

# Geotechnology

...not your grandfather's map

## **Potential and Pitfalls of Applying Map Analysis in Natural Resources**

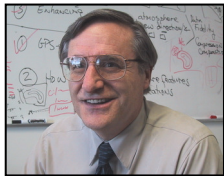
Pingree Park Alumni Reunion, August 8-10, 2008

Presented by **Joseph K. Berry**, MS in Business Management '72 and PhD emphasizing Remote Sensing '76

Forestry and Natural Resources were early users and developers of Geographic Information Systems (GIS) technology. Today, the U.S. Department of Labor recognizes Geotechnology as one of the three "mega-technologies for the 21<sup>st</sup> century" with the other two being Biotechnology and Nanotechnology. Whereas the early uses of GIS focused on inventory and mapping (*Where is What*), contemporary applications in many fields have evolved to analyzing spatial patterns and relationships (*Why and So What*). This transition from "Mapping" to "Map Analysis" is revolutionizing natural resources research, planning and management. Techniques in Spatial Statistics support a new perspective of mapped data and new map-ematical and statistical tools that extend the traditional non-spatial analysis and modeling most of us learned in school as "central tendency" theory expressed as the Average and Standard Deviation describing the typical condition over an area. From this new perspective, maps are viewed as organized sets of numbers and the detailed spatial distributions augment the traditional numerical distributions used in data analysis. Techniques in Spatial Analysis support entirely new concepts, such as landscape fragmentation, variable-width buffers, visual exposure and optimal paths, that analyze the coincidence and context among map layers for better understanding of complex natural systems. This presentation investigates the similarities and differences between the traditional and new set of data analysis tools, their current application in related fields, such as Precision Agriculture, and future directions of Geotechnology for Natural Resources.

### **Further Reading:**

- <http://www.nature.com/nature/journal/v427/n6972/full/nj6972-376a.html> ...article in Nature describing *Geotechnology* as one of the three "mega technologies" for the 21st Century.
- [http://www.innovativegis.com/basis/Papers/Other/Geotechnology/Geotechnology\\_history\\_future.htm](http://www.innovativegis.com/basis/Papers/Other/Geotechnology/Geotechnology_history_future.htm) ...a white paper titled "A Brief History and Probable Future of Geotechnology."
- [http://www.innovativegis.com/basis/present/GW05\\_wildfire/Wildfire\\_GW05.htm](http://www.innovativegis.com/basis/present/GW05_wildfire/Wildfire_GW05.htm) ...feature article entitled "Quantifying Wildland Fire Risk" describing a risk-assessment framework that incorporates spatial and temporal factors.
- [http://www.innovativegis.com/basis/present/GW98\\_PrecisionAg/GW98\\_PrecisionAg.htm](http://www.innovativegis.com/basis/present/GW98_PrecisionAg/GW98_PrecisionAg.htm) ...feature article entitled "Who's Minding the Farm" discussing Precision Ag principles and approaches.
- [http://www.innovativegis.com/basis/Papers/Online\\_Papers.htm](http://www.innovativegis.com/basis/Papers/Online_Papers.htm) ...listing of several papers on the concepts, considerations, procedures and applications of Geotechnology and Map Analysis.
- <http://www.innovativegis.com/basis/MapAnalysis/Default.htm> ...online book, Beyond Mapping III, is a collection of Joseph K. Berry's popular *Beyond Mapping* columns published in *GeoWorld* magazine from 1996 through present.



**Dr. Joseph K. Berry** is the Principal of Berry & Associates // Spatial Information Systems (BASIS), consultants and software developers in Geographic Information Systems (GIS) technology. He has written over two hundred papers on the analytic capabilities of GIS and is the author of the popular books Map Analysis, Spatial Reasoning, Beyond Mapping, Analyzing Precision Ag Data, Analyzing Geo-Business Data, Analyzing Geo-Spatial Resource Data, The Precision Farming Primer (online) and Beyond Mapping III (online). He serves as the Keck Scholar in Geosciences at the University of Denver and is an Adjunct Faculty member at Colorado State University. He holds a BS degree in Forestry from UC Berkeley and two degrees from CSU—MS in Business Management (1972) and PhD emphasizing Remote Sensing (1976).

Website: <http://www.innovativegis.com/basis/>

### Geotechnology

#### New Year Geotechnology Map

Geotechnology is the application of geographic information systems (GIS) and remote sensing technologies to solve real-world problems. It combines spatial data with analytical tools to provide insights into various fields such as urban planning, environmental management, and public health.

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Surface modeling is the process of creating a digital surface model (DSM) from a digital elevation model (DEM) and other data. It involves interpolating data points to create a continuous surface representation of the terrain.

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### Spatial Interpolation

Spatial interpolation is the process of estimating values at unknown locations based on known values at surrounding locations. It is commonly used in GIS to create continuous surfaces from discrete data points.

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### Comparing Spatial Interpolation Results

Comparing spatial interpolation results involves evaluating the accuracy and quality of different interpolation methods. This is typically done by comparing the results against ground truth data or other reference surfaces.

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### Spatial Data Mining

Spatial data mining is the process of discovering patterns and relationships in spatial data. It involves using statistical and machine learning techniques to analyze large volumes of geographic information.

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### Clustering Maps for Data Zones

Clustering maps for data zones involves grouping similar geographic features into distinct clusters. This is useful for identifying areas with similar characteristics and for targeted analysis.

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### The Precision Ag Process

The precision agriculture process involves using GIS and remote sensing to optimize crop management. It includes data collection, analysis, and decision-making to improve yield and reduce resource waste.

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### Data Analysis Perspectives

Data analysis perspectives involve examining data from multiple angles to gain a comprehensive understanding. This includes spatial, temporal, and thematic analyses to uncover hidden insights.

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### Precision Conservation

Precision conservation is the application of GIS and remote sensing to protect natural resources. It involves monitoring land use changes and identifying areas for conservation.

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### Spatial Analysis

Spatial analysis is the process of examining the spatial relationships between geographic features. It involves using statistical and spatial models to understand patterns and trends in the data.

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### Calculating Slope and Flow

Calculating slope and flow is a fundamental GIS operation. It involves determining the steepness of terrain and the direction of water flow based on a digital elevation model.

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### Deriving Erosion Potential

Deriving erosion potential involves assessing the likelihood of soil erosion in different areas. This is typically done by combining factors like slope, soil type, and land cover into a composite index.

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### Calculating Effective Distance

Calculating effective distance is a GIS technique used to measure the impact of barriers on movement between locations. It is often used in urban planning and transportation analysis.

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### Conclusions

Geotechnology offers powerful tools for solving complex spatial problems. By integrating GIS and remote sensing, we can gain valuable insights into our world and make more informed decisions.

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### Where to go from here...

For more information on geotechnology and its applications, please visit our website at [www.innovativegis.com](http://www.innovativegis.com). We offer a wide range of services and products to help you succeed in your GIS projects.

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