## National Phenology Network Developing

For more than two years, Julio Betancourt of the Desert Laboratory of the USGS in Tucson has been collaborating with Mark Schwartz of the University of Wisconsin-Milwaukee and scientists from various disciplines, federal agencies, academic institutions, and environmental networks to develop a national phenology observation network for the United States (USA-NPN). Now, with funding from the USGS and the University of Arizona, the National Coordinating Office has been established at the University of Arizona, an executive director is about to be hired, and design of the cyber infrastructure to manage all the observations is underway.

Phenology is the study of periodic plant and animal life cycle events that are influenced by environmental changes, especially seasonal variations in temperature and precipitation driven by weather and climate. Such events include the timing of leafing, flowering, and fruiting in plants, agricultural crop stages, insect emergence, and animal migration. Variations in phenophase affect the abundance and diversity of organisms, their interactions, their ecological functions, and their effects on fluxes in water, energy, and chemical elements at various scales. Phenological data and models are used in agricultural production, integrated pest and invasive species management, drought monitoring, wildfire risk assessment, and treatment of pollen allergies.

The USA-NPN aims to establish a national network of integrated phenological observations comprising four components or tiers, representing different levels of spatial coverage and quality/quantity of phenological and related environmental information: 1) locally intensive sites focused on process studies (such as AmeriFlux, which monitors ecosystem-level exchanges of carbon dioxide, water, and energy); 2) spatially extensive scientific networks focused on large-scale phenomena (such as National Weather Service cooperative observer stations and National Park Service monitoring sites); 3) volunteer and educational networks; and 4) remote sensing products that can be ground-truthed and assimilated to extend surface phenological observations to the continental scale.

*Visit www.uwm.edu/Dept/Geography/npn/.*

## Pacific Institute Fights for Science Integrity

*From the Pacific Institute*

The California-based Pacific Institute recently launched an Integrity of Science Initiative to respond to and counter what it perceives as the assault on science and scientific integrity in the public policy arena, especially on issues related to water, climate change, and security. The new initiative supports sound science, exposes fraudulent use and abuse of scientific discovery, educates policymakers and the public, and refutes the doubters.

During the past decade, a small number of organizations have waged a concerted effort to substitute partisan "science" in order to advance narrow political agendas, silence researchers, and muddy good science. The media paid close attention to the deliberate tampering and editing of EPA climate change documents by non-science senior White House officials. Unfortunately, most efforts to subvert science do not command such media attention. As a result, these efforts to undermine sound policymaking and blur the public perceptions of science go unanswered and are alarmingly successful.

In recent years, the Pacific Institute has worked to educate journalists on the science behind climate change, the economics of effective water policies, and the dark side of bottled water marketing; successfully fought off a lawsuit from a "climate change skeptic"; joined more than 8,000 scientists to voice concern over the current administration's misuse of science; and written numerous editorials calling for an end to science-bashing. Going forward, the Pacific Institute is committed to continuing the fight through its new Integrity of Science blog and other efforts.

*Send examples of science misuse and abuse to integrityofscience@pacinst.org. Read and comment on the Integrity of Science blog at scienceblogs.com/integrityofscience/.*

## 'Nanorust' Removes Arsenic from Drinking Water

The discovery of unexpected magnetic interactions between ultrasmall (smaller than viruses) specks of rust is leading scientists at Rice University's Center for Biological and Environmental Nanotechnology to develop a new, low-cost technology for cleaning arsenic from drinking water. The new technique was described in the Nov. 10 issue of *Science*.

"Magnetic particles this small were thought to only interact with a strong magnetic field," center director and lead author Vicki Colvin said. "Because we had just figured out how to make these particles in different sizes, we decided to study just how big of a magnetic field we needed to pull the particles out of suspension. We were surprised to find that we didn't need large electromagnets to move our nanoparticles, and that in some cases hand-held magnets could do the trick."

The experiments involved suspending pure samples of uniform-sized iron oxide particles in water. A magnetic field was used to pull the particles out of solution, leaving only the purified water. By measuring the particles after they were removed from the water, researchers determined that the particles were not clumping together after being tractored by the magnetic field.

"It turns out," co-author Doug Natelson explained, "that the nanoparticles actually exert forces on each other. So, once the hand-held magnets start gently pulling on a few nanoparticles and get things going, the nanoparticles effectively work together to pull themselves out of the water."

Because iron is well known for its ability to bind arsenic, Colvin's group repeated the experiments in arsenic-contaminated water and found that the particles reduce the amount of arsenic to levels well below the EPA's drinking water standard.

Preliminary calculations indicate the method could be practical for settings where traditional water treatment technologies are not possible. The cost of the materials could be quite low if manufacturing methods are scaled up. The primary raw materials used to prepare the iron oxide are rust and fatty acids, which can be obtained from olive oil or coconut oil.

*Visit cben.rice.edu.*

## New Mexico's First Artificial Recharge Project Planned

Having observed its neighboring states artificially recharging aquifers for decades, the first such project in New Mexico has appeared on the horizon. The Albuquerque-Bernalillo County Water Utility Authority is planning a $1 million study to test the feasibility of diverting water from the Rio Grande into an arroyo, which will serve as a natural recharge basin, according to an *Associated Press* report in the *Albuquerque Tribune*.

Although the project must first be approved by the state, the utility hopes to begin the project this fall, using about 1,000 acre-feet of river water to measure the recharge rates that can be achieved, said the *AP* report. Monitoring wells and instrumentation will be used to track its progress to the aquifer 300-500 feet below the surface.

*AP* interviewed John Stomp, manager of the city-county water utility, who said underground storage and recovery is "part of the utility's long-range plan." Eventually the utility hopes to bypass the recharge basin and use recharge wells to inject river water treated to drinking water standards directly into the aquifer.

*Visit www.abqtrib.com.*

*Crossroads, continued from page 25*

major dams are removed, surface-water withdrawal rates would likely decrease.

Groundwater resources will not be the answer: impacts to aquifers from excessive pumping in the latter half of the 20th century will limit new groundwater development and future use. Furthermore, climate variability is expected to affect snowfall and precipitation, the timing of spring runoff, and streamflow volumes, resulting in many regions experiencing significant reductions in reservoir storage, and surface-water and groundwater availability.

These limitations on fresh water supplies are forcing expansion of the use of nontraditional waters such as brackish water, seawater, and wastewater to supplement supplies in many areas. The growth in nontraditional water use over the past decade has been remarkable as water treatment technologies have matured. Wastewater reclamation and reuse and desalination are growing at rates of 15 and 10 percent per year, respectively. As shown in the chart below left, nontraditional water consumption is predicted to equal fresh water consumption for nonagricultural needs by 2035.

### Addressing Energy and Water Resource Challenges

The chart below right shows that projected growth in water consumption for energy is the major driver for future water demands. These new water demands will increasingly be met by the use of nontraditional water resources. Energy demands for water alone could outstrip available nonagricultural fresh water supplies by 2035. These interdependencies between energy and water and their impact on future economic growth are being recognized by energy officials and energy and water managers. For example, in mid-2005, Congress funded the Department of Energy to develop an energy-water report to Congress to help identify and quantify emerging energy and water challenges and issues (DOE, 2007). Congress also funded a series of regional workshops to help identify research and development efforts to address these emerging challenges and issues (see *www.sandia.gov/energy-water*). These efforts are the first steps in improving and coordinating energy and water resource planning and development to ensure future energy and water reliability and sustainability.

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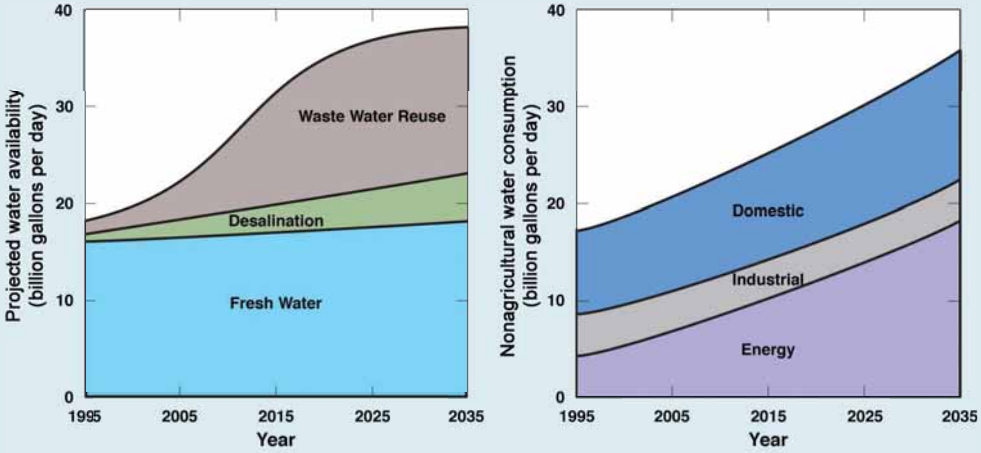


*Nonagricultural water consumption and water supply trends for the United States, 1995-2035.*