Future Directions of GIS in Forestry:
Extending Grid-based Map Analysis and Geo-web Capabilities

Information has always been the cornerstone of effective forestry decisions. As the industry continues to extend beyond our paper map legacy primarily focused on data editing and maintenance, geo-query and mapping, two broad fronts of innovation can be identified—Map Analysis and Geo-web Applications.

Map Analysis marks a turning point in the use of maps from one emphasizing physical description of geographic space, to one of interpreting mapped data, combining map layers and finally, to spatially characterizing and communicating complex spatial relationships. This movement from "*where is what*" (descriptive) to "*so what, why and what if* " (prescriptive) has set the stage for entirely new geospatial concepts and tools. It also has set the stage for radical changes in how we conceptualize, geo-register and store mapped data.

Desktop GIS has been the conventional platform for Map Analysis in forestry, providing the performance and data requirements for implementing complex analytical models. However, with recent advancements in the ArcGIS Server environment, forestry is primed for an explosion of analytical and modeling capabilities on the web.

Geo-web Applications radically change how we perceive, visualize, communicate with mapped data while minimizing the technical requirements of users. Forestry applications, particularly for editing and land base data management, have been using web mapping capabilities for a few years. However, rarely has analytics or modeling been actively applied across the web. With new capabilities afoot, we are about to see geo-web applications become the norm of deploying capabilities to the forester, manager and public in the near future. This is due to enhanced capabilities for Geoprocessing Services and performance not readily available before ArcGIS v10.1.

This presentation reviews current activities and technology opportunities with an eye on the future.

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Online Materials and Further References

To download this Handout and the PowerPoints used in the presentation, see
www.innovativegis.com/basis/Papers/Other/Esri_Forestry2011

Topic #1 – Conceptual Framework for Map Analysis Operations and Procedures

o **A Brief History and Probable Future of Geotechnology** — *white paper on the evolution and future directions of GIS technology*
o **An Analytical Framework for GIS Modeling** — *white paper presenting a conceptual framework for map analysis and GIS Modeling*
o **GIS Modeling and Analysis** — *book chapter on grid-based map analysis and modeling*
    …all three references are included in <u>Online Papers</u>, posted at www.innovativegis.com/basis

o **Moving Mapping to Analysis of Mapped Data** — *describes Spatial Analysis and Spatial Statistics as extensions to traditional mapping and statistics*
o **Bending Our Understanding of Distance** — *uses effective distance in establishing erosion setback to demonstrate spatial analysis*
o **Use Spatial Statistics to Map Abnormal Averages** — *discusses surface modeling to characterize the spatial distribution inherent in a data set*
    …all three references are included in <u>Topic 24</u>, *Overview of Spatial Analysis and Statistics* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

Topic #2 – Example Applications of Grid-based Map Analysis

Spatial Analysis

− Backcountry Emergency Response (on- and off-road travel-time surfaces)
o **E911 for the Backcountry** — *describes development of an on- and off-road travel-time surface for emergency response*
o **Extending Emergency Response Beyond the Lines** — *discusses basic model processing and modifications for additional considerations*
o **Comparing Emergency Response Alternatives** — *describes comparison procedures and route evaluation techniques*
  …all three references are included in *Topic 29, Spatial Modeling in Natural Resources* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

− Available/accessible forest locations and "Timbersheds"
o **Harvesting an Understanding of GIS Modeling** — *describes a prototype model for assessing off-road access to forest areas*
o **Extending Forest Harvesting's Reach** — *discusses a multiplicative weighting method for model extension*
o **A Twelve-step Program for Recovery from Flaky Forest Formulations** — *describes a spatial model for identifying Landings and Timbersheds*
  …all three references are included in *Topic 29, Spatial Modeling in Natural Resources* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

− Deriving "Viewshed" maps and "Visual Exposure" density surfaces
o **Identify and Use Visual Exposure to Create Viewshed Maps** — *discusses basic considerations and procedures for establishing visual connectivity*
o **Visual Exposure is in the Eye of the Beholder** — *describes procedures for assessing visual impact and creating simple models*
o **Use Exposure Maps and Fat Buttons to Assess Visual Impact** — *investigates procedures for assessing visual exposure*
  …all three references are included in *Topic 15, Deriving and Using Visual Exposure Maps* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

Spatial Statistics

o **Babies and Bath Water** — *discusses the information lost in aggregating field data and assigning typical values to polygons (desktop mapping)…Topic 7, Linking Data Space and Geographic Space*, posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

o **Comparing Apples and Oranges** — *describes a Standard Normal Variable (SNV) procedure for normalizing maps for comparison*
o **Correlating Maps and a Numerical Mindset** — *describes a Spatially Localized Correlation procedure for mapping the mutual relationship between two map variables*
  …both references are included in *Topic 18, Understanding Grid-based Data,* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

Topic #3 – Dominant Forces Driving GIS's Future

Dominant GIS Forces

o **Referencing the Future** — *describes current and alternative approaches for referencing geographic and abstract space*
  …Introduction, posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis
o **Thinking Outside the Box** — *discusses concepts and configuration of 3-dimensional geography*
o **From a Map Pancake to a Soufflé** — *continues the discussion of concepts and configuration of a 3D GIS*
  *…both references are included in Topic 27, GIS Evolution and Future Tre*nds, posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

Dominant Human Forces

o **Early GIS Technology and Its Expression** — *traces the early phases of GIS technology (Computer Mapping, Spatial Database Management and Map Analysis/Modeling)*
o **Contemporary GIS and Future Directions** — *discusses contemporary GIS and probable future directions (Multimedia Mapping and Spatial Reasoning/Dialog)*
o **Innovation Drives GIS Evolution** — *discusses the cyclic nature of GIS innovation (Mapping, Structure and Analysis)*
  …all three references are included in *Epilog, of* the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

o **Lumpers and Splitters Propel GIS** — *describes the two camps of GIS (GeoExploration and GeoScience)*
o **The Softer Side of GIS** — *describes a Manual GIS (circa 1950) and the relationship between social science conceptual frameworks for understanding/judgment in GIS modeling*
o **Melding the Minds of the "*-ists*" and "*-ologists*"** — *elaborates on the two basic mindsets driving the geotechnology community*
  …all three references are included in *Epilog, of* the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

o **GIS's Supporting Role in the Future of Natural Resources** — *discusses the influence of human dimensions in natural resources and GIS technology's role, Topic 29, Spatial Modeling in Natural Resources* posted with the online *Beyond Mapping III* book at www.innovativegis.com/basis/mapanalysis

For a compilation of "Beyond Mapping" columns appearing in GeoWorld 1989-present (listed by Topics and Chronically),
see the online book, *Beyond Mapping III*, posted at **www.innovativegis.com/basis/MapAnalysis/**