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Student Grant Recipients Report Research Results

Students study salt cedar impacts and contaminants in water

by Sara Ash, WRI



Maritza Macias-Corral and colleague collect ET and climate data at 30-minute intervals using data logger at the Bosque del Apache tower.

Remote Sensing Used to Determine Riparian Evapotranspiration

Maritza Macias-Corral, a graduate civil engineering student at New Mexico State University, received one of the Water Resource Research Institute's 2005-2006 student research grants. Macias-Corral is working along with her faculty advisors, Dr. Zohrab Samani and Dr. Salim Bawazir, to obtain better estimates of riparian evapotranspiration (ET) in the Middle Rio Grande region.

There is an urgent need to account more accurately for ET along the Rio Grande to understand the impacts of eradicating riparian vegetation, to balance the water budget, and to better manage the river. Currently, riparian ET is not very accurately measured, because ET varies from one location to another depending on the species of plants present, the density of plants, soil conditions, climate, and depth to groundwater. Many sampling points are necessary to obtain accurate ET estimates, but this makes the process quite expensive and complicated.

One alternative is to estimate ET by using remote sensing technology. Remote sensing uses regional satellite data and site measurements to calculate regional ET. The technology is currently used in many countries throughout the world, including Egypt, India, China, the Netherlands, and the United States. Researchers at NMSU developed a Regional ET Estimation Model (REEM) that uses real-time satellite data,

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climate data, and localized ET measurements to calculate ET values for various crop canopies.

Using the technology developed at NMSU, Macias-Corral performed in situ measurements of evapotranspiration and collected ET data from two flux towers located at the Bosque del Apache National Wildlife Refuge. The field work was conducted with the help of the NMSU Civil Engineering Water Resources Work Group. She used the information collected to develop regional maps of ET for the Middle Rio Grande Region using the REEM algorithm. Point measurements from one propeller eddy covariance (OPEC) towers were taken and compared with the satellite derived ET using the REEM algorithm. At the south salt cedar flux



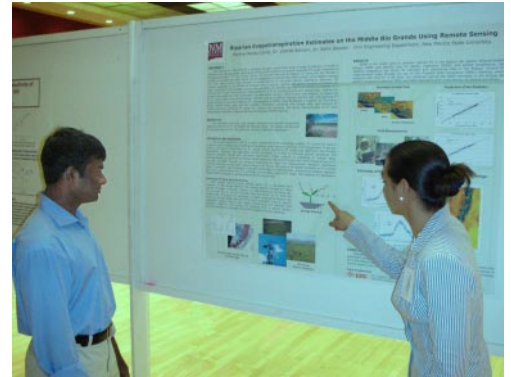
Macias-Corral and colleague download and record ET and climate data from data logger into laptop.

tower, measured ET was 6.87 mm/day, while the REEM algorithm estimated ET to be 6.52 mm/day. At the north salt cedar flux tower, measured ET was 7.43 mm/day and estimated ET was 7.77 mm/day. The two methods show “excellent agreement,” said Macias-

Corral. “REEM can provide real time ET values with high accuracy.”

These better ET estimates can help to evaluate the effects of the eradication of riparian vegetation. For instance, salt cedar has been reported to increase evapotranspiration and soil salinity.

Controlling the spread of salt cedar may help to restore native vegetation and improve wildlife habitats. According to Macias-Corral, “with ET mapping, the change in consumptive



Maritza Macias-Corral presented her research results at several events.

use from specific sites where salt cedar removal is being implemented can be compared to the ET before treatment,” which would help evaluate and quantify the environmental impacts of salt cedar eradication.

Not only do accurate ET measurements help quantify the effects of salt cedar eradication, but they also allow “better estimate of the water budget for the Middle Rio Grande Region,” Macias-Corral said. “Consequently, better management of the Rio Grande and water allocation for human and environmental needs would be possible.”

Macias-Corral will graduate in the spring of 2007 with a doctorate in civil engineering. She is currently applying for faculty positions at different universities and conducting research for WERC on the remediation of groundwater contaminated with organic compounds. She hopes to continue water related research, especially in the areas of remediation and alternative sources for drinking water.

Student Investigates Salt Cedar Leaf Litter Impacts on Surface Soil Chemistry

New Mexico State University graduate student Cheryl Rosel used her WRRI student grant to study salt cedar leaf litter (duff) impacts on surface soil chemistry. Rosel, along with her faculty advisor Dr. April Ulery, hypothesized that salt cedar duff would significantly increase the salinity and sodicity of the surface soil after rainfall events.

To test her hypothesis, Rosel performed a greenhouse experiment at the Fabian Garcia Science Center. She placed salt cedar duff on sandy loam soil in three treatments (0, 2, and 6 cm thick, based on weight). The duff was comprised of salt cedar leaves, twigs, and seeds which naturally

contained sodium (Na⁺), magnesium (Mg²⁺), calcium (Ca²⁺), and potassium (K⁺) salts.

She then simulated rainfall events on the duff and soil to quantify salinity and sodicity changes occurring in the soil through time. Approximately 13 mm simulated rainfalls were applied to the soil in three different stages representing different moisture patterns: very wet with little or no soil drying, wet with some soil drying, and complete soil drying. Rosel sampled the soil weekly at 0-1 cm depths and 1-5 cm depths. She analyzed 1:5 soil:water (w/w) extracts for electrical conductivity (EC) and sodium adsorption ratio (SAR).

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The EC and SAR significantly increased in all experimental stages. However, the most marked increase occurred in the third stage in which the soil completely dried. "Salt cedar duff can considerably increase the surface soil salinity if at least one rainfall event followed by soil desiccation occurs," Rosel said. "The 0-1 cm soil depth was more susceptible to increases in salinity and sodicity than the 1-5 cm depth." This is due to the effects of ion redistribution and accumulation at the soil surface caused by evaporation.

"Excessive quantities of soluble salts can be harmful to plants by interfering with water uptake," Rosel said. Rosel's findings quantify the effects of salt cedar duff on the surface soil, which may contribute to better riparian restoration techniques.

Rosel will graduate with a master's degree in agronomy this December. She plans to begin work for the US Forest Service as a soil scientist in the Plumas National Forest in January 2007.



Cheryl Rosel collecting surface soil samples and leaf litter samples from a live salt cedar tree at the Bosque del Apache NWR.

NMSU Student Researches Rapid Detection of Human Fecal Contamination

Water sources contaminated with human fecal matter are a substantial public health concern. Rapidly detecting contamination is essential to minimizing health threats, but current bacterial culture methods are slower than other indicators, such as human secretory immunoglobulin alpha (sIgA). The body produces large quantities of human sIgA, which are present in fecal matter; consequently, sIgA potentially is a good indicator of fecal contamination.

To determine the feasibility of human sIgA as an indicator of human fecal contamination in raw sewage and groundwater, Jessica Hamel, a New Mexico State University undergraduate microbiology student, conducted research with the help of her faculty advisors, Dr. Kevin Oshima of the Environmental Protection Agency and Dr. Geoff Smith of the NMSU's Biology Department.

Hamel collected water samples from the Rio Grande and from sewage treatment facilities, concentrated and filtered them, and performed an enzyme-linked immunoadsorbant assay (ELISA) to detect sIgA samples. In an ELISA, a 96-well microtiter plate is used to bind antibodies and antigens. The result is a color reaction that can be read with a spectrophotometer at 450 nm. From this reading, Hamel plotted a line using Graph Pad software

and used it to determine the concentration in ng/mL of the unknown samples.

Hamel spiked ten liters of groundwater with an approximately 200 ng/mL concentration of human sIgA. She concentrated these samples to 250 mL using an ultrafiltration method so that the sIgA would be concentrated into detectable levels. The ELISA was performed, and the percent recoveries for the groundwater were 33.74 percent.



Graduate student Jessica Hamel in the lab.

For the raw sewage tests, Hamel used a 1 mL raw sewage sample before being treated at the wastewater treatment plant, diluted it to eight 1:1 dilutions, and tested for the presence of sIgA. Seventy-one percent of the dilutions tested positive for sIgA. One liter samples were concentrated to 50 mL samples to determine the recovery of sIgA in concentrated raw sewage after the ultrafiltration method. The percent recoveries of the concentrated raw sewage were 45.5 percent.

"Results indicate that human sIgA has promise as an indicator of human fecal contamination," Hamel said. "It will provide a new method for identifying water that has been impaired by human fecal matter." The sIgA assay "proves to be an efficient, rapid, and cost effective procedure."

Hamel will graduate from NMSU this fall with her bachelor's degree in microbiology. She plans to pursue a Ph.D., although she does not yet know where she will attend graduate school or on what emphasis she will focus.



NMHU Student Assesses Arsenic and Other Groundwater Impairments

Water quality studies conducted in the Gallinas Watershed show that during times of elevated flow the



Justin Johns-Kaysing is working on a B.S. in environmental geology at NMHU.

Gallinas River contains elevated concentrations of arsenic that exceed the EPA's drinking water standard. The arsenic detected in river samples comes from the weathering of Permian and Cretaceous shales that underlie over 60 percent of the watershed, as noted by Valerie Duran and others in their 2005 work. Justin Johns-Kaysing, an undergraduate environmental geology student at New Mexico Highlands University (NMHU), along with his faculty advisor Dr. Jennifer Lindline, hypothesized that a correlation exists between arsenic in groundwater and bedrock geology.

With the help of a WRRRI student water research grant, Johns-Kaysing sampled eleven wells throughout the watershed to quantify arsenic levels

and other constituents such as heavy metals, hardness, pH, and dissolved oxygen. During the summer of 2006, Johns-Kaysing took multiple samples from each site. Water was pumped from the wells for about three minutes before he collected the samples. These samples were sent to Activation Laboratories in Ontario, Canada for ICP-MS elemental analysis. The hardness and alkalinity tests were performed by Simone Yelah Tar at NMHU. The dissolved oxygen, pH, conductivity, and nitrate tests were also conducted at NMHU.

Johns-Kaysing found that hardness, alkalinity, and conductivity values increase with decreases in elevation, while nitrate was consistently low throughout the watershed. Most



Storrie Lake is one of Las Vegas' secondary water resources.

chemical elements were also found in low concentrations, except for bromine, rubidium, and uranium, which showed relatively higher levels at the Montezuma Hot Springs and at

wells along the eastern edge of the study area. The Montezuma thrust fault separates wells in the upper watershed to the west and lower watershed to the east. "The general trend of chemical and mineral loading occurring across the study area represents a dynamic interaction between surface water, groundwater, and geology," Johns-Kaysing says.

The arsenic concentrations in groundwater samples were all less than 2.5 ug/L, which is well below the EPA drinking water standard of 10 ug/L. However, statistical analysis showed that arsenic concentrations are significantly higher at lower elevations than at higher elevations, ranging from 0.05 ug/L to 0.60 ug/L.

"Arsenic values are lower in wells in the upper watershed where Precambrian crystalline rocks dominate and higher in wells in the lower watershed where the Madera and Niobrara/Carlisle shale formations dominate," Johns-Kaysing says. Even though the concentrations of arsenic are low, Johns-Kaysing says it is important to understand the mechanisms related to the mobilization and transport of arsenic through the watershed. "A similar terrain with slightly different conditions could result in very different behavior of natural contaminants." Further research would help determine the effects of different conditions on the

concentrations of arsenic in the watershed.



Student Conducts Groundwater Quality and Well Water Assessment in Las Vegas

Around Las Vegas, New Mexico, the drinking water generally meets the state's drinking water standards; however, the area often experiences sporadic violations of the standards. Joel Lowry, a New Mexico Highlands University student, used a WRI student water research grant to assess the groundwater quality in northern New Mexico. "The sporadic violations must be detected early to prevent adverse health effects to consumers," Lowry said. "The potential for adverse health effects makes water quality monitoring necessary."

With the help of faculty advisors Michael Meyer and Jennifer Lindline, Lowry assessed the groundwater quality in the Las Vegas area to determine if contaminants were in household water supply systems. Lowry collected water samples from 12 groundwater wells and the Montezuma Hot Springs in May and November 2006. The wells were selected based on their distribution in

the watershed, depth, age, and permission of the land owner. Any wells 20 years or older were not used in the study, because Lowry wanted to ensure all the wells he tested had secure casings. The samples were tested for *E. coli*, nitrate, hardness, alkalinity, electrical conductivity, and pH.

Alkalinity and nitrate concentrations increased from May to November. This increase may have been caused by increases in precipitation. The spring of 2006 was relatively dry with an accumulated precipitation of 10 inches at the end of May, whereas the accumulated precipitation at the beginning of November was approximately 37



New Mexico Highlands University laboratory student assistant Simone-Camille Yelah Tar helped Lowry test water samples.

inches. Consequently, Lowry's November samples represent groundwater quality after a wetter period. One well used for human consumption exceeded the drinking water standard

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FY 2007 National Competitive Grants Program Issues RFP

The U.S. Geological Survey in cooperation with the National Institutes for Water Resources requests proposals for matching grants to support research on the topics of water supply and water availability, which are issues of importance nationwide. Proposals are requested on the topics of water supply and availability, including investigations of possible new sources of supply, improvement of impaired waters to usable quality, conservation of existing sources, and limiting growth in demand. Proposals are sought in not only the physical dimensions of supply and

demand, but also quality trends in raw water supplies; the role of economics and institutions in water supply and demand; institutional arrangements for tracking and reporting water supply and availability; and institutional arrangements for coping with extreme hydrologic conditions.

The amount available for research under this program is estimated to be \$920,000 in federal funds. Interested faculty researchers in New Mexico are eligible to apply for a grant through the New Mexico Water Resources Research Institute and should contact the WRI as early in the proposal planning stage as possible.

Proposals involving substantial collaboration between the USGS and university scientists are encouraged. Proposals may be for projects of 1 to 3 years in duration and may request up to \$250,000 in federal funds. Successful applicants must match each dollar of the federal grant with one dollar from non-federal sources.

Proposals must be filed on the Internet at <https://niwr.net/> by **5:00 PM, Eastern Standard Time, February 16, 2007**. The announcement and RFP are available on the WRI website at: http://wri.nmsu.edu/research/research_program.html



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of 10 mg/L of nitrate and nitrite, with a concentration of 14.4 mg/L.

One well tested positive for *E. coli*, but is not used for human consumption. All other wells tested negative for *E. coli*. “*E. coli* does not appear to be a problem for drinking water supplies from the wells sampled in this study,” Lowry said. However, 60 percent of the wells tested positive for total coliform bacteria.

Well chemical characteristics change with season, climate conditions, elevation, and depth. Even though there are no serious public health concerns with the majority of tested wells, Lowry recommends that individual households have their water tested at least twice a year and that one of those samples is collected during a wet period or immediately following a wet period.

Lowry will graduate in 2008 with a degree in geology. After graduation, he plans to study hydrology or sediment geology in New Mexico.



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Knowledge and Understanding of the Hydrogeology of the Salt Basin in South-Central New Mexico and Future Study Needs by G.F. Huff and D.A. Chace (OFR 2006-1358)

This report provides a synopsis of the current state of knowledge and understanding of the hydrogeology of the Salt Basin and offers possible areas of future study. Substantial variability exists in current estimates of (1) ground-water recharge, (2) natural ground-water discharge, (3) the volume of ground water in storage, (4) the volume of recoverable ground water, (5) the conceptual model of ground-water flow, (6) the distribution of ground-water quality, and (7) the distribution of hydraulic characteristics. Uncertainty in these estimates leads to uncertainty in estimates of hydrogeologic characteristics. This report proposes a strategy that may reduce the uncertainty in assumptions currently made with respect to the hydrogeology of the Salt Basin allowing for better water-resources management.

Data Delivery and Mapping over the Web – National Water-Quality Assessment Data Warehouse by R.W. Bell and A.K. Williamson (Fact Sheet 2006-3101, August 2006)

NMSU and GE to collaborate on water research

New Mexico State University and General Electric have signed a Memorandum of Understanding (MOU) for the creation of a water technology research collaboration to find solutions to problems related to quality, availability, and affordability of water supplies.

The major focus of the joint initiative would be new technologies for treating saline and brackish water, which represents a large source of untapped groundwater in New Mexico and in many parts of the world.

The collaboration will tackle some of the toughest technical challenges of desalination, such as developing oxidation-resistant reverse-osmosis membranes that are not prone to fouling in brackish water, reducing the liquid discharge from desalination operations, and developing more effective technologies for disposing of the discharge.

The collaboration would build upon the expertise of two NMSU institutes, the Institute for Energy and the Environment and the New Mexico Water Resources Research Institute. The partnership would involve research and development at NMSU and at GE’s Global Research Center in New York. It is anticipated that the collaboration will include student internships with GE and exchanges of NMSU faculty researchers and GE scientists.

Senator Pete Domenici has included funding for the collaboration in the Fiscal Year 2007 Energy and Water Appropriations Bill. “This is a bold partnership to harness some of the brightest minds to find better ways to make more water available in water-scarce areas of the world,” Domenici said at the MOU signing in late October at NMSU.

Report of the Rio Grande Compact Commission 2005

The findings of the 67th Annual Meeting of the Rio Grande Compact Commission held in El Paso Texas on March 23, 2006 have been issued. Contact WRRRI at 505-646-4337 for a copy of the report.



Water Research Symposium

In its fifth year, the 2006 New Mexico Water Research Symposium took place on the New Mexico Tech campus in mid-August. The nearly 180 participants, including 57 students, reviewed 34 posters and chose from among 26 oral presentations. Attendees came from throughout New Mexico as well as Texas, Arizona, and Colorado.

The one-day symposium gives scientists and other water experts an opportunity to meet and share with each other their research ideas and findings. Participants include faculty and students from universities, water agency personnel from the federal and state government, and their colleagues from the private sector.

This year students participated in poster and oral presentation competitions, and awards were made by the American Water Resources Association (AWRA).

The symposium is sponsored by the New Mexico WRI in cooperation with Sandia National Laboratories, Los Alamos National Laboratory, New Mexico Interstate Stream Commission,

U.S. Geological Survey, AWRA-New Mexico Section, and the state's major research universities.

Poster and oral presentation abstracts, along with the student award

recipients, are available on the WRI website at: <http://wri.nmsu.edu/publish/sympabs/abstracts2006.html>



New Mexico State University's Department of Civil Engineering was well represented at the 2006 Water Research Symposium.

Upcoming Meetings

February 1-2, 2007 – Law of the Rio Grande, Eldorado Hotel and Spa, Santa Fe, NM (www.cle.com)

March 1-2, 2007 – NEPA 2nd Annual National Conference, Flamingo, Las Vegas, NV (www.cle.com)

April 1-5, 2007 – 17th Annual 2007 Environmental Design Contest, WERC, New Mexico State University, Las Cruces, NM (www.werc.net)

April 29 - May 3, 2007 – 2007 Ground Water Summit, National Ground Water Association, Albuquerque Convention Center, Albuquerque, NM (www.ngwa.org)

June 3-6, 2007 – Strengthening the Roles of Land Trusts and Local Governments in Protecting and Restoring Wetlands and Riparian Areas, Western State Workshop, Treasure Mountain Inn, Park City, UT (www.aswm.org)

June 25-27, 2007 – AWRA 2007 Summer Specialty Conference, Emerging Contaminants of Concern in the Environment: Issues, Investigations, and Solutions, Fail Cascade Resort, Vail, CO (www.awra.org)



2006-2007 Student Research Grant Recipients Announced

The New Mexico Water Resources Research Institute (WRI) has announced recipients of the 2006-2007 Student Water Research Program. This program funds water-related research projects conducted by students at any of New Mexico's universities.

The program encourages and supports graduate and undergraduate student research in disciplines relevant to water resources issues and assists New Mexico educational institutions in developing student research expertise and capabilities. Students will begin research on these projects in December 2006 and will complete their projects within a year. Students work with a faculty advisor on their campus. The WRI monitors the student projects, and updates are available at the institute's website at wri.nmsu.edu/research/researchprogram.html. The WRI website also provides summaries and final reports for previously awarded student projects.

New Mexico State University

Jesus Q. Cantu, Department of Physics (advisor: Jacob Urquidi), *Characterization of Heavy Metal Binding by Functional Groups Found in Biomaterials*

Ryan McShane, Department of Fishery and Wildlife Sciences (advisor: David Cowley), *Community and Ecosystem Effects of a Nonnative Fish in Refugia in an Intermittent Stream: Implications for Native Fish Restoration*

Kristin Swaim, Department of Fishery and Wildlife Sciences (advisor: Wiebke J. Boeing), *Relating Fish Abundance and Condition to Environmental Factors in Desert Sinkholes*

University of New Mexico

David J. VanHorn, Department of Biology (advisor: Clifford Dahm), *The Effects of Eutrophication on the Structure and Function of Stream Biofilms*

Matthew F. Kirk, Department of Earth and Planetary Sciences (advisor: Laura Crossey), *Experimental and Numerical Modeling Analysis of Arsenic-sulfide Precipitation in Groundwater Environments*

Eastern New Mexico University

Irene M. Roselli, Department of Biology (advisor: Marvin M.F. Lutnesky), *The Influence of Predator Detection on Life History Strategies in DAPHNIA*

Nicole M. Harings, Department of Biology, (advisor: Marvin M.F. Lutnesky), *The Influence of Larval Culiseta sp. (Diptera: Culicidae) on Behavior and Growth Rate of Tadpole Shrimp Triops longicaudatus (LeConte) (Notostraca: Triopsidae)*

New Mexico Highlands University

Chemanji Shu-Nyamboli and Joel Lowry, Department of Natural Sciences (advisor: Edward A. Martinez), *Determination of Heavy Metal Distribution in the Gallinas River Using Aquatic Macrophytes*

Carlos R. Herrera, Department of Natural Sciences (advisor: Michael L. Meyer), *Uranium and Heavy Metals in Macroinvertebrates in the Santa Fe River on the Cochiti Reservation*

New Mexico Tech

Marty D. Frisbee, Department of Earth and Environmental Science (advisor: Fred Phillips), *Runoff Processes and the Evolution of Water Chemistry in the Saguache Creek Watershed of the Upper Rio Grande*

Taufique Mahmood, Department of Earth and Environmental Science (advisor: Enrique Vivoni), *Use of Remotely Sensed Observations for Improved Distributed Hydrological Modeling in the Jemez River Basin*

Katrina Koski, Department of Earth and Environmental Science (advisor: Penelope J. Boston), *Multi-disciplinary Analysis of a New Mexico Cold Water Tufa Spring Mound*



Kudos

John W. Hawley recently received the 2006 Distinguished Service Award from the Quaternary Geology & Geomorphology Division of the Geological Society of America (GSA). Hawley is a New Mexico Tech adjunct faculty member with the research university's Department of Earth & Environmental Science (E&ES) and an emeritus staff member of the New Mexico Bureau of Geology and Mineral Resources. He is also a Senior Hydrogeologist with the New Mexico WRI. The award was presented to Hawley in Philadelphia on October 24, at the annual meeting of the GSA. The citationists were Marith Reheis of the U.S. Geological Survey and Fred Phillips, a hydrology professor at New Mexico Tech.

"At 74 years old, Hawley remains more active as a geologist than many professionals half his age," Phillips said. "He continues to work as an independent consulting geologist. He is a legendary resource for knowledge of the geology of the Southwest and spends much of his time helping others with their research."

At the awards ceremony at the GSA meeting, Hawley received a custom-made award consisting of a fossil horse jaw attached to a walnut plaque. In honor of his legendary verbal accomplishments, the fossil was accompanied by an inscription reading: "To the champion jawboner of the Quaternary."



John W. Hawley and his "jawbone" Distinguished Service Award at the recent Geological Society of America annual meeting in Philadelphia. Pictured from left to right are: Marith Reheis, citationist; Hawley, and Fred Phillips, citationist.



New Mexico Tech hydrology professor **John L. Wilson II** was elected president of the Hydrology Section of the American Geophysical Union, and, as such, is currently serving a term as president-elect for two years, which will be followed by another two-year stint as president of the largest division of the AGU. Wilson has been on the New Mexico Tech faculty since 1984 and has been an AGU member since 1974. Wilson's major area of interest in both teaching and research at the state research university is focused on current topics in groundwater hydrology, particularly contaminant source identification, stream-aquifer interaction, and recharge in mountains. Wilson and some of his students have received funding from the WRI for various projects over the past twenty years.



John L. Wilson II





Reports Available

WRI technical completion reports

A Joint Investigation of Evapotranspiration Depletion of Treated and Non-Treated Saltcedar at the Elephant Butte Delta, New Mexico by A.S. Bawazir, J.P. King, S. Kidambi, B. Tanzy, F. Nibling, N.H. Stowe, and M.J. Fahl (WRI #328, at printer)

Saltcedar (*Tamarix sp.*) was introduced to the U.S. as an ornamental plant to control soil erosion. The control of saltcedar now has become a major concern since studies have reported that evapotranspiration (ET) of saltcedar ranges between 3 ft - 5 ft of water per year. A joint project to study the reduction of saltcedar ET by herbicide treatment was undertaken in early 2005 with several collaborators including New Mexico State University, U.S. Bureau of Reclamation, New Mexico Office of the State Engineer, and the New Mexico Soil and Water Conservation Districts in conjunction with the Lower Rio Grande Salt Cedar Control Project.

To study the reduction of saltcedar ET by herbicide treatment, a large area of dense saltcedar was treated, and an adjacent area was left untreated in order to compare the effects of ET losses after herbicide treatment. Evapotranspiration measurements from both sites indicated that the treated saltcedar stand during a comparison of 83 growing days was less than the non-treated site by about 57 percent. During the non-growing season, the treated site had higher ET than the non-treated site by 37 percent. Soil salinity data were also collected from the treated and non-treated sites. Soils at the study site were slightly alkaline. The salinity at the treated site was lower than the non-treated site by an average of 33 percent. The project results including all data are contained in the final completion report that will be published by the WRI in December 2006. Results will be used by New Mexico policy makers to determine the best strategies for saltcedar treatment and control.

The Development of a Coordinated Database for Water Resources and Flow Model in the Paso del Norte Watershed by S. Tillery, Z. Sheng, J.P. King, B. Creel, C. Brown, A. Michelsen, R. Srinivasan, and A. Granados (WRI #337, at printer)

This joint project was conducted by researchers at New Mexico State University and Texas Agricultural Research & Extension Center of Texas A&M University. It was developed to enhance the coordinated database that was originally developed by the Paso del Norte Watershed Council to fulfill

needs for better management of regional water resources. It also expanded the Upper Rio Grande Water Operations Model (URGWOM) to cover the river reaches between Elephant Butte Dam, New Mexico and Fort Quitman, Texas. In an earlier phase of the project, hydrological data needed for flow model development were compiled and data gaps were identified. This phase of the project developed a conceptual model of the Rio Grande flow between Elephant Butte Dam and American Dam by using data collected in the first development phase and enhanced the data portal capabilities of the PdNWC Coordinated Database Project (Database).

The first part of this report summarizes the hydrological models developed for surface water and groundwater flows and management of regional water resources in terms of model configuration, advantages, and limitation of each modeling approach. This part of the report also identifies and verifies the availability of relevant hydrological data needed for development of the RiverWare model, especially the hydrology of drain return flows. The second part of the report summarizes the data portal enhancements to the Database for its linkage to URGWOM development. The report describes enhancements to the data portal capabilities through the development of a low-end user interface that would serve GIS-based graphics of each data set and enhanced metadata of relevant data sets.



USGS recent publications

The U.S. Geological Survey has recently published several reports of interest to New Mexico water experts. Copies are available for inspection at the USGS District Office in Albuquerque (5338 Montgomery Blvd NE, Suite 400; 505-830-7923). The Water Resources Research Institute library also has the reports on file. They may be ordered from the USGS, Federal Center, Box 25286, MS 517, Denver, CO 80225. You may call 1-888-ASK-USGS for price information or go to www.usgs.gov.

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Effects of Roads and Well Pads on Erosion in the Largo Canyon Watershed, New Mexico, 2001-02 by Anne Marie Matherne (SIR 2006-5039)

This report presents the results of a two-year study to evaluate the effects of roads and well pads associated with oil and gas operations on the erosion potential of Bureau of Land Management lands in the Largo Canyon watershed, New Mexico. Data are presented for sediment dams on hillslopes and downslope from roads and well pads and for surveyed transects across roads and well pads. Contributions to erosion from roads and well pads are compared to background contributions from the hillslopes. A conceptual model of the role of roads and well pads in erosion and sediment-transport processes in an arid landscape is presented.

Water-Level Data for the Albuquerque Basin and Adjacent Areas, Central New Mexico, Period of Record through 2004 by R.K. DeWees (OFR 2006-1281)

A network of wells was established in 1983 to monitor changes in ground-water levels throughout the Albuquerque Basin. This network consisted of 6 wells with analog-to-digital recorders and 27 wells where water levels were measured monthly. By 2004, the network consisted of 234 wells and piezometers. This report presents water-level data

collected by U.S.G.S. personnel at 155 sites through 2004. Water-level and other data for 71 sites were collected by other agencies.

Questa Baseline and Pre-Mining Ground-Water Quality Investigation. 21. Hydrology and Water Balance of the Red River Basin, New Mexico 1930-2004 by Cheryl A. Naus, Douglas P. McAda, and Nathan C. Myers (SIR 2006-5040)

This report describes the hydrology of the Red River Basin and documents the development of a water balance for pre-mining conditions for the part of the Red River Basin upstream from the USGS streamflow-gaging station Red River near Questa, New Mexico. Hydrologic discussions include descriptions of precipitation, surface water, and ground water. Water-balance components include estimates of average annual precipitation, evapotranspiration, basin yield and ground-water components. This report is one in a series of reports that will contribute to the overall USGS study objective to infer pre-mining ground-water quality at the mine site.

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2006 Water Festival

WRRRI staff members Sara Ash and Peggy Risner participated at the 2006 Water Festival in Truth or Consequences, New Mexico on September 21, 2006. The festival was coordinated by the WERC program of New Mexico State University. This year's theme was "Our Watershed, Our Resources." The festival is funded by the U.S. Bureau of Reclamation through the Water Stewardship Education Program and was co-hosted by Sierra and TorC elementary schools. Some 474 students in grades K-5 and 31 teachers took part in the day-long activities. This community event was part of a two-year program that has reached 6,754 teachers and students with water stewardship training.



Sara Ash, WRRRI student assistant, talked to elementary students about the importance of water in our everyday lives. Photo by Peggy Risner.



Annual Water Conference Focuses on Water Quality Issues

The 51st Annual New Mexico Water Conference focused on water quality issues. Participants met for the day-and-a-half conference in Albuquerque in early October. A tour of Albuquerque's water treatment plant, currently under construction, took place on the afternoon before the conference began.

A highlight of the conference was the Albert E. Utton Memorial Lecture given this year by Professor Em Hall of the University of New Mexico's School of Law. The lecture, "100 Years Under the Water Code" was very well attended. Professor Hall lived up to his reputation for making history come alive with his knowledge and insight into the complex water issues of the time replete with colorful characters who inhabited that era. The lecture in its entirety will be included in the conference proceedings, which will also include all presentations given at the conference. The proceedings will be available in early 2007. Check the WRRRI website for updates at <http://wrri.nmsu.edu>. (Photos by Stephen's Photo Service.)



Mary Utton and John Draper.



Frank Yates, Jr. and Tom Davis.



Fred Hennighausen and A.J. Olsen.



Scott Anderholm and Chris Canavan.



Bill Turner and Anita Miller.



Mike Hightower, Bob Wessely, and Stephanie Moore.

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