

A Watershed-Based Hydrogeographic Analysis System for Forest Products Industry Stakeholders

An Integrated Database and Geographic Information System for Industry Water Program Research

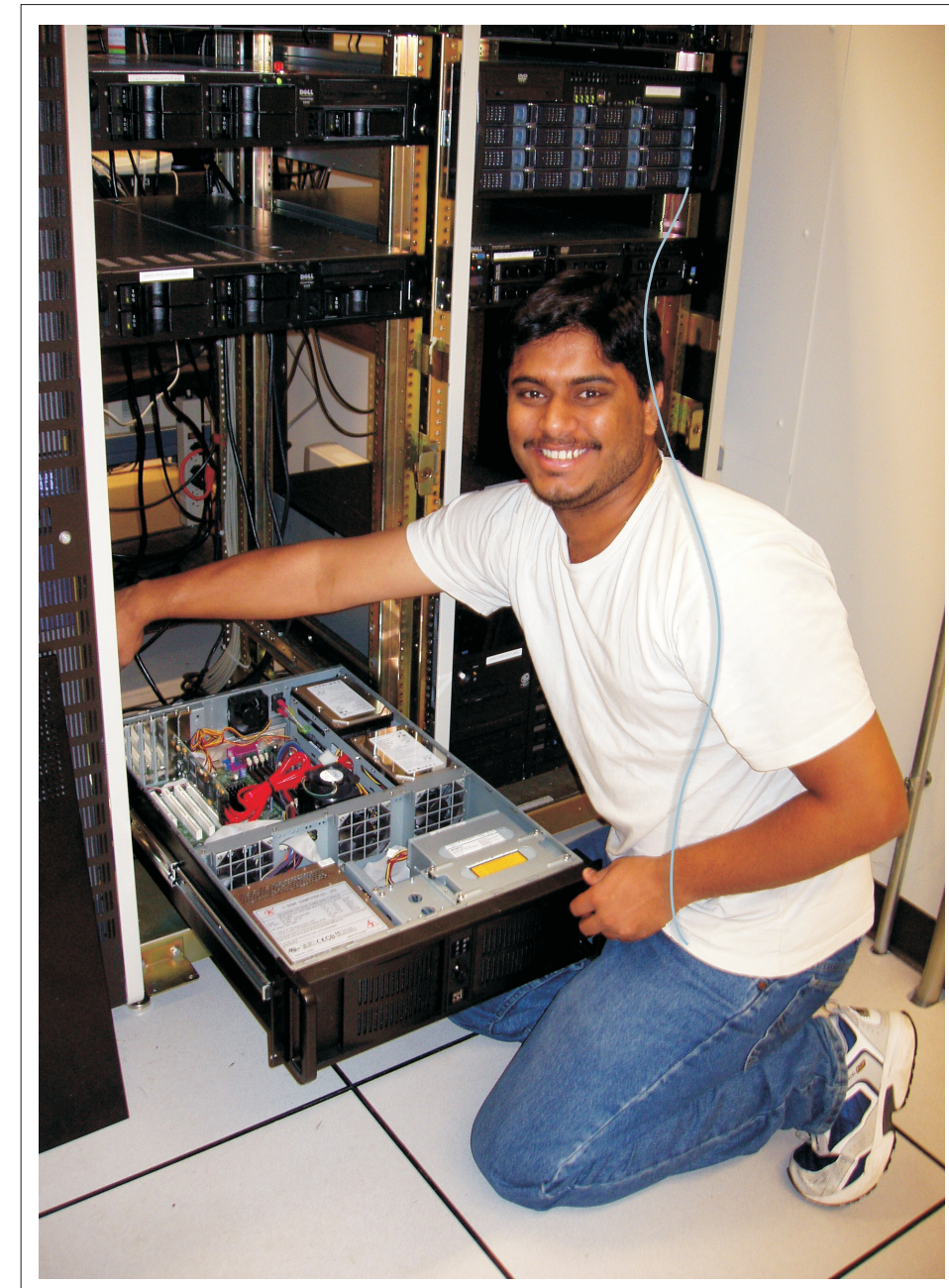
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Introduction

The NCASI hydrogeographic analysis system, also known as our Receiving Water Database (RWDB), was built as an assessment tool to better understand the potential regulatory implications of water quality initiatives and other developing water resource challenges. Example uses include assessments of potential outcomes from changes in **water quality criteria** for nutrients and aquatic life, effluent limitation guidelines, and surface water impairment determinations. Analysis of receiving water impairments (for individual companies and the industry as a whole) are important for providing information on agency expectations for total maximum daily load (TMDL) development. The database has also been used to address **water resource management policies**, critical habitat designations, and to prioritize research proposals.

Description and Purpose

Most of spatial information in this GIS database/analysis system is based on the **National Hydrography Network**, including NHDPlus. In addition to providing industry-wide assessments, this system is also designed to process information at smaller scales (e.g., river basins and specific watersheds). **Data sources** include facility locations, water quality, Clean Water Act §303(d)/TMDL information, stream flow, dams and associated impoundments, watersheds, topography, ecoregions, landuse/cover. Other agency information, including from EPA Office of Water, the USDI Nationwide Rivers Inventory, and as well as the USGS SPARROW model and StreamStats program, has been incorporated into the system for more rapid analysis of current and proposed water management activities.

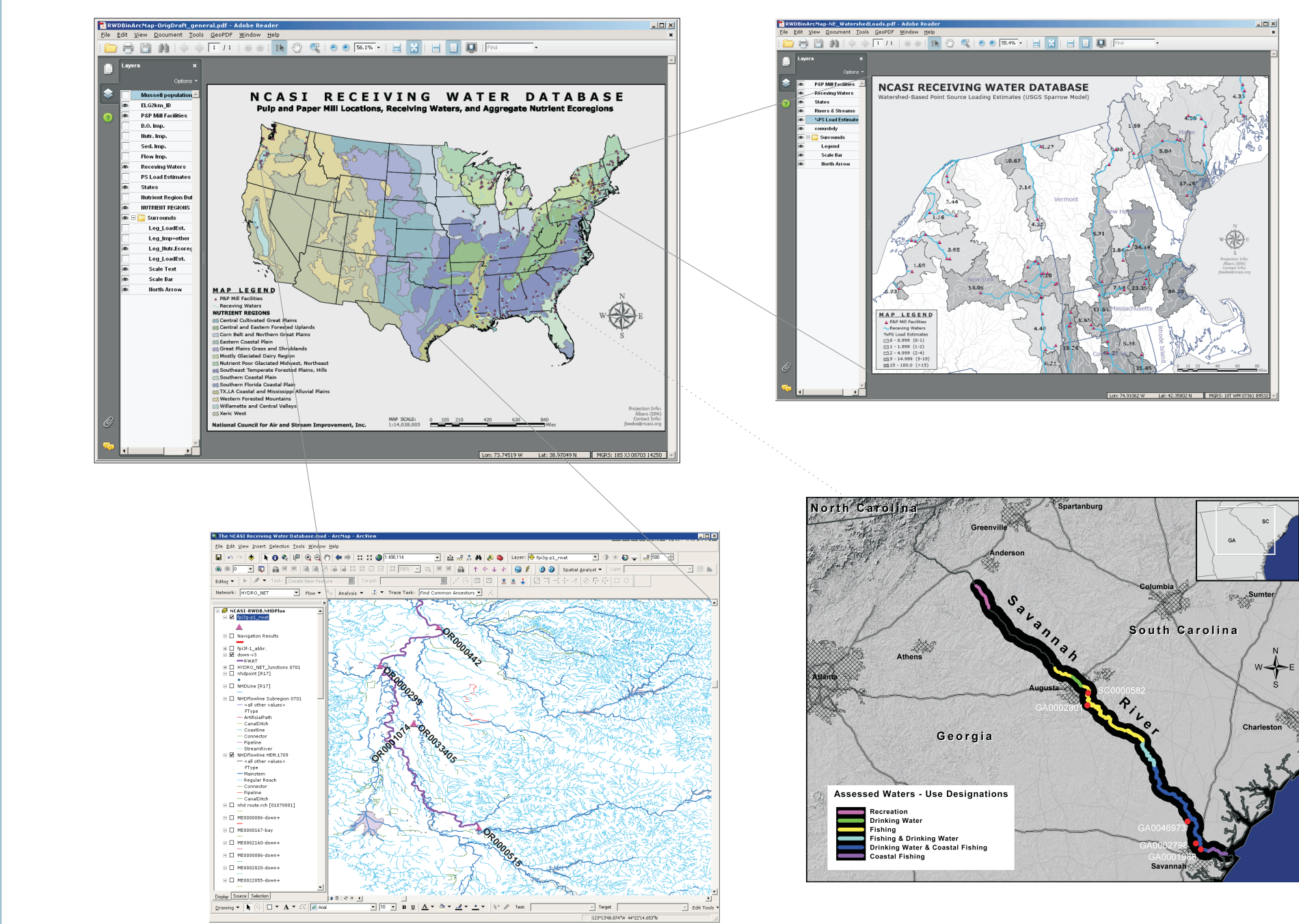


Background and Development

This analysis system originated in the mid-90s with increased interest in water quality criteria, receiving water impairments, and stream dilution ratios. It was formalized in 2003 when we combined multiple databases and GIS projects into a single, complex framework designed to efficiently access environmental data for generating technical reports and other related information. The system is designed to emphasize information for all NCASI member companies operating in nearly 300 watersheds throughout the country.

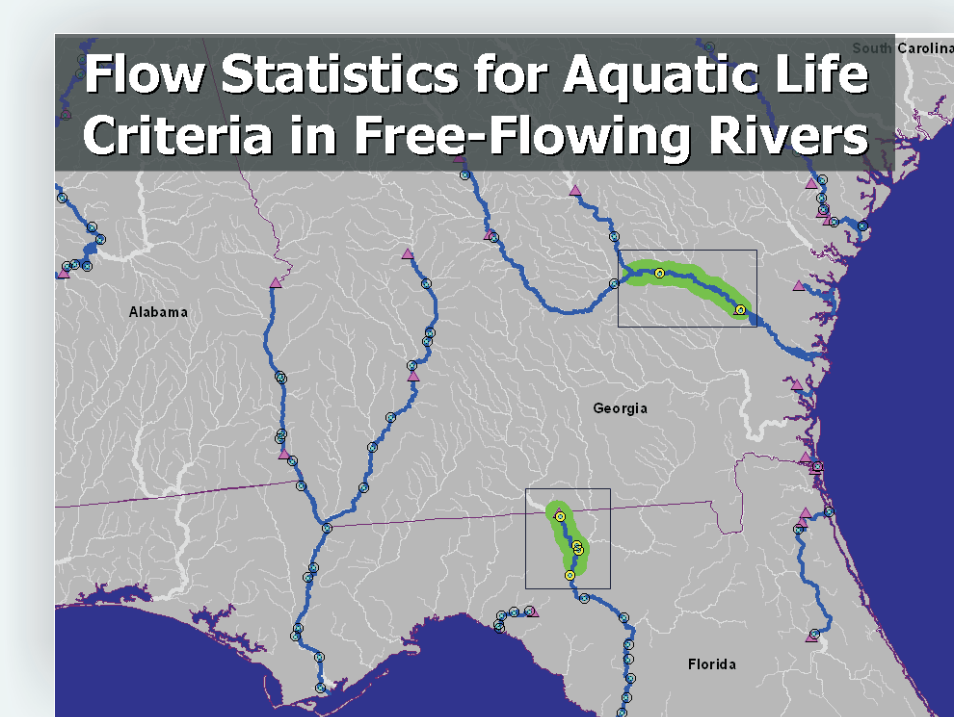


NCASI projects designed to support water quality studies include data collection and assessment to identify the industry's involvement in areas (from forestland to mill product) where waters have been identified as impacted. Studies are designed to enhance the understanding and utility of water quality models used for stream assessment, and evaluation of the appropriateness of newly recommended water quality standards.



Aquatic Life Criteria and Low Flow Statistics

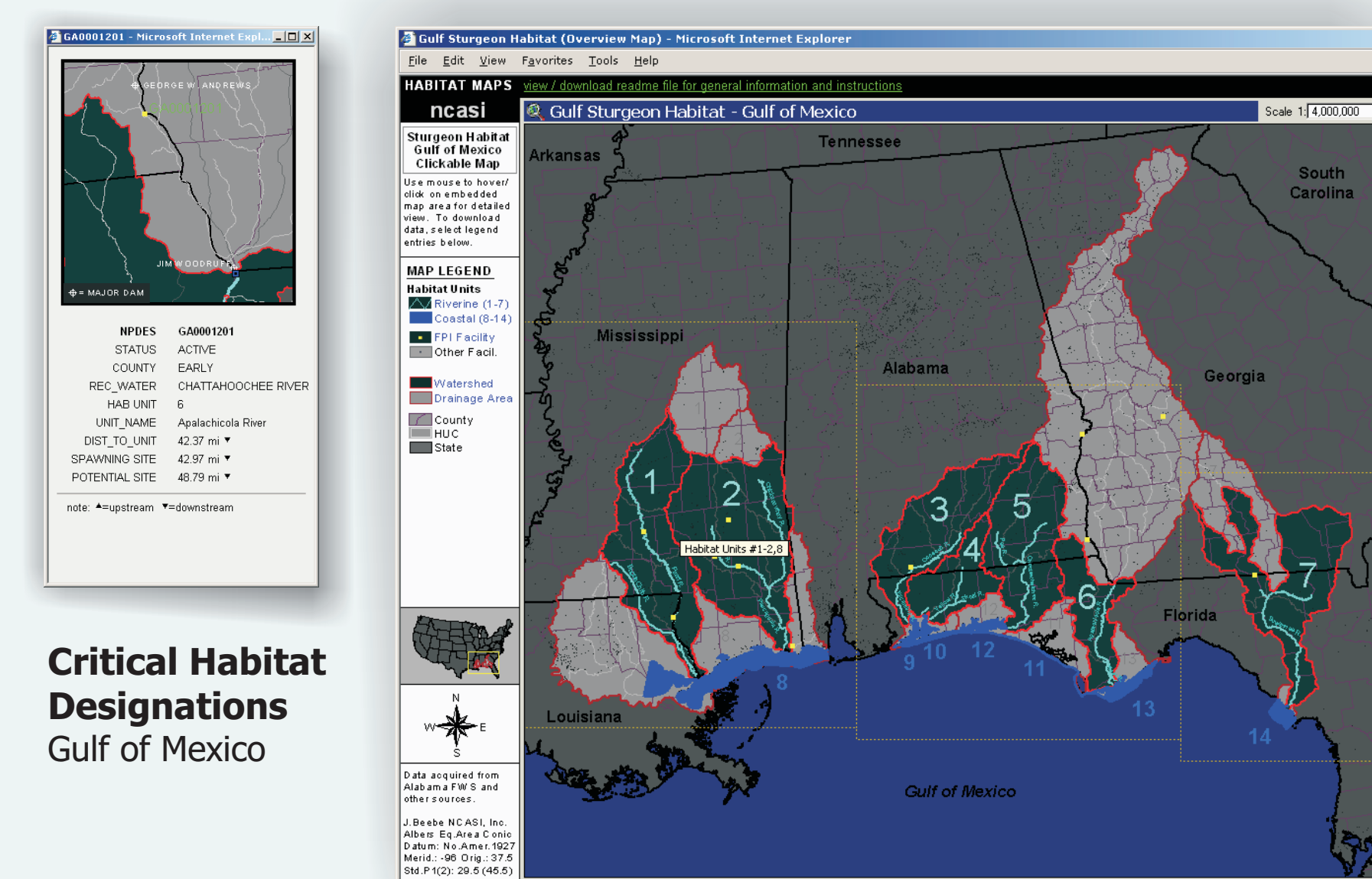
Other research using the NCASI hydrogeographic analysis system involved an evaluation of different forms of low flow statistics (i.e., 7Q10 and mean annual daily flow) under consideration for use in water withdrawal policy. Results demonstrated that low flow conditions in many areas were part of a normal, natural variation for free-flowing river systems. The RWDB was used with information from the national



StreamStats database (USGS) and ARC/INFO data from the Nationwide Rivers Inventory (USDI/NPS). The analysis compared the frequency of critical low flow conditions for river systems in the Southeast, and yielded results that had important biological as well as

policy implications. The conclusions were helpful in shaping policies that will put water withdrawal permits on a more rational, scientific basis (NCASI 2009). This analysis also led to work on a national low-flow database for industry receiving waters.

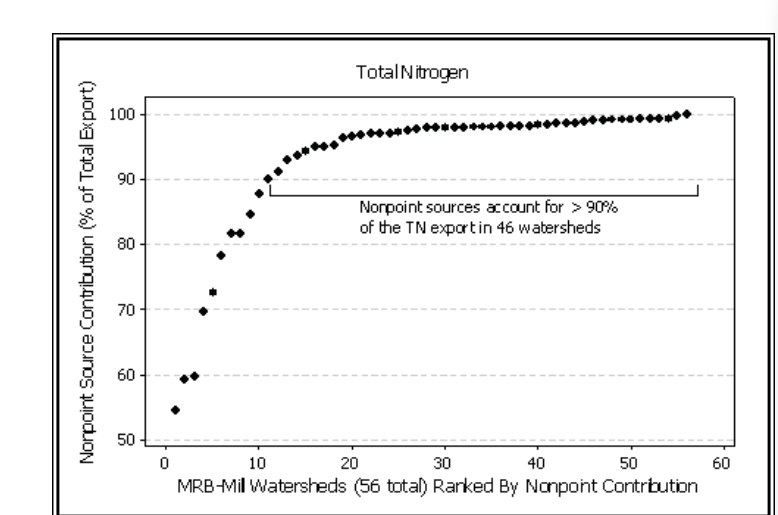
In addition to low flow analysis, the RWDB was designed to assess changes to aquatic life criteria in response to freshwater habitat designations. In 2002, the system was used to assess critical habitat designations for Gulf sturgeon by estimating distances between spawning sites and mill locations.



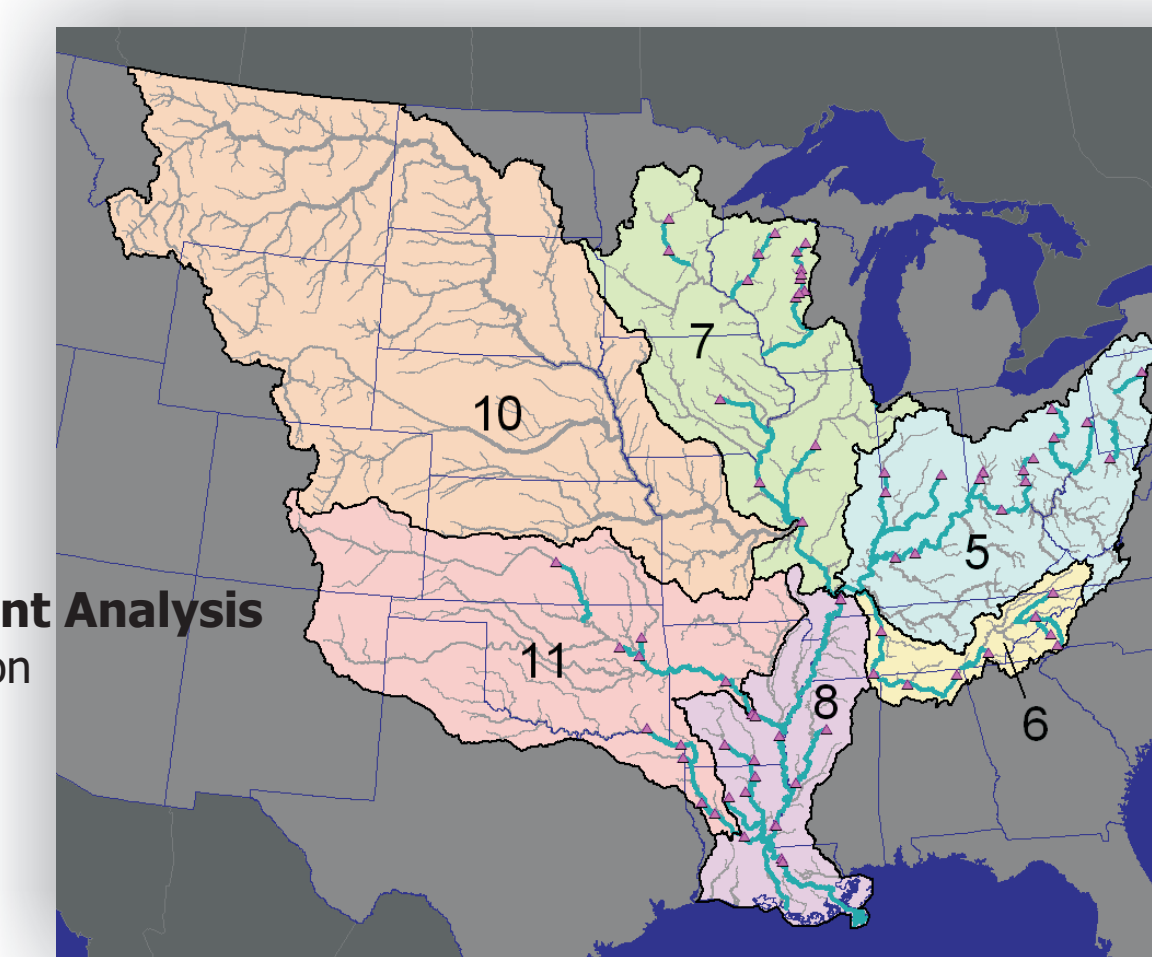
NCASI's analysis system was also used in conjunction with information on the location of dams to inventory ownership and management of dam structures associated with drinking water/water supply reservoirs. Some NCASI member companies used this information to assess overall risk of downstream areas relative to the location of specific industry facilities.

Nutrient Control Initiatives and Criteria Development

Another important example use of NCASI's hydrogeographic analysis system involved assessing the role and potential impact of forest products industry nutrient loadings within the Mississippi River Basin (MRB) in response to hypoxia in the Gulf of Mexico. This analysis demonstrated which forest product companies are not only geographically involved, but which facilities that manage nitrogen and/or phosphorus in their effluent discharges might be affected by certain river basin nutrient control initiatives. Results from our initial geographic analysis indicated that roughly one-fourth of all U.S. pulp and paper facilities are located in the MRB, even though many are located on river systems hundreds of miles from the Gulf. Using information obtained from the USGS SPARROW model, the analysis also provided a summary of estimated fractions of nutrient loadings in mill watersheds relative to other sources. For the vast majority of watersheds with one or more mill facilities, a large percentage of the estimated total nutrient loading (nitrogen and phosphorus) came from *non-point* sources, primarily agricultural.

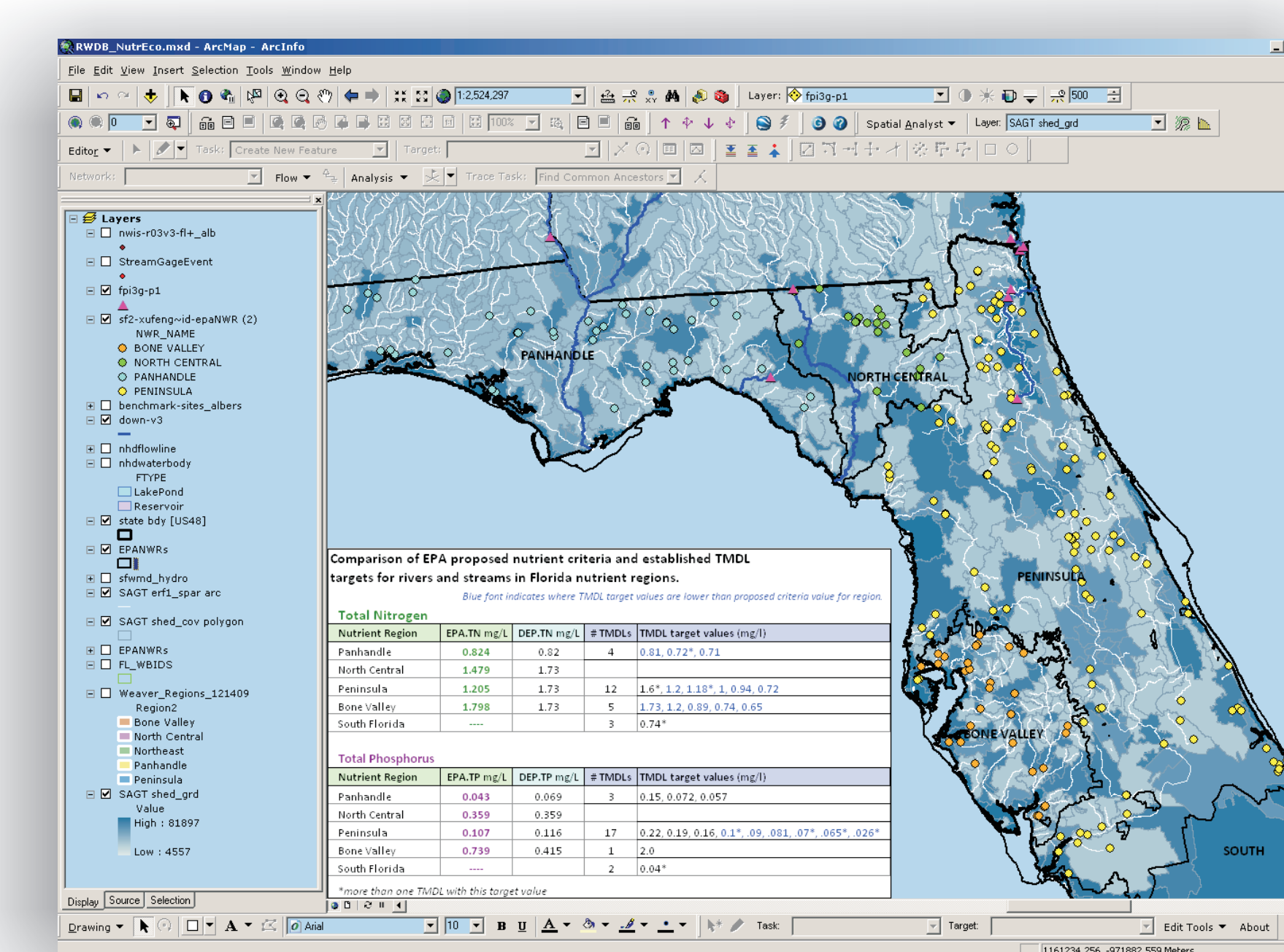


Mississippi River Basin Nutrient Analysis
Facility locations by hydrologic region



This effort also resulted in two other assessments involving national nutrient ecoregion guidelines and a national summary of nutrient loadings for the industry. As in the MRB, the national loading analysis concluded that a large majority of the industry's mills are *not* significant contributors of nutrient loads for their watersheds.

More recently, NCASI has collaborated with HydroQual and the Florida Pulp and Paper Association in an evaluation of EPA's numeric nutrient criteria proposed for the state of Florida. This effort emphasized a review of statistical analyses used in the derivation of the criteria, evaluation of the locations and associated data from designated ecoregions of the state, and a critique of output from the regional SPARROW (SAGT) model application for specific drainage areas. Components of this analysis utilized, in part, our existing analysis framework and data, in particular for areas in which mill facilities and other forest product companies operate.

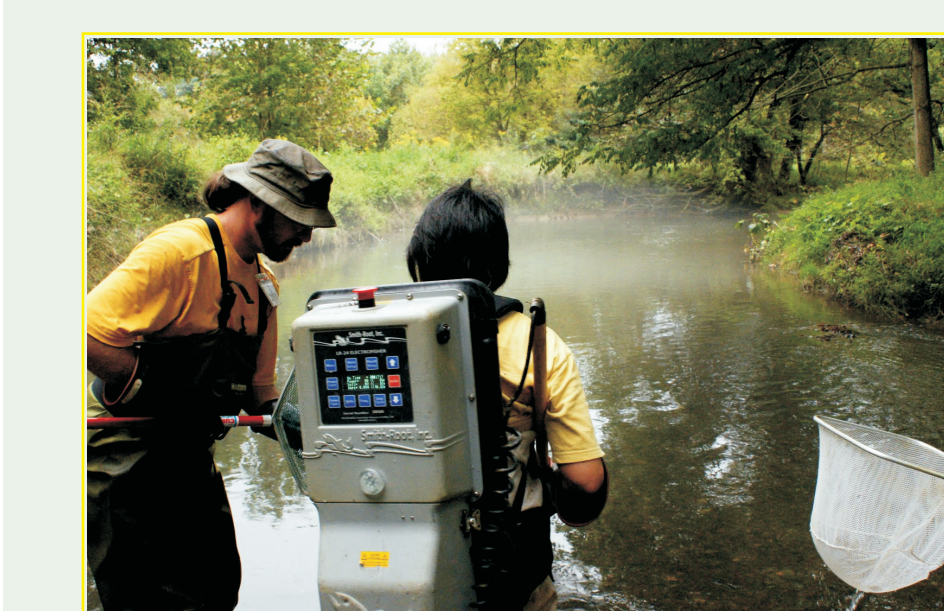


Other Uses

The system framework and RWDB have also supported the establishment of water quality studies, including research being conducted by Louisiana State University in the Flat Creek Experimental Watershed (Ice, *et al.* 2010; Xu, *et al.* 2008) which brings together spatial information on research and management activities from forest product companies operating in North Central Louisiana. The information was combined with research objectives to determine candidate sites for the collection of water quality data and other information for investigating dissolved oxygen patterns of low-gradient forested headwater streams in response to silvicultural best management practices.



This analysis system has supported other activities at NCASI including an evaluation of data from EPA's National Fish Tissue Study. At state and local levels, the RWDB has been used to respond to site-specific questions pertaining to stormwater and watershed-based permitting, evaluation of stream temperature data for criteria development,

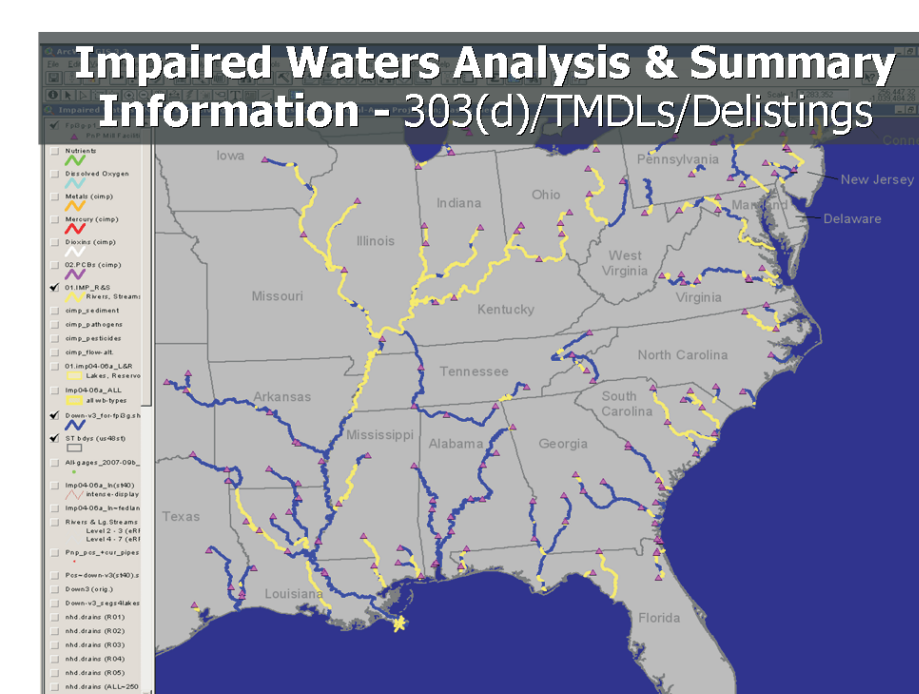


threatened and endangered species evaluations, and other activities involving the evaluation of nutrient and sediment reductions for water quality trading potential.

The current system is undergoing several major revisions to make it a more efficient and comprehensive environmental data resource for the forest products industry.

Receiving Water Impairment Analysis

In this example, we combined agency data from EPA Watershed Assessment, Tracking & Environmental Results (WATERS/RAD-IMS) with the NHD-based receiving water information we compiled for company operations around the country. Since 2005, summary



information has been used to generate comprehensive national and regional assessment reports that address, for example, what proportion of industry receiving waters include certain impairment types, and which of the 21 key industry states are leading in TMDL development activity (Beebe 2007).

Other geographical considerations for certain 303(d) listing and delisting activities have also been analyzed to better understand the potential implications of future TMDL development. Updating this information periodically has enabled NCASI to generate company and facility reports for its members. Custom reports feature KML



output for viewing impairment and TMDL information in Google Earth with direct links to web-based data such as integrated reports from EPA ATTAINS and watershed-based information from the USGS Water Resources Web.

Beebe, J. 2007. *Impaired Water Summary for the Pulp & Paper Industry*. NCASI Staff Report. January 2007. Research Triangle Park, North Carolina (RTP, NC).

National Council for Air and Stream Improvement, Inc. (NCASI). 2009. *A review of the relationship between flow, habitat, and biota in lotic systems and methods for determining instream flow requirements*. NCASI Technical Bulletin No. 961. RTP, NC.

Ice, G., Beebe, J., Xu, Y. and B. Sugden. 2010. *Forest Streams and Dissolved Oxygen: a New Understanding*. As presented at the NCASI Southern Regional Meeting. Charleston, SC.

Xu, Y.J., Beebe, J., Ice, G. 2008. *Implications of Diurnal Dissolved Oxygen Patterns in Low-gradient Forested Headwater Streams for Silvicultural Best Management Practices*. 15th Biennial Southern Silvicultural Research Conference. Hot Springs, AR.

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