



# DIVINING ROD

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

Vol. XXIX, No. 2

May 2006

## New Mexico critical water issues survey results reported

*Frank Ward, New Mexico State University  
Member, New Mexico Water Science and Education Center*

In response to a 2004 request by new NMSU president Michael V. Martin, a center of research excellence at the university in natural resources was established. The New Mexico Water Science and Education Center unveiled its strategic plan in May 2005. That vision consists of being a regional, national, and international leader in water research, technology, education, service, and policy.

New Mexico faces major challenges in ensuring an adequate, safe, and reliable water supply for the long term. This challenge affects every New Mexican, touches all parts of the state, and influences both current and sustainable economic growth of New Mexico. The severe and sustained drought currently affecting the state and southwest region has added urgency to the challenge.

New Mexico's water supply is finite and highly variable. In many areas it is not sustainable given present use levels, let alone future demands. Most of the state's surface water is already claimed, although only a small percentage of the state's streams has been adjudicated. So in many parts of the state, legal rights to appropriate water exceed the supply.

NMSU has 84 faculty members conducting water-related studies in more than 20 departments and centers. The Center hopes to enhance the cross-campus and external linkages among these programs required to deliver valued and science-based outcomes to water related problems.

The Center supports the mission of NMSU by providing leadership in the application of basic and applied science for the effective management of water resources in several ways. These include (1) enhancing excellence in water resources research; (2) promoting educational opportunities in water resources; (3) supporting information and technology transfer programs; and (4) providing expertise in public service activities.

To support a direction for future water resources programs at NMSU, the Center decided in September 2005 to survey New Mexico water experts and water stakeholders to solicit their views on critical water program needs in New Mexico. The first wave



### INSIDE

Call for Abstracts  
technical symposium

page 3

NMSU student studies ET  
of pecan trees

page 4

science fair students receive  
WRRRI recognition

page 6



(continued from page 1)

of the survey was administered to the 300 attendees at the October 2005 50<sup>th</sup> annual water conference in Las Cruces. A follow up wave was administered to 1,900 New Mexicans registered on the New Mexico Water Resources Research Institute's mailing list. The survey consisted of a request to rank the importance of 46 water issues to help guide NMSU's future water research agenda. These included 15 water supply areas, 19 water demand problems, and 11 water institutional issues.

Respondents were asked to rank the importance of those 46 areas in terms of their importance for future research, teaching, and service directions for the university. Among the 244 returned surveys, the top 9 issues are listed below.

The intent of the Center is to help NMSU serve as the objective platform to bring together a large number of different perspectives to provide balanced contributions to discussions and debates on New Mexico's water resources

plans, water policies, water programs, water administration, and water legislation.

The Center recognizes the importance and needs of agriculture, cities, industry, and the environment. It also recognizes the importance of responsible growth, building, and sustaining of New Mexico's economy, producing and sustaining high paying jobs, and responsibly managing the state's water supplies.

The Center also acknowledges the importance of promoting awareness of critical water issues at all levels, including the highest decision-making level, to facilitate efficient conservation, protection, development, planning, management and use of water in all its dimensions on an environmentally sustainable basis for the benefit of New Mexicans.

Future *Divining Rod* newsletter articles will describe NMSU's current research activities and expertise regarding the critical water issues identified in the survey and discuss NMSU's water research agenda in more detail.

## **Top Issues in New Mexico for Future Water Research, Teaching, and Service**

- Improve existing supply enhancing technologies.
- Assess levels of vulnerability of New Mexico aquifers.
- Examine cost effective methods to promote water conservation.
- Improve water use efficiency and increase economic returns for water used.
- Increase safety of wastewater treated for use as drinking water.
- Promote conjunctive use of surface water and groundwater.
- Develop better measures for reducing water pollution.
- Understand what influences water use by agriculture, municipal, industrial, and environmental users.
- Understand effects of land use changes on water pollution.



# Call for Abstracts

## Presentations and Posters



*Monica Enke, master's student at Eastern New Mexico University collects sediment samples.*

## 2006 New Mexico Water Research Symposium

One-day Technical Symposium

Macey Center,  
New Mexico Tech  
August 15, 2006

Abstracts for consideration for presentations and/or posters at the 2006 New Mexico Water Research Symposium will be accepted through July 7, 2006. Abstracts related to any and all water research and management topics will be considered. Abstracts must not exceed 250 words or a single page and must be submitted online via the New Mexico Water Resources Research Institute's homepage. All accepted abstracts will be made available to participants.

Presenters whose papers are accepted for oral presentations will be limited to a 20-minute talk. All speakers and poster presenters must register for the Symposium by July 28, 2006. The registration fee for everyone, including speakers, poster presenters, and other attendees is \$20. The fee will be waived for students presenting an accepted paper or poster. The fee includes a reception, lunch, breaks, and notebooks with abstracts. All registration is online via the WRRI's homepage at <http://wrri.nmsu.edu>.

Final symposium agendas will be emailed to all poster presenters and speakers in early August and will be posted on the WRRI website.

### Student Paper and Poster Competition

This year the American Water Resources Association, New Mexico Section, will sponsor a student presentation and poster competition. Two awards of \$200 each will be presented in both categories, posters and oral presentations. Award winners will be announced at the symposium.



*Simone-Camille Yelah Tar in the life sciences lab at New Mexico Highlands University.*

### Technical sessions will be organized around these topics:

- water and wastewater treatment and reuse
- erosion and sediment control
- water quality
- economics and policy analysis
- watershed assessment, planning, and management
- wetlands and riparian issues
- agricultural, industrial, and municipal water use
- atmospheric, surface, and groundwater modeling
- fish and wildlife; endangered species
- groundwater
- water supply
- water management
- impaired water
- desalination
- pollution prevention
- water security
- public health
- ecosystem services

### TIMETABLE

Abstract Deadline: July 7  
Acceptance Notification: July 21  
Registration Deadline: July 28  
Symposium Reception: August 14  
5:30-6:30 pm  
Symposium: August 15

Sponsored by the New Mexico Water Resources Research Institute  
in cooperation with  
Sandia National Laboratories, Los Alamos National Laboratory, University  
of New Mexico, New Mexico Tech, New Mexico State University, New  
Mexico Interstate Stream Commission, New Mexico Office of the State  
Engineer, U.S. Geological Survey, American Water Resources Association -  
New Mexico Section



# Civil engineering student studies wind profile in pecan orchard

by Sara Ash, WRII

Eric Lopez, a senior civil engineering student at New Mexico State University, agilely climbs a 75-foot tall tower in the middle of a Stahmann Farms pecan orchard, checking his instruments along the way. Working with Dr. Salim Bawazir, he aims to determine if the logarithmic estimation of the vertical wind profile of pecan trees is as accurate or reliable as the same estimation for short agricultural crops.

Wind is a major factor in evapotranspiration (ET) rates, but is not usually directly measured. Traditionally, the vertical wind profile of short agricultural crops has been estimated using a logarithmic relation. In order for the logarithmic function to estimate the wind profile accurately, the surface of the crop must be relatively smooth, and the boundary layer must be under conditions of neutral atmospheric stability. The surface structure of pecan trees is much rougher than short agricultural crops, such as alfalfa. The pecan trees at Stahmann Farms are forty to sixty-five years old, approximately 50 feet tall, and 1.25 to 1.64 feet in diameter. There are thirty feet between trees and sixty feet between rows, which allow the wind to penetrate into the canopy.

To measure the wind profile, Lopez attached three anemometers to a 75-foot tall tower. They were originally located at 48.6 feet, 52.5 feet, and 62.3 feet in height along the tower; however, as the growing season progressed, he moved the anemometers to 52.3 feet, 57.5 feet, and 68.6 feet. "Because of increased foliage, I had to raise the anemometers to get better results," he says. A fourth sensor, at 61.5 feet on the tower, measures more



*Eric Lopez attaches a thermocouple wire to the tower located at Stahmann Farms, south of Las Cruces, New Mexico.*

Photos by Sara Ash

accurately and provides verification for the other three sensors.

The anemometers measure the horizontal wind speed through the canopy, and the vertical placement of the anemometers along the tower provides a vertical wind profile. A data logger, powered by a battery that recharges with a solar panel, collects one sample per second from each of the anemometers and averages the data every thirty minutes. The data provide a daily vertical wind profile during the day.

Lopez used the data averaged every thirty minutes to find daily means. On days of the year 202, 208, 209, 210, and 216, the wind profile followed the logarithmic profile similar to that of short

crops. Since the wind profile is logarithmic, it allows for predictions of wind behavior within and above the canopy of pecan trees and for estimations of evapotranspiration, which according to Lopez are quite beneficial.

Using a graphical procedure, the zero plane displacement, roughness length, friction velocity, and the shearing stress were determined. The average roughness length was 0.003 meter; the average friction velocity was 0.120 meters/second, and the zero plane displacement was 14.64 meters. These results were based only on data from the growing season. Further research during the off season will be conducted to determine wind profile changes throughout the seasons.

*(continued on page 5)*



*(continued from page 4)*

“This research has been a good learning experience,” Lopez says. The outcomes of his research will benefit farming, because better estimates of ET help determine how much water is needed and when to water a particular crop, thereby saving water. “This research will improve estimation of plant water use and show us how to use water more conservatively,” he asserts.

When asked how he became interested in this research, Lopez replied that he has always been interested in agriculture and engineering because his family owns a 107-acre farm in Carlsbad, New Mexico. He also credits his advisor, Dr. Bawazir, who “has been really helpful. He makes the subject interesting.”

Lopez plans to continue his education after graduating this year from New Mexico State University. Currently, he is thinking about pursuing a master’s degree in civil engineering with an emphasis on water resources. He may go on to pursue a doctorate in agricultural engineering, although becoming a professional engineer also appeals to him.

He will soon install a 3D sensor system onto the tower. “The maximum number of sensors that we can have is five,” Lopez says, “but this sensor will verify all of the friction velocity calculations made so far. We can tell from that if our numbers are off or not.” Also in the near future contingent on funding, he will install a new tower in a young pecan orchard to continue his research.



*Eric Lopez and fellow civil engineering student Atzuko Reveles install anemometers at different heights along the tower.*



*At 75 feet above the ground, Eric Lopez checks the instruments at the top of the tower.*

**Mark Your Calendars!!**

**51<sup>st</sup> Annual New Mexico Water Conference**

**October 3-4, 2006**

**Hotel Albuquerque Old Town**

This year’s conference will highlight **Water Quality Issues**

Program details available on the WRRRI website as they become available: <http://wrrri.nmsu.edu>



# Students present water-related science fair projects at state competition

Middle and high school students received recognition from the WRRRI for their water-related science projects on April 8 at the 2006 New Mexico Science and Engineering Fair. Students from around the state qualified through their local science fair competitions to compete at the state fair in Socorro.

In the Senior Division, Tara Elkins of Grants High School was awarded first

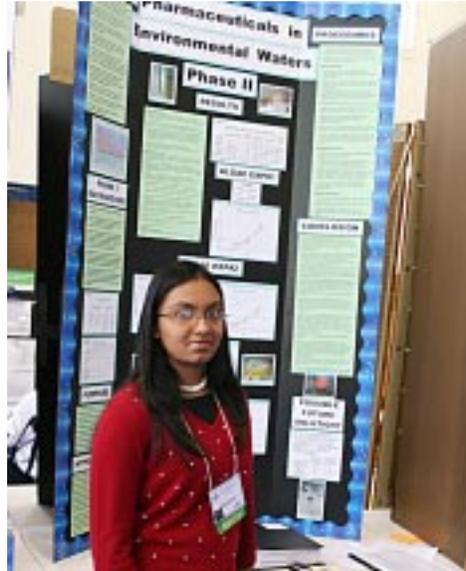
the polluted water just a few hundred feet below them, but only a small few have a fact-based, strong understanding of the issue.” Tara looked at the trends in migration of contaminants in the alluvial aquifer southwest of the tailings pile. She reviewed the data collected from 16 wells over a nine-year period by Homestake Mining Company.

Tara concluded it is possible that plotting more data points and further research of the idea could possibly uncover a more apparent trend.

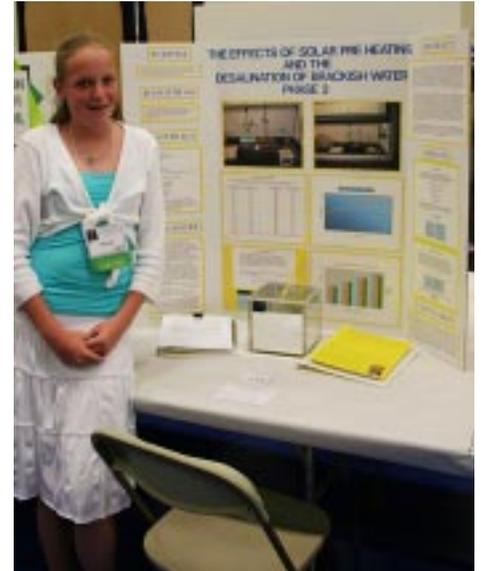
Tara will attend Hillsdale College in Hillsdale, Michigan next fall and is interested in public policy. She plans to double major in political economics and international business with a minor in biology. She has participated in the New



Tara Elkins photos by Sara Ash



Bushrah Hossain



Nicole Puissant

place and \$100 for her project entitled, *Contamination Migration: An Analysis of Contamination in the Alluvial Aquifer Southwest of the Grants Mill and Tailing Pond*. Tara, a high school senior, studied a controversial debate concerning contamination in and near the Homestake Milan Uranium Mill/tailing ponds located to the northeast of the housing development where she and her family live.

According to Tara, “Every family that lives or raises livestock in the area has a different fear, a different complaint, and a different statistic about

Concentrations of uranium, selenium, total dissolved solids (TDS), and sulfate were then analyzed, and average yearly changes in concentration were calculated. The results were plotted on maps of the site to show migration trends. Tara also took additional water samples from four of the sites. Her samples were filtered, preserved, and tested for the four constituents. After analyzing her data, Tara found small correlations suggesting a southwesterly contamination flow, but no strong overall trend in migration of uranium, selenium, TDS, or sulfate was observed.

Mexico science fair since 6<sup>th</sup> grade and attended the international competition in Portland, Oregon in 2004. She will represent the Four Corners region this spring at the national competition in Indianapolis. Of her experience at the international competition, Tara said, “It was so much fun to talk with Nobel Prize winners and kids from all over the world and to see the things they are doing is unreal.”

The WRRRI awarded second place and \$50 to Bushrah Hossain, a senior at Menaul School in Albuquerque. She has been participating in the science fair for

*(continued on page 7)*



(continued from page 6)

three years, and this is her second trip to the state competition. Bushrah is a senior and will attend either New Mexico Tech or Baylor University in the fall and plans to major in medicine and minor in biology or environmental science. She credits her mentor, Dr. Janet Benson, an Albuquerque toxicologist, for the guidance she provided throughout the experimentation aspect of her science project.

Bushrah is interested in studying pharmaceuticals in environmental waters and has done so for the past two



Christopher McCallum

years. The purpose of this year's study was to assess the potential toxicity that common pharmaceuticals and vitamins have on aquatic life such as algae and Zebrafish. She looked at acetaminophen, ascorbic acid, caffeine, ibuprofen and salicylic acid. She hypothesized that the toxicity of the chemicals at different ranges of doses may affect the growth of algae and the development of Zebrafish.

For the algae experiments, she used an Algal Toxkit to examine the affects of the chemicals on the growth of algae. For the Zebrafish experiments, fertilized eggs were obtained from

naturally reproducing adult Zebrafish. Groups of eggs were exposed to different concentrations of ibuprofen, acetaminophen, and caffeine. The results of her study were inconclusive, partly due to a problem that arose concerning the Zebrafish embryos that she purchased from an entity in Florida. The vast majority of embryos were dead on arrival, and Bushrah had to learn how to distinguish a live embryo from a dead one. She considered this part of the learning process and was philosophical about the unforeseen problems that scientists encounter in their research.

In the Junior Division, 8<sup>th</sup> grader Nicole Puissant from Queen of Heaven in Albuquerque received first place honors and a check for \$100. She was interested in what may be the only source of "new water" available for the future, namely, brackish water. Nicole looked at "...using solar energy to preheat brackish water so that less energy is required to remove salt by the thermal distillation process." Her project was entitled, *The Effects of Solar Pre-Heating and the Desalination of Brackish Water – Phase 2*.

Through her experimental design, Nicole found that solar preheating does indeed significantly reduce the amount of energy needed to remove salt from brackish water using the thermal distillation process. Nicole concluded that the sun is a good source of additional energy in many parts of the world, including New Mexico.

Nicole said she "has always loved science" and was influenced by her aunt who is a chemist. She has prepared science projects every year since 6<sup>th</sup> grade.

Second place in the Junior Division was awarded to Christopher McCallum for his project entitled, *Is there Pollution in the Rio Hondo?* Christopher set out to see if the Taos ski valley is polluting the Rio Hondo. He used a bacteria/nitrite/nitrate test kit to look at E-coli bacteria, nitrates, and nitrites at two

stream sites, one above the Taos Ski Valley and one below the Taos Ski Valley sewer plant. Christopher found one sample out of four at the upstream site tested positive for bacteria with none indicating the presence of nitrates or nitrites. At the site below the sewer plant, three out of four samples resulted in positive readings for bacteria with none indicating nitrates and nitrites. He used a dipstick to measure for nitrates, and in a future study would like to use a more reliable method to get better readings.

A 7<sup>th</sup> grader at Taos Middle School, Christopher has prepared science fair projects since 2<sup>nd</sup> grade and indicates that he will continue to do so. "It's so fun," according to Christopher. He credits Mr. Lopez, his science teacher at Taos Middle School and his dad for their encouragement and help. Christopher isn't sure what he'll study in the future, but he knows that his love for science will be a part of it.

### **Pesticides in the Nation's Streams and Ground Water, 1992-2001**

has been published as part of the USGS series of publications on *The Quality of Our Nation's Waters*.

The report summarizes a 10-year assessment by the National Water-quality Assessment (NAWQA) Program and provides the most comprehensive national-scale analysis to date of pesticide occurrence and concentrations in streams and ground water.

The report and companion materials are available on the Internet at: <http://ca.water.usgs.gov/pnsp/pubs/cir1291/>.



# Join Us in Santa Fe in July

The Universities Council on Water Resources and The National Institutes for Water Resources will hold its joint annual meeting in Santa Fe on July 18-20, 2006. Over 120 papers will be presented on topics related to this year's theme of *Increasing Freshwater Supplies*.

Plenary speakers include representatives from the offices of New Mexico **Senators Jeff Bingaman and Pete Domenici**. Other plenary speakers include **Pat Mulroy**, manager of the Las Vegas Valley Water District; **Rochelle Araujo**, Associate Director of EPA's National Exposure Research Laboratory; **Ed Archuleta**, general manager of the El Paso Water Utilities; **Mike O'Neill**, National Program Leader for Water Resources in the USDA Cooperative State Research, Education,

and Extension Service; **Les Shephard**, Vice President of Energy, Security, and Defense Technologies at Sandia National Laboratories; **Jeff Mosher**, Acting Executive Director of the National Water Research Institute; and **Tom Jennings**, International Affairs, Bureau of Reclamation.

A welcome reception will be held at the Georgia O'Keeffe Museum. An awards banquet at La Fonda will honor several individuals and groups for their outstanding contributions to our nation's water resources. Two rafting trips on the Rio Grande and a technical tour of the Valles Caldera National Preserve are also available to participants.

The preliminary program and registration information is available online at <http://www.ucowr.siu.edu>.



The *Divining Rod* is published by the New Mexico Water Resources Research Institute.

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