DIVINING ROD
NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE
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Identifying *E. coli* contamination in surface waters

WRRI Student Research Grant provides funding to monitor sites around the city of Las Vegas, New Mexico

Purpose of the study

New Mexico Highlands University student Greg Huey and his advisor, Dr. Mike Meyer, analyzed DNA fingerprints from whole *E. coli* cells to identify sources of fecal contamination in surface waters around the city of Las Vegas, New Mexico. The four stream monitoring sites included a section of a catastrophically burned forest (Cow Creek near Pecos, NM), a mixed conifer forest (Gallinas River near Montezuma, NM), a rangeland prairie (Spring Arroyo, northeast of Las Vegas), and commercial/urban land (Gallinas River below Las Vegas).

Greg Huey takes a grab sample at the Montezuma Monitoring Site during the summer of 2004.

The forested Gallinas River watershed, upstream from the village of Montezuma, provides 95 percent of the water supply for 18,000 residents of the city of Las Vegas. According to Greg, "There are approximately 200 full-time and seasonal residences, a dormitory-style summer camp, several recreational areas and two campgrounds in the watershed, all of which utilize either pit latrines or individual septic systems." He added that "there is also a variety of input from nonhuman sources throughout the watershed, including intensive wildlife and livestock grazing in the flood plain."

The Gallinas River downstream from Las Vegas extends approximately 20 miles before joining the Pecos River and flowing to the Santa Rosa Lake State park, a recreational reservoir. Several small communities reside on land grants and private property near the rivers between Las Vegas and Santa Rosa, using the surface water for irrigation and as a residential water source.

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INSIDE

From the Director . . .

Karl Wood, Director

Much of New Mexico's future depends on having an adequate supply of clean water to meet both human and ecosystem needs. To insure water for New Mexico's future, we must be innovative and clever in resolving the inevitable conflicts over water. To be innovative and clever and reach agreements regarding water resources allocations, we must be well informed about the amounts and pathways of water as it moves through our state. New Mexico has always been a leader in developing the sciences and institutional arrangements to support efficient and effective water management systems. We can't stop producing new knowledge now without negatively impacting the ability of tomorrow's water managers to be well informed, innovative, and clever, in satisfying New Mexico's future water needs.

The New Mexico Water Resources Research Institute has been a leader in New Mexico for 40 years coordinating, funding, and disseminating water research throughout our state. Since about 1980, our state funding support has been flat. Operating costs and salary increases have eroded our ability to fund water research projects to the six state universities in New Mexico. State support is crucial because it is often required as matching funds for proposals to federal and private sources. Each state-appropriated dollar can be used to obtain several dollars from these sources. Neighboring states are much more competitive nationally for research funds because they have many more dollars for the match. These states have successfully used their research findings for leverage in interstate water disputes.

Some examples of new federal funding in water research are noteworthy. The National Science Foundation is helping fund a new non-profit organization to facilitate the acquisition of hydrologic data at scales much larger than traditional single investigator (or single university/agency) studies permit. The Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) is taking a lead in organizing the hydrologic community to acquire and share hydrologic data at large watershed scales. New Mexico's universities and national laboratories are partnered to participate in CUAHSI. The Bureau of Reclamation initiated *Water 2025* to reduce crisis and conflict in water management. The *Water 2025* initiative recognizes that many conflicts in water management are caused by a weakness in our scientific understanding, particularly with respect to emerging areas of societal interest. A conference was held in Denver last November to discuss the ways enhanced science could help reduce water conflicts in the West. The new Tularosa Basin National Desalination Research Facility is being built by the Bureau of Reclamation and will give New Mexico's water scientists opportunities to expand desalination and concentrate disposal research. Federal funding cosponsored by Senators Bingaman and Domenici and others will allow the Water Resources Research Institutes in New Mexico, Texas, Arizona, and California, along with Sandia National Laboratories and the U.S. Geological Survey, to assess groundwater resources along the U.S.– Mexico Border. And many other exciting opportunities are in the works for water research in New Mexico.

In 2003, the New Mexico Legislature increased the New Mexico WRRI's budget by $100,000. We used this increase to start a student mini-grant program. Twelve grants were provided to graduate and undergraduate students at the University of New Mexico, New Mexico Tech, New Mexico Highlands University, Eastern New Mexico University, and New Mexico State University. Students from Western New Mexico University were also eligible for grants but didn't apply this first year. Results from these studies were presented at our water research symposium in Socorro in August and at our annual water conference held in Ruidoso this past September.

Because WRRI does not have statutory authority, our legislative agencies try to "sunset" us every year or two. The Legislature in 2004 decreased our budget, wiping out most of the increase we obtained in 2003. Therefore, our student mini-grant program ended after one year. We are going back to the New Mexico Legislature in 2005 and asking for statutory authority and a permanent annual increase of $200,000 for new research projects. This initiative is the top priority of New Mexico State University. Anyone wishing to support this initiative is urged to contact the legislative and executive branches of our state government in Santa Fe.

2004 New Mexico Water Research Symposium

Water research experts from around the state gathered in Socorro on August 10 for what has become an annual event. The WRRI along with the state's national laboratories, state universities, state and federal agencies as well as private entities sponsored the 2004 New Mexico Water Research Symposium.

Nearly 100 participants learned about their colleagues' current water research efforts through the daylong symposium featuring posters and oral presentations. Several students presented research results, including recipients of WRRI's Student Water Research Awards.

A broad range of water research was covered including projects on improving efficiency and utilizing alternative sources of water through improved irrigation practices, use of saline waters and coal-bed methane produced water; characterizing surface and groundwater interactions; modeling processes including a presentation on the requirements for a defensible groundwater model; and water quality issues such as tracking surface water contaminants.

Abstracts for all presentations and posters are available on the WRRI website (http://wrri.nmsu.edu). Several requests were made by participants asking that the actual posters presented be included on WRRI's website. We have requested that presenters send their poster files to us for our website and several posters are already available.

From top to bottom: (1) Mustafa Chudnoff of Glorieta Geoscience, Inc. greets Francis West. Sara Chudnoff, a student at New Mexico Tech is seated at the right. (2) Nearly 100 water specialists representing 24 private, state and federal entities participated in this year's water research symposium. (3) Rhonda Skaggs of NMSU's Department of Agricultural Economics and Agricultural Business presented a talk on *Farm Size, Irrigation Practices, and On-Farm Irrigation Efficiency*. (4) The symposium offers colleagues Robert Myers (left), Dave Love (middle) and Cynthia Ardito (right) an opportunity to share their current water research interests.

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The City of Las Vegas has established separate sanitary and storm water sewer systems to minimize the chance for contamination of the Gallinas River with raw sewage. However, there is still potential for introduction of human waste into the river. Fecal coliform levels are generally much lower in stream base flow than during storms, unless an inappropriate sewage discharge is present upstream. Even with separate sewer systems, human sewage can be introduced into surface waters during sanitary sewer overflows. These overflows can be caused by leaks in older sewer systems, power failures at pumping stations, and particularly during storm events.

About one-fourth of all American households rely on on-site septic systems to dispose of their wastewater, which translates to about 20 million individual systems. After solids are trapped in a septic tank, wastewater is distributed through a subsurface drain field and allowed to percolate through the soil. Bacteria are effectively removed by filtering and straining water through the soil profile, if the system is properly located, installed, and maintained. The system may fail when wastewater breaks out or passes through the soil profile without adequate treatment.

The rate of septic system failure is thought to range from 5 percent to nearly 40 percent, with an average of about 10 percent. Systems of special concern are those located in inadequate soils; poorly designed, sited, tested or inspected; hydraulically overloaded; containing tree growth in the drain field; of old age; and those that are not on a regular cleaning schedule. To identify potentially failing systems, inspectors are trained to consider septic systems older than 20 years, those situated on smaller lots, serving multiple homes or providing seasonal treatment, located adjacent to shorelines or ditches, on thin or excessively permeable soils, or close to bedrock or the water table.

There is a potential for all of these contamination sources to be found throughout the city of Las Vegas and the upper watershed of the Gallinas Canyon. A dispersed agricultural population lives on the prairie to the east of Las Vegas, which is drained by the Spring Arroyo, a tributary to the

Greg Huey concentrates a Cryptosporiduium/Giardia sample for enumeration in the New Mexico Highlands University's Natural Sciences Department lab.

Pecos Arroyo that joins the Gallinas River immediately south of Las Vegas and upstream from the sampling location. This population is assumed to depend exclusively on septic systems for their household waste. Therefore, waste from the eastern prairie may be identified at either the Spring Arroyo monitoring site or south of Las Vegas at the Lower Gallinas monitoring site. The burned Cow Creek watershed also supports a scattered population of residences in its upper reaches that depend on septic systems and pit latrines.

Analysis of water samples

The researchers collected water samples during an array of environmental conditions. Samples were collected manually during periods of base flow. During storm events, flow-based samples were collected using automated sampling equipment established at each site prior to the start of the project. Several samples were collected manually during a period of increased discharge following a severe spring snowstorm.

E. coli sources were identified using DNA fingerprinting. Source Molecular, Inc. in Gainesville, Florida performed the DNA analysis. The process determines if *E. coli* is produced from human or nonhuman sources by analyzing a DNA "fingerprint" from genes that code for ribosomal nucleic acids. A database of these fingerprints allows for comparison of the minute differences between bacterial cells that have adapted to the internal environments of the varying sources. The company compiled a database of fingerprints for the variations of cells that have adapted to the antibiotics developed in the human body, and those of many other sources, and can identify these adaptations in other cells that have experienced the same conditions. Five to seven isolates were examined from each sample that was submitted for testing.

Occasionally, there is no comparable fingerprint in the database to match the cells being tested. These isolates are listed as "indeterminate" and cells from known sources within the specific region where sources originate must be tested to expand the database. Likewise, cells listed as "animal" can be specified if matches are detected from specific nonhuman animal samples.

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Study Results

Five water samples were submitted for fingerprinting from the Montezuma Monitoring Site (Gallinas River upstream from the Village of Montezuma). Two of these were collected during spring snowmelt and three were collected during storm events during July 2004. One of the July samples, while supporting a viable population of *E. coli* at collection, experienced cell "die-off" during the shipping period and therefore lacked enough bacteria for testing. All 20 isolates processed from this location were found to be from nonhuman sources.

Five water samples were submitted for fingerprinting from the Lower Gallinas Monitoring Site (Gallinas River downstream from the City of Las Vegas). Two of these were collected during spring snowmelt and three were collected during storm events during July 2004. Of the twenty-nine isolates processed from this location, 25 were found to be nonhuman, three were indeterminate, and one was determined to be from a human source.

Two water samples were submitted for fingerprinting from the Spring Arroyo Monitoring Site (Spring Arroyo in the prairie northeast of the City of Las Vegas). These were collected during spring snowmelt and the ten isolates were found to be from nonhuman sources.

Two samples were submitted for testing from the Cow Creek Monitoring Site (burned forest in the Upper Pecos watershed). These samples held low, though viable, populations of *E. coli* at collection; however, upon delivery for DNA fingerprinting, the populations had decreased below minimum processing levels and were therefore not analyzed.

The numbers of samples submitted from each site vary due to the relevance of the Gallinas River for human interaction. Therefore, emphasis was placed on the Montezuma and Lower Gallinas monitoring sites. In the future, New Mexico Highlands University researchers intend to perform DNA fingerprinting on campus. That will allow additional testing to be performed on all locations. This will be more economical and allow for decreased holding time of water samples and, consequently, fewer cells dying off prior to testing.

Study Conclusions

These results suggest that there is no human input of fecal coliform bacteria to surface waters from the upper Gallinas watershed or the Spring Arroyo northeast of Las Vegas.

Twenty-nine isolates were tested from the Gallinas River downstream of Las Vegas. Nineteen were from increased discharge during storm events. Of these nineteen, one to four isolates were from human origin. This suggests that the city of Las Vegas may be experiencing sanitary sewer overflows or unauthorized drainage during storm events. The researchers strongly encourage further testing.

Because the Cow Creek watershed experiences low levels of *E. coli* bacteria, source testing was not possible with the minimal bacteria levels. This is another area in which additional testing could be done if funding for the project continues.

Greg Huey received a WRRI Student Research Award during the 2003-2004 year to conduct this project. The project may continue under funding from New Mexico Highlands University in the coming year, when the university acquires the resources to perform DNA fingerprinting in its on-campus facilities.

New Mexico Highlands University students Greg Huey (left) and Catherine Tabe-Ebob (right) measure flow at the Cow Creek Monitoring Site.

Mosquito fish habitat studied

Eastern New Mexico University student, Tony Spitzack, has completed his study of the mosquito fish (*Gambusia affinis*) and its habitat. Tony, a biology graduate student, conducted his study under the supervision of Dr. M.M.F. Lutnesky.

The study was funded by the New Mexico Water Resources Research Institute's Student Research Grant Program 2003-2004. "This experiment illuminates important life history traits of the mosquito fish, a poeciliid species that has been widely introduced for the biological control of mosquitoes and is closely related to at least one endangered species, *Gambusia nobilis*," according to Spitzack.

Tony collected mosquito fish for his project from the Pecos River near the Fort Sumner bridge, below the Alamogordo Dam. He then transferred the fish into the laboratory for experimental analysis.

Eastern New Mexico University graduate students Jennifer Buntz (left) and Tony Spitzack (right) collect mosquito fish on the Pecos River during the summer of 2004.

Spitzack explains that "Habitat use by fishes often varies spatially and temporally, and may have fitness consequences depending on the habitat that is chosen. Depth selection is an extremely important habitat choice in the life histories of fishes, and may be influenced by many variables."

Some understudied variables that may affect depth choice include predation risk and sex. Furthermore, little is known about the effects of sexual interactions on depth choice. In this experiment, the role of predation risk, sex, and sexual interactions on depth choice (quantified as the distance from surface and distance from shore) in the mosquito fish was investigated.

Spitzack designed an experimental apparatus with a depth gradient, such that a fish of 10-50 mm could choose a distance from the surface ranging from 0-42 cm, and a distance from the shore ranging from 0-120 cm. A MANOVA test was performed to determine if predation risk, sex, and sexual interactions had any effect on depth choice. If a significant multivariate interaction of treatment and factors was found, Spitzack performed univariate tests for each variable.

A second test for sexual selection was performed by comparing regressions to determine if a relationship existed between the size of the companion individual and the depth or activity of the focal individual. If any of the regression analyses revealed a significant relationship between companion size and focal individual depth, ANCOVA analyses were used to test if the sex of the companion individual changed the relationship between companion size and focal individual depth.

Finally, regressions were performed to determine whether the focal individuals' size affects its depth distribution. The MANOVA analysis revealed both sex and predation risk affect the depth distribution of mosquito fish. Although the MANOVA analysis revealed only a trend of companion sex affecting focal individual depth, the second regression analysis revealed that increasing male size resulted in decreased female distance from the surface.

The subsequent ANCOVA analysis showed that female reaction to companion size was significantly different in the presence of another female than in the presence of a male. Therefore, it appears as though female *G. affinis* in this study incur increased predation risk to avoid sexual harassment by males. Although no evidence of a risk behavior trait was found in male *G. affinis*, that is, moving deeper in the presence of females versus in presence of other males, females appear to be more receptive to larger males by moving up in the water column, reducing the predation risk that they take upon themselves.

Since females participate actively in the probability of success of a given male, sexual selection is occurring as active sexual selection rather than passive sexual selection.

Deborah Allen Joins WRRI Staff as Records Specialist

Deborah Allen

WRRI is pleased to welcome its newest staff member, Deborah Allen. Deborah joined the WRRI in mid-October as Records Specialist. She is the institute's receptionist and is responsible for mailings, filling publication requests, maintaining the library and assisting its patrons, assisting with conferences and meetings, and assisting staff members with various projects.

Deborah comes to the WRRI with vast library experience having worked at the New Mexico State University library for the past 12 years, most recently in government publications. Her knowledge will be very helpful in maintaining and adding new references to the WRRI's library holdings of over 10,000 books, reports, and journals, and its extensive collection of maps.

During her tenure at the NMSU library, Deborah worked on a soil sciences degree and will receive a B.S. in soil science this December. In November, Deborah will celebrate her first wedding anniversary with her husband, Marvin Allen.

Deborah replaces Michelle Del Rio who worked at the WRRI for the past five years. Michelle resigned in September and is looking forward to new challenges. The staff wishes her well.

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pushing for a loan guarantee program for the Bureau of Reclamation. The money is intended to revitalize existing infrastructure with an eye to increasing all forms of efficiency.

Conservation is also essential, as you know. I am a strong proponent of two initiatives: to clean up our forest watersheds and to improve the health of our riparian bosque areas. Last year we were successful in passing healthy forest legislation. This year we hope to pass a salt cedar management demonstration program. New water supplies are essential. We must tap resources that have previously been unusable, like the large saline aquifers. We need to reuse water as we have been saying. The key issues to expanding water supplies are cost effective water treatment and appropriate disposal of waste by-products.

I am a believer in technology. I got together a bi-partisan group in the Senate along with a similar group in the House to introduce a bill to develop a new national program in water technology. Our desire is to revitalize U.S. water augmentation technology and the development effort that will accompany it. To do this, we are going to try to invest as much as $225 million a year in an array of technologies. Best of all, the national laboratories and universities of New Mexico, in partnership with their colleagues throughout the Southwest, will lead this effort.

A couple of weeks ago, I toured the city of Rio Rancho where they have a water reuse pilot plant and was very encouraged by what I saw. El Paso is also moving forward aggressively with desalinization. Alamogordo and Albuquerque are also making steps in this direction.

My goal is to give groups an opportunity to implement new technologies to address their water needs. It is my expectation that much of the development, testing, and manufacture of the next generation's water technology will occur in New Mexico if we are vigilant and work hard to make sure what we have is known. Those of you here are aware of the crisis we are facing and are dedicated to finding solutions and options that will address the water shortage. I am pleased to see so many water experts and policy makers gathered to discuss these problems and to look forward to their solutions. I look forward to them with you. We will do our part, you do yours. Thank you very much and it is good to be with you.

NMSU Student Studies Use of Nonpotable Water on Turf

Story by Darrell J. Pehr, Agricultural Communications, New Mexico State University

LAS CRUCES – New Mexico State University student Casey Johnson kneels in the grass near the NMSU golf course and squints in the sunlight.

Working on a crucial putt? No. But Johnson is working to ensure others will be able to enjoy green lawns and have a more abundant supply of drinking water.

His research looks at using nonpotable, saline groundwater to grow a variety of turf watered by sprinklers or subsurface irrigation. His research plot covers almost an acre south of the golf course and includes 21 types of grass.

Johnson is one of 12 students who received research grants from the Water Resources Research Institute at NMSU through increased funding from the 2003 New Mexico Legislature. The one-year grants, up to $5,000 per project, support water resource research by undergraduate and graduate students at New Mexico's six public universities.

Johnson, of Auburndale, Wisconsin, is a second-year NMSU master's student. He earned a bachelor's degree in horticulture from the University of Wisconsin and was attracted to NMSU's agronomy and horticulture department because of the type of water research being conducted.

For Johnson, the project is a chance to study the importance of water in a water-restricted environment, much different than his native state.

"I guess we kind of take water for granted (in Wisconsin)," he said. "It's something I think you have to take seriously in the desert."

Johnson's faculty adviser, NMSU Cooperative Extension Service turfgrass specialist Bernd Leinauer, said with 70 to 80 percent of the groundwater in New Mexico considered highly saline, the research is extremely important. Leinauer said using low quality groundwater, brackish water, and effluent from wastewater treatment plants can save good water while sustaining landscapes and sports fields, such as golf courses. Leinauer estimates golf courses' green fees and cart rentals generate $120 million a year in the state's economy.

The key is finding grass varieties that can thrive in salty conditions.

Casey Johnson, NMSU graduate student, examines a blade of grass at the NMSU golf course. He and others are trying to produce recreational lawns using low quality groundwater, brackish water, and wastewater effluent. (Photo by J. Victor Espinoza)

"It's really hard to find the perfect grass that can sustain those salt loads," Leinauer said. Complicating matters are New Mexico's seasonal temperature extremes. And with many new turf varieties coming on the market, more research is necessary.

Johnson's project uses geothermal water that also is used to heat part of the university. It is cooled from 120 to 140 degrees to about 80 degrees, then piped to the plot. Assisting Johnson is the university's facilities and services office.

Now that the plots are becoming more established, they can be tested for salt accumulation in the soils and its affect on the turf. Researchers also will look at how salts are pushed into the soil and whether they will impact shallow groundwater. The project will continue over about 10 years, said Leinauer.

Senator Domenici addresses water conference participants

The 49th Annual New Mexico Water Conference, *Water Desalination and Reuse Strategies in New Mexico* was held in Ruidoso on September 20-21. Although Senator Domenici was unable to attend the conference because Congress was in session, he made a video tape of his comments, which was shown at the conference. The Senator's comments follow.

Hello, I'm Senator Pete Domenici and it is my pleasure to speak with you today. Let me first extend my gratitude to the Water Research Institute for hosting the 49th annual water conference.

More and more people are moving to this beautiful state that we call home and we need to find a way to sustain our water needs to accommodate a growing population and most importantly, create new and better jobs. I am particularly pleased that the theme of this conference is water desalinization and reuse strategies for New Mexico. The use of water purification technology will be one of the key tools in our efforts to provide usable water for all New Mexicans.

I would like to have been with you today, in particular I would like to have gone with you to take the tour of the Tularosa Desalination Facility in Alamogordo. I have a keen interest in bringing less expensive, less energy intensive, and less wasteful water purification technology into common use in New Mexico and hopefully across the nation.

The Tularosa Desalination Facility, once complete, will allow us to do cost performance testing for new technology in order to reduce the financial risk of using a new technology for our communities. Improved technology will also help our access to much lower quality water, which is currently stored in the Tularosa Basin and basins like it.

Commissioner John Keys of the Bureau of Reclamation and I are working to have the facility ready to begin testing the new marine expeditionary force desalinization unit in the early spring. The facility should be completed by the end of 2005.

While the key theme of this conference is desalinization and water reuse, I need to provide you with a glimpse of the wider federal efforts we are undertaking to help our state and other water-stressed areas. We have a global water supply problem. In 1998, 28 countries experienced water stress or scarcity. That number is expected to rise to 800 million people in 56 countries by 2025. Water shortages will be faced by nearly every major city in the world over the next 20 years. New Mexico and the southwestern United States already know what I am talking about. Transfers and advanced water treatment are necessary. Our small communities are even more dramatically impacted.

Our solutions will require a broad set of tools including water markets, understanding our resources more completely, efficient use of existing supplies, and expanding water supplies. A key issue in establishing water markets is to build a cohesive understanding of water rights. In many regions of the West, Indian rights have not been adjudicated and this uncertainty affects a long-term investment needed to expand our water supplies. At this point, we are working on four such settlements that affect New Mexico alone. These negotiated settlements, if completed within a manageable budget, offer the best opportunity to support existing uses and to bring surety to the basins in conflict. Congress does not negotiate the settlements but I have directed a great deal of my staff time to study these settlements. All of them are difficult and all are expensive. But I am confident that we will persevere to completion. An equally important job related to water markets is assessing existing resources. We are working to support the Office of the State Engineer by providing support for the measurement of water resources within the state of New Mexico. Additionally, Senator Bingaman and I are developing a new program to assess the groundwater resources along the U.S.-Mexican border with initial focus on the basins in southern New Mexico.

Efficiency means more than just turning off the tap when you do not need water. It means rebuilding infrastructure in a way that utilizes every drop of diverted water to its maximum extent. However, the money to build or revitalize our infrastructure is lacking. To partially address this issue, I am

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NMSU Student Researches Forest Hydrology

Story by Darrell J. Pehr, Agricultural Communications, New Mexico State University

LAS CRUCES - The negative effect of dense forests is clear, but the impact of various forest thinning treatment techniques can be murky. New Mexico State University graduate student Anthony Madrid hopes to bring greater understanding of thinning options through his research in Mora and Cloudcroft.

"We need to look at these thinning treatments and how they affect these areas," said Madrid, who grew up on a cattle ranch near Cuba, N.M.

Of particular interest, after thinning, is how much erosion will take place from runoff across sparsely vegetated areas on the forest floor, and whether any of the runoff will percolate into subsurface flows.

Madrid is a range science student who earned a bachelor's degree in natural resources management from New Mexico Highlands University in 2003. His research is divided between four research sites in Mora and three in Cloudcroft. He is studying ponderosa pine as well as mixed conifer forests at about 9,000 feet in elevation.

The Mora site has not yet been thinned. Madrid is studying the forest in gently sloping areas as well as steep places.

In Cloudcroft, where trees less than 9 inches in diameter already have been thinned, Madrid is researching sites where logs are piled up as well as areas that have scattered slash and comparing them to untreated areas.

Madrid and 11 other students received research grants from the Water Resources Research Institute at NMSU that were supported by the 2003 New Mexico Legislature. The one-year grants, up to $5,000 per project, support water resource research by undergraduate and graduate students at New Mexico's six public universities.

"We've had 100 years of fire suppression that have led to denser forests, a lot of pine needles and not a lot of herbaceous cover," said Sam Fernald, Madrid's faculty adviser and an assistant professor of animal and range sciences at NMSU.

"The hope is by thinning the forest, we'll have more surface vegetation," Fernald said. "Hopefully we'll get better forest health and better watershed health."

Madrid conducts several experiments at his research sites, such as simulating rainfall and measuring runoff, erosion and vegetative cover. Soil moisture sensors below the ground help determine whether the rainfall is percolating into the soil.

"A lot of watersheds need help," Madrid said. "We need to manage them a little better."

The research also is a chance to reach out to the community. Next month, Madrid will lead a Cloudcroft High School FFA team on a tour of his research plots.

"He's really been a great emissary for the university," Fernald said.

NMSU graduate student Anthony Madrid is studying the relationship between forest thinning and watersheds at research sites in Cloudcroft and Mora. (Photo by J. Victor Espinoza)

Water Information

Report of the Rio Grande Compact Commission 2003 has been published. For a copy, contact the WRRI at 505-646-4337 or email a request to nmwrri@wrri.nmsu.edu.

Fellowships

The Ivanhoe Foundation provides a limited number of fellowships to assist needy and deserving foreign students studying for a practical M.S. degree in engineering or science, with an emphasis on water resources. U.S. students majoring in water conservation and recycling issues will also be considered for the 2004-2005 year. Contact lfivanhoe@aol.com for more information.

USGS Reports Available

Geochemical characterization of ground-water flow in the Santa Fe Group aquifer system, Middle Rio Grande Basin, New Mexico by L. Niel Plummer and others (WRIR 03-4131); contact Phil Bowman at 505-830-7923 for copies of the report.

Water Quality in the Nation's Streams and Aquifers - Overview of Selected Findings, 1991-2001 (Circular 1265); contact Iris Collies at 703-648-6860 for copies of the report.

2005 NOAA Postdoctoral Program in Climate and Global Change pairs recently graduated postdoctorates with host scientists at U.S. institutions to work in an area of mutual interest. The Program focuses on observing, understanding, modeling, and predicting the climate system on seasonal to centennial time scales and assessing the regionally specific socioeconomic consequences of climate variability. The program offers two-year postdoctoral fellowships. For information, visit web site: http://www.vsp.ucar.edu.

REQUEST FOR PROPOSALS

NATIONAL COMPETITIVE GRANTS PROGRAM - FY 2005

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, issues of importance nationwide. 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 $1,000,000 in federal funds, though there has not been a FY 2005 appropriation of funds for this program as of the date of this Announcement. Any investigator at an institution of higher learning in the U.S. is eligible to apply for a grant through a Water Research Institute or Center. 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 http://niwr.org/ by 5:00 PM, EST, February 22, 2005 and must be approved for submission to the National Competitive Grants Program not later than 5:00 PM, EST, March 4, 2005 by the Institute or Center through which they were submitted. The Government's obligation under this program is contingent upon the availability of appropriated funds.

New Mexico investigators interested in submitting a proposal should contact the WRRI at (505) 646-4337 as soon as possible.

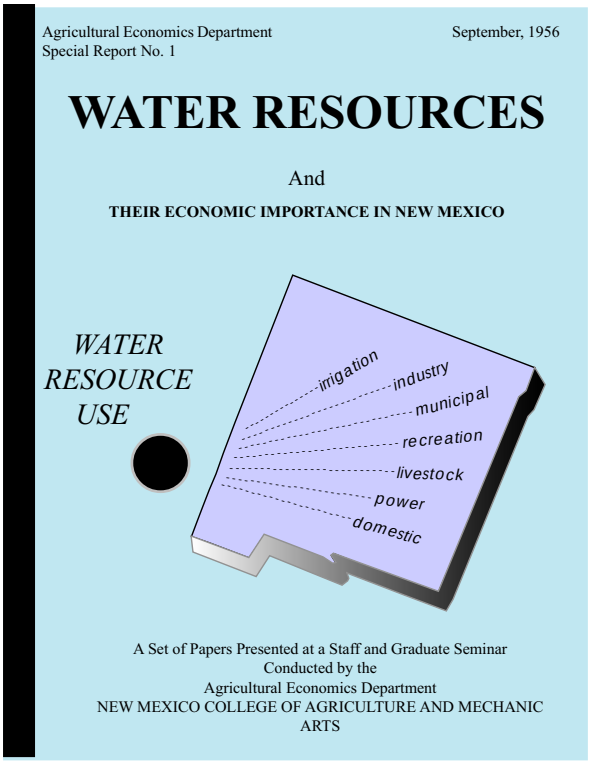
Help Us Celebrate by Planning to Attend

Water Resources Research Institute's

50th Annual New Mexico Water Conference

October 18-20, 2005
Corbett Center
New Mexico State University

In conjunction with the 50th Annual New Mexico Water Conference, we will be hosting a staff reunion. If you worked at the WRRI in the past or know of someone who did and where they are working or living now, please call us at 505-646-4337 or email us at nmwrri@nmsu.edu.



Cover of the First Annual New Mexico Water Conference proceedings (1956)

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