilities have extended the traditional "where is what" spatial inventories to "why, so what and what if" understandings of spatial interactions among critical factors that are radically changing natural-resources research, policy formation, decision making and operations. This topic examines the use of *Effective Distance* in generating more realistic assessments of forest access for timber harvesting and emergency response, and then extends the discussion to how spatial technology promises to change the very fabric of the natural-resources paradigm.

Topic 9 **Math/Stat Framework for Map Analysis —** Map Analysis and GIS Modeling are poised to radically change science, technology, engineering and math (STEM) curricula at the K-12 and college levels by infusing spatial reasoning and analysis into traditional classroom settings. This topic establishes a generalized math/stat framework that directly extends current quantitative data-analysis procedures into the spatial realm by considering maps as "spatially organized data layers" (as opposed to graphical images) that have all the rights, privileges, responsibilities and analytical potential of traditional nonspatial data.

Topic 10 **Future Directions and Trends —** Geotechnology's only consistent element is its ability to change. In just four decades, it has evolved from automated cartography to spatial database technology to analytic engine operating with mapped data and software in the cyber-cloud. This topic suggests a probable future that dramatically alters perspectives of "what a map is and isn't" by expanding the flat 2-D (x,y) view of geographic space to a 3-D (x,y,z) and 4-D (x,y,z,time) view by fundamentally changing the 300-plus-year-old Cartesian referencing system.

Epilog **The Continuing Promise of GIS Modeling —** Geotechnology has great potential for good (and bad). This topic discusses the good, the bad and the ugly sides of geotechnology, with particular attention to enduring impacts on how people perceive, process, promote and practice

innovative ways to understand the spatial patterns and relationships that impact all systems (physical, climatic, biological, economic, political, social and cultural).