

# DIVINING ROD

NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

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## Tech scientists use state-of-the-art genetic technology Biodegradation study of contaminants in New Mexico aquifers

New Mexico Tech biologist Dr. Rebecca Reiss and environmental engineer Peter Guerra have recently brought the intricate methodologies of molecular biology to bear on the problem of understanding how and to what extent naturally occurring microbes



Environmental scientist Peter Guerra of Rio Grande Environmental Inc., who received his master's degree from NMTech in 2001, is shown here using a sampling pump.

can remove some dangerous contaminants from New Mexico groundwater. Their research findings will be published by the WRRRI later this spring in a technical completion report. Interested readers are encouraged to obtain this comprehensive report for the technical details that are necessary for a full appreciation of their work, while here we can only highlight qualitatively their principal findings.

In their study, the chemical culprits are combinations of ethane, a hydrocarbon gas in the same alkane family as methane or natural gas, and members of the reactive halogen family of elements including especially chlorine and bromine. In particular, they focus on dibromoethane (EDB) and dichloroethane (EDC), both of which are toxic carcinogens. These chemicals are used in the petroleum industry, and according to the authors there are over 100 locations in New Mexico that have dihaloethane contaminated soil and groundwater, often as a result of leakage from underground storage tanks. Evaporation and sunlight (which induces photochemical reactions) can

remove some of the dihalogens from surface soils, but they can persist for years underground unless they are biodegraded by microorganisms. This is the reason for the focus of the authors on the problem of quantifying the role of microbes in biodegrading these contaminants.

Since these microorganisms consist of single cells, they have nothing we would recognize as a mouth with which to munch on the dihalogens. Instead, they rely on enzymes called dehalogenases to disrupt the carbon-halogen chemical bond so that they can utilize the remaining alkane substrate. The instructions for making these enzymes come from particular genes. One such is named *dhla*, short for haloalkane dehalogenase. This gene is on a section of DNA isolated from the bacterium *Xanorbacter autrophicus* strain labeled as GJ10. Another similar enzyme that degrades EDB but not EDC is coded for by a similar gene labeled *dhaA*, which was discovered in the microorganism *Rhodococcus rhodochromus*. This knowledge base was acquired largely through tradi-

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date set

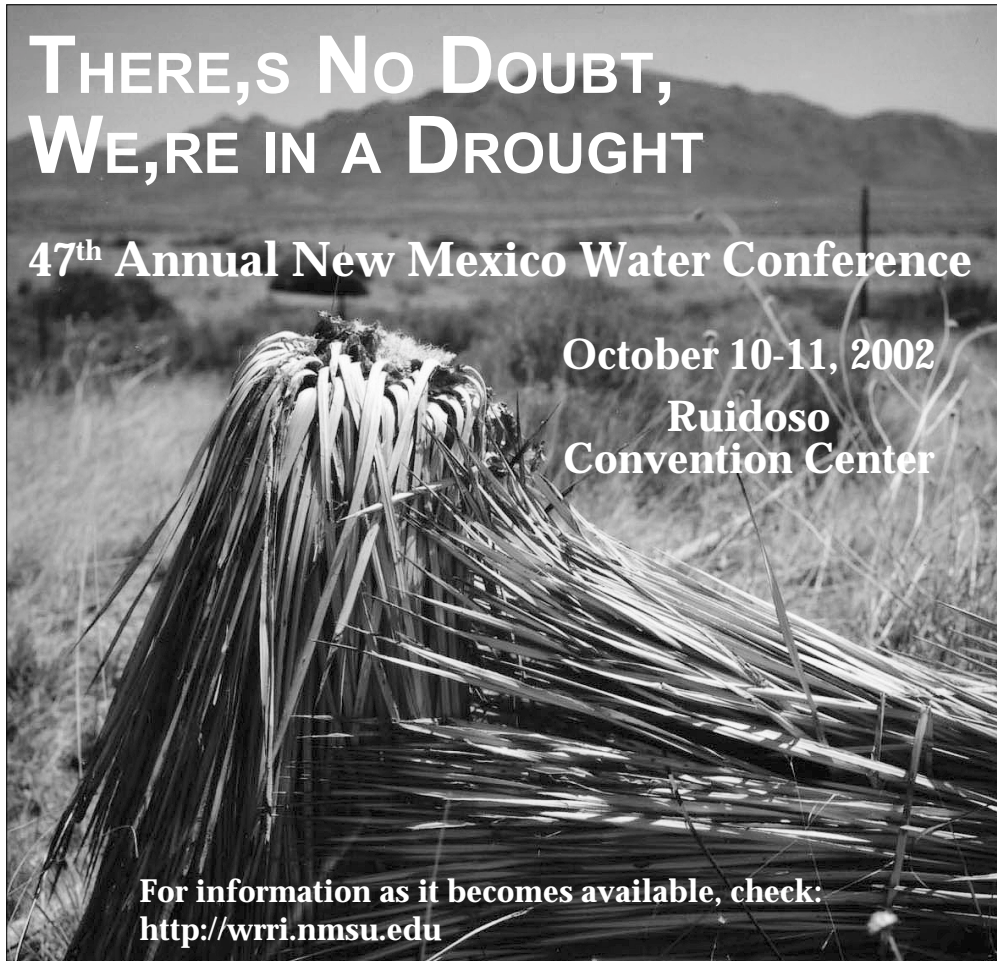
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**THERE'S NO DOUBT,  
WE'RE IN A DROUGHT**

**47<sup>th</sup> Annual New Mexico Water Conference**

**October 10-11, 2002**

**Ruidoso  
Convention Center**

**For information as it becomes available, check:  
<http://wrrri.nmsu.edu>**

Photo by Victor Espinosa

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tional microbiological techniques that depend on the ability to culture the responsible organisms, thereby isolating and amplifying the sought for components. Newer molecular techniques that allow the selective amplification of much smaller portions of the genome (the organism's full set of genetic instructions) can provide much more information on the diversity of species responsible for dehalogenation, and in this fashion, the widespread ability in nature for biodegradation of dihalogens has been established. As an example, from their search of the literature the authors list a total of 26 microbes known to have dehalogenase activity.

The initial objective of the authors was to characterize the biodegradation of EDB and EDC in New Mexico aquifers by monitoring the *dhla* gene. To focus on a single gene like this requires

the ability to boost its concentration. The cutting edge technique for doing this is PCR, which stands for Polymerase Chain Reaction. A polymerase is a naturally occurring enzyme that can catalyze the formation and repair of DNA. In 1993 Kary Mullis was awarded the Nobel Prize in chemistry for finding a way to start and stop a polymerase's action at specific points along a single strand of DNA. In the process, two small "primer," bits of DNA that reflect the coding of the DNA target strand at its endpoints serve to constrain the polymerase to replicate just the selected DNA sequence. Often this target sequence can be amplified a billionfold in just a matter of hours. With this discovery it has become possible to generate adequate quantities of precise genetic material

that molecular biologists need for their work.

Although the authors' preliminary results suggested that the *dhla* gene from DNA extracted from groundwater could be detected by PCR, the process was found to be unreliable. For example, sequence analysis on PCR products from the groundwater samples gave the same sequence as the positive control bacterium GJ10, possibly indicating cross contamination. In any case, under these conditions reliable detection of the *dhla* gene in groundwater samples was not possible.

The good news is that the researchers found an alternative approach that was successful, namely the detection of dehalogenase activity in crude protein extracts made from groundwater samples. Recall that while the genes

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## Meet the Researcher

### Dr. Rebecca Reiss

Assistant Professor of Biology  
New Mexico Tech since 1995

#### Research Focus

Molecular evolution of arthropod populations isolated by climate change.

#### Education

Ph.D., genetics, Cornell University, 1991

Dissertation entitled *Repetitive DNA in the malaria vector Anopheles gambiae* (analysis of repetitive DNA in mosquitoes)

M.S., genetics, University of New Hampshire, 1978

B.S., biology, University of Colorado, 1976

Certificate, Photography, Modern School of Photography, 1976

#### Experience

Assistant Professor.  
New Mexico Tech.  
1995-present.

Post-Doctoral  
Researcher: Univer-  
sity of North Dakota,  
Department of  
Biology, 1993-1995;  
developed molecular  
genetic techniques to  
study the biogeogra-  
phy of modern and  
fossil arctic and  
alpine beetles.

Post-Doctoral  
Researcher: Univer-  
sity of California at Irvine, Depart-  
ment of Molecular Biology and  
Biochemistry; conducted research  
aimed at developing novel methods

of controlling the transmission of  
insect borne infectious diseases.

#### Teaching

General Biology  
Genetics  
Molecular Ecology  
Biotechnology

#### Advising

Presently, 4 undergraduate students  
2 master of science teaching students  
2 thesis committees

#### Research Grants

WRRI: *Genetic Techniques for the  
Verification and Monitoring of  
Dihaloethane Biodegradation in New  
Mexico Aquifers*; co-author with Peter  
A. Guerra, master of science student;

National Science Foundation: *DNA  
Sequencing, a Multidisciplinary  
Approach*, Instrumentation and  
Laboratory Improvement; Period:  
1998-2000, \$69,919

Hispanic Collaborative for Research  
and Education in Science and Tech-  
nology (HiCREST) program. Pro-  
vides support for undergraduates to  
work on verification of dh1A gene  
polymerase chain reaction signal from  
aquifer samples. Period: 1999-2000.  
\$5,000.

National Science Foundation: *Paleo-  
genetics of Quaternary Coleoptera*,  
Small Grant for Exploratory Re-  
search; Period: 1996-1998. \$7,700

#### Publications

Reiss, R.A. and P.  
Guerra. Estimation of  
biodegradation rates  
from direct enzyme  
assays on uncultured  
groundwater samples.  
To be submitted to  
*Applied Environmental  
Microbiology*.

Reiss, R.A., P. Guerra,  
M. Stavelly, K.L.  
Duidier, N. Godard, and  
K. Watson. In prepara-  
tion. DNA and protein  
isolation and analysis  
from groundwater  
samples. *Biotechniques*.

Reiss, R.A., D.P.  
Schwert, and A.C.  
Ashworth. 1999.

Molecular genetic  
evidence of post-Pleistocene population  
divergence of the arctic/alpine ground  
beetle *Amara alpina* (paykull). *Journal  
of Biogeography*.

(continued on page 10)



Professor Rebecca Reiss (middle) stands with her students in front of their first-place poster at the New Mexico Environmental Health Conference in October 2000. Peter Guerra, a graduate student is at the left, and undergraduate Malinda Stavelly is on the right.

Period: 2000-2002, \$50,000. Final  
report currently under review and  
should be published during the spring  
of 2002



# CALL FOR ABSTRACTS

## New Mexico Water Research Symposium

August 13, 2002  
New Mexico Tech, Socorro

This one-day symposium provides a forum for researchers, engineers, and students in the region to present their current water resources and water infrastructure related research and development activities and projects. Concurrent sessions will feature presentations and information exchanges on a wide range of water-related research. Posters will be displayed throughout the day.

**Technical Sessions are being organized around the following topics:**

- Water and Wastewater Treatment and Reuse
- Erosion and Sediment Control
- Water Quality and Pollution
- Economics and Policy Analysis
- Watershed Assessment, Planning, and Management
- Wetlands and Riparian Issues
- Agricultural, Industrial, and Municipal Water Use
- Atmospheric, Surface and Groundwater Modeling
- Groundwater
- Water Management
- Water Quantity
- Impaired Water
- Desalination
- Pollution Prevention
- Water Security
- Fish and Wildlife/Endangered Species

Abstracts for presentations in these focus areas are particularly solicited; however, abstracts related to any and all water research and management topics will be considered, and sessions may be added depending upon abstracts received. Abstracts are also solicited for poster presentations.

Abstract requirements: Please submit abstracts of 400 words or less in Microsoft Word or WordPerfect for PC by email to [nmwri@wri.nmsu.edu](mailto:nmwri@wri.nmsu.edu). Abstracts will be provided to conference participants.

All registration is on-line at [wri.nmsu.edu](http://wri.nmsu.edu).

Deadline for abstracts for either presentations or posters: July 1.

Deadline for general registration: July 31.

Cost is \$20/person and includes lunch.

Final symposium agendas will be provided to all registrants in early August and will be posted on the WRRRI website: <http://wri.nmsu.edu>

The Symposium is 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, Office of the State Engineer, U.S. Geological Survey, John Shomaker and Associates, Inc., American Water Resources Association, New Mexico Section, and WaterBank.

## Student research is particularly welcome!



## Reports Available

### USGS reports

The following two reports were recently published by the U.S. Geological Survey. Copies are available for inspection at the USGS District Office in Albuquerque (5338 Montgomery Blvd NE, Suite 400). 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.

**Estimation of hydraulic characteristics in the Santa Fe Group Aquifer System using computer simulations of river and drain pulses in the Rio Bravo study area, near Albuquerque, New Mexico** - by D. Michael Roark, prepared in cooperation with the City of Albuquerque (WRIR 01-4069)

**Analysis of the magnitude and frequency of the 4-day annual low flow and regression equations for estimating the 4-day, 3-year low-flow frequency at ungaged sites on unregulated streams in New Mexico** - by Scott D. Waltemeyer, prepared in cooperation with the New Mexico Environment Department (WRIR 01-4271)



### Water conservation handbook

Well known conservation leader Amy Vickers has written *Water Use and Conservation*. This long-awaited book, totaling 446 pages, covers the topic of water conservation planning and discusses a long list of conservation measures for the residential,

landscape, industrial and agricultural sectors. The author is an engineer with an independent consulting practice, specializing in water conservation and integrated resources management, and has overseen water conservation projects in the United States, England, and Eastern Europe. To order, go to [www.waterplowpress.com](http://www.waterplowpress.com).



### New curriculum for Rio Grande/Rio Bravo

*Discover a Watershed: The Rio Grande/Rio Bravo Educators Guide* is the newest publication in the Discover a Watershed series from The Watercourse/International Project WET. Its publication is the result of a collabora-

tive effort among thousands of educators, students, resources managers, scientists, and others from both Mexico and the United States. The curriculum provides educators and students from grade six through university level with opportunities to investigate the hydrology, geology, geography, plants, fish and wildlife, culture, history, or contemporary issues of the Rio Grande/Rio Bravo watershed, and includes activities on water conservation topics. A Spanish edition of the curriculum will be available in the near future. To order, contact Linda Hveem at The Watercourse/International Project WET at 406-994-1916. The cost is \$23.95.

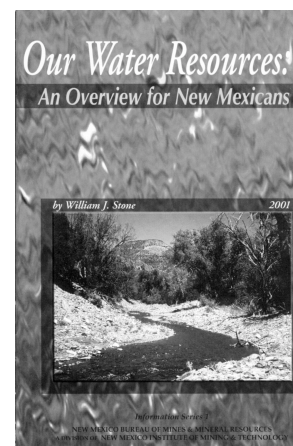


### Overview of New Mexico's Water Resources

The New Mexico Bureau of Mines and Mineral Resources has published Information Series 1, *Our Water Resources: An Overview for New Mexicans*, written by William J. Stone. According to Stone, the purpose of this booklet is to bring together under one cover an overview of New Mexico water-resource facts and concerns and to familiarize the reader with the various agencies that deal with water resources in the state. The 40-page full-color booklet answers the questions:

- Where does our water come from?
- Why do water availability and quality vary across the state?
- What contaminants can get into our water?
- Is my water safe and how can I find out?
- Are there laws governing water use and pollution in New Mexico that I should be aware of?
- What can we do to protect our water resources?
- What information is available on the water resources of my area and where can I get it?

The publication was prepared in cooperation with New Mexico Environment Department, New Mexico Office of the State Engineer, and the U.S. Geological Survey, Water-Resources Division. The booklet is available by calling the New Mexico Bureau of Mines and Mineral Resources Publications Office in Socorro at 505-835-5410 or in Albuquerque at 505-366-2530. The web site address is <http://geoinfo.nmt.edu>.







# Senior Water Essays Captivate Water Conference Participants

At last year's WRRRI water conference, participants were treated to high school students reading their award winning essays during the luncheon. Students from around the state responded last fall to the WRRRI's water essay contest by writing about the following scenario:

*The year is 1905 and you live in the New Mexico territory, which has been experiencing drought conditions for the past decade. Describe your life, telling us where you live, how you make a living, your daily experiences with obtaining water for your needs, how you are preparing for continued dry conditions, and what your concerns are for your children and grandchildren regarding their future water needs.*

Essays were judged in two categories: Juniors (9<sup>th</sup> and 10<sup>th</sup> grades) and Seniors (11<sup>th</sup> and 12<sup>th</sup> grades). First place in each category received \$300 and second place received \$200. Several students received Honorable Mention certificates. In the last issue of the Divining Rod (Winter 2001), we published the Junior winning essays. This issue contains the winning essays in the Senior category.

## First Place - Senior Division

Kurt Sanders

Cimarron High School

On the day that my great-grandson and I celebrated our birthdays, my 114<sup>th</sup> and his 16<sup>th</sup>, he posed a question to me.

"Granddad, what were things like when you were sixteen?," The only answer I could give him was that things were a lot different. He wouldn't understand not being able to turn on a faucet and have cold, clear water come pouring out at no end. His question really had me thinking. I suppose that I, too, take water for granted nowadays. Ninety-eight years ago it was a different story.

My family had settled in the New Mexico Territory before I was born. Growing up on the northeast plains near a small town called Cimarron allowed me to learn the ways of the land and the vicious cycle of nature at an early age. I was born in 1887 on the family ranch, and the only way of life that I knew was that of the rancher. For the first eight years of my life that I could remember, my father prospered. He had a fine herd of Hereford cattle and they made him a decent living until the first of the droughts hit in 1895. As soon as this happened, the grass began to wither until the only evidence of it ever being there were parched, desiccated clumps that were not palatable by the cows. Because of this, my father had to make weekly trips to town to buy feed for

the cattle. This put quite a dent in his budget for the next year so he sold off 100 of his steers and heifers to the market in hopes of recovering his losses.

The winter was long, cold, and worst of all, it was dry. If we were lucky enough to have a snowstorm blow through, it did just that; it blew through. Any snow that hit the ground blew away or stacked into small drifts that turned to solid ice under the decree of the relentless wind. A few of the older mama cows died and some of the late born calves had a real tough time of it, but they pulled through. Hope against hope, my father prayed for the spring rains, but March passed without seeing a sole drop of rain. April and May also left nothing but more wind, dust, and death. With the passing of these months went the hope of seeing vast thunderheads gather on the horizon to bring life-giving rain. Before summer even arrived, the days were already unusually long and hot. Each day my father had to lead the cows to water and feed them there so they wouldn't become parched trying to search for the life giving nectar of the earth. As the summer wore on, my mother's prized vegetable garden withered and died. Each day my older brother and I had to haul water from the creek in tin pails to help her water her garden. As soon as we poured the water on the plants it would soak into the ground and disappear. A few hours later the ground was cracked and parched as before but we couldn't spare any more water for the garden because our family as well as the livestock needed it far more

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desperately. Seeing this broke my mother's heart as each year she looked to the harvest for vegetables to can and put away for the winter.

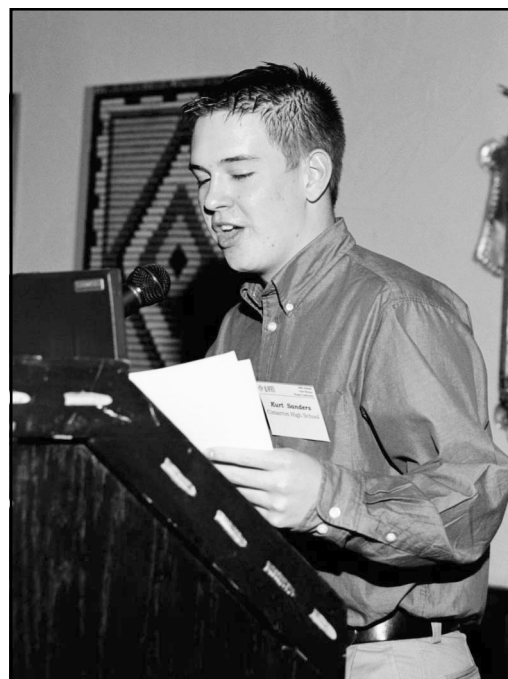
As the summer neared its end, my father had to make an arduous decision. Could he hang on for one more year in hopes of the rains returning, or would times get so bad that he would have to sell out to support his family? As I lay in bed one night, I overheard him talking to my mother.

"Ethel, the cows is dyin' and I cain't do nuthin about it. I don't want to sell out but I gotta keep food on the table for ya'll., Then I would hear my mother's soothing voice reassure him followed by silence. Now, my father was not an educated man, but he knew the land and the ranching lifestyle. He also knew when it was time to toss in the towel. He could be stubborn and hang on like his neighbors, but he also had a wife and three children to support.

We managed to hang on for two more years but finally the cows were so dismal, they weren't even recognizable as my father's once prized herd. The money finally ran out and my older brother took a job in town as a blacksmith's apprentice. This helped to keep us fed, but it just wasn't enough. An eleven year old can only do so much to help, but when he doesn't understand the severity of the situation, he feels as if all effort is in vain. Circumstances finally became unbearable and my father was forced to sell the ranch. What little money the parched land and emaciated cattle brought was used to buy a house in the town of Cimarron where my father hired on at the livery stable. My mother took a job in the general store while my little sister and I attended school. My older brother was already eighteen and had a good job. He had also found him a nice girl to settle down with but he was worried about starting a family with things in the state that they were.

As the years drug on, I watched many once prosperous ranchers hit bottom and have their hopes and dreams blow away with the dust on the wind. Finally 1903 rolled around and I turned sixteen. I was through with school and now I had to find work. I had always wanted to follow my father's footsteps and run the family ranch. Since there was no ranch, I struck out for Denver. I got a job in a bank and worked myself up to the position of teller. The drought ended in 1905 but I stayed on in Denver with my new wife to raise the first of my five sons. Soon enough however, I was called into service in the First World War. After my service was through I took the pension the Army had given me and I struck out for Cimarron with my family. I managed to buy back most of my father's ranch, but he wasn't around to see me prosper. The land had recovered so my new herd of

*Kurt Sanders reads his essay during lunch at the November 2001 Water Conference. Kurt received first place in the Senior Division.*



cattle flourished. I rebuilt the ranch house and made a nice little living off of the land. None of my five sons was interested in continuing the ranching business, so when I retired I sat on the property until I decided it was time to pass it on. "Granddad, do you want some cake?,"

My great grandson's voice snapped me out of my thoughts. He had always been the outdoors type and seeing an opportunity, I decided it was time to pass on the ranch.

"No thanks. Pull up a chair would you? I've got a story for you and then I'm going to give you a birthday present like no other.,

"My father settled in the New Mexico Territory before I was born. I grew up on the northeast plains near a small town called Cimarron....,





## Second Place - Senior Division

Jennifer Stone

La Cueva High School

The year is 1905 and New Mexico territory is suffering from the worst drought we have ever seen. There has been very little rain or snow here since 1896. I know this isn't the first drought New Mexico has ever had and it certainly won't be the last. After several years of drought and dust storms, many people abandoned their farms, leaving New Mexico Territory in search of better land and plentiful water. Just a few years ago, multitudes of settlers had crossed the nation, lured by the open land and the promise of a good life. Unfortunately, they had assumed that the water would remain as plentiful as when they arrived. They brought ranching and farming techniques that were successful back east, but were a miserable failure during this extended drought. Some of those who might have stayed were forced to leave after losing their property to foreclosures when they were unable to pay their mortgage. One by one, they pulled up stakes and headed west toward California or back east to seaboard cities. Others have turned to a life of crime. I hear stories of robbing stagecoaches and holding up railroad cars. About a year ago we found out our neighbors were stealing cattle. The local lawmen came out to talk to them, but they were already gone.

I live in the northern region of the New Mexico territory on the San Juan River. Life is hard. Work in the fields is tough; the soil is hard and difficult to till. The few cattle that are left are very temperamental. They don't want to just graze on the dry tufts of buffalo grass; they want the soft, green fescue and clover of better, moister times. It seems like we are no longer a farming and ranching community, but a place in the desert for the travelers and railroads to

stop, refuel and get water to travel on to a more hospitable place.

The natives say we, the white settlers, have offended the gods and are being punished for our sins. They say that we have wasted our natural resources. My parents say that maybe they are right. We do sometimes waste water on buffalo. Some local folks say the drought stems from just bad luck and soon Mother Nature will bring back the rain. Others say it is a sort of natural selection: a survival of the fittest. Honestly, after almost ten years, I don't know what to think. I am only 13 and I can't remember plentiful water or rain. My parents always seem so worried about how we are going to be able to keep the cattle alive and the crops standing. At church I hear people talking amongst themselves

about this drought.

There has been talk of our territory becoming a state in the United States of America. I wonder if this drought and the shrinking population will affect that. We all worry if we have seen the worst or if this is just the beginning.

Night can be scary in New Mexico. About a year ago, my brother was bitten by a rattlesnake. I can't believe he didn't hear the snake rattle. I heard it across the barnyard. He had been tending the livestock in the fields all day, and he was ex-

hausted. We never used to have wild animals come in so close to our homes, but they are constantly on the move, looking for water just as we do. When my Dad goes hunting, he often returns empty-handed. There certainly seems to be a dwindling supply of deer and antelope in the bosque. They too suffer from the shortage of water and the subsequent reduction in vegetation to graze on. Migratory waterfowl have become scarce as their habitat has disappeared. The coyotes, searching for something to eat, keep getting closer and closer into town. Often I see their tracks just outside our front door. Sometimes at night, I am awakened by the sounds of barking dogs and neighbors shooting at the coyotes. A couple months ago, my small dog, Spot, disap-



*Tom Bahr, former WRRI director, congratulates Jennifer Stone for her second place award in the Senior Division of the 2001 Water Essay Contest.*

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peared. Dad told me he must have run away, but I heard he and my Mom talking about it late one night. Coyotes had gotten him.

It does rain occasionally. We all rejoice and pray for a gully-washer, but are always disappointed. When it does rain, we set out pails to catch every drop of water we can get. It doesn't really amount to much but it always feels so good on my parched tongue. We have also built cisterns to try to save every precious drop for future use. My brother asked me if the drought was going to get worse and if it was ever going to end. Tears welled up in my eyes as I told him I didn't know. I feel so bad for him, he is only seven and this drought is starting to affect him. He is supposed to be playing out in the yard with his the friends, not going with my mother and I to get water from the San Juan River because the level in our well is so low.

We don't know when this drought is going to end, so we are preparing for the worst. We have started raising sheep instead of cattle as they eat less and seem to be able to subsist on the meager vegetation better than cattle. We have also started looking for crops that need less water than the corn and potatoes we are raising now. Our family started digging deeper wells hoping that the water levels will hold until there is another rain. The town is considering building a dam on the San Juan to try to reserve the water. We continue to worry that the towns upstream of us will build a dam or somehow divert the river and not allow any of the water to reach us. If that were to happen I don't know what

we would do. I have heard people actually talk of having a range war over water! My dad mentioned at dinner last night the beginnings of a population growth plan. He said it would keep people from coming to New Mexico and using up all of our water. I don't know why anyone would willingly come to this place during such a dreadful drought. There is news of unrest in Europe. I wonder if they are having the same problems in Europe that we are having here.

Conservation of the precious water we have is the key to our future. One-hundred years from now, we certainly don't want to have to worry about our water supply. Learning to conserve now and teaching our children to conserve could save us from problems in the future. Not only do we need to use less water; we need to use it more wisely. We should ensure that we plant native trees and plants whenever possible to use less water. We also have to practice smarter farming so that drought doesn't result in erosion caused by winds blowing the dry, barren topsoil away. Strip cropping, crop rotation, and contour plowing as well as planting cover crops in fields will help prevent erosion. Planting native trees like red cedar, green ash, and aspen that require little water along fence lines can also reduce wind damage and erosion. Monitoring grazing and limiting the number of cattle per acre to prevent overgrazing will also help. Most importantly, we must learn to regard water conservation and storage as important all the time; drought or not. Clean, fresh water is necessary for our very existence. It must be respected and preserved.



## Call for Proposals

The U.S. Bureau of Reclamation's Desalination & Water Purification Research & Development Program is soliciting pre-proposals for research studies, pilot-scale systems, and demonstration projects. Approximately \$1 million is available in Fiscal Year 2002 for this effort. The funding supports investigations into ways of reducing the cost of desalting and water purification technologies. The ultimate purpose is to augment water supply in the United States.

Research focus areas include membrane processes, non-traditional and alternative desalination processes/technology, ancillary and economic improvements, concentrate issues, pilot-scale system testing, and demonstration plant/module design, construction, and testing.

The official solicitation can be found at [www.eps.gov/spr/DOI/BR/postdate\\_1.html](http://www.eps.gov/spr/DOI/BR/postdate_1.html). Scroll down the page to the February 13 posting date and select either line 1 or line 3. Line 1 contains information about research proposals excluding demonstration projects; line 3 contains information about demonstration projects. Reclamation will issue full proposal packages beginning April 30, 2002. Full proposals can be submitted without a pre-proposal. Those proposing a project must be willing to cost-share 50% or more of the project, except for academic institutions, which are not required to cost-share projects.



## Upcoming Meetings

- May 2-3, 2002 CLE International's The Law of the Colorado River, Sheraton El Conquistador Resort and Country Club, Tucson, AZ ([www.cle.com](http://www.cle.com))
- May 9-10, 2002 American Society of Civil Engineers, Stormwater Utilities, Austin, TX ([www.asce.org/distancelearning/index.cfm](http://www.asce.org/distancelearning/index.cfm))
- May 13-15, 2002 American Water Resources Association Spring Specialty Conference, Coastal Water Resources, Sheraton New Orleans, New Orleans, LA ([harriette@awra.org](mailto:harriette@awra.org))
- May 14-16, 2002 Udall Center for Studies in Public Policy at The University of Arizona, Environmental Conflict Resolution: The State of the Field and Its Contribution to Environmental Decision-Making, Loews Ventana Canyon Resort, Tucson, AZ (<http://conference.ecr.gov>)
- June 13-14, 2002 American Society of Civil Engineers, Hydrologic Modeling Using HEC-HMS, Sioux Falls, SD ([www.asce.org/distancelearning/index.cfm](http://www.asce.org/distancelearning/index.cfm))
- August 13, 2002 Water Research Symposium, New Mexico Tech, Socorro, NM ([wrri.nmsu.edu](http://wrri.nmsu.edu))**
- August 26-27, 2002 CLE International's New Mexico Water Law Conference, Bishop's Lodge, Santa Fe, NM ([www.cle.com](http://www.cle.com))
- October 10-11, 2002 WRRI's 47<sup>th</sup> Annual New Mexico Water Conference, There's No Doubt, We're in a Drought, Ruidoso Convention Center, Ruidoso, NM ([wrri.nmsu.edu](http://wrri.nmsu.edu))**
- October 28-30, 2002 7<sup>th</sup> Annual New Mexico Environmental Health Conference, Sheraton Old Town Hotel, Albuquerque, NM ([www.nmehc.org](http://www.nmehc.org))
- November 18-22, 2002 The First International Symposium on Transboundary Waters Management, Monterrey, México ([www.TransboundaryWatersMexico.org](http://www.TransboundaryWatersMexico.org))



## Public Meetings of the Upper Rio Grande Basin Water Operation

- Tuesday, April 16, Espanola, Rio Arriba County Complex, 1122 Industrial Rd.
  - Wednesday, April 17, Abiquiu, Abiquiu Elementary School, US Highway 84, Gate #21342
  - Tuesday, May 14, USBR Alamosa, CO, USBR Alamosa Field Division, 10900 HWY 160 E.
  - Wednesday, May 15, Pilar, BLM Visitors Center, HWY 68
- (additional information available at [www.spa.usace.army.mil/urgwops/](http://www.spa.usace.army.mil/urgwops/))



(continued from page 3)

Reiss, R.A. and B. Rutz. 1999. Quality Control PCR: A method for detecting inhibitors of Taq. DNA Polymerase. *Biotechniques*. 27:5:920-926.

Reiss, R.A., D.P. Schwert, and A.C. Ashworth. 1999. Field preservation of Coleoptera for molecular genetic

studies. *Environmental Entomology*. 24:3:716-719.

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(continued from page 2)

constitute the recipes for making proteins, it is the proteins themselves that provide the building material of the cells and are involved in most of the processes essential to sustain the organism. Among the proteins that are present in the microbial samples obtained from the groundwater are the dehalogenase enzymes. The extraction process for these included intense agitation of the water samples with sound waves ("sonication,") to disrupt cellular membranes, following by separation in ultracentrifuges providing a centrifugal force 45,000 times the strength of gravity. Proteins were analyzed in part using the technique of electrophoresis, wherein a protein mixture is applied to the edge of a thin gel that separates proteins in one direction according to their size within an electric field.

After obtaining the protein extracts, the assessment of the dehalogenase activity was based on a procedure that determines the amount of chlorine released from EDC when the protein extract is added. The release of chloride ions in solution was detected through the formation of strongly colored iron complexes. The dependence on acidity (pH) was also explored, and confirmed expectations that enzyme activity should diminish with increased acidity (greater hydrogen ion concentration), since that condition slows the diffusion rate of the hydrogen released by the chemical bonds broken by the enzyme, thereby increasing the time required for the enzyme to become re-activated to release more chlorine.

As a result of all these delightfully complex operations, the authors were able to establish these principal findings: 1) The protein analysis has the greatest potential for monitoring bioremediation of dihaloethanes. 2) The protein extraction process is relatively fast and easy, and requires only microbial samples that can be obtained on site through filtration techniques.

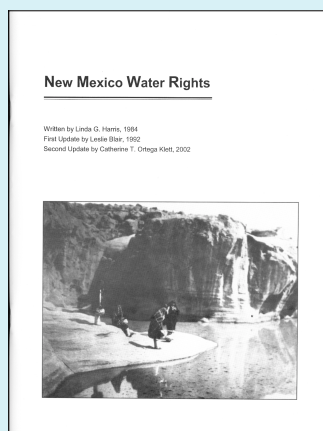
## New Mexico Water Rights Booklet Updated

WRI's most popular publication over the past 18 years has been *New Mexico Water Rights*. It was written in 1984 by Linda G. Harris, and updated in 1992 by Leslie Blair, and most recently, this year by Catherine Ortega Klett. Staff of the Office of the State Engineer were helpful in reviewing the booklet, particularly (now retired) John Nixon, Alice Darilek, and Paul Saavedra.

This 50-page booklet was written for the layperson. According to Harris' Introduction, "Its purpose is not to make you a water rights expert, but to help you understand more about the history, the laws, and the administration of New Mexico's water rights.,,"

The new edition contains updated maps of New Mexico's river basins, major aquifers and areas of the state covered by declared groundwater basins.

To order copies of this publication, contact the WRI at 646-4337, or order on-line at <http://wri.nmsu.edu>. The cost of the publication is \$10.50, which includes postage.



3) The assay for chlorine production can be used to estimate biodegradation rates in groundwater, which can then be incorporated directly into contaminant attenuation models that include non-biotic factors such as evaporation and photochemical oxidation. 4) Microbial culturing is not required. 5) Accurate estimates of enzyme activity can be made even if more than one gene is involved. 6) The method is not prone to contamination like PCR, since there is no amplification of product.

The authors also emphasize that the direct enzyme assay approach precludes the need for information about the variety of microbes in an aquifer. On the other hand, by combining the enzyme data with information regard-

ing species diversity, a better understanding of the bacterial species responsible for biodegradation will result.

Dr. Reiss indicated, "With adequate funding, we will be able to rapidly develop standard operating procedures for environmental engineers to monitor biodegradation potential within contaminated aquifers. Once we have a better idea of how nature cleans up pollutants, we will be able to develop more efficient techniques for bioremediation.,,"

The WRI report, *Genetic Techniques for the Verification and Monitoring of Dihalooethane Biodegradation in New Mexico Aquifers* will be available online at <http://wri.nmsu.edu> when it is ready for publication.





### WRRRI Staff Commemorates Anniversaries

In February, New Mexico State University honored staff celebrating milestones in the number of years worked at the university. Two WRRRI employees were among those receiving gifts in recognition of their service.

Peggy Risner, Administrative Secretary, joined the WRRRI in the spring of 2001. Peggy has worked in several departments in her 20 years with NMSU. She and her husband, Bob, life-long residents of Las Cruces, enjoy outdoor activities such as 4-wheeling and traveling. They also have great fun with their six-year old granddaughter.

Darlene Reeves celebrated an impressive 35 years with NMSU, with 28 of those years at the WRRRI. Darlene is the fiscal coordinator for the institute. In her many years with the institute, Darlene has assisted with over 29 water conferences and is often relied upon for her "institutional memory.," Darlene is married to Jim, who recently retired from NMSU's Entomology Department after 31 years. Darlene and Jim have two children and two grandchildren. They enjoy traveling whenever they can get away.



*Darlene Reeves (left) was honored by NMSU President Gogue for 35 years of service to the university. Peggy Risner celebrated 20 years with NMSU.*

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

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New Mexico Water Resources Research Institute

### DIVINING ROD

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