

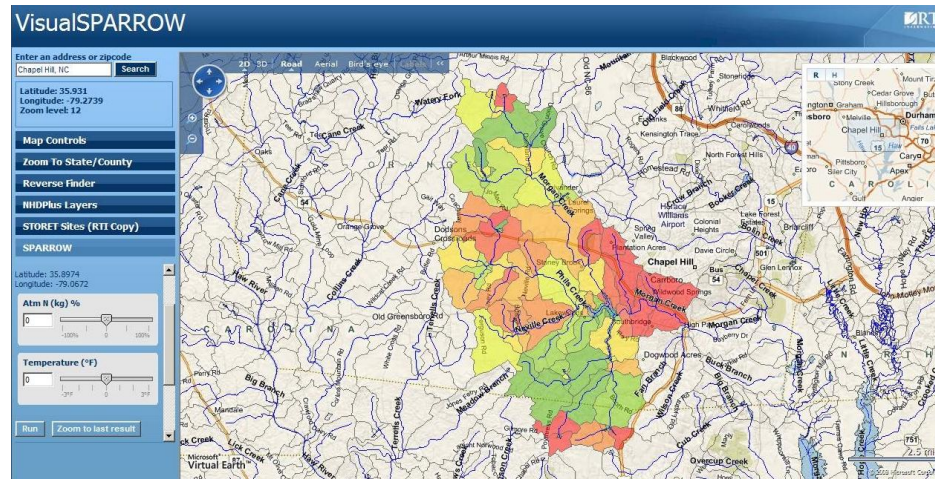


**RTI experience with decision support systems applying
SPARROW and other empirical tools for watershed-based
water quality management**

Michele Cutrofello and James I. Rineer

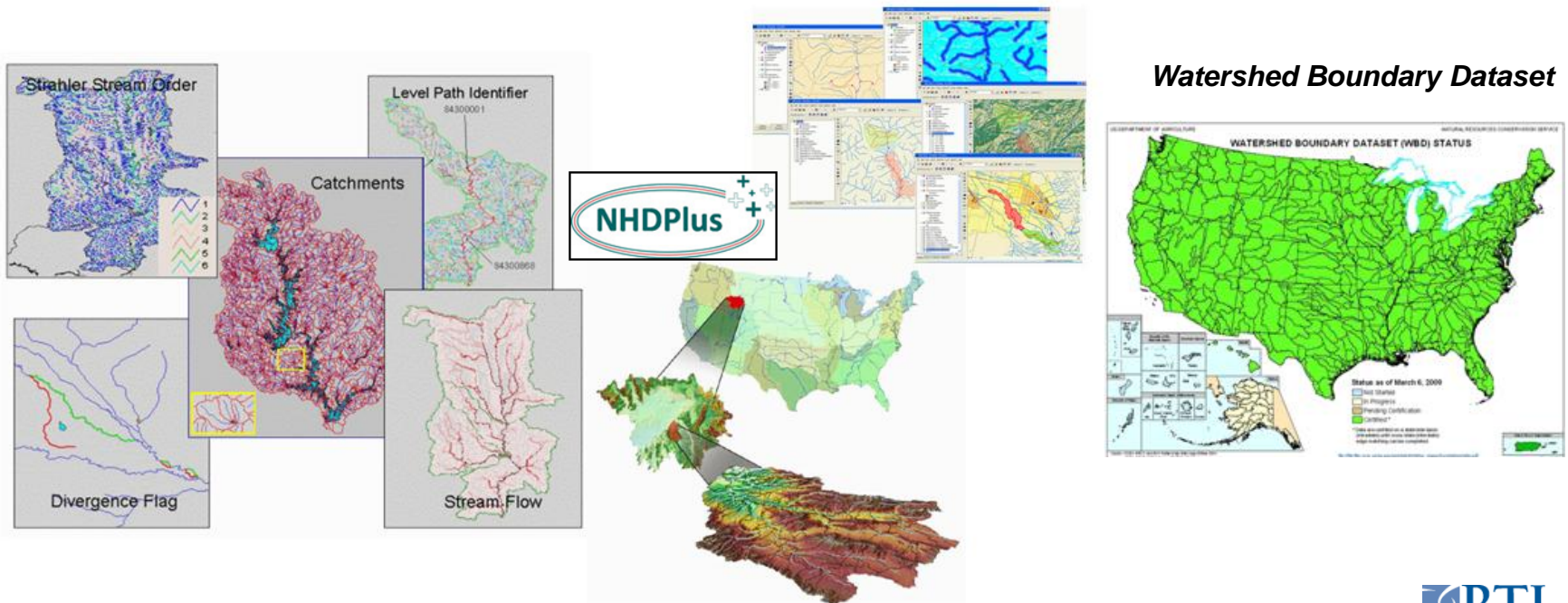
Presentation Outline

- RTI experience with NHD-based geospatial frameworks
- SPARROW and related empirical decision support tools
- Closing thoughts



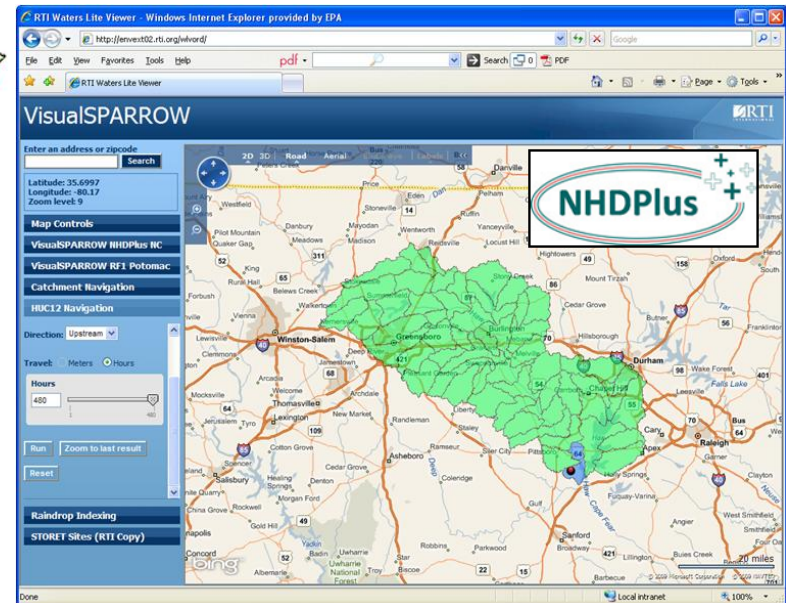
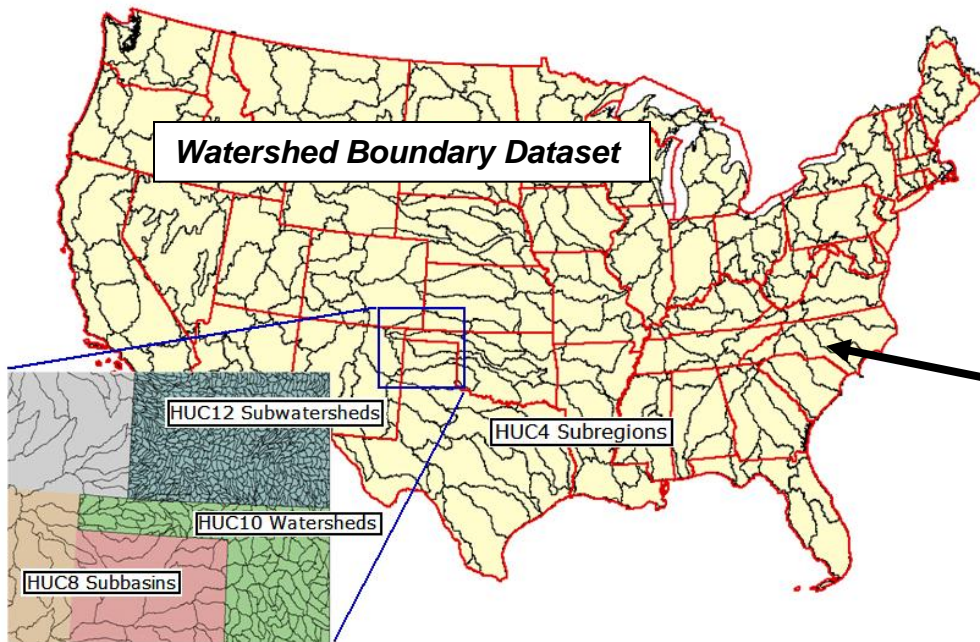
NHD-based geospatial frameworks

- RTI has experience building geospatial frameworks based on the National Hydrograph Dataset (the NHD)
- Experience with the enhanced NHD (the NHDPlus) and EPA and USGS Reach File-based networks (RF1)
- And experience linking the Watershed Boundary Dataset (WBD) with the NHDPlus system of flowlines and catchments



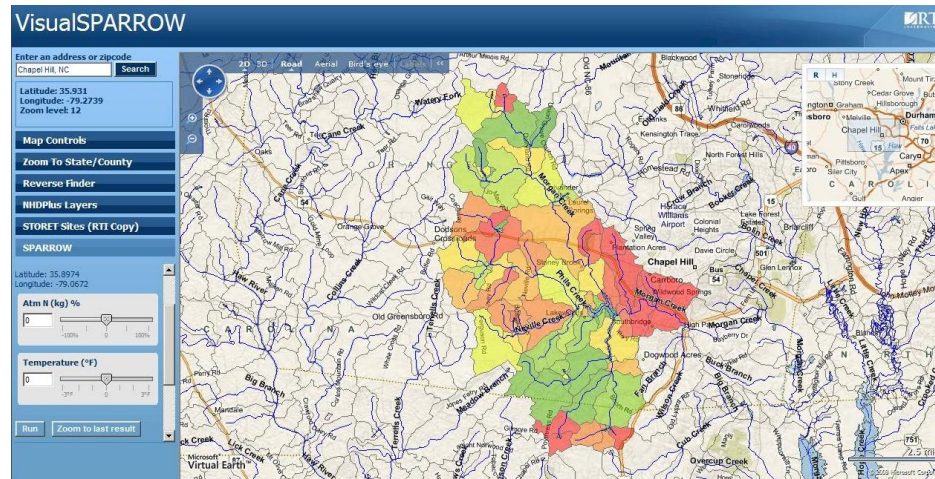
NHD-based geospatial frameworks

- RTI geospatial tools can link the NHDPlus flowlines and catchments with the WBD
- Provide web-based approaches for building larger watershed management frameworks from smaller units such as the HUC12 subbasins.



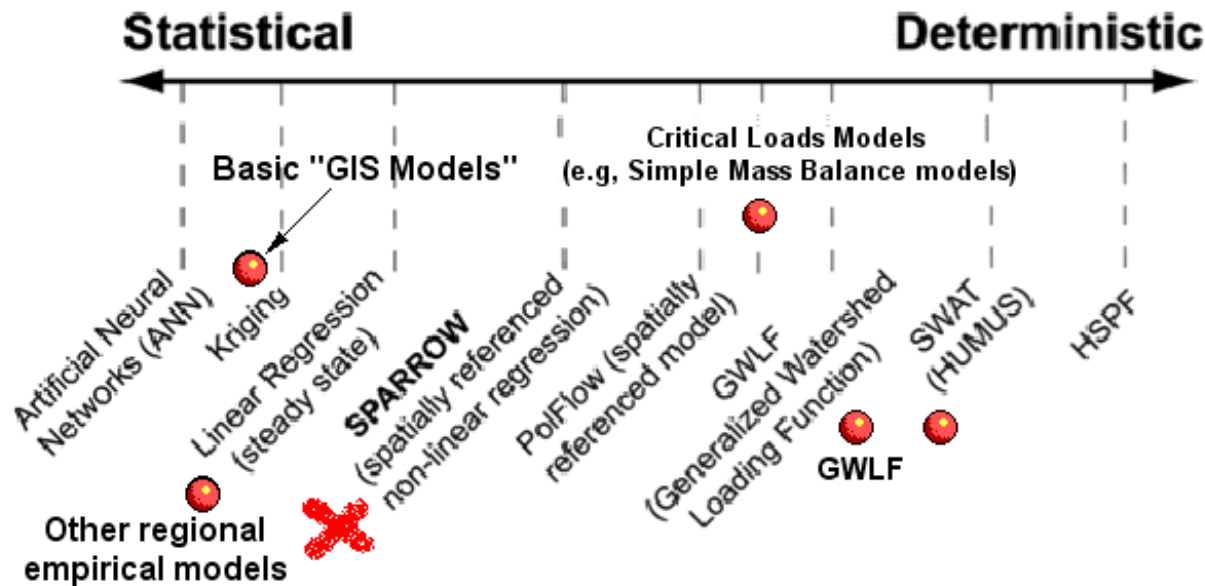
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SPARROW and related decision support tools

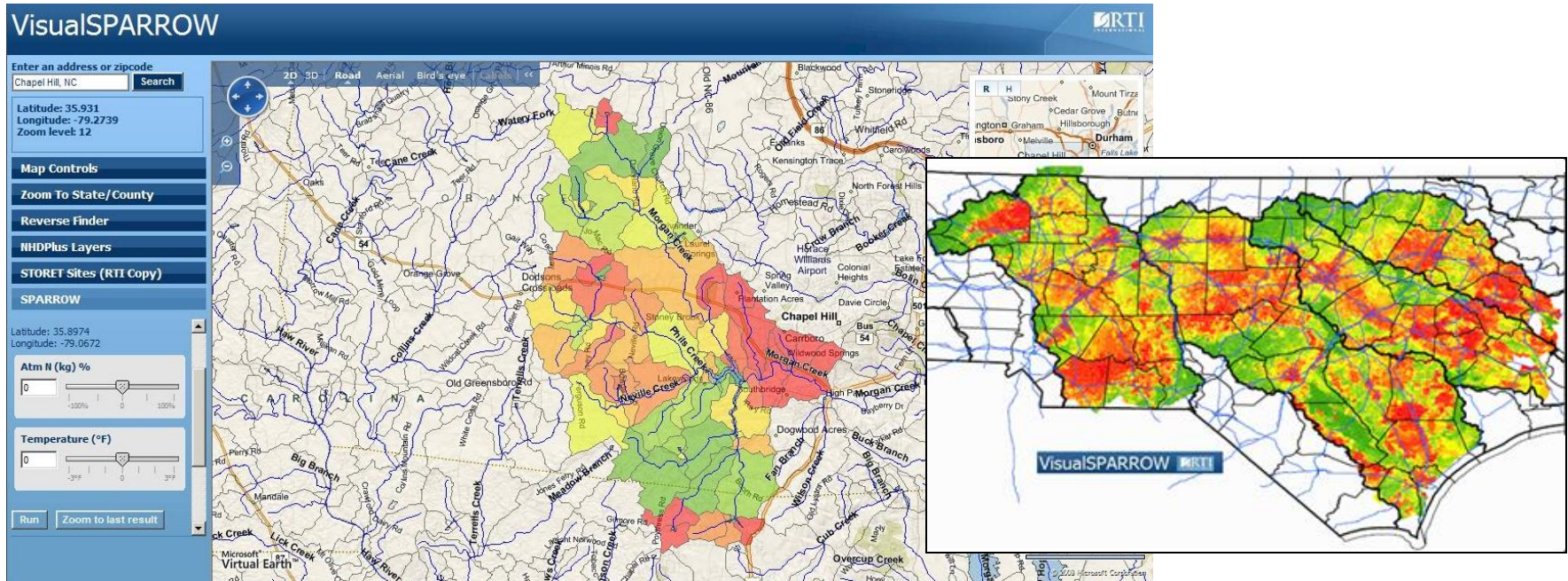
- RTI has experience with empirical/statistical models such as SPARROW
- As well as engineering “process” models



Continuum of model types based on the level of statistical and mechanistic descriptions of contaminant sources and biogeochemical processes

Based on: Schwarz, G.E., Hoos, A.B., Alexander, R.B., and R.A. Smith, 2006, The SPARROW surface water-quality model: Theory, application, and user documentation, U.S. Geological Survey Techniques and Methods Report, Book 6, Chapter B3. <http://pubs.usgs.gov/tm/2006/tm6b3/>

SPARROW and related decision support tools

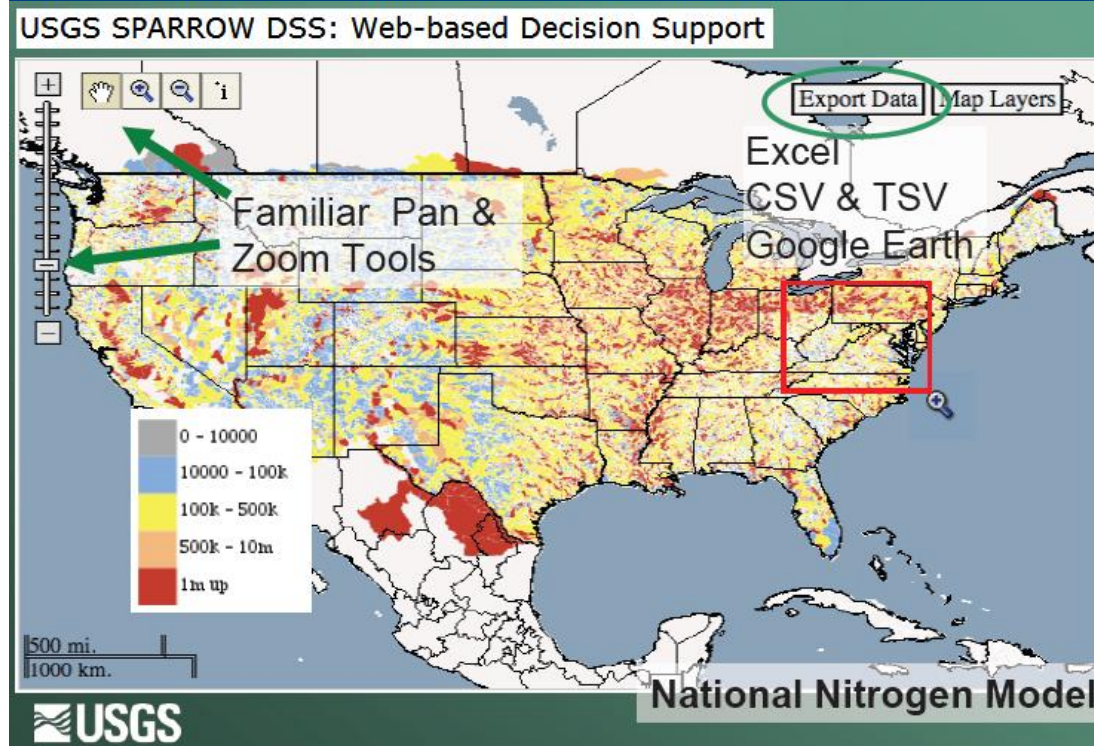


- Web-based implementation of SPARROW – Visual SPARROW
- Implemented for basins throughout North Carolina
- Based on national SPARROW model
- Leverages the Python SPARROW (pySPARROW) open source codebase from researchers at Duke University & the University of South Carolina

Chambliss, Emily. 2008. Modeling land use patterns and water quality: An evaluation of the pySPARROW model. Masters project submitted in partial fulfillment of the requirements for the Master of Environmental Management degree in the Nicholas School of the Environment and Earth Sciences of Duke University 2008.

http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/492/MP_ekc7_a_200805.pdf?sequence=1

SPARROW and related decision support tools



- Visual SPARROW design parallels USGS SPARROW Decision Support Pilot
- Aims to involve local watershed managers as stakeholders contributing to initiatives covering larger spatial frameworks
- Appeals to modelers but also to a wider audience of decision makers

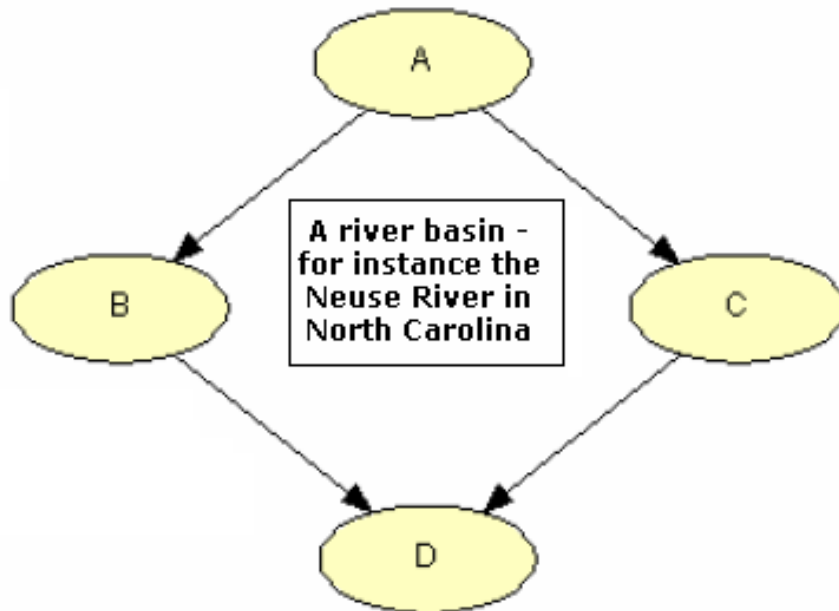
Booth, Nathaniel and Everman, Eric. 2008. Taking SPARROW to the Web: A Tool for Water-Quality Research and Resource Management. Sixth National Monitoring Conference - Monitoring: Key to Understanding Our Waters, May 18-22, 2008, Atlantic City Convention Center, Atlantic City, New Jersey. U.S. Department of the Interior, U.S. Geological Survey.

http://acwi.gov/monitoring/conference/2008/presentations/session1/12-C_Everman.pdf

SPARROW and related decision support tools

Simple explanatory Bayesian network

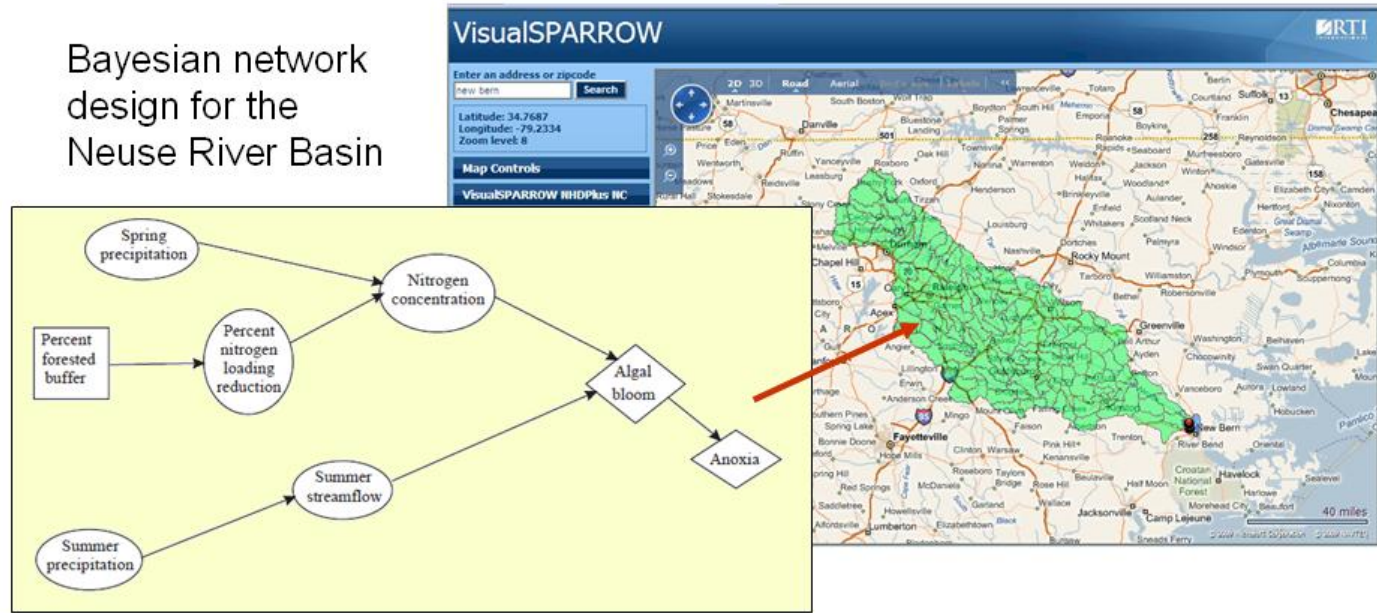
$$p(A,B,C,D) = p(D|C,B) p(C|A)p(B|A) p(A)$$



RTI has shared concepts with local researchers with Duke University and the USGS on applying Bayesian statistics where regional monitoring programs provide ongoing monitoring data to refine statistical inferences for watershed-based management frameworks applying both *a priori* and *a posteriori* information.

SPARROW and related decision support tools

Bayesian network design for the Neuse River Basin



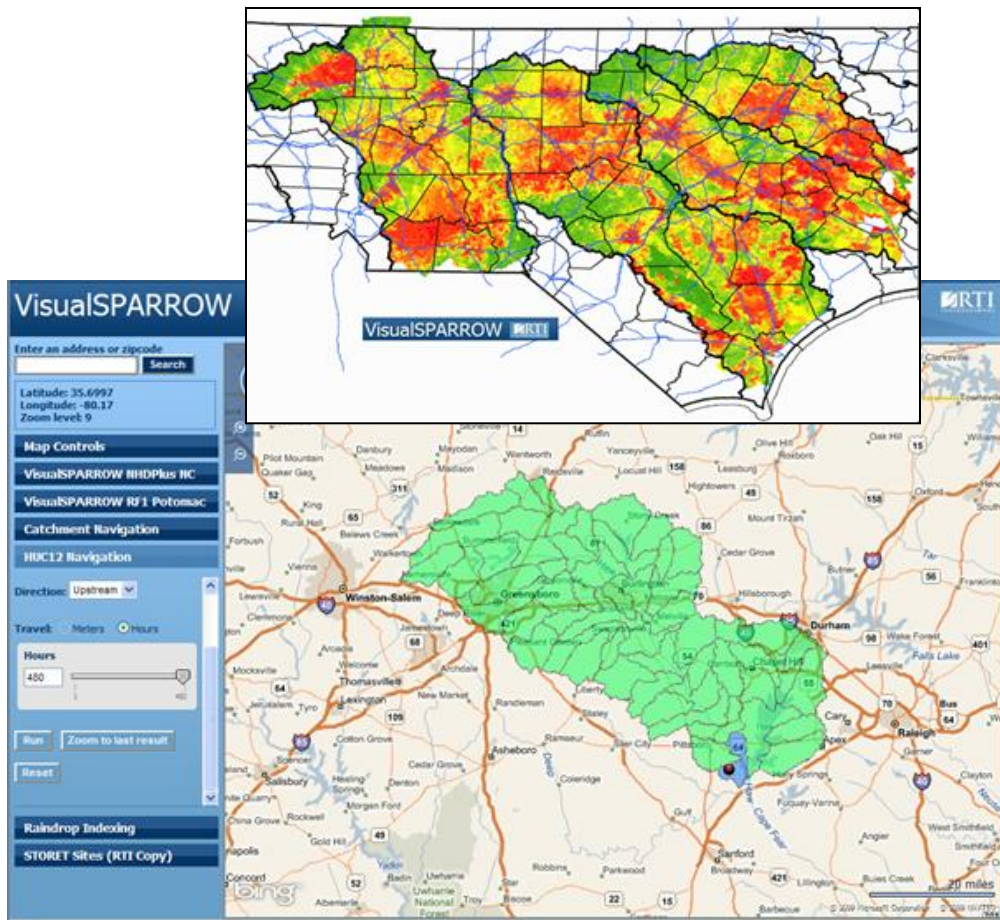
- Qian, Song and Goodall, Jonathon. 2010. Bayesian Sparrow for Understanding the Dynamic Changes in Nutrient Loadings. In *Proceedings of the AWRA 2010 GIS Specialty Conference*. Orlando, FL , (March 29-31, 2010).
- Urban, Dean. 2008. Landscape Pattern and the Accounting of Ecosystem Services. U.S. Nicholas School of the Environment and Earth Sciences of Duke University. Presented at the EPA Ecological Research Lecture Series, May 12, 2008. EPA Environmental Science Connector (<http://portal.epa.gov/ESC>) Ecosystem Services Seminar Project.
- Qian, S. S., K. H. Reckhow, J. Zhai, and G. McMahon (2005), Nonlinear regression modeling of nutrient loads in streams: A Bayesian approach, *Water Resources Research*, 41, W07012, doi:10.1029/2005WR003986.
- Reckhow, K.H. (1999) Water Quality Prediction and Probability Network Models. *Canadian Journal of Fisheries and Aquatic Sciences*. 56:1150-1158.

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Closing thoughts



- Great potential in EPA's TMDL and the Water Quality Standards programs to apply SPARROW and related decision support tools to set up watershed-based management frameworks.
- Opportunities to leverage support from non-EPA programs through state and local governments, other federal agencies, and other watershed stakeholders.

Closing thoughts

U.S. EPA. 2011. Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution. Office of Water, Memorandum Guidance, Nancy Stoner, Acting Assistant Administer for Water, March 16, 2001.

http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/memo_nitrogen_framework.pdf

U.S. EPA. 2011. National Water Program Guidance Fiscal Year 2012: Draft. EPA 850-P-11-001. Office of Water, February 2011.

http://www.epa.gov/planandbudget/annualplan/FY_2012_DRAFT_OW_NPM_Gdnce.pdf

- These new initiatives touch base with the original ideas behind the watershed management framework ...

- Watershed-based management emphasized in new EPA guidance ...

National Research Council. 1992. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy; National Research Council. The National Academies Press: Washington, DC.

http://www.nap.edu/catalog.php?record_id=1807

U.S. EPA. 1996. Watershed Approach Framework, June 1996, EPA 840-S-96-001. Washington, DC, Office of Water.

<http://water.epa.gov/type/watersheds/framework.cfm>

More Information

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