

Map Analysis and Modeling in Forestry's Future:

...where we are headed and how we can get there

Esri Forestry GIS Conference

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Most of the GIS's recent growth has been in its capabilities as a "technical tool" for corralling vast amounts of spatial data and providing near instantaneous access to remote sensing images, GPS navigation, interactive maps, asset management records, geo-queries and awesome displays. In just forty years, GIS has morphed from boxes of cards passed through a window to a megabuck mainframe computer, to today's sizzle of a 3D fly-through of terrain anywhere in the world with back-dropped imagery and semi-transparent map layers draped on top— all pushed from the cloud to a GPS enabled tablet or smart phone. What a ride! However, GIS as an "analytical tool" hasn't experienced the same meteoric rise— in fact it might be argued that the analytic side of GIS has somewhat stalled over the last decade. But the future of GIS in forestry is moving from a "down the hall and to the right" specialist's role providing mapped data, to a broader and more active role providing spatial information through analysis and modeling that directly interacts with research, policy formation, planning and management decisions. The shifting emphasis from data-centric tools for mensuration (*Where is What*) to application-specific constructs of prescriptive mapping (*Why, So What and What If*) infuses consideration of geographic patterns and relationships within problem-solving contexts. The paradigm shift replaces spatially-aggregated tools and models that assume uniform or random distribution of typical conditions in



geographic space, with spatial reasoning and analytical procedures that capitalize on the variation within and among map variables. The result is a "map-ematical" structure that enables resource professionals from various disciplines to better understand and communicate complex spatial interplay of edaphic, topographic, biological, ecological, environmental, economic and social considerations. This paper describes a comprehensive framework for grid-based map analysis and modeling concepts and procedures as direct spatial extensions of traditional mathematics and statistics enabling individuals with minimal or no GIS background to develop spatial reasoning skills— "thinking with maps."

(Presentation materials and further references are posted at www.innovativegis.com/basis/Papers/Other/Esri_Forestry2012)



Joseph K. Berry is a leading consultant and educator in the application of Geographic Information Systems (GIS) technology. He is the principal of Berry and Associates // Spatial Information Systems (BASIS), consultants and software developers in GIS technology and the author of the "Beyond Mapping" column for GeoWorld magazine since 1989. He has written over two hundred papers on the theory and application of map analysis techniques, and is the author of several popular books. Dr. Berry serves as the Keck Scholar in Geosciences with the University of Denver, Geography Department and is an affiliate faculty member with Colorado State University, Warner College of Natural Resources.

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Further Reading in Map Analysis and Modeling

See Topic 29, "**Spatial Modeling in Natural Resources**" and Topic 24, "**Overview of Spatial Analysis and Statistics**"
...posted in the *Beyond Mapping III* online book that contains Introduction, 29 Chapters and Epilog as a compilation of the popular *Beyond Mapping* columns published in GeoWorld magazine by the presenter from 1989 through the present.

For a compilation of "Beyond Mapping" columns (listed by topics and chronically) see

www.innovativegis.com/basis/MapAnalysis/

Additional Information *(by slide #)*

Slide 1, Title – The presentation PowerPoint with notes and “live links” is posted online at—

www.innovativegis.com/basis/Papers/Other/Esri_Forestry2012/

The following links are to the online book *Beyond Mapping III* posted at **www.innovativegis.com**

- Slide 2, Making a Case for Map-ematics (Analytical Tool) – Topic 27, [A Multifaceted GIS Community](#); Topic 4, [GIS Education’s Need for “Hitchhikers”](#); Topic 24, [Overview of Spatial Analysis and Statistics](#)
- Slides 3 and 4, The “-ists” and the “-ologists” and (A Bigger Tent) – Epilog, [Melding the Minds of the “-ists” and “-ologists”](#), [The Softer Side of GIS](#); Topic 4, [Fitting Square Pegs in Round GIS Education Holes](#)
- Slide 5, Spatial Analysis Operations (Geographic Context) – Topic 24, [Simultaneously Trivializing and Complicating GIS](#); Introduction, [SpatialSTEM Has Deep Mathematical Roots](#); Topic 18, [Understanding Grid-based Data](#); Topic 23, [Suitability Modeling](#)
- Slide 6, (Math Examples) – Introduction, [Map-ematically Messing with Mapped Data](#); Topic 11, [Characterizing Micro-terrain Features](#); Topic 22, [Reclassifying and Overlaying Maps](#)
- Slide 7, (Distance Examples) – Topic 25, [Calculating Effective Distance and Connectivity](#); Topic 25, [E911 for the Backcountry](#); Topic 19, [Routing and Optimal Paths](#); Topic 14, [Deriving and Using Travel-Time Maps](#); Topic 15, [Deriving and Using Visual Exposure Maps](#); Topic 13, [Creating Variable-Width Buffers](#); Topic 17, [Applying Surface Analysis](#)
- Slide 8, Spatial Statistics Operations (Numeric Context) – Topic 24, [Infusing Spatial Character into Statistics](#); Introduction, [Paint by Numbers Outside the Traditional Statistics Box](#)
- Slide 9, (Linking Data Space with Geographic Space) – Topic 2, [Spatial Interpolation Procedures and Assessment](#); Topic 7, [Linking Data Space and Geographic Space](#);
- Slide 10, (Data Mining Examples) – Topic 16, [Characterizing Patterns and Relationships](#); Topic 10, [Analyzing Map Similarity and Zoning](#)
- Slide 11, The Softer Side of GIS (The NR Experience) – Topic 29, [GIS’s Supporting Role in the Future of Natural Resources](#); Topic 21, [Human Dimensions of GIS](#)
- Slide 12, So What’s the Point? – Epilog, [Is GIS Technology Ahead of Science?](#); Topic 27, [GIS Evolution and Future Trends](#); Topic 29, [Spatial Modeling in Natural Resources](#)

Additional References: (Links are posted at www.innovativegis.com, “Papers” item)

- [Making a Case for SpatialSTEM](#) — white paper describing a framework for grid-based map analysis and modeling concepts and procedures as direct spatial extensions of traditional mathematics and statistics.
- [SpatialSTEM: Extending Traditional Mathematics and Statistics to Grid-based Map Analysis and Modeling](#) — white paper describing an innovative approach for teaching map analysis and modeling fundamentals within a mathematical/statistical context
- [An Analytical Framework for GIS Modeling](#) — white paper presenting a conceptual framework for map analysis and GIS Modeling
- [GIS Modeling and Analysis](#) — book chapter on grid-based map analysis and modeling
- [A Brief History and Probable Future of Geotechnology](#) — white paper on the evolution and future directions of GIS technology