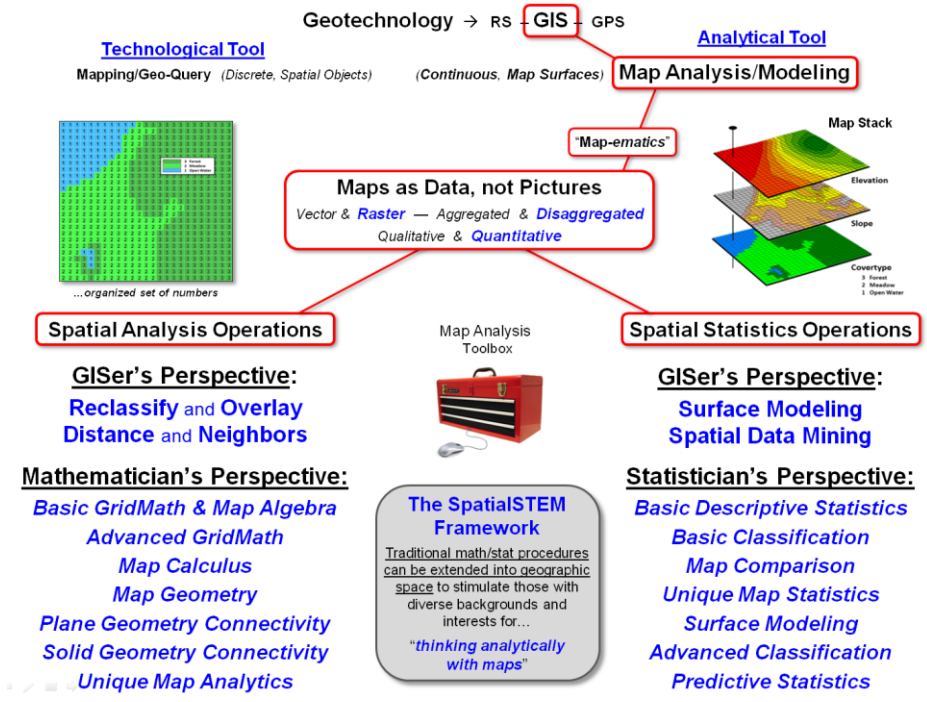
*Spatial*STEM:

A Mathematical/Statistical Framework for Understanding and Communicating Grid-based Map Analysis and Modeling

Presentation by **Joseph K. Berry**



This paper describes the idea of ***Spatial*STEM for understanding and communicating spatial reasoning, map analysis and modeling fundamentals within a mathematical/statistical framework** that resonates with science, technology, engineering and math/stat communities. The premise is that "modern maps are numbers first, pictures later" and we do mathematical things to mapped data for insight and better understanding of spatial patterns and relationships within decision-making contexts—from *Where* is *What* graphical inventories to a *Why*, *So What* and *What If* problem-solving environment.

The map-*ematical* approach focuses on analytical tools used in spatial reasoning by non-GIS communities instead of traditional "GIS mechanics" of data acquisition, storage, retrieval, query and display of map features directed toward GIS specialists. The goal is to get the STEM communities to "think with maps" and infuse direct consideration of spatial patterns and relationships into their endeavors, as an alternative to spatially-aggregated math/stat procedures that assume uniform or random distribution of map variables in geographic space.

Topics:

Quantitative Nature of Modern Maps – *conceptual approach, mathematical framework and data structure supporting a mathematical treatment of mapped data; grid-based data format uses Lat/Lon to form a Universal dB Key for joining data tables based on location*

Spatial Analysis Operations – *extensions of traditional mathematics that focus on "contextual" geographic relationships (e.g., map math, algebra, calculus, plane and solid geometry, and unique map analytics)*

Spatial Statistics Operations – *extensions of traditional statistics that focus on "numerical" relationships of map values (e.g., map descriptive statistics, normalization, comparison, classification, surface modeling, and predictive statistics)*

References:

- **Simultaneously Trivializing and Complicating GIS** — *white paper describing a mathematical structure for Spatial Analysis/ Statistics.*
  http://www.innovativegis.com/basis/Papers/Other/SpatialSTEM/TrivializingComplicating_GIS.pdf
- **SpatialSTEM: a mathematical/statistical framework for understanding and communicating grid-based map analysis**, *paper presented at ASPRS 2013 Annual Conference, Baltimore, Maryland, March 28, 2013.*
  http://www.innovativegis.com/basis/Papers/Other/ASPRS13_sSTEM/
- **A Math/Stat Framework for Grid-based Map Analysis and Modeling** — *more detailed discussion of SpatialSTEM in Topic 30 in the Beyond Mapping III online book in the three-part compilation series of the Beyond Mapping columns published in GeoWorld since 1989.*
  http://www.innovativegis.com/basis/MapAnalysis/Topic30/Topic30.htm

About the Presenter: Dr. Berry is a leading consultant and educator in the application of GIS technology. He is the principal of Berry and Associates // Spatial Information Systems (*BASIS*), consultants and software developers in geotechnology and the author of the "Beyond Mapping" column for GeoWorld magazine since 1989, several books and over 200 papers on GIS theory and applications. He conducted basic research and taught courses in GIS for twelve years at Yale University's Graduate School of Forestry and Environmental Studies, and is currently an adjunct faculty member in Geosciences at the University of Denver and in Natural Resources at Colorado State University.
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Presentation PowerPoint slides and related materials are posted at ***www.innovativegis.com/basis/Courses/SpatialSTEM/***

Online Book Chapter on the SpatialSTEM Approach

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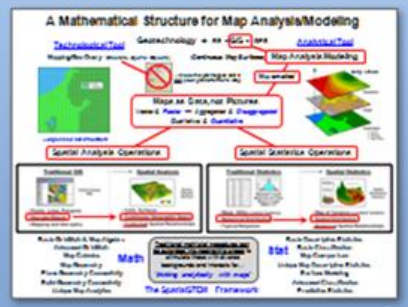

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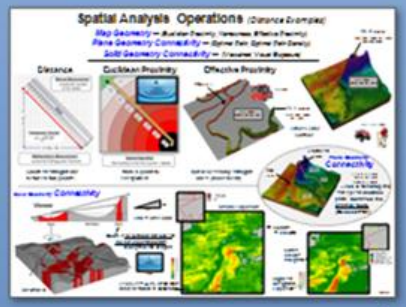

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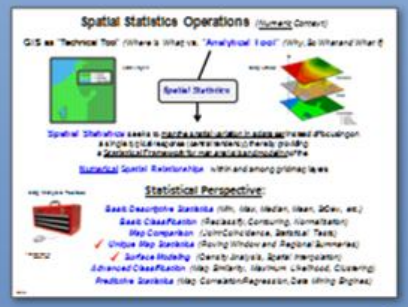

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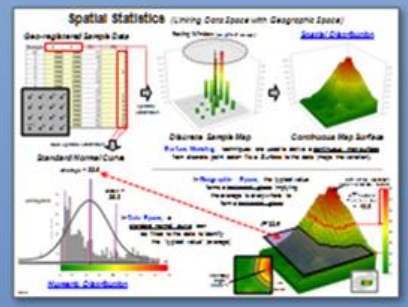

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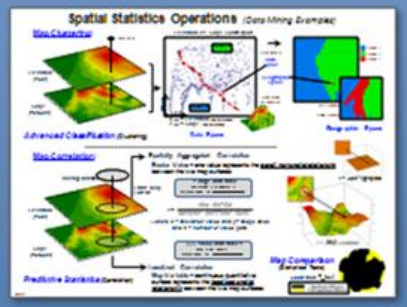

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A ten-part series of Beyond Mapping columns in GeoWorld is compiled into Topic 30, "SpatialSTEM: A Math/Stat Framework for Grid-based Map Analysis and Modeling" in the online book Beyond Mapping III posted at…

www.innovativegis.com/basis/MapAnalysis/Topic30/Topic30.htm