



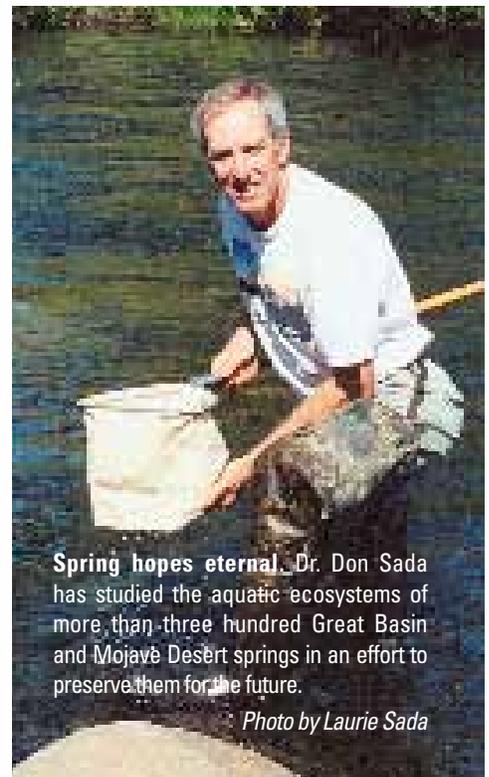
A Snail's Tale: The amazing story of survival in North American springs and wetlands

Across the western United States and northern Mexico, thousands of small springs, seeps, and wetlands provide the sole source of moisture in miles of inhospitable desert. Many of these small water sources are virtually unknown, while others have been fully developed for urban use, agriculture, recreation, native wildlife preservation, and even geothermal energy generation. Some of these springs gained notoriety as important waypoints in the American western migration of the nineteenth century. Others, for many millennia, have filled a critical role as the only point of relief in a parched landscape, with the most meager only barely darkening the surface of the ground.

In the past few years, a remarkable story of ecological transformation, adaptation, and survival spanning millions of years has been emerging from these small water holes, crusty seeps, and muddy playas. But it is a tale that is losing chapters as fast as they are being discovered. Within the most arid landscape of North America, scientists have discovered one of the largest collections of aquatic diversity existing anywhere in the world, let alone in a desert. At the same time, scientists are watching this newly revealed diversity disappear at what may be the fastest rate of any ecology on the North American continent.

Imagine, in this arid landscape, a past vast network of connected waterways—giant lakes, freely flowing streams and rivers, and thriving marshes—from the northern Great Basin to the Chihuahuan Desert of northern Mexico. In the Intermountain West, surface waters would be linked from the Owens Valley, along the eastern slope of the Sierra Nevada, south to Death Valley and the Amargosa and Mojave rivers, then on to the southwest and the San Bernardino River,

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Spring hopes eternal. Dr. Don Sada has studied the aquatic ecosystems of more than three hundred Great Basin and Mojave Desert springs in an effort to preserve them for the future.

Photo by Laurie Sada

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▲ **An early success in preserving unique habitats.** Jackrabbit Spring is one of about 50 in the Ash Meadows system. The rich biodiversity of this area, unexpected for such a harsh setting, was protected by the area's designation as a National Wildlife Refuge in 1984. It is located approximately 90 miles northwest of Las Vegas in the Amargosa Valley of southern Nye County, Nevada.

Photo by Don Sada

▶ **A prehistoric network of lakes and rivers.** Scientists believe climate conditions produced large lakes connected by rivers that allowed early species of springsnails and various fish to spread from Owens Lake to the Colorado River.

continued from page 1

and to the Colorado River in the southeast. Within these interconnected waterways, a few species of snails, known collectively as springsnails, gradually spread their range west from the Colorado River region and south from the Owens Valley to encompass the entire area.

This watery network, covering different expanses of this region at different times, was the result of periodic wet, or “pluvial” periods in North America’s climate. During the past two million years, these high water stands occurred at roughly 100,000-year intervals, with the lakes and rivers rising for the last time about 13,000 years ago.

Each time the region dried up, the springsnails and other aquatic species were stranded in isolated colonies, surviving only within the sharply defined boundaries of the small springs, seeps, and wetlands. When large lakes and rivers disappeared, the salts and minerals of the local soils, and the geochemistry and geothermal aspects of the surviving aquifers, concentrated their influence on the small, residual ecosystems. As the several springsnail species adapted to the conditions of each inhabitable water source, an inevitable process of divergent evolution began to create the multiple species being discovered continually today.

▲ **Limited habitat, critical resource.** Only a few feet across, the McNett Ranch Spring in Fish Lake Valley supports a tui chub habitat, one example of an endemic fish population that has managed to coexist with cattle. The springsnail population disappeared from this spring when its outflow was blocked to create a pond.

Photo by Don Sada



Dr. Don Sada, an aquatic ecologist in DRI’s Division of Hydrologic Sciences, says, by the broadest

definition, there are likely more than 100,000 springs, spring-fed wetlands, and seeps in the Western U.S., many of which have—or once had—unique ecosystems boasting their own unduplicated collections of aquatic species and riparian lifeforms that survived along the fringes.

“Many of these springs and wetlands have disappeared. Others are capped and piped to tanks, small settlements, farms, and ranches, or they have been obliterated by cattle or wild horses, or simply altered by tourists visiting popular rest stops or natural history sites,” Sada says. In other cases, adjacent groundwater development inadvertently diverted or reduced the supporting aquifer until groundwater no longer reached the surface.

As many as there are, according to Sada, “smaller springs have not had much scientific attention, until very recently. It’s only been in the last few years that attention has broadened from work on large springs, and the ecological importance of small springs has been recognized. Until a few years ago, nobody really had a clue

that small springs are ecologically important; unfortunately this was after many had been severely altered.”

For the past decade, Sada has been one of the leading scientists involved in an emerging effort to discover and describe the significance of these unique ecosystems. He says there is a growing cooperative effort among federal, state, and local resource managers, land owners, water utilities, and public interest groups, all working together to figure out a method to preserve this disappearing diversity amid conflicting claims and objectives.

While species of fish and amphibians have had the early glamour roles in this story, in fact, the central and most numerous actors are a multitude of virtually microscopic snails, that class of the phylum Mollusca known as gastropods. Not surprisingly, they have been historically overlooked in favor of horses, cows, and other large animals in the Intermountain West whose economic or environmental significance was easy to understand.

The study of snails—malacology—has existed for several hundred years, but, in the past, it almost always focused on species in larger systems. “A few nineteenth century naturalists noted the presence of snails in western desert springs,” says Sada, “but the first serious modern attempt to scientifically define the wealth of snail biodiversity in the Great Basin really did not occur until Dr. Dwight Taylor started his studies in the 1940s.”

Then it was not until the 1980s that Sada, then with the U.S. Fish and Wildlife Service in Nevada, and Dr. Robert Hershler, who is now a zoological curator with the Smithsonian Institution in Washington, D.C., began discovering the amazing “snails’ tale” of widespread adaptation and survival. Their examination of the proliferation of snail species throughout the West—specifically species of spring-snails within the family Hydrobiidae—began at Ash Meadows in southern Nevada and now has spread to hundreds, if not thousands, of sites.

They picked a good starting point. Ash Meadows, with about 50 fresh water springs, was already the focus of a major environmental controversy surrounding the endangered Devils Hole pupfish. The area, now a National Wildlife Refuge, has a higher number of endemic (locally originating) species for its given area than any other place in the United States, and is second only to Quatro Cienegas in Coahuila, Mexico, in all of North America.

“Refuge status is protecting that site,” notes Sada, “but across the West, pressure to develop scarce water resources, plain carelessness or neglect, and simple lack of awareness are rapidly claiming other springsnail habitats.”

But there is a glimmer of hope.

In 1998, six federal land management and resource agencies, along with the Smithsonian Institution and The Nature Conservancy, signed a Memorandum of Understanding to work to conserve the nearly 100 species of springsnails in habitats on federal and Nature Conservancy lands in the Great Basin. The agencies and involved scientists are working to identify threatened habitats and raise the awareness of a broad range of springs stakeholders throughout the West (See Conference sidebar at right).

“The likelihood of losing a great many more of these springsnail species is extremely high,” says Sada. “But finally there’s a genuine awareness beginning to take hold that this biodiversity resource is priceless, both for its endemic species and for the knowledge they hold about the natural history of the West.”

—John Doberty

DRI Hosts Spring-Fed Wetlands Conference in Las Vegas

More than 150 scientists, land use and water resources managers, land owners and land developers, and environmental activists met in a three-day conference sponsored by the Desert Research Institute in Las Vegas, May 7-9. They came together to discuss a common problem: how to manage the unique ecosystems and valuable resources of thousands of springs, seeps, and wetlands throughout the Intermountain West that are in danger of disappearing.

Dr. Don Sada, conference coordinator and a DRI aquatic ecologist who has studied western springs and wetlands for more than 20 years, said the conference was organized when it became clear that all of these wetlands stakeholders had a common interest in this resource, though they often disagreed on how to use the springs while maintaining their cultural and biological integrity.

“We realized these people were not talking to one another or coordinating their efforts. I think the conference made them realize how much their objectives have in common.”

The conference included presentations by speakers representing organizations ranging from the Texas Parks and Wildlife Department to the Smithsonian Institution to the Australian Museum. Nevada speakers, including representatives of the Southern Nevada Water Authority, DRI, and the University of Nevada campuses in Reno and Las Vegas, joined research colleagues from the University of Arizona, the University of California, Davis, and the U.S. Geological Survey.

An afternoon field trip to the Ash Meadows Wildlife Refuge examined one of the major successes in preserving an endangered spring ecosystem and several endemic species that exist only in that location. Sada said the University of Nevada Press will produce conference proceedings, and conference participants are committed to working together to ensure that follow-up conferences and colloquia continue the discussions among wetlands stakeholders.

Snail Science:

Old shells, isotopes, and salty water

Following the trail of snails through the springs and seeps of the Great Basin is a means to an end for Dr. Saxon Sharpe, a paleoecologist in the Desert Research Institute's Division of Earth and Ecosystem Sciences. Sharpe's purpose is clear: she wants to know what ancient snail shells remaining from the region's prehistory can reveal about past—and perhaps future—climate and the conditions that supported the snails' many tiny, unique, and isolated habitats.

Sharpe works with shells as small as the tiny balls of medicine packed inside 24-hour cold relief capsules—in fact, that's how she stores them! Others are as large as the familiar restaurant variety, and there are many sizes in between. Radiocarbon dating is used to determine the age of the shells, or of the material in the sediment in which the snails' shells were found. After preparing her shell specimens, Sharpe sends them to a laboratory for analyses of the isotopic ratios of oxygen and deuterium contained in the shells.

“Snail shells can be considered waste products excreted by the snails that eventually grow into their protective armor,” she says. “Included in that waste are fixed stable isotope ratios from the water the snails lived in that help to identify changes in the hydrology that occurred during the snails' lifetime.”

“Was there a steady flow of water through the snails' habitat, or did the water flow in and stay there to evaporate? This approach gives us specific data about how each spring or seep was affected by varying precipitation, groundwater flow, and climate.”

Another approach of Sharpe's research, and one that is brand new in the field of malacology—the branch of zoology dealing with mollusks—is to understand how the relative proportion of



▲ **Snails' details are important.** Examined by microscope, Sharpe identifies snail shells for further preparation before sending samples for stable isotope analysis.

Photo by John Doherty

▶ **A spoonful of clues to past and present environments.** These are some of the larger varieties of snails that Sharpe analyzes for clues to ancient climates and the unique mix of salts that make up suitable habitats for individual species.

Photo by John Doherty



▲ **Where the snails are.** Dr. Saxon Sharpe collects snail shells for clues to the environment thousands or millions of years ago.

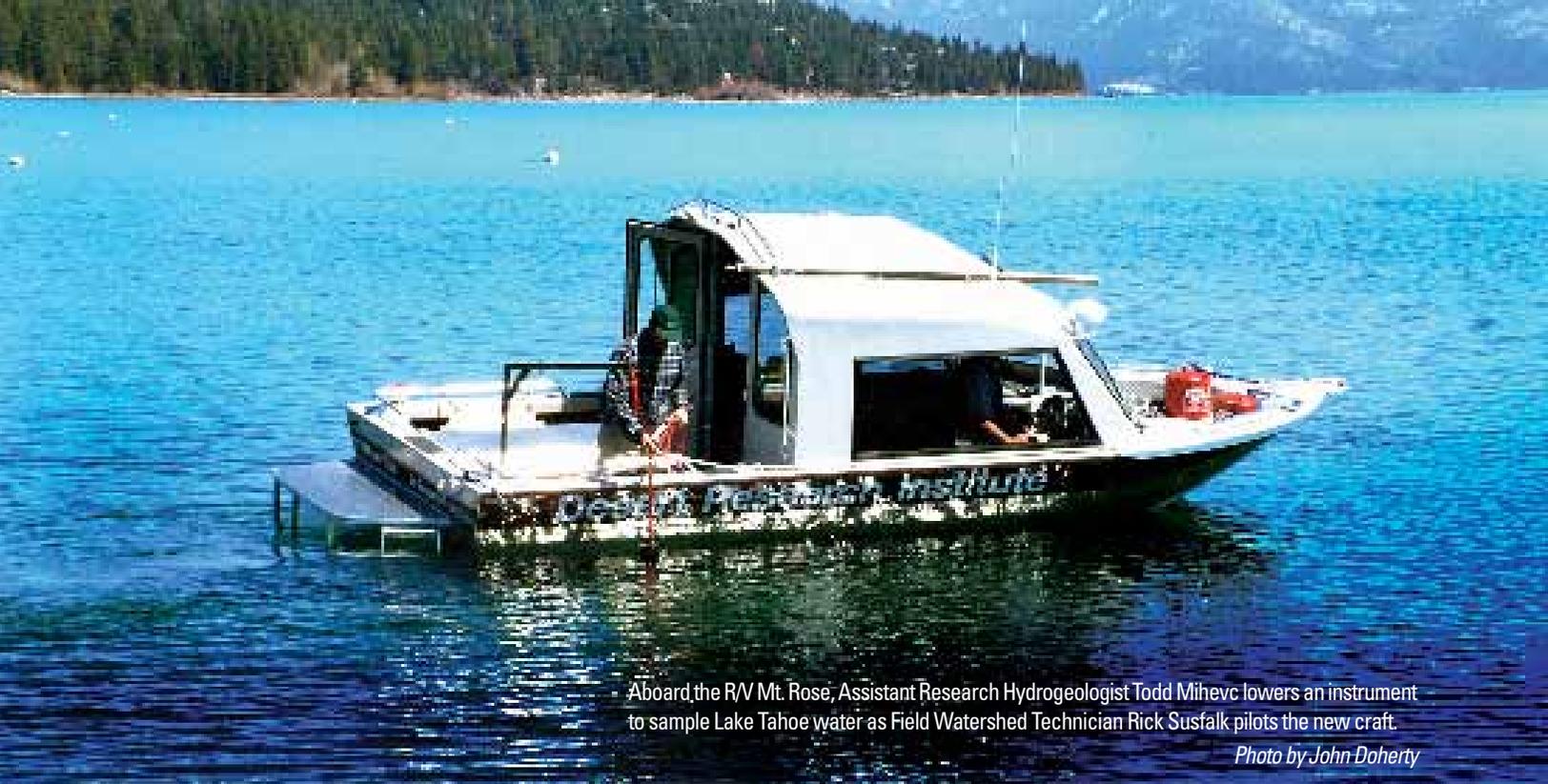
Photo by Kelly Conrad

salts—specifically calcium and carbonate—in water affects the distribution of different snail species.

“For example,” Sharpe says, “the occurrence of an individual springsnail species may be tied to a particular ‘type’ of water. This water ‘type’ is based on something we, as humans, cannot see, taste, or feel: the percentage of calcium or carbonate. The ‘type’ of water a snail inhabits may turn out to be as important as water temperature or food sources.”

And why is it important to know so much about snails? Because, Sharpe points out, “once we understand what's important to a particular species, we can begin to figure out how to preserve the essential aspects of individual habitats and preserve biodiversity for the future.”

—John Doherty



Aboard the R/V Mt. Rose, Assistant Research Hydrogeologist Todd Mihevc lowers an instrument to sample Lake Tahoe water as Field Watershed Technician Rick Susfalk pilots the new craft.

Photo by John Doherty

“R/V (Research Vessel) Mt. Rose”

DRI Research Boat Launched on Lake Tahoe

The Desert Research Institute launched a new research boat on Lake Tahoe early this spring, providing an important new tool to support DRI’s studies of watershed processes in the endangered national treasure. Dr. Ken Taylor, a hydrologist and research professor in DRI’s Division of Hydrologic Sciences, said the 21-foot craft—funded by private donors to the Institute—is set up flexibly for installation of a variety of types of research equipment required by different sampling tasks.

An enhanced electrical system handles multiple instruments and data recording systems, with a boom on the side for lowering instruments into the water. A probe on the boat’s bow allows collection of water samples in front of the boat before the boat’s turbulence disturbs the water. The propellerless water jet propulsion system enables the boat to work in shallow shoreline water to identify locations where poor quality water enters the lake from streams, storm drains, overland flow, and groundwater.

The boat’s enclosed, heated cabin shelters the instruments and operators during poor weather. “This is particularly useful because some of the research involves determining the influence of storms on the lake, so we’ll be working in less than optimal weather,” Taylor notes.

According to Taylor, initial studies conducted last summer indicated that most of the material contributing to the clarity loss along the shore appears to be coming into the lake from a small percentage of the lakeshore. The studies were funded by the sale

of Nevada’s Lake Tahoe specialty vehicle license plates and by the Lahontan Water Quality Control Board.

“In the next year, we will be trying to identify the specific locations of these problem areas. This will allow environmental improvement efforts to focus where they will be most effective. To accomplish this, we need to keep the boat on the lake, ready to commence sampling on short notice, to detect the influence of mountain storm conditions and the resulting surface runoff along the shoreline,” Taylor explains. This work is part of a larger program with the University of California, Davis and the University of Nevada, Reno to determine how much undesirable material is entering the lake and what the source of that material is.

Taylor is hoping to enlist assistance for DRI’s research effort in the coming year. “Tahoe City Marina donated a slip to DRI for our old pontoon research platform last winter,” he says. “We will be focusing on the south end next fall and winter, and we are hoping someone in that area will offer us a place from which we can operate the boat.” Taylor asks that anyone who might be able to help contact him at kendrick@dri.edu or (775)673-7300.

DRI scientists work alongside researchers from the University of Nevada, Reno and the University of California, Davis on a wide range of projects in the Lake Tahoe Basin. For further information, visit DRI’s web site and read the related articles: <http://newsletter.dri.edu/2001/fall/TahoeChallenges.htm>.

—John Doherty

You Mean We Have a Choice?

Alternative futures assessments help planners determine where they want to be

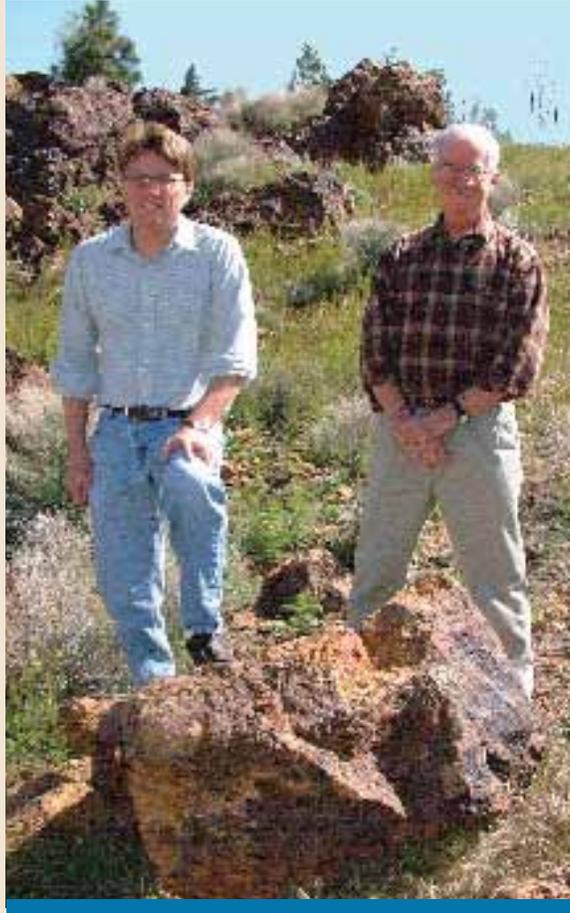
Not sure what life has in store for you? Need help making important decisions about your future? An ancient Greek might have traveled to Delphi to consult the resident Oracle, while these days you might just travel to the phone to consult that network of supposedly psychic friends. But, if you're looking for something a bit more credible, and if you're particularly concerned with how society and the environment will interact in a rapidly changing world, you might ask Drs. David Mouat and Scott Bassett about an alternative futures assessment.

Far from being supernatural or mystical, an alternative futures assessment combines hard physical sciences like hydrology, ecology, and biology with a healthy dose of sociology. The process is being increasingly recognized as a valuable land-use planning tool—especially where competing interests vie for increasingly limited space and resources.

An alternative futures assessment provides a compelling framework for visualizing possible future landscapes, leading to more effective planning and better-informed decision-making. In this sense, an alternative futures assessment is something like looking into a crystal ball, a crystal ball that describes a range of possible future conditions based on the specific issues that concern an area.

“We try,” says Mouat, currently the principal investigator for an alternative futures assessment at the Marine Corps Base at Camp Pendleton in Southern California, “to present a reasonable array of likely futures based on the expectations and values of those who live and work in a place—the stakeholders—and the economic, physical, and environmental realities of the region.”

Who those stakeholders are and what they value and expect varies, of course, from place to place. For instance, in the



How many futures can you imagine? Drs. Scott Bassett, left, and David Mouat consider the range of possibilities stemming from various land use decisions.

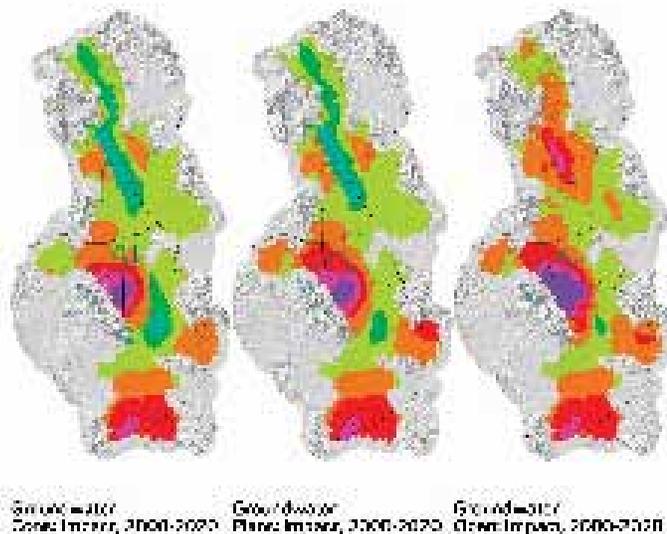
Photo by John Doherty

Upper San Pedro River Basin in southern Arizona and Mexico where Mouat and Bassett recently helped complete an alternative futures assessment, stakeholders include the United States Army based at Fort Huachuca, the copper mining industry, the farming and ranching communities, land developers, residents, and environmental groups. Naturally, all of these stakeholders have their own concerns and issues. Environmentalists want to protect habitat for species like the southwestern willow flycatcher and the pronghorn antelope. Farmers and ranchers want water for crops and cattle. Developers want that same water for growing communities. Residents want to maintain views and the aesthetic value of wide-open spaces and living close to wilderness. Mining companies want to stay in business, and the Army wants to quiet calls for closure of the base by showing that its activities are not to blame for declining species numbers

and falling groundwater levels.

“In the San Pedro area, water is really the key issue,” says Bassett. “It drives everything. But that’s not necessarily going to be the case everywhere.” The issues—whether they be water, biodiversity, fire and flood protection, or air quality—have to be identified individually for each area, and to do that, Bassett says, you have to really get to know a place and its people.

“It’s a matter of discovering what is really important to people, and they are not always sure themselves. They may say it’s important to them to see the cottonwoods from their window. But are they willing to cut their water consumption by half to keep the trees alive? Are they willing to pay more for that water? Are they willing to limit development to specific areas? These are the kinds of things we want to find out.”



“Water is really the key issue.” These three maps show groundwater level changes stemming from development scenarios for the Upper San Pedro River Basin, likely results of three approaches to land use planning, from a lesser depletion of the local aquifer, on the left, to a greater depletion on the right.

The researchers do that in a variety of ways, including combing local newspaper articles, sending out questionnaires, conducting phone surveys, and holding workshops. It is the first step in creating the alternative futures scenarios, and, according to Bassett, it is a valuable process in itself. “At the very least, a futures project helps a community figure out its expectations for the future and exactly what it values.”

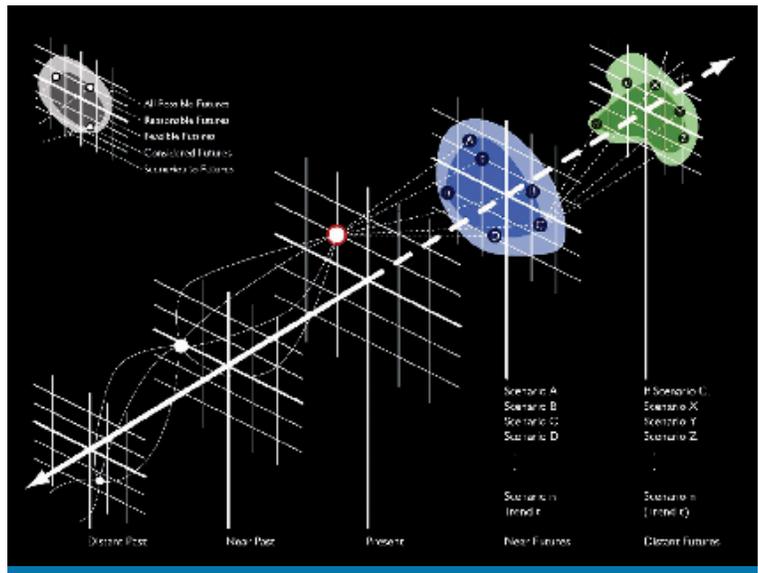
Next, the researchers determine which factors, say growth rate and development patterns, will be likely to affect those values and expectations and begin designing the alternative futures. “Obviously,” explains Mouat, “there are hundreds of options to work with, ranging from ‘everybody moves out and nature takes over’ to ‘we pave over and build on every square inch.’ We try to pick a range of realistic ones.”

Using a hypothetical example, three different population projections—one based on present trends, one based on lower-than-forecast growth, and one based on higher-than-forecast growth—and three different building scenarios—one concentrating development in a central area, one allowing it to spread at random, and one creating satellite communities in outlying areas—could be combined to create nine reasonable future scenarios. “At the end,” explains Mouat, “you have a series of alternative futures and a series of impacts that each of those scenarios will have on the identified issues (e.g., water availability, habitat).”

Finally, the researchers hold public meetings where the alternative futures and their resultant impacts are laid out in detail. While it marks the conclusion of the researchers’ work, it is only the beginning for the stakeholders who must then turn the data into action—planning, negotiating, and decision-making. And that is really the ultimate goal. “At its core,” says Mouat, “an alternative futures study should be about giving people a conceptual framework to resolve conflicts and plan for the future.”

But that does not mean it makes everyone happy. In fact, says Mouat, “the parties at either end of the spectrum are often very unhappy. The developers are mad at us, the environmentalists are mad at us. The futures don’t favor their positions.” Often, too, the futures show that negative impacts are unavoidable, as in the San Pedro study where all scenarios resulted in a loss of groundwater storage, affecting both wildlife habitat and municipal water supplies. “Truth is,” says Bassett, “when everyone wants the same thing, something’s got to give.” While an alternative futures assessment can’t change that fact, it can present stakeholders with a realistic set of expectations and alternatives and, perhaps most important, a chance to look at the situation from another point of view. “It opens people’s eyes,” says Bassett, “and allows them to see possibilities they might otherwise never have considered.”

Mouat and Bassett hope to take their eye-opening assessments to other areas struggling with tough decisions about the future. Recently, they made a presentation on the technique to the

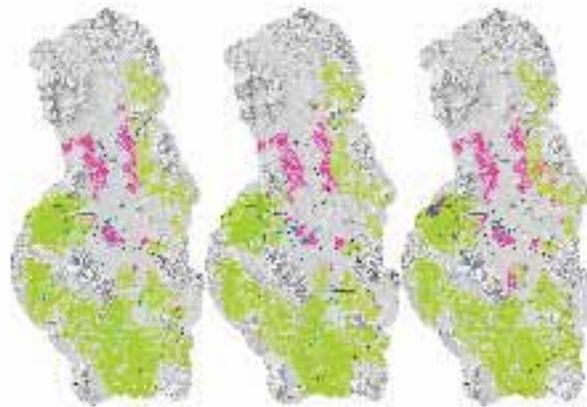


No easy decisions: defining the boundaries within which possible futures might lie. This diagram gives a hint of the many variables and value-weighted choices land use planners must consider. Based on predictive modeling and ecological and demographic data from a Geographic Information System, it helps identify possible alternatives.

Graphic by Allan Shearer, Harvard Design School

Western Governors' Environmental Summit in Salt Lake City, Utah. Mouat has also traveled to Namibia where communal farmers (the indigenous people), the eco-tourism industry, environmental interests, the mining and diamond industries, and ranchers create a complex web of competing needs, all dependent upon the country's very limited water supply. "The alternative futures process is really most useful in a dynamic area like that, where there are a lot of competing interests to consider and no clear way to reconcile all their needs."

In another current DRI effort in the arid and semiarid parts of China, Mouat and Dr. Walter Zachritz, director of DRI's Center for Arid Lands Environmental Management, are trying to seek solutions to the problem of land degradation. Degradation has resulted in blowing dust, reducing visibility, closing airports in China and South Korea, and causing significant environmental and health hazards. Mouat points out that



Pronghorn
Census Impact, 2025-2050 Pronghorn
Census Impact, 2025-2050 Pronghorn
Census Impact, 2025-2050

Animals and plants also have alternative futures. These maps projecting possible future population densities for the pronghorn antelope are an example of how native flora and fauna factors are calculated for land use planners. The antelope is a prominent native species and a key indicator of environmental health as development increases in the Upper San Pedro River Basin region.

the natural world with humanity. And, as much as possible, it serves them all."

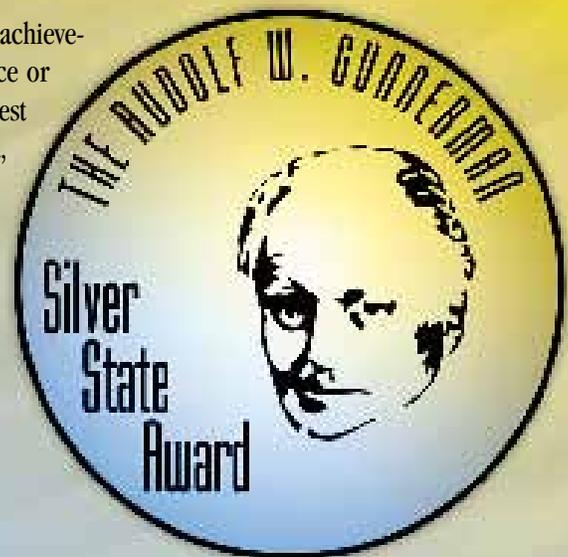
—Jackie Allen

August 1, 2002 Deadline for Nominations: Rudolf W. Gunnerman Silver State Award for Excellence in Science and Technology

The Gunnerman Award is presented annually to a Nevadan to recognize achievement that clearly satisfies a societal need either through fundamental science or its application. The purpose of the Gunnerman Award is to recognize the "best and brightest" of scientific achievement and technology development in Nevada, thereby showcasing the state as a strong supporter of these key areas of innovation. The Award includes a minted medallion and \$25,000 cash prize.

For information on the award or to download nomination forms, please visit the award's pages on DRI's web site: <http://ia.dri.edu/Gunnerman/> or contact Dr. James Coleman, DRI Vice President for Research and Business Development, Desert Research Institute, 2215 Raggio Parkway, Reno NV 89512-1095.

Email: jcoleman@dri.edu. Telephone: (775) 673-7322



Anderson, Costello, SBC Nevada Bell, and NDA receive DRI President's Medals

The Desert Research Institute has awarded DRI President's Medals to two long-time DRI supporters, retired IBM executive and business consultant Dr. Arthur Anderson, and Las Vegas attorney R. Richard Costello, former chair of the DRI Research Foundation. DRI President Stephen G. Wells also awarded the medals to two Nevada corporations, SBC Nevada Bell and the Nevada Development Authority (NDA). SBC Nevada Bell was recognized for its sponsorship of DRI's national science award, the Nevada Medal, and WeatherNet, one of DRI's K-12 educational programs. Nevada Development Authority received the President's Medal for the Authority's cooperative work with DRI to promote diversification of Nevada's economy, particularly in the technology arena.

Anderson, an emeritus trustee of DRI's Foundation, has served on DRI's National Science Advisory Committee since the early 1980s, and he has provided pro bono guidance on Institute planning and strategy efforts. He also set up the nomination and selection process for DRI's Nevada Medal program. Costello, a former chair and current trustee of the DRI Research Foundation, has advised DRI on patenting and technology-transfer initiatives and has also volunteered as a diver on DRI Arctic research programs.

SBC Nevada Bell was the charter sponsor for DRI's Nevada Medal and continues to provide the annual medallion and \$10,000 prize. The company has also been instrumental in establishing WeatherNet, a DRI science education program that involves weather stations at rural schools throughout Nevada.

NDA has worked with DRI to encourage the adoption of a plan to incubate technology-based business development through the establishment of new research programs within the University and Community College System of Nevada.



- ▶ Dr. Arthur Anderson
- ▲ DRI President Stephen G. Wells (left) and R. Richard Costello.
- ◀ DRI President Stephen G. Wells and Marsha Lindsey, President, SBC Nevada Bell.
- ▼ Left to right: DRI President Stephen G. Wells, NDA President Somer Hollingsworth, and NDA Chairman of the Board Ken Ladd.



NEVADA MEDAL DINNERS



▲ In Reno, left to right seated around the table: Dana Hall, Rita Utt, Judi Cail, Jerry Cail, and Sam Derrivan. Standing: Linda Nicoll and Regent Howard Rosenberg. Also in attendance at the Reno event, but not pictured, was Regent Douglas Roman Hill.



▲ In Reno, left to right: John Dobra, Mary Korpi, John Todd, and Jonathan Brown.

◀ In Reno, left to right: Medalist M. Gordon Wolman, Geraldine (Gerrie) Lilley, Mary Ansari, and UNR President John Lilley.



▲ In Las Vegas, left to right: Assemblywoman Ellen Koivisto, Vic Koivisto, Commissioner Myrna Williams, Assemblyman Bob Price, Assemblywoman Kathy McClain, Roger Jacobson, and Ellen Jacobson.



◀ In Las Vegas, left to right: DRI Research Foundation trustee Fred Gibson, Jr., Regent Dorothy Gallagher, and Governor Kenny Guinn.



▶ In Reno, left to right: DRI Research Foundation Co-Vice-Chair David Fulstone II, Assemblyman Joe Dini, Sheriff Dennis Balaam, Diane Balaam, and Mouryne Dini.



◀ In Las Vegas, left to right: Summer Lee, Assemblyman John Lee, Terry Murphy, Be-Be Adams, Marcia Holmberg, Bud Cranor, and Warren Hardy II.

▲ In Reno, left to right: DRI President Stephen G. Wells, Beth Wells, DRI Research Foundation trustee John H.O. LaGatta, Nazir Ansari, and Countess Angela Dandini.



◀ In Reno: Congressman Jim Gibbons and Assemblywoman Dawn Gibbons' table.



▶ In Las Vegas, left to right: UNLV President Carol Harter and Senator Dina Titus.



NEVADA MEDAL DINNERS



◀ In Las Vegas: Tom Krob and State Controller Kathy Augustine.



▲ In Reno, left to right: Senator Bernice Martin Mathews, Gene Sullivan, Anita Sullivan representing U.S. Senator Harry Reid, and DRI President Stephen G. Wells.

▶ In Reno, left to right: Senator Randolph Townsend, Gail Sande, John Sande, Assemblyman Greg Brower, Lauren Brower, and Jim Webster.



◀ In Las Vegas: Tim Crowley and UCCSN Board of Regents Chair Thalia Dondero. Regent Douglas Seastrand, not pictured, also attended the event.



▲ In Reno, left to right: Joyce Newman, Assemblywoman Vivian Freeman, and Richard Freeman.



▲ In Las Vegas for the Nevada Medal presentation, left to right: DRI President Stephen G. Wells, SBC Nevada Bell Area Manager for External Affairs Bob Bass, Medalist M. Gordon Wolman, and Governor Kenny Guinn.



▲ In Reno, left to right: Julia Pierko, John Tracy, UCCSN Chancellor Jane Nichols, and Jim Nichols.



▲ In Las Vegas, left to right: Steve Sebelius, Regan Mitchell, and Regent Mark Alden.



◀ In Las Vegas, left to right: Assemblywoman Kathy McClain, Assemblywoman Vonne Chowning, Maureen Brower, Gene Segerblom, and DRI President Stephen G. Wells.

▶ In Las Vegas, left to right: DRI Research Foundation trustee Troy Wade II, Mary Wade, Elaine Wolman, and Medalist M. Gordon Wolman

All Nevada Medal Dinner photos by Scott Gerz.



The 2002 Nevada Medal Dinners raised more than \$115,000 to support DRI's environmental research programs.



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|-------------------------------------|--------------------------------------------|-------------------------------------------------|-------------------------------------------|
| A Classy Lady | Dr. Reinhard Bruch & Jutta Gietel | Ethel M Chocolates | Regent Douglas Roman Hill |
| Be-Be Adams | John Burrows | Dr. William Eubank | Dr. Kent Hoekman |
| Adspec/Joe Cervantes | Steve & Linda Buszka | Euphoria Salons & Day Spas | Houssels Family Foundation |
| Airport Plaza Court Restaurant | Jerry and Judi Cail | Excitement Mountain Bike Tours | Hyatt Regency/Lake Las Vegas Resort |
| Allen Sarac's Professional Karate | Cake & Flower Shoppe, Inc. | Executive Gift Source/
Stephanie Lerude | Illuminations Salon & Spa |
| Alpha Services/Jeanne Richard-Jones | Shelley Cannon | Frank J. Fahrenkopf, Jr. | International Services/Dana Hall |
| Alpine Meadows Ski Corporation | Canyon Gate Country Club | Mr. & Mrs. Ben Farahi | Mark & Barbara Jackson |
| Senator Mark Amodei | Capriotti's Sandwich Shop | Jack Fegely & Doloris Darden | Dr. Roger & Ellen Jacobson |
| Anderson Dairy/Kim Webster | Robert Cappuro | Frank & Victoria Fertitta | Bruce & Nora James |
| Dr. Arthur Anderson | Lee Chapman | First American Title Company | Kevin Janison |
| J. Robert Anderson | Chevy's Fresh Mex | First Class Pawn & Jewelry | John Ascuaga's Nugget |
| Angel Park Golf Club | Circus Circus | Fisher Space Pens | Jones Vargas |
| Nazir & Mary Ansari | Senator Bob Coffin | Fitness Millennium/Leslee Bender | Ann Keaveney |
| Dr. Goesel Anson, M.D., F.A.C.S. | James & Adele Coleman | Flowing Tide Pub | Commissioner Mary Kincaid-Chauncey |
| Arizona Charlie's Hotel Casino | Margaret Conway | John & Tammy Fountain | Cheryl Kinder |
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Darren Meadows Wins 2002 Guinn Environmental Fellowship

Darren Meadows, a DRI graduate research assistant and Ph.D. candidate in hydrology at the University of Nevada, Reno, has been awarded the 2002 Kenny C. Guinn Environmental Research Fellowship. Meadows will use his fellowship to study the role of desert pavements—the natural crust that forms on the surface—in desert ecology.

Meadows is interested in investigating the relationship between the condition of the pavement and the infiltration and distribution of water within the soil directly beneath the pavement. His winning research proposal noted that pavements, generally composed of a layer of closely packed gravel over a layer of silt, are suspected to be one of the most significant factors influencing arid land ecosystems.

The fellowship, in its second year, provides a one-year award of \$15,000, an office at DRI, and use of the Institute's computer and laboratory facilities. DRI established the fellowship in honor of Governor Guinn's efforts in behalf of higher education in Nevada.



DRI Graduate Student Darren Meadows, third from left, is joined by Nevada First Lady Dema Guinn and Secretary of State Dean Heller as DRI President Stephen G. Wells announces Meadows' selection as the Guinn Environmental Fellow.

Photo by Scott Gerz

Dr. Leland Tarnay Receives Colin Warden Award



Mrs. Maureen Warden, widow of the award's namesake, poses with award winner Dr. Leland Tarnay. Mrs. Warden holds a photo of Colin Warden cycling at Lake Tahoe.

Photo by John Doherty

Dr. Leland Tarnay has received the Desert Research Institute's 2001 Colin Warden Memorial Endowment Award for his studies suggesting that western forests do not absorb atmospheric nitrogen from air pollution as rapidly as forests in wetter environments. Tarnay, a former DRI graduate research assistant who recently earned a Ph.D. from the University of Nevada, Reno, conducted his research as part of a larger effort to understand how air pollutants contribute to the loss of Lake Tahoe's famous water clarity.

Tarnay exposed fir and pine seedlings to nitric acid vapor in a laboratory simulation of Lake Tahoe's summertime conditions to observe how effectively the seedlings removed nitrogen, a significant nutrient cause of algal growth in lake water. His findings show that under arid summer conditions, when nitrogen levels from auto emissions are at their highest, the absorption capacity of pine and fir trees is nearly a third lower than prevailing scientific models have predicted.

"The full extent of what this means to the overall nitrogen budget of the Tahoe Basin isn't clear," says Tarnay, "but this indicates that prevailing predictive models developed in more humid environments may not accurately describe what is occurring in arid western forests." He believes the distinctions between dry and humid conditions could also influence other factors that affect the levels of algal nutrients entering Lake Tahoe.

The \$1,000 award is named for Colin Warden, a Washoe Medical Center electrician and an ardent environmentalist who died in 1991. His family and friends established the endowment to promote environmental research by graduate students working at DRI or supervised by DRI scientists.

Dr. Judith Chow Receives AWMA's Frank A. Chambers Award

The Air and Waste Management Association (AWMA)—the world's largest air quality association—has presented its most prestigious scientific honor, the Frank A. Chambers Award, to Dr. Judith Chow, a senior scientist in the Desert Research Institute's internationally recognized air quality research program. Chow accepted the award in June at the AWMA Annual Conference in Baltimore. She is the third DRI air quality scientist to be honored with the Chambers award (the previous recipients were Dr. William Pierson and Dr. John Watson), giving DRI the highest number for any single research or academic organization.

A member of DRI's research faculty since 1985, Chow directs a worldwide program of research at DRI focusing on the detection and analysis of extremely small airborne particulates that affect human respiratory health and impair scenic visibility. Shortly after joining DRI, Chow founded the Institute's Environmental Analysis Facility, where she leads a team of scientists and technicians in designing and implementing studies to quantify the state of air quality on local, regional, national, and international scales.

Chow is a research professor in DRI's Division of Atmospheric Sciences and has been the chief scientific investigator, or a major collaborator, on more than 50 large air quality studies and many smaller projects, with a total contract value exceeding \$20 million. She joined DRI after receiving her doctorate in Environmental Sciences from Harvard University.

DRI President Stephen G. Wells says Chow's research projects have been among the most significant air quality studies in the United States and the world, and her research results have been influential in national and international decisions to implement prevention and mitigation strategies. Especially prominent among the studies have been the State of Nevada Air Pollution Study, two Denver Brown Cloud studies, the Mexico City Particulate Study, and Chow's ongoing particle measurements in the California Regional PM₁₀/PM_{2.5} Air Quality Study and the Southern Nevada Air Quality Study.

Chow has developed and applied methods to determine organic and light-absorbing carbon (from vegetation and combustion sources) in U.S. national parks to support improved visibility in these scenic areas. She was recently awarded a five-year, \$3.3 million contract from the National Park Service's IMPROVE program to continue work on this project, which began in 1988.

Other sponsors of Chow's work include the U.S. Department of Energy, EPRI, the U.S. Environmental Protection Agency, the California Air Resources Board, the Hong Kong Environmental Protection Division, Harvard University, and Columbia University.

Chow has published more than 100 peer-reviewed journal articles and 50 book chapters in the areas of aerosol measurement, chemical composition, and the determination of pollutant sources through laboratory and field analyses. Her more than 200 scientific presentations and training courses have influenced scientists, regulators, and industry personnel throughout the world.

Chow is currently a member of the National Academy of Sciences/National Research Council Committee on Research Priorities for Airborne Particulate Matter. Formed at the request of Congress, the committee is charged with identifying the most important research priorities in setting particulate matter standards, developing a conceptual plan for particulate matter research, and monitoring research progress on the relationship between particulate matter and public health.

Chow also has been called upon to prepare and revise sections of the Environmental Protection Agency's air quality documents pertaining to chemical analyses and pollutant source emissions. She has prepared EPA guidance materials for aerosol measurement methods and developed sampling strategies and databases for the agency's guidance documents on network design. The documents are intended for use by scientists and air quality managers across the country.

—John Doherty

Jonathan O. Davis Scholarship and Stipend Awarded

The Desert Research Institute has awarded the \$3,750 Jonathan O. Davis Scholarship in Quaternary Sciences to University of Wisconsin-Madison graduate student Benjamin J. C. Laabs. Teresa Wriston, a graduate student at the University of Nevada, Reno, has been awarded the \$1,475 Jonathan O. Davis Stipend.

The scholarship is open to graduate students enrolled in a geology-related M.S. or Ph.D. program at any U.S. university. The stipend is open to graduate students enrolled in a geology-related M.S. or Ph.D. program at the University of Nevada, Reno. Jonathan O. Davis was a prominent DRI geologist and ge archaeologist who died in an automobile accident in December 1990. The endowment for the awards was established by Davis' family, colleagues, and friends.

For additional information, see <http://www.dri.edu/Opportunities/JonathanDavis.html>.

Peter B. Wagner Medal of Excellence Awarded to Xiaolong “Bill” Hu

Dr. Xiaolong “Bill” Hu, a soil and groundwater scientist in DRI’s Division of Hydrologic Sciences in Las Vegas, has been named the recipient of the 2002 Peter B. Wagner Medal of Excellence. The Wagner Medal, named in honor of Peter B. Wagner, a DRI atmospheric scientist who died in the crash of a research aircraft in 1980, acknowledges outstanding scientific accomplishments by DRI faculty in the early stages of their careers. Recipients receive a \$1,000 prize and minted medal.

Hu’s work at DRI focuses on developing mathematical models to describe the natural variability of groundwater movement and the transport of pollutants by groundwater through rock and soil. A member of DRI’s research faculty since 1997, he received his Ph.D. in Soil and Groundwater Environmental Science at Purdue University. Hu received the award based on his record of publications, peer recognition, and service. DRI President Stephen G. Wells said the Wagner Medal “is a fitting recognition of the standard of excellence Dr. Hu has already achieved in research creativity, productivity, and contributions to science.”

The award was established in 1998 by Peter Wagner’s widow, Sue Wagner, a member of the Nevada Gaming Commission and former Nevada lieutenant governor and state senator. She also established the Peter B. Wagner Memorial Award for Women in Atmospheric Sciences, an annual national paper award to foster and recognize achievement by women graduate students in that field.

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