

**Providing Perspective,  
Gaining Insight**

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## **Validation of Modeling Outcome:**

### **Rationalization and Recognition of Realistic Results**



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## **Presentation Outline**

- ▶ Introduction
  - Use of GIS today
  - Current Concerns
  - Data Inputs vs. Data Outputs
- ▶ History of GIS
- ▶ Spatial Modeling
  - Developing a framework
- ▶ Data Issues
  - Data management
  - Data quality
- ▶ Validation Approaches
  - Case specific nature
  - Implications of a model



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## Introduction

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- ▶ GIS Today
  - Daily parts of everyone's life
  - Ever evolving technology
  - Divide between GIS users and professionals
- ▶ Current Concerns
  - GIS as a tool in organizations
  - Data extensibility
- ▶ Data Inputs vs. Data Outputs
  - Importance of validation data outputs



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## History of GIS

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- ▶ Use of spatial information for analysis prior to computers
- ▶ Computerized GIS beginnings
  - Primarily a mapping tool
  - GIS functionalities correlates with advancement of computer technology
- ▶ Transition of GIS use



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# Spatial Modeling

- ▶ What is it?
- ▶ The power of spatial modeling within GIS
- ▶ Reasons for emergence of spatial modeling
  - Data quality advancements
  - Explore and discover relationships
  - Provides a framework for decision making
  - Cost saving for organizations

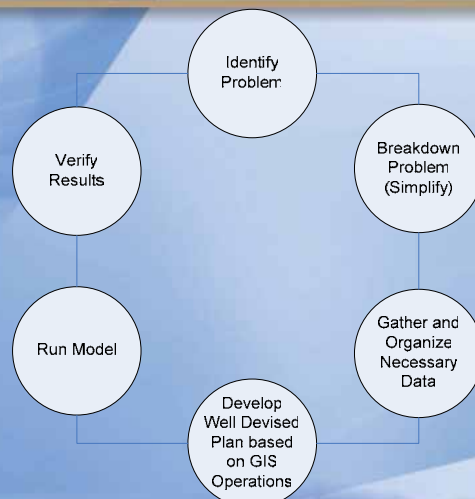


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# Spatial Modeling



**Generic Modeling Process**



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## Data Issues

- ▶ Case Specific Nature of Spatial Modeling
  - Highly variable datasets
  - Need for professionals to “know” their data.
    - ▶ Not only what they are using, but the abilities of separate datasets individually and combined
  - Output quality is typically dependant on Input data quality



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## Data Quality Issues

- ▶ Cautions and Concerns
  - Resolution (or Scale)
    - ▶ Pixel size of raster data
    - ▶ Vector problems resides in digitizing and overlays
  - Logical Consistency
    - ▶ Error created from the data outputs rather than the inputs



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## Data Quality Issues

### ▶ Cautions and Concerns

#### – Data Completeness

- ▶ Missing features
- ▶ Ex. A dataset that contains water bodies throughout a city.

#### – Interpolation

- ▶ Method of creating data by predicting values based on a sample dataset
- ▶ Works for certain data types (continuous data sets)
  - Ex. Rainfall, snowfall, elevation
- ▶ Caution must be taken in order to accurately derive a new dataset.



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## Data Quality Issues

### ▶ Cautions and Concerns

#### – Spatial Errors (Positional Errors)

- ▶ Occur when features are not located in the correct place on the earth's surface
- ▶ Visible when datasets are overlaid
- ▶ This can also be used as a method of validation

#### – Attribute Errors

- ▶ Blunders in data (i.e. data entry error or data manipulation error)
- ▶ Ex. Incorrectly named features (streets labeled incorrectly or as a different feature type)



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## Data Quality Issues

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- ▶ Resolution and Scale are not spatial errors rather are the extensibility of data
- ▶ Many errors link to each other
  - Ex. Attribute errors are often associated with age of data, logical consistency, and data completeness



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## Data Validation

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- ▶ Importance of Validation
  - Proof that the model has produced the correct (or near correct) results
  - Method to acquire buy-in from organizations
  - Provide supporting evidence to prove the results display factual information
- ▶ GIS techniques can be used evaluate and analyze the model's output data
- ▶ Developed methodologies for validation may exist



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## Data Validation

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- ▶ Very case specific and data dependant
- ▶ Methods
  - Ground truthing
    - ▶ Expensive and not always an option
  - Visualization Techniques
    - ▶ Ex. Derive a hillshade from a DEM to help identify artifacts in its source data
  - Re-run model using a subset of data (in hopes of finding the same outputs)
  - Use the Model's rules and methods
    - ▶ Check to see if they hold true
    - ▶ Ex. Downhill flow constraint



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## Data Validation

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- ▶ Implications of a model
- ▶ Models are abstractions of reality



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## Conclusion

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- ▶ Documentation, data awareness, and data validation are steps and concepts that every professional needs to grasp in order for the use of spatial modeling to increase
- ▶ Lack of documentation of GIS processes is reason to demand each professional set and maintain QA/QC practices and processes.
- ▶ By following rigorous procedures and standards, GIS will remain and increase as a credible business tool



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## Questions??



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## References

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- ▶ Bolstad, Paul, “GIS Fundamentals”, May 2001, Eider Press: White Bear Lake, MN

