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The American Water Resources Association – GIS and Water Resources III

Many of the Nation's leading experts in the application of geographic information systems for water resources gathered in Nashville, Tennessee the week of May 17 to share their latest developments. This emerging scientific specialty is making significant progress due to a number of factors outlined by Dr. David Maidment, one of the field's leading visionaries, in his keynote address: (1) Progress in GIS, (2) the availability of water resource functions in a GIS, such as ArcHydro, (3) the standardization of data across the country, (4) hydrologic modeling in GIS, (5) tremendous advancement of national databases, such as the NHD and NED, and (6) GIS as an integrating framework to bring together the sciences contributing to water resources. Thirty-three sessions were held, each presenting three to five papers. In addition, 53 posters were presented with authors present. Major topics of discussion revolved around (1) modeling of water quality such as SPARROW, (2) modeling of hydrology such as STREAMSTATS, (3) software applications, (4) the NHD, (5) NED and EDNA, (6) LIDAR, (7) data preparation, and (8) applications in the real world. Common themes that transcended these topics were an accurate reflection of the progressive factors outlined by Dr. Maidment at the beginning of the conference. The future of GIS in water resources is sure to expand far beyond its current state due to a number of emerging technologies: (1) time-series data such as time-sequenced streamgage readings, (2) the integration of real-time contributing data such as NEXRAD, (3) the availability of reach catchment polygons, (4) flow volume and velocity characteristics for calculating time-of-travel, (5) the reach indexing and sharing of attributes such as streamgages, impaired waters, dams, and permitted discharge sites, (6) the availability of a nation-wide high-resolution NHD, (7) more accurate elevation and elevation derivative data, and (8) value-added attributes to enhance processing. This list could go on and on to include general trends such as better web access, better modeling inputs, better modeling algorithms, better GIS systems, better education, etc. As the contributing disciplines represented at the conference in geography, hydrology, biology, geology, computer science, resource management, policy making, and a host of others, continue to converge and interact on the subject of GIS and water resources, the field will create new opportunities for growth and consequently generate exciting new knowledge of water resource issues.

Synopsis of AWRA Papers Presented – Following One of Three Tracks in Days 1 and 2

- Stormwater Assessment Modeling – Efrain Giron (University of New Orleans): This metropolitan scale GIS uses elevation and precipitation data, combined with pumping station capacity, to determine number of houses affected by flooding in New Orleans. Uses Geodatabase in ArcGIS.
- Water Quality Data Modeling for the Chesapeake Bay – William Samuels (SAIC): Use of kriging interpolation of water quality sampling points and processing to produce an animated visualization of data cross-sections sequenced down Chesapeake Bay. Study of complex watershed systems.
- A Web-Enabled Geographic Information System of Estimating Flood Frequencies for Unregulated Streams in Karst Areas of Tennessee – George Law (USGS): Highly customized ArcIMS interface to provide STREAMSTATS-based streamflow estimates in karst topography. Karst areas are hand-delineated for more effective analysis.
- 3-D Based GIS Applications Along the Coast of Long Island – Laurel Krynock (Moffatt and Nichol): Mapping of shoreline inundation due to storms and calculating resulting volumetric change due to sediment transport. Used to study storm damage reduction.
- Fast Track! Serving Custom GIS in Record Speed – Bruce Taylor (Clayton County Water Authority, Georgia): A metropolitan water management system GIS for Atlanta, Georgia. Highlights access to extensive water system information made possible by GIS.

- Watershed Boundary Dataset – Mike Laitta (USGS): A grassroots effort by the Nation's water resource community to develop a single, seamless, nation-wide, 1:24,000-scale dataset of watershed and sub-watershed perimeters. Standardization and certification for multi-agency use.
- A Watershed GIS for the Puyallup Tribe of Indians – Jonathan Pickus (SAIC): Using a GIS to locate and display fish habitat near Tacoma, Washington. Hydrography and fish data from tribe with fish habitat indexed by milemarker. Employs streamgages and EPA water quality data.
- Combining LIDAR-Derived Elevation Data With the National Hydrography Dataset – Silvia Terziotti (USGS): Using the established navigation network of the NHD to aide in processing of LIDAR to get an accurate LIDAR-based stream network of greater resolution. NHD reach indexing used for network analysis relating permitted discharges to streamgages.
- Assessing Hydropower Potential of the United States – Shane Cherry (Idaho National Engineering and Environmental Laboratory): Analysis of hydrography and elevation data finds that there is a potential of 300 megawatts of energy available, but GIS shows us that 90 megawatts of that is on lands which cannot be developed.
- How Well Does a Digital Elevation Model Represent Terrain – Suzanne Wechsler (California State University): Used GPS to field-test the elevation values of a DEM matrix in mountainous terrain. Results show closely matching elevation values.
- GIS Applications Supporting Spatially Referenced Regression Modeling in the Chesapeake Bay Watershed – John Brakebill (USGS): Use of the SPARROW model provides multiple techniques to support monitoring.
- New England SPARROW: Application of NHD for Water Quality Nutrient Modeling – Richard Moore (USGS): Analysis of nitrogen and phosphorous sources and the effect of the landscape on transport through the hydrography network with load assessment at the receiving waters. Advancement of earlier SPARROW techniques with strong role for NHD.
- Application of New England SPARROW Model to Water Quality Management – Laura Blake (New England Interstate Water Pollution Control Commission): Overcoming hypoxia in Long Island Sound would require a 58% reduction in nitrogen load on Connecticut River. Careful analysis of New England SPARROW performance shows strong results.
- Introduction to the NHD – Keven Roth (USGS): Emphasis on the NHD as the hydrography theme for *The National Map*. Explored the themes, scales, characteristics and functionality of the NHD, as well as look in detail at some example data. Review of status and downloading.
- A Survey of Applications of the NHD – Jeff Simley (USGS): A look at recent examples of how 20 members of the user community are applying the NHD to analyze scientific problems. Users are taking good advantage of the reach indexing and network characteristics of the NHD.
- Minnesota Hydrographic Data, Supporting Water Quality Protection – Mark Olsen (Minnesota Pollution Control Agency): A single web-enabled state repository of Minnesota NHD-based hydrography with an extensive database of water characteristics indexed to the data. Application focus on impact of construction on healthy streams.
- Using the NHD and WATERS for National Water Policy Analysis – Thomas Dewald for Thomas Dabolt (EPA): The NHD is an integrating framework for many techniques, databases, and applications utilized in the inventory, reporting, analysis, and regulation of the Nation's water. Over a dozen EPA databases are geo-referenced using the NHD. WATERS provides a system for measuring performance, reporting and regulatory development.
- The NHD Surface Water Network, You've Uncompressed the Data, Now What? – Cindy McKay (Horizon Systems): A thorough review of the many characteristics of the NHD that need to be understood when utilizing the data in analysis. Basic training for the GIS analyst.
- Using the NHD's Power to Build Surface Water Models – Tim Bondelid (RTI International): A look at routing techniques, reach catchments, climatic data, and modeling methods to produce flow velocity measurements.

- Estimating Drainage Areas Using Thiessen Catchments for the NHD – Al Rea (USGS): The objective is to produce flow and velocity measurements, but to do this reach catchment polygons are needed. Several methods are explored. Thiessen polygons are by no means perfect, but their very low cost makes them very attractive.
- A Three-Dimensional Description of River Channels Using Two-Dimensional NHD Reaches – Venkatesh Merwade (Univ. of Texas-Austin): Determining the characteristics of channel cross-sections based on the planimetric shape of the river.
- GIS-Automated Model Development for the Mystic River Flood Study – James Herberich (ENSR): Generating flood plain maps using the NHD, watershed delineation, landcover, soils, structures, bridge locations, channel cross-sections, and hydrologic modeling software.
- River Assessment Support tools for Michigan – Lidia Szabo Kraft (Univ. of Michigan): Combining data such as the NHD, fish population, recreation, physical features, boundaries, and many others to give a biologist the power to perform thorough assessments.
- Regional Watershed Modeling System for the San Antonio River – David Maidment (Univ. of Texas-Austin) for Brian Shirley (PBS&H): A watershed modeling system designed for flood and water quality analysis. Utilizes previous studies and provides consistent modeling. Creates DFIRM data.
- Spatial Models of the Distribution and Dynamics of Radionuclides Within Reservoir Sediments – Steven Harper (Savannah River Ecology Laboratory): Cesium 137 is deposited in lake sediments over time. Mapping of concentrations shows results the reverse of expectations. Sheds new light on sediment transport within a lake. Wind an important factor.

Thanks to Keven Roth.