******Please share these highlights with your staff or other colleagues******

Welcome to the USGS NAWQA Program Quarterly Highlights, October - December 2011

Highlights are from the USGS National Water-Quality Assessment Program (NAWQA), which has assessed the physical, chemical and biological characteristics of streams, rivers, and groundwater across the Nation since 1991.

Access: DATA STUDIES PUBLICATIONS NATIONAL MAPS MODELS

In this quarter's highlights:

Ecology

• **BioData: A National aquatic bioassessment database –** Access the USGS Fact Sheet 2011-3112 online. Learn about other NAWQA ecological national synthesis studies. For more information on the study, contact Dorene MacCoy.

BioData is a USGS web-enabled database that delivers bioassessment data collected by local, regional, and national USGS projects. BioData offers field biologists advanced capabilities for entering, editing, and reviewing the macroinvertebrate, algae, fish, and supporting habitat data from rivers and streams. It offers data archival and curation capabilities that protect and maintain data for the long term. BioData also provides the USGS with centralized data storage for delivering data to other systems and applications through automated web services. BioData currently accepts data collected using two national protocols: (1) NAWQA and (2) U.S. Environmental Protection Agency (USEPA) National Rivers and Streams Assessment (NRSA). Additional collection protocols are planned for future versions.

• **Impacts of agricultural land use on biological integrity –** Access the featured article in December 2011 issue of the Ecological Applications journal online. Learn about other NAWQA NEET studies. For more information, contact Mark Munn.

Geographic variability and causes of agricultural impacts on stream biotic integrity were investigated using 226 stream sites located in eight agriculture-dominated study units across the United States. Structural equation modeling (SEM) was used to develop a national and regional set of causal models linking agricultural land use to measured instream conditions. On the national scale, cropland affected benthic communities by altering structural habitats and imposing water quality-related stresses. Cropland had strong negative total effects on the invertebrate community in the national, Midwest, and Western models, but a very weak effect in the Eastern Coastal Plain model. Habitat effects were important in the Western Arid model, but negligible in the Midwest and Eastern Coastal Plain models. Riparian forested wetlands had positive effects on biotic integrity in the Eastern Coastal Plain and Western Arid region models, but no statistically significant effect in the Midwest. These differences in regional response to cropland and riparian cover suggest that best management practices and planning for the mitigation of agricultural land use impacts on stream ecosystems should be regionally focused.

Groundwater

• **Programs for simulation of groundwater recharge areas –** Access the featured article in the May-June 2012 issue of Groundwater journal online. For more information on the study, contact Jeffrey Starn.

Particle tracking can be used to simulate contributing recharge areas to wells or springs, but uncertainty exists in the accuracy of these recharge areas because parameters such as hydraulic conductivity and recharge have errors associated with them. Python-language scripts were developed that run a Monte Carlo simulation with Latin hypercube sampling where model parameters such as hydraulic conductivity and recharge are randomly varied for a large number of model simulations, and the probability of a particle being in the contributing area of a well is calculated based on the results of multiple simulations. Monte Carlo simulation provides a useful measure of the variability in modeled particles and parameter sets derived from the optimal parameters, their standard deviations, and their correlation matrix.

• **Modeling nitrate losses to drains and groundwater in the Corn Belt, USA –** Access the featured article in the January 2012 issue of Environmental Science and Technology journal online. For more information on the study, contact Bernard Nolan.

Nitrate losses by tile drains to streams and by leaching in the unsaturated zone to groundwater in the Corn Belt, USA, were predicted using metamodels that consist of artificial neural networks to simplify and upscale mechanistic fate and transport models. The models used readily available data comprising farm fertilizer nitrogen (N), weather data, and soil properties as inputs. The models effectively related the outputs of the underlying mechanistic model (Root Zone Water Quality Model) to the inputs. Predicted nitrate generally was higher than that measured in groundwater, possibly as a result of the time-lag for modern recharge to reach well screens, denitrification in groundwater, or interception of recharge by tile drains.

• **Assessing the vulnerability of public-supply wells to contamination--Edwards aquifer near San Antonio, Texas –** Access the USGS Fact Sheet 2011-3142 online. For more information on the study, contact Martha Jagucki.

A public-supply well field consisting of 6 production wells set in the Edwards aquifer near San Antonio, Texas, was assessed for vulnerability to contamination. Overall, the study findings point to four primary factors that affect the movement and fate of contaminants and the vulnerability of the well field: (1) groundwater age (how long ago water entered, or recharged, the aquifer), (2) fast pathways for flow of groundwater through features formed or enlarged by dissolution of bedrock, (3) recharge characteristics of the aquifer, and (4) natural geochemical processes within the aquifer. Constituents of concern in the Edwards aquifer for the long-term sustainability of the groundwater resource include nitrate and anthropogenic contaminants such as atrazine, tetrachloroethene, and chloroform. Groundwater-flow-model particle tracking indicated that the concentrations would begin to respond to contaminant loading in the recharge zone within 1 year. Within 10 years, contaminant concentrations in the public-supply well would be equal to 90 percent of the input concentration for a contaminant (such as nitrate) that does not degrade in the oxic conditions of the Edwards aquifer.

• **O_2 reduction and denitrification rates in shallow aquifers –** Access the featured article in the December 2011 issue of Water Resources Research journal online. For more information on the study, contact Jim Tesoriero.

O_2 reduction and denitrification rates were determined in shallow aquifers of 12 study areas representing a wide range in sedimentary environments and climatic conditions. O2 reduction rates varied widely within and between sites. Moderate denitrification rates were observed in most areas with O2 concentrations below 60 μmol L−1, while higher rates occur when changes in lithology result in a sharp increase in the supply of electron donors. Denitrification lag times (i.e., groundwater travel times prior to the onset of denitrification) ranged from <20 yr to >80 yr. The availability of electron donors is indicated as the primary factor affecting O2 reduction rates. Electron donors from recharging dissolved organic carbon are not sufficient to account for appreciable O2 and nitrate reduction. These relations suggest that lithologic sources of dissolved organic carbon and sulfides are important sources of electrons at these sites but surface-derived sources of dissolved organic carbon are not.

Streams

- **Application of the SPARROW watershed model to describe nutrient sources and transport in the Missouri River Basin –** Access the USGS [Fact Sheet 2011-3104] online. For more information on the study, contact [Julianne Brown]. Learn more about NAWQA [SPARROW] models.

Spatially Referenced Regression On Watershed attributes (SPARROW) models were developed to provide spatially explicit information on local and regional total nitrogen and total phosphorus sources and transport in the Missouri River Basin. Model results provide estimates of the relative contributions from various nutrient sources and delivery factors. The models also describe instream decay and reservoir and lake attenuation of nutrients. Results aid in the prioritization of nutrient-reduction strategies by identifying major sources and delivery factors contributing to instream nutrient loads and stream reaches carrying the largest nutrient loads in the Missouri River Basin.

- **Congressional Briefing on SPARROW Model –** Access the USGS [Multimedia Gallery Home Video 462] online. For more information on the study, contact [Stephen Preston].

In this briefing, USGS demonstrated a new and innovative online decision support system used to identify sources of nutrients to downstream waters, such as the Gulf of Mexico, Long Island Sound and others. The decision support system provides access to six newly-developed regional models that describe how rivers receive and transport nutrients to sensitive waters. This decision support system saves time and resources by giving water managers access to sophisticated water-quality models that relate nutrient sources, such as atmospheric deposition, agriculture, waste water treatment plants, and others, to stream water-quality conditions. Managers can easily map and track predictions of nutrient conditions, sources, and quantities transported to downstream waters, and evaluate alternative nutrient reduction scenarios.

- **TOPMODEL simulations of streamflow and depth to water table in Fishing Brook Watershed, New York, 2007-09 –** Access the USGS [Scientific Investigations Report 2011-5190] online. For more information on the study, contact [Elizabeth Nystrom]. Learn about other NAWQA [Mercury] studies.

Streamflow and depth to water table for the period January 2007–September 2009 was simulated in the Fishing Brook Watershed in northern New York using TOPMODEL, a physically based, variable-source area rainfall-runoff model. TOPMODEL uses a topographic wetness index computed from surface-elevation data to simulate streamflow and subsurface-saturation state, represented by the saturation deficit. Depth to water table was computed from simulated saturation-deficit values using computed soil properties and matched observed water-table depth moderately well. The calibrated TOPMODEL results for the entire study area were applied to several subwatersheds within the study area using computed hydrogeomorphic properties of the subwatersheds.

Share these highlights with your staff or other colleagues.

To subscribe to USGS nawqa-highlights, send an email message to: Listproc@listserver.usgs.gov with a message body - **subscribe nawqa-highlights FirstName LastName** (example: subscribe nawqa-highlights John Smith)

IMPORTANT NOTES:

- A **subject line is not required.**

- subscribe/unsubscribe and listname may be lower or upper case

- No characters can appear in front of the word subscribe. For example: " /0/0 subscribe nawqa-highlights John Smith" will result in an error and your email address will not be subscribed to the nawqa-highlights mailing list.

- Both FirstName and LastName are required. For example, “subscribe nawqa-highlights” will result in an error, and your email address will not be subscribed to the nawqa-highlights mailing list.

- Do not enter a middle name, the listserver will only read two names.

- Make sure that your "subscribe request" is the only line of text in the message body. Any text characters appearing after the subscription request will result in an error message being sent to your email address. For example, a signature will result in the listserver emailing you an error message.

- The USGS list server will email you an acknowledgement of your subscription.

To unsubscribe to USGS nawqa-highlights, send an email message to: Listproc@listserver.usgs.gov (a subject line is not required) with a message body: **unsubscribe nawqa-highlights**

The USGS list server will email you an acknowledgement of your unsubscribe request.

You must send your unsubscribe email request from the same email address that you used to subscribe to the nawqa-highlights mailing list.