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DRI News

WINTER 2008

nature

features Paul Verburg and
Jay Arnone's climate research



Climate-Change Research at DRI: Turning up the Heat

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DRI EcoCELL facility

Above: Jay Arnone and Paul Verburg in the lab.

Right: Verburg monitors data.

DRI EcoCELL research results in *Nature* cover story

On the Reno campus of the Desert Research Institute, what looks like an ordinary, large greenhouse is attached to the back of the Great Basin Research Environmental Laboratory building. However, this greenhouse is anything but ordinary—it contains DRI's EcoCELL facility. Sealed off from the outside environment, prairie-grass plots transported to Reno from Oklahoma have been growing under strict scientific control in the EcoCELLs. Air and soil temperatures and watering have been controlled in each plot to determine which of these variables affect different functions of this tall-grass prairie ecosystem.

Another variable studied in the DRI EcoCELL facility is carbon dioxide (CO_2) uptake by these prairie plants and soils. Carbon dioxide is a greenhouse gas and higher levels of CO_2 in the atmosphere contribute to global warming. Helping regulate the amount of carbon dioxide in the atmosphere, plants absorb CO_2 during growth, storing carbon in their leaves, stems and roots. This carbon is sequestered in the soil when plants die, and when soil bacteria feed on dead plant parts, they release some of the carbon as CO_2 back into the atmosphere.

The cover story in the 18 September 2008 issue of *Nature* highlights results from a DRI EcoCELL study by DRI Division of Earth and Ecosystem Sciences (DEES) faculty members Jay Arnone and Paul Verburg, as well as scientists from other institutions. Funded by a grant from the U.S. National Science Foundation, Arnone and Verburg subjected the EcoCELL plots to varying conditions and monitored CO_2 uptake for four years. Their study showed that when just one abnormally warm year was simulated in the EcoCELLs, the amount of CO_2 taken up by these grassland ecosystems decreased for up to two years, effectively increasing the amount of CO_2 released to the atmosphere. "This is the first study to quantitatively track

the response in carbon dioxide uptake and loss in entire ecosystems during anomalously warm years," said Arnone. "The 'lagged' responses that carry over for more than one year are a dramatic reminder of the fragility of ecosystems that are key players in global carbon sequestration."

This *Nature* study, coauthored with scientists from the University of Nevada, Reno, University of Oklahoma, University of New Hampshire, the National Center for Atmospheric Research and Rice University, presents results from experiments using tall-grass prairie ecosystems sealed inside four living-room-sized environment chambers in the DRI EcoCELL facility.

The 12-ton, six-foot-deep plots were extracted and transported intact from the University of Oklahoma's prairie research facility near Norman, Oklahoma, to minimize the disturbance of plants and soil bacteria. Each containerized ecosystem at DRI sits on a scale that serves as a weighing lysimeter—an instrument that allows tracking of how much water was taken up or lost by the plants and soil during the study—and has controls allowing air and soil temperatures to be regulated within the ecosystem cell.

During the first year inside DRI's EcoCELL chambers, all daily and seasonal changes in temperature and rainfall that occurred in the control plots in the Oklahoma prairie were replicated. In the second year of the study, half of the EcoCELL plots were maintained at normal temperatures and half were subjected to abnormally warm air and soil temperatures on the order of those predicted to occur later this century by the Intergovernmental Panel on Climate Change. For the third and fourth years of the study, temperatures around the warmed plots were turned down again to match temperatures in the control plots. The CO_2 flux—the amount of carbon dioxide moving between

the atmosphere and biosphere—was tracked in each chamber for all four years of the study.

The plots exposed to higher temperatures trapped only about one-third the amount of carbon than did the plots exposed to normal temperatures. This effect of decreased CO₂ uptake was evident for the next two years of monitoring the ecosystems. “Large reductions in net CO₂ uptake in the warm year were caused mainly by decreased plant productivity resulting from drought, while the lack of complete recovery the following year was caused by a lagged stimulation of CO₂ release by soil microor-

ganisms in response to soil moisture conditions,” explained Verburg.

This *Nature* study demonstrates an unexpected outcome, with increased temperatures leading to decreased CO₂ uptake in prairie grasslands. This study implies that more CO₂ would be released into the atmosphere in abnormally warm years, possibly creating a cycle of warming. Using the EcoCELL facility at DRI, Arnone and Verburg have contributed to a better understanding of CO₂ cycles in tall-grass prairie ecosystems and the impact that a warming climate may have on these ecosystems.

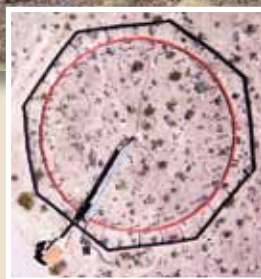
DRI researchers show deserts absorb greenhouse gas

An ongoing study by DRI researchers shows that deserts may be absorbing more carbon dioxide (CO₂) from the atmosphere than previously thought. DRI faculty members Lynn Fenstermaker and Jay Arnone, together with their colleague Georg Wohlfahrt of the University of Innsbruck, Austria, published their initial findings in *Global Change Biology*. Their work also was highlighted in May in the Nature Publishing Group’s online journal, *Nature Reports Climate Change*. “We are excited by the results presented in this paper, which demonstrate that deserts are a larger sink for carbon dioxide than had previously been assumed,” Fenstermaker said.

Fenstermaker, Arnone and DRI colleague Richard Jasoni are tracking the fate of carbon in desert soils and plants. Their preliminary results indicate that cyanobacteria, lichens and mosses that live on soil surfaces form desert-soil crusts, which may be a significant Mojave Desert carbon sink. By removing CO₂ from the atmosphere and storing it as carbon, these desert-soil crusts may play a large role in regulating this greenhouse gas.

By combining measurements of atmospheric CO₂ and vertical wind speed, Fenstermaker and Arnone quantified the net CO₂ consumed by the Mojave ecosystem’s biomass, from shrubs to the microscopic organisms living in the soil. The annual removal of greenhouse gases from the atmosphere at the research site was upwards of 100g of carbon per square meter, with the majority consumed during the spring months. This figure is on a par with some temperate forests and represents a significant source for uptake and storage of carbon. Data also were gathered in summer 2008 to obtain a set of measurements under more extreme temperature conditions.

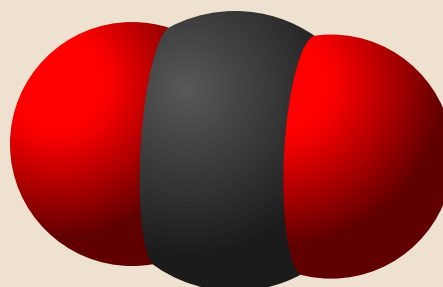
“Our results indicate that if all the desert ecosystems in the world—which together make up more than 30 percent of Earth’s land surface—are taking up carbon dioxide at the same rate as our Mojave Desert site, then the amount of carbon dioxide taken up each year would match the amount emitted to the atmosphere globally through burning of fossil fuels (about 6–7 gigatons of carbon dioxide per year).” Arnone said. “Another way to look at this is, without deserts, the annual rate of anthropogenic carbon dioxide rise might be twice as rapid as it is presently and might therefore promote more rapid global warming.”



DRI's FACE Facility

Above: A detail view of the ring.

Left: Photo taken by Lynn Fenstermaker and Eric Knight using a radio-controlled helicopter.



The culprit, a three dimensional model of a carbon dioxide molecule. Two oxygen atoms (red) attached to a single carbon atom.



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University and Community College System of Nevada



From the desk of Steve Wells

Desert Research Institute News is published by the Desert Research Institute, a nonprofit, statewide division of the Nevada System of Higher Education. DRI is internationally recognized for excellence in environmental research. DRI operates two campuses: one in Las Vegas and one in Reno at the Dandini Research Park. Articles appearing in DRI News may be reprinted with appropriate attribution given to the Desert Research Institute.

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As faculty, staff, Foundation trustees and friends work together planning for DRI's 50th anniversary celebration in 2009, now is a good time to reflect on DRI's contributions to building environmental sciences into a significant component of Nevada's research and development portfolio. DRI also plays a critical role in defining the scope and breadth of research needed to steward our state and nation's natural resources, to make our nation secure, and in shaping the role that environmental sciences play in improving peoples' lives around the world.

As we say at DRI, tomorrow started yesterday. Over the past 50 years, DRI's innovative faculty have worked tirelessly to set the stage for the scientific and engineering contributions our institution will make for the next 50 years. DRI's pioneer efforts and long-term contributions to the environmental sciences have prepared the institute for a global leadership role at a time when earth's humanity and resources will be tested at unprecedented levels.

Never before has the world faced the challenges of supporting more than six billion people. Globally, economics, political stability, educational needs and scientific and technological advancements are changing rapidly along with Earth's environment. We are at a point when these issues are not "someone else's problem." Particularly, never before in human history has there been such an acute awareness of stresses on Earth's environment. I cannot think of any more critical challenges facing our state, the nation and the world than managing precious resources such as water, developing research and technology for clean and sustainable energy, and for studying evolving environmental conditions that will affect human health.

DRI is proud to be part of the Nevada System of Higher Education. In return for a small investment, Nevada and the nation receive much in return from DRI. For example, in the 2006 National Science Foundation national rankings

of federal research and development expenditures in the environmental sciences at universities and colleges, DRI ranks 19th. For context, John Hopkins is ranked 16th, with Harvard and Stanford ranking 27th and 38th, respectively. DRI conducted \$37 million in sponsored projects last year leveraged from \$9 million in state funding—just 1.2 percent of NSHE's state-supported budget. Taking this a step further, over an eight-year period, \$60 million of state support was leveraged into \$227 million in funded grants and contracts. DRI's blend of academics with an entrepreneurial business model has worked well for both DRI and Nevada's economy. All but one of our 181 non-tenured research faculty earns their own salary through grants and contracts outside of Nevada's general funds.

Now as Nevada, the nation and the world confront momentous environment issues, we find ourselves facing one of the most significant economic downturns of the past 100 years, with all state-supported entities potentially facing the deepest budget reductions in decades. Nevada's citizens must realize that the level of proposed budget cuts will profoundly reduce all NSHE institutions' ability to educate, innovate and provide services at this critical time. For example, at DRI, it could result in the elimination of cloud-seeding, a major service provided to the state for enhancing water resources.

In these challenging times, the words of U.S. President Abraham Lincoln offer guidance to our state as well as our nation. In 1859, President Lincoln observed that if one adds the fire of genius to the fuel of interest, "the discovery and production of new and useful things" result. There is no doubt that the fuel of interest exists, and I am proud to say that DRI will do all it can to promote the fire of genius. I remain optimistic that the tide will turn with an improving economy, and DRI will continue to make Nevada and the world a better place to live.



DRI

DRI receives \$5 million from NSF EPSCoR collaborative grant

DRI has been awarded \$5 million from a five-year, \$15 million National Science Foundation EPSCoR (Experimental Program to Stimulate Competitive Research) grant to the Nevada System of Higher Education to study climate change and its effects on Nevada. The grant will fund science, education and outreach at DRI, Nevada State College, UNLV and UNR. NSHE also is providing almost \$6.6 million to the project from non-Federal sources. At DRI, coordination for this grant will be through co-principal investigators Gayle Dana and Nick Lancaster, both faculty members in the Division of Earth and Ecosystem Sciences. Dana also is the Nevada NSF EPSCoR Project Director.

This climate-change project will create a statewide interdisciplinary program exploring the effects of regional climate change in Nevada. The project will quantify and model the effects of regional climate change on landscapes, ecosystems and water resources, and will communicate research results to decision-makers and the public. “This award allows the continued commitment that the Nevada System of Higher Education EPSCoR has provided for more than 15 years to academic research infrastructure and education,” said Dr. William Schulze, director of the Nevada EPSCoR Office & NSHE Sponsored Programs Office. “This long-term collaborative partnership between the NSHE institutions will expand the academic research and development enterprise and improve student education in science and technology.”

The six main areas that this NSF grant is broken into are climate modeling, ecological change, water resources, cyberinfrastructure, education and policy, decision-making and outreach.

The grant allows new equipment to be purchased for use in environmental transects in order to determine effects of climate change on ecosystems and water resources, including groundwater recharge. DRI, UNLV and UNR will participate in this area as equal partners. DRI will take the lead in the area of enhancing computing resources and personnel to develop regional climate-modeling capabilities. DRI also will receive funding to support more regional climate-modeling as well as ecosystem-modeling personnel.

Other portions of this grant include support for creating a data portal for project information to be housed at UNR, and a state-of-the-art visualization facility at UNLV to aid communications among scientists, decision makers and the public. Nevada State College will take the lead in K-12 education and outreach programs, and statewide undergraduate- and graduate-level classes in climate-change topics—including a graduate certificate program in climate-change science—will be offered. Funding is available for numerous undergraduate and graduate scholarships, as well as three post-doctoral researchers. Finally, many outreach programs are planned, including creating opportunities for underrepresented minorities to explore this topic, such as through a bilingual website.

To broaden and increase the impact of this project, Nevada is part of a tri-state collaboration with New Mexico and Idaho, which also received NSF EPSCoR funding for climate-change infrastructure this year. DRI is proud to be part of this collaborative effort leading to an understanding of how water and ecosystems are intertwined in Nevada and the Western region of the United States.

Mike and Leah Benjamin give donation for Public Information Officer



Mike Benjamin

Mike and Leah Benjamin have generously given \$100,000 to DRI to help fund a Las-Vegas based public information officer over the next two years. “Mike and Leah’s very generous gift highlights more than two decades of their support to DRI,” Stephen Wells, DRI President, said.

Mike Benjamin, of Las Vegas, is CEO and president of Benjamin Enterprises, a consortium of companies involved in gaming,

land development, retail investing and marketing consulting. In the 1980s, his firm, the Creative Group, helped develop a marketing strategy and branding effort for DRI. Mike Benjamin has stayed involved with DRI through the years and currently is chair of the DRI Research Foundation.

“Mike is a successful businessman with a deep understanding of how important this position is for DRI,” Wells said. “We’re very grateful to Mike for this generous gift and also for his leadership and commitment to the institute.”

Commenting on why he made his donation to specifically fund a public information officer, Mike Benjamin said, “DRI does important environmental research around the world, and if DRI doesn’t have the ability to tell its story, then how can the world know of the tremendous positive impact we are having on the environment? This is why funding this position is so important to the success of the institute’s mission.”

In the current budget-cutting climate in Nevada, the Benjamin’s gift will help enable DRI to better tout the institute’s accomplishments in Nevada and around the world. “DRI not filling this position for more than a year speaks volumes as to how lean the institute is. My father taught me to lead by example. My hope is others will continue to follow and support this world-class applied-research institute. It’s an international scientific jewel based right here in Nevada,” says Mike Benjamin.

DRI and UNR get grant for biomass-conversion process

Researchers from DRI and the University of Nevada, Reno, are part of an almost \$4.7 million study sponsored by the Gas Technology Institute to find economical processes to convert different kinds of biomass to useful fuels and chemicals. "This work will directly address the nation's high priority of increasing the supply of domestic and renewable energy by integrating advanced technology that improves the conversion of biomass into fuels and power," said U.S. Senator and Majority Leader Harry Reid, who secured funding in an Energy and Water Appropriation for the project.

This grant will allow DRI researchers to explore conversion of different biomass sources into a uniform, compacted feedstock, which, when heated, could produce synthetic gas (syngas) or other fuels and chemicals. Currently, because of the difficulty or cost of preparation, many biomass materials cannot be converted into feedstock. One of the major barriers to global use of biomass-based energy production is that reliable systems to change different kinds of biomass sources to a standard feedstock have not yet been engineered.

While a complementary project is focusing on biomass in the southeastern United States, for this study, DRI and UNR will focus on biomass characteristics of Nevada and the West. Sponsored by the U.S. Department of Energy (DOE), these initiatives focus on development

of different biomass types into a single, uniform feedstock of similar consistency and character.

Kent Hoekman, a faculty member in DRI's Division of Atmospheric Science who also heads up DRI's renewable energy program, is the principal investigator of the study. Other participants from DRI include Alan Gertler, Amber Broch, Curtis Robbins, Jay Arnone, Paul Verburg, Tim Minor and Richard Jasoni. Chuck Coronella and Victor Vasquez are participating from UNR, and the Renewable Energy Institute International (REII), which will conduct a techno-economic analysis of different biomass-to-energy options in Nevada, also is a partner.



Kent Hoekman

"One group at DRI is doing a resource assessment to determine the type and amount of biomass within Nevada; another group is characterizing products resulting from the pretreatment process," said Hoekman. "There are also chemical engineers from UNR working with us to optimize the pretreatment conditions. One of the most exciting parts of this project is the eventual deployment of a small processing plant here in Nevada that will demonstrate the conversion

of biomass to useful products." This study, in which DRI plays a large part, may produce a better-engineered feedstock from different kinds of biomass in order to develop this globally important source of renewable energy.

DRI recognized for excellence by U.S. Department of Commerce

The U.S. Department of Commerce Economic Development Administration (EDA) recently recognized DRI with an award for excellence in economic development grant performance. "DRI won for its notable demonstration of organizational leadership, innovation, entrepreneurship and regional collaboration to achieve greater competitiveness in the global marketplace," said Barbara Earman, from the EDA. In 2006, DRI received an EDA grant of \$57,000, facilitated by U.S. Senator and Majority Leader Harry Reid. DRI will receive an additional \$5,700 with this award. "DRI plays a critical role in the environmental research that occurs within Nevada's System of Higher Education. I'm excited about the prospects of the research park, which will tap into emerging technologies and clean energy," said Reid.

DRI initially was recognized for a feasibility study of a new business incubator to be located at DRI's Dandini Research Park on its Reno

campus. The proposed incubator is designed to provide resources and expertise to entrepreneurs during planning, early stage and start-up phases. "To be recognized by the EDA for performance excellence with an additional financial award is a tremendous shot in the arm, and even more important are the relationships our community is building with the EDA and the Department of Commerce," said Jeff Pickett, managing director of the DRI Research Park.

DRI, along with fellow Nevada winner Nevada's Center for Entrepreneurship and Technology (NCET), were notified of the awards by U.S. Congressman Dean Heller's office. "I am very pleased that the EDA has selected two Nevada organizations for this honor," Heller said. "DRI and NCET are excellent examples of how the private and public sectors can work together for the betterment of all Nevadans."

DRI's Edwards one of the leading Western drought experts

DRI's Laura Edwards, a faculty member in the Division of Atmospheric Sciences (DAS) and part of the Western Regional Climate Center (WRCC) at DRI, knows all about drought. Edwards helps monitor Western drought conditions, and as part of the National Drought Monitor Center (NDMC), is one of only nine lead authors of weekly national U.S. Drought Monitor maps.

In spring 2008, California governor Arnold Schwarzenegger declared a statewide drought emergency. Data from the WRCC at DRI and the California Department of Water Resources (DWR) showed that March through May was the driest in over 114 years, with precipitation only twenty-two percent of average in California, triggering a drought emergency. "The WRCC serves as the archive for climate data in the Western United States," said Edwards in an earlier interview. "At DRI, the Western Regional Climate Center has developed products to monitor climate in California, and in this case, the California Climate Tracker (CCT)." Data from the CCT at DRI contributed directly Schwarzenegger's declaration of a drought emergency in California.

As part of a new collaborative effort to study California climate, Edwards, Jim Ashby and Michelle Breckner from the WRCC are helping to set up a volunteer weather observation network in California as part of the national effort called CoCoRaHS, the Community Collaborative Rain, Hail, and Snow Network. Volunteers measure statewide rain, hail and snow as part of a nationwide internet-based weather network. "This is a great opportunity for people to get involved in weather and climate observation from their homes and backyards," said Edwards. California is the 36th state to join the CoCoRaHS network, which has more than 11,000 volunteers.

Another area where Edwards is having an impact on reporting drought conditions is by authoring U.S. Drought Monitor maps, which are very important to the public and policy-makers. Used by the public to see where areas of drought are, policy-makers use U.S. Drought Monitor maps for planning purposes, and to trigger possible federal aid to areas delineated on

the maps as being in extreme or exceptional drought.

Authors of the U.S. Drought Monitor maps are drawn from federal agencies, universities and research institutes, and rotate authorship, with the lead author having to integrate a variety of different data on drought conditions, soil moisture and water supply to produce weekly updates of the Drought Monitor map. In addition to these data, there are almost 250 people around the country, including National Weather Service employees, county cooperative-extension agents and state climatologists, who provide data for the maps. Edwards was a weekly Drought Monitor contributor for several years before becoming an author.

Edwards currently is the only author west of Lincoln, Nebraska, where the NDMC is based, and lends a valuable Western presence to these maps. She trained at the NDMC with Brian Fuchs, a NDMC climatologist, and was lead author on her first U.S. Drought Monitor map in September. Fuchs traveled to DRI to help Edwards create her first published Drought Monitor map, and said of Edwards, "She will bring a needed Western perspective to the Drought Monitor maps and she understands Western issues." Edwards is currently working developing a program called the West-Wide Drought Tracker, which she hopes to tie into the U.S. Drought Monitor maps. Edwards and other DRI faculty will continue to keep DRI in the lead in researching pressing issues such as drought in the West.



Above: Laura Edwards holds up her first U.S. National Drought Monitor map.

Right: U.S. National Drought Monitor Map.

Background: A California reservoir showing extremely low water levels in summer 2008.

Photo courtesy California Department of Water resources.



International Polar Year Antarctic Research

As part of the 2008 International Polar Year (IPY), DRI Division of Earth and Ecosystem Sciences faculty members Joe Grzyski and Alison Murray went to the Antarctic during the winter in the Southern Hemisphere to study life in one of the harshest environments on Earth. These scientists went to the Antarctic during winter to examine how microbes survive, and even thrive, during the coldest time of the year in the coldest place on Earth. By figuring out how microbes function in this unforgiving climate, these scientists hope to gain clues as to how life in other extreme environments on Earth, as well as the possibility of life on other planets, manages to adapt to living in inhospitable environments.

The Western Antarctic Peninsula is experiencing one of the most rapid rates of climate warming on Earth, with an increase of about 2.5°C (4.5°F) in mean annual temperature over the last 50 years—much faster than other parts of the world. Murray and Grzyski are investigating the diversity of microbial life during the Antarctic winter, and the impact that the warming climate may have on these microbes. This collaborative study with Woods Hole Marine Biological Laboratory professor Hugh Ducklow is funded by an IPY grant from the National Science Foundation (NSF), and is part of an ongoing environmental genome-sequencing program at the Joint Genome Institute. Murray and Grzyski are collaborating on this research with scientists from around the world, including England, Canada, Australia and France.

“A major limitation in predicting an impact is that we have very little information concerning bacterioplankton (Archaea and bacteria that live in water) diversity, energy-generating processes and adaptive capabilities — particularly in the Antarctic winter,” Murray said. “These features are all encoded in the Antarctic bacterioplankton environmental genome.”

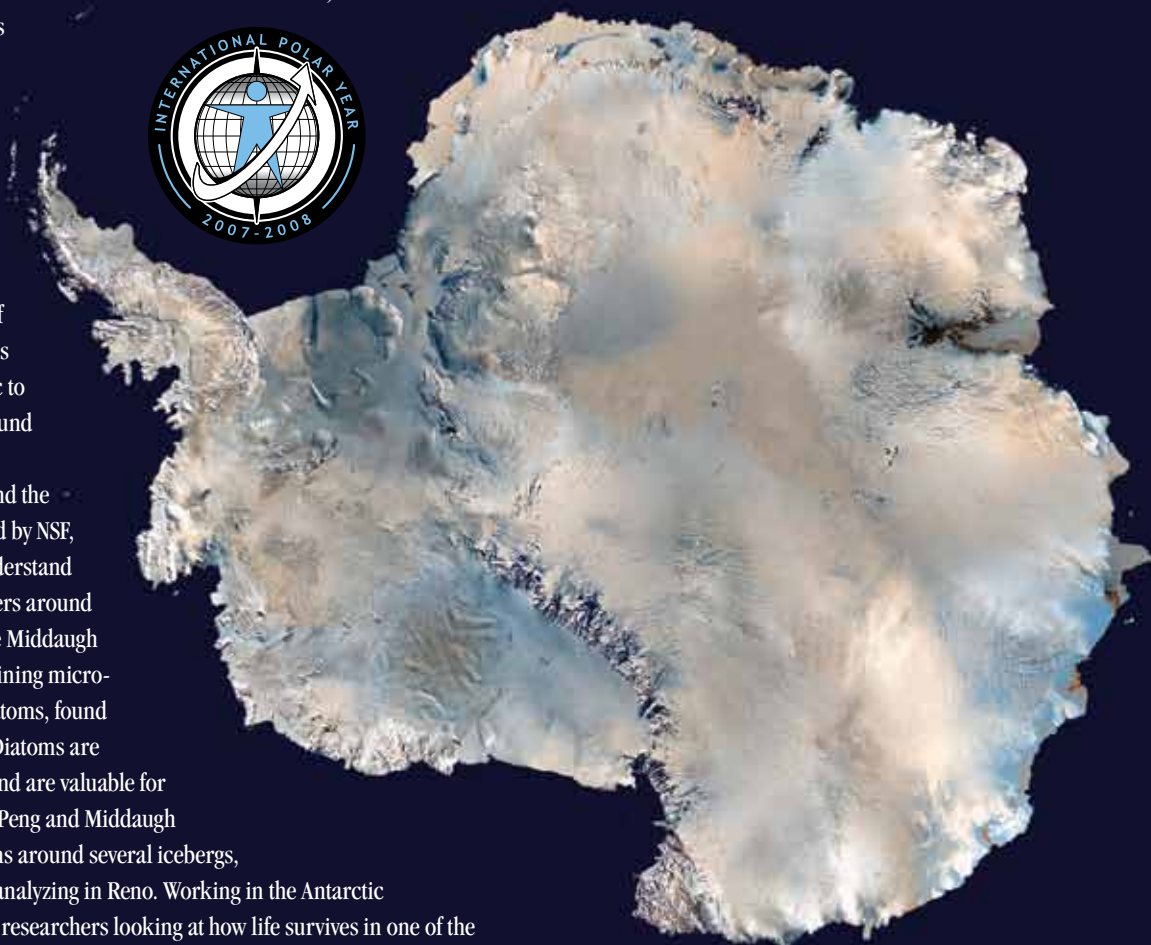
Also as part of the IPY, two of Murray’s DRI research assistants went on a cruise in the Antarctic to study the marine ecosystem around icebergs. Icebergs appear to be hotspots of biological activity, and the goals of this project, also funded by NSF, are to quantify and to better understand the ecosystems in the frigid waters around icebergs. Vivien Peng and Nicole Middaugh are working with Murray, examining microscopic marine plants, called diatoms, found in the waters around icebergs. Diatoms are abundant in the polar oceans, and are valuable for studying ocean carbon cycling. Peng and Middaugh were able to study the ecosystems around several icebergs, and collected samples they are analyzing in Reno. Working in the Antarctic winter was a challenge that DRI researchers looking at how life survives in one of the harshest places on Earth met successfully.



Above: The blue ice covering Lake Fryxell, in the Transantarctic Mountains, comes from glacial meltwater from the Canada Glacier and other smaller glaciers.

Joe Mastrolanni, National Science Foundation

Below: An orthographic projection of NASA's Blue Marble data set (1 km resolution global satellite composite).



Greenland ice core shows pollution spike



Above and below: Collecting ice cores in Greenland.

As part of a study funded partially by the National Science Foundation, DRI Division of Hydrological Sciences faculty members Joe McConnell and Ross Edwards recently published an analysis of pollutants found in ice-core samples from Greenland in the *Proceedings of the National Academy of Sciences*. Ice cores were transported to Reno and analyzed in DRI's Ultra-Trace Chemistry Laboratory, where the age of the ice in the core was determined and the ice was melted and analyzed for pollutants, specifically heavy-metal contaminants such as cadmium, thallium and lead. Because heavy metals concentrate up the food chain, they ultimately pose a risk to human health.

Not surprisingly, McConnell and Edwards' results show that manmade pollution is present in Greenland's ice record. What was a surprise was when the worst of the pollution was deposited in Greenland. The highest levels of pollution found in the ice core were not recent, or even from the 1960s and 1970s, when heavy industries were booming in the United States and Europe. McConnell and Edwards found that the worst industrial pollution in the 115-meter-long core was deposited around 1900, and was anywhere from two to five times higher than modern levels of those same heavy-metal pollutants. They were able to correlate this spike in heavy-metal pollutants with the intense use of coal in homes and industrial applications in Europe and United States from the late 1800s to the early 1900s.

This conclusion gives cause for concern for the modern world. Currently, pollution generated in China and India—and other rapidly industrializing countries—is mainly from burning coal, and may cause a similar spike in heavy-metal pollution. This study shows that heavy-metal pollution from burning coal affects the global environment, and that countries around the world should be encouraged to use cleaner coal technology to avoid generating heavy-metal pollution that will enter ecosystems and ultimately endanger human health.



DRI's 12th Annual Golf Tournament at Red Hawk

Launching the 12th annual DRI golf tournament this year was a wine-pairing dinner on the Friday night before the tournament. DRI Golf Tournament Chairman and Foundation Trustee Skylo Dangler was a great master of ceremonies at the wine tasting, and was instrumental in helping to put on this wonderful event at the Resort at Red Hawk. The evening featured a live auction by master auctioneer Christian Kolberg, who helped raise \$16,000 for DRI. The raffle grand-prize winner was Shawn Oliphant of the Wheeler Family Foundation Team II, who won a \$1,500 gift card to Pebble Beach. Ameriprise Financial generously sponsored a \$25K putting contest, which was great fun for all participants. As has become traditional, KOLO News Channel 8 Meteorologist Dick Stoddard presented his evening broadcast from the tournament kick-off.

Many friends of DRI attended the event, including Founding DRI Foundation Fellow Lou Emmert and her husband, Gerald Emmert, who came all the way from Florida to participate in the tournament. Registration began on a Saturday morning with many DRI volunteers generously giving their time to assist the golfers. Many thanks go to the Tournament Committee members, including Tournament Chairman Skylo Dangler, Tournament Coordinator Dawn Coots, and committee members Steven Braun, Steve Buszka, Jerry Cail, Joe Cervantes, Ryan Coots, Diana Dillon, William Dippel, Jason Glavish and Dave Richardson for all of their hard work in making this event possible. Thanks also go to all of the teams, sponsors and volunteers who you will find listed in the following pages. We could not put on this tournament without all of you—thank you, and see you next year for DRI's 13th Annual Golf Tournament!



Registration was bright and early Saturday morning, with over 25 volunteers assisting.

DRI thanks all of our 2008 Golf Tournament volunteers:

Connie Arias	Jeff Dean	Dave Huber	Margie Stuart
Jim Ashby	Diana Dillon	Pat Hughes	Jamie Trammell
Sue Ashby	Wayne Doeber	Russel Kost	Marie Trammell
Don Bailey	Cindy Doeber	Cindy Littlefield	Chris Tumbusch
Greg Bortolin	John Gardner	Nanette Merlino	Leilani Valdez
Kelsey Carter	Lori Goldfin	Ali Pyne	Kenda Walters
Jenna Coots	Mitch Goldfin	Yvonne Rumbaugh	Mike Walters
Ryan Coots	Vicki Hall	Jeff Saunders	



More than 140 people enjoyed a beautiful Friday evening Wine Pairing at the Resort at Red Hawk.

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Advertising Specialties
Ameriprise Financial
Ami Jewelers
Anixter/Justin Webb
Jim Ashby
Associated Management
Atlantis Casino Resort
Tom Atkinson
AT&T
Baja Fresh
Dan Barnett
Petra Bartella
Bed Bath & Beyond
Russ Bergin
Big 5 Sporting Goods
The Bijou
Black Mountain Golf & Country Club
Bobo's Mogul Mouse
Michelle Breckner
Brick's Restaurant
Broddarp, Inc.
John Burrows
Business Travel & Tours
Jerry & Judi Cail
Cal Neva Hotel Casino
Carlson Wagonlit Travel
Carriage House Hotel
Kelsey Carter
Casa Blanca/Oasis Resort
Lee and Jill Chapman
Robert Chavez
Chuck's Boulevard Pizza
Grace Cloninger
Cold Stone Creamery
Rod Collins
Daniel Coming
D. Allison Copening
Costco/Carson City
Bill Coloumbe
Coyote Springs Golf
Mark Crawford
D'Andrea Golf Club
Skylo and Cathy Dangler
Dayton Valley Golf Course
Desert Rose Golf Course
William Dippel
Joyce Duncan
Ward Dunn
Eagle Valley Golf Course
Laura Edwards
El Adobe Café
Eldorado Hotel/Casino
Embarq
Jerry and Lou Emmert
W. Michael Fagen
FASTFRAME
Foley's Irish Pub
Chris Fritsen
Fuller Color Center
Furnace Creek Golf

Tom and Mary Kay Gallagher Foundation
Fred Gibson, Jr.
Jason Glavish
Gold & Silver Restaurant
The Golf Club at Fernley
Gold Dust West
Mitch Goldfin
Golf Headquarters
Keith Gottschalk
The Grill
Fred Groves, Jr.
Groves-Fischer Construction Company
Vicki Hall
Harrah's Reno
Steve Hess
Hidden Valley Country Club
Home Depot
Honey Treat Yogurt
Alan Honeycutt
HT Electronics
Pat Hughes
Hyatt Place
Ice Box Kitchens
JMA Architecture Studios
Sara Jenkins
Jimmy John's Gourmet Subs
John Ascuaga's Nugget
Juicy's Hamburgers
Kap Construction
Kid's Museum
Klarquist Sparkman, LLC
KNPB Channel 5
KOLO-TV News Channel 8
Greg Ladd
Lakeridge Golf Course
Nick Lancaster
Las Trojes
Paul Laxalt
Jay Lebel
Legacy Golf Club
Rocky Lepori
Links at Kiley Ranch
Little Waldorf Saloon
Phil McDonald
McDonald's/Tom McKennie
Alan McKay
Martha McRae
Nanette Merlino
Mimi's Café
Subhashree Mishra
Moana Nursery
Dave Mouat
John Mudge
Maureen Mullarkey
Chris Mulloy
National Auto Museum
NewMarket Advisors
Newmont Mining Company
NIREC/Ian Rogoff
Bob & Del Noland
North American Title Company

Cindy O'Kelly
Papa John's Pizza/Jason Coots
Patrick James
Peppermill Resort Casino
Pepsi
Pioneer Crossings Casino
Pizza Baron
Pizza Plus
PJ & Company
Albert Polanski
Andy Ramirez
Rapsallion's Seafood House & Bar
Dave Reeder
Reno Gazette Journal
Reno Mattress Company
The Resort at Red Hawk
David Rhode
Rhodes Ranch Golf Club
Rollermonkey, Inc.
Sage Hill Clay Sports/Rodney Bullard
Larry Sheetz
Bill Sherman
Sierra Pacific Resources
Sierra Sage Golf Course
Silver Peak Restaurant & Brewery
Somerset Golf Course
Southwest Airlines
Southwest Gas Corporation
Sparks Florist
Sports West Athletic Club
Squaw Valley USA
Squeeze Inn
Margie Stuart
Sue Sullivan
Super Cuts
TGI Fridays
LeoneThierman
Thunder Canyon Golf
Top Hat Party Rentals
Truckee Bagel Company
Truckee Meadows Electric
U.S. Bank/Ken Ladd
Gayle Valdes
Van Scoyoc Associates
Kenda Walters
Wal-Mart/Carson City
Stephen G. and Bethany Wells
Wells Fargo
Welty Concrete
Welty Paving, Ltd.
West Coast Contractors
Western Village Inn & Casino
Wheeler Family Foundation
Wild Creek Golf course
Wild Island Adventure Park
Wild West Electronics
Wolf Pack Athletics
Wolf Run golf Club
Xcentrix Salon/Bonny Schultz



Raffle Grand Prize Winner Shawn Oliphant,
Wheeler Family Foundation Team II.



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DRI 2008 GOLF TOURNAMENT RESULTS

Longest Putt (Women): Mendy Elliott
Longest Putt (Men): Andy Rameriz

Longest Drive (Women): Carol Scott
Longest Drive (Men): George Manguso

Closest to the Pin without Going in (Women): Nancy Bostdorff
Closest to the Pin without Going in (Men): John Mudge

Best Dressed Mixed Team: Pepsi
Best Dressed Women's Team: UNR Athletics Department
Best Dressed Men's Team: Ad Spec

First Place Mixed Team: Newmont
Second Place Mixed Team: Ice Box Kitchens
Third Place Mixed Team: Team Chavez

First Place Women's Team: UNR Athletics Department.

First Place Men's Team: Advertising Specialties
Second Place Men's Team: Peavine Construction
Third Place Men's Team: Wells Fargo

Last Place/Sportsmanship Award: Ami Jewelers



8

12th Annual Golf Extravaganza Highlights



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1 1st Place Mixed Team: Newmont (L to R): John Mudge, John Burrows, Jill Chapman and Lee Chapman.

2 Washoe County Manager Katy Simon and DRI Foundation Trustee and President, AT&T Nevada, Hal Lenox.

3 L to R: Greg Bortolin, Don Bailey, Fred Davis, Russel Kost.

4 1st Place Women's Team and Best Dressed: UNR Athletic Department Team (L to R): Laura Scott, Carol Scott, Cary Groth and Nancy Bostdorff.

5 DRI Golf Tournament Chairman and Foundation Trustee Skyla Dangler.

6 Jack Gamba, North American Title Company team, and youngest player in the tournament, gets some practice in.

7 DRI Founding Foundation Fellow Lou Emmert and husband Gerald Emmert.

8 West Coast Contractors Team (L to R): Tom Hill, TJ Dobson, Andy Ramirez and Herb Dorszynski.

9 KOLO News Channel 8 Meteorologist Dick Stoddard interviews DRI President Stephen G. Wells.

10 L to R: Chayah Masters and DRI Foundation Trustee Sandy Masters.

11 Longest Putt Winner (Men): Andy Ramirez, West Coast Contractors Team II accepts his award from Ryan Coots.

12 Keith Gottschalk, Ameriprise Financial team, putts in the \$25K Putting Contest sponsored by Ameriprise Financial.

13 Returning Team Anixter players (L to R): Gary Schick, Brian McKinney, Regent Jason Geddes, Shane Kittle.

14 Best Dressed for Mixed Teams: Pepsi Team (L to R): Randy Long, Wanda Clark, Matt Allee and Josh Baxter.



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August 22 & 23, 2008



Congressional reception hosted by DRI

Members of the DRI's staff and Foundation Board attended a Nevada Congressional Delegation reception put on by DRI this summer. This reception, held annually in Washington, D.C., provides a chance for DRI Foundation Board members to talk to Nevada's national policy makers about why they support DRI, and how DRI's research benefits Nevada, the nation and the world. Meeting with DRI representatives and Foundation Board members were U.S. Congressman Dean Heller, U.S. congresswoman Shelley Berkley, and U.S. Senator and Majority Leader Harry Reid.



Left, top to bottom:

L to R: DRI Foundation Trustee Lou Emmert, John Gardner and U.S. Congresswoman Shelley Berkley.

L to R: U.S. Senator and Majority Leader Harry Reid, DRI Foundation Trustee Skylo Dangler, Jessica Malow, DRI Foundation Chair Mike Benjamin, John Gardner.

DRI Foundation Board members at the Congressional Reception in Washington, D.C.



Right, top to bottom:

DRI President Stephen Wells listens to U.S. Congressman Dean Heller.

DRI President Stephen Wells talks to U.S. Senator and Majority Leader Harry Reid.

Below:

DRI Staff and Foundation Board members at the Newseum in Washington, D.C.



Outreach

DRI participates in Reno Corporate Challenge

In Reno, DRI employees participated in the 2008 Corporate Challenge, a citywide event that pits like-sized companies against each other in various fun and competitive sports, including dart, horseshoes, 8-ball, bowling, tug-of-war, golf, running, swimming and biking. DRI, participating after a several-year hiatus, took second place out of 10 teams in the “B” category. What DRI Events Coordinator and Corporate Challenge organizer Dawn Coots is most proud of is that DRI won extra points for their volunteers, given to DRI for having the most—and most enthusiastic—volunteers at certain Corporate Challenge events. With such great support, Team DRI is hoping for first place next year!

Top to bottom on left: Harlan and Sherril Schmidt at the Corporate Challenge bowling tournament; Team DRI getting ready for Track and Field events; These DRI women are ready to take on the world at the 2008 Corporate Challenge; Team DRI discussing basic softball strategy before taking the field; Team DRI gets ready to dig in for Tug-of-War.

Below: DRI had the loudest cheering section at Corporate Challenge swimming events.

Bottom: Team DRI ready to bike their way over hill and trail.



Update on changes in DRI's Administration

By DRI President Stephen G. Wells

DRI's administration is undergoing a series of changes this year, with two of our vice presidents stepping down. For the past five years, DRI has been well served by Dr. Chris Maples in the position of Executive Vice President for Research (EVPR). I thank Chris for his dedication and service, and all of us wish him the best as he takes over the reins as President of the Oregon Institute of Technology. Also retiring from administrative work is Dr. Roger Jacobson, who has been with DRI for 33 years. He has stepped down as Vice President for Faculty and Academic Support, and has returned to the faculty. Roger has been a trusted member of my administration, and I salute him for his distinguished career at DRI.

DRI is privileged to have two gifted executive division directors, John Warwick and Mike Auerbach, who have agreed to take on Vice Presidential duties on an interim basis through June. Warwick is the interim EVPR and Auerbach is interim Vice President for Academic and Business Development, a combination of the Vice President of Faculty and Support and the Vice President of Business Development positions.

Warwick will focus on DRI's research mission, and, along with the executive division directors, will be an integral part of developing our federal-initiative program, which has provided DRI an invaluable financial safety net in these lean

economic times. Warwick also will focus on developing a business plan and structure for our CAVCaM program.

Auerbach's position will provide leadership for all of DRI's academic affairs, as well as providing support for emerging research and business development activities, including intellectual property



and technology transfer. The position is a cost-saving hybrid between two existing Vice President positions, the Vice President of Academic and Faculty Services and the Vice President for Business Development. Auerbach also will examine our renewable energy and human health and environmental change programs and will seek ways to expand these important areas.

Current DHS deputy division director Michael Young will serve as acting DHS executive director while Warwick is interim EVPR. Paul Verburg will oversee day-to-day operations as acting DEES executive director while Auerbach is in the new hybrid Vice President position. I have great confidence

in both Warwick and Auerbach, who have distinguished themselves during their time here at DRI. Although nothing is written in stone, I anticipate that at the completion of a national search process to fill the EVPR position, both Warwick and Auerbach will return to their respective positions as executive directors of DHS and DEES, respectively.

We wish both Chris and Roger the best in their next endeavors, and I want to also express both my confidence and gratitude to everyone who has agreed to take on additional duties and responsibilities during this transitional period at DRI. With the extraordinary people here at DRI who have stepped up to the plate, there should be a seamless transition to new administrators as soon as these positions are filled. I thank everyone for their help in pitching in to get these jobs done at this critical time.



Jacobson to step down as VP for Academic Affairs

Roger Jacobson is stepping down as DRI's Vice President for Academic Affairs to return to the faculty in the Division of Hydrological Sciences and to participate in DRI's renewable-energy program. Jacobson is a longtime member of DRI's faculty, having been with DRI since 1975. Jacobson came to DRI after working as a post-doctoral researcher and as a faculty member in Germany.

"Roger has had a distinguished career at DRI and he is a fine example of the many faculty who have come here over the years and spent nearly all of their career here," said Stephen Wells, DRI President. "He has served my administration well and I look forward to his continued good work in the area of renewable energy. I would be remiss if I didn't mention his work in the community, specifically through the Kiwanis Club, where he rehabilitates bicycles for needy children."

Jacobson's advisor from Penn State had just taken a sabbatical leave at DRI and recommended that Jacobson apply to an open position, telling him that DRI was unlike anywhere else. Jacobson took the position, and agrees, saying, "DRI was and is not like any academic environment anywhere I had been."

Jacobson has been based at both DRI campuses, living in Las Vegas from 1988–1998 while overseeing DoE programs at DRI. Jacobson remembers when DRI was housed in a series of duplexes in Las Vegas as well as on the campus of University of Nevada, Reno, and marvels at how far DRI has come since those days. "When we were in the duplex on Maryland Parkway [Las Vegas], we would ask potential clients to meet in their offices because DRI only had these series of temporary offices," Jacobson recalls. "Now, when new faculty come to DRI, they have no idea what it was like to not have a permanent home. The campuses in both Reno and Las Vegas establish DRI firmly as a world-class stand-alone research institute," said Jacobson.



Roger Jacobson

Kunkel named new DAS Executive Director

Kenneth Kunkel is the new Executive Director of the Division of Atmospheric Sciences (DAS) at DRI. DAS, which conducts air-quality and atmospheric research, currently has 50 employees who hold doctoral degrees and is the home of the Western Regional Climate Center. Kunkel's recent research makes him a great fit as DAS executive director. Kunkel's research focuses on climate—specifically, variability, extremes and change. He has published numerous articles in peer-reviewed scientific journals, written three book chapters, and numerous articles in the proceedings of scientific conferences and symposia. Kunkel has served on numerous advisory and review panels, and is a lead author on two upcoming reports of the U.S. Climate Change Science Program, entitled, "*Weather and Climate Extremes in a Changing Climate*" and "*Climate Change Models: An Assessment of Strengths and Limitations*."

Kunkel comes to DRI from the Illinois State Water Survey (ISWS), an organization with about 140 professional staff affiliated with the Illinois Department of Natural Resources and the University of Illinois at Urbana-Champaign. "I believe Ken will be a very good fit at DRI as he comes from a like-minded scientific organization, the Illinois State Water Survey, where he was the interim chief," said Stephen Wells, DRI President. "For nine years, Ken was the Director of Center for Atmospheric Sciences at ISWS.

He steps into a storied division here at DRI that is known for its cloud-seeding program, but does so much more."

Kunkel earned his bachelor's degree in physics from Southern Illinois University-Edwardsville in 1972, then attended the University of Wisconsin-Madison, and earned his Master's and PhD degrees in meteorology, finishing in 1978. After graduation, he worked at the Atmospheric Sciences Laboratory at White Sands Missile Range, studying atmospheric optical phenomena. From 1982–1988, Kunkel served as the New Mexico State Climatologist, and held a research and teaching appointment as an Associate Professor at New Mexico State University. Kunkel then moved to Illinois, where he became director of the Midwestern Regional Climate Center at ISWS, a position he held for a decade. He was the director of the Center for Atmospheric Sciences for approximately nine years before becoming interim chief. Kunkel and his wife Lezlie are settling into Reno, having moved from Illinois earlier this year.



Ken Kunkel

Maples named President at Oregon Institute of Technology

Chris Maples, DRI's Executive Vice President for Research, officially stepped down from his duties at DRI October 1, 2008 to become President of the Oregon Institute of Technology in Klamath Falls, Oregon. Maples came to DRI in 2003 from Indiana University, where he was Chair of the Department of Geological Sciences. He began work on DRI's Las Vegas campus, but realized he was spending much more of his time on the Reno campus, and moved to Reno in 2004. Maples continued to travel to the Las Vegas campus every week to keep in touch with the faculty there.

"I'm going to miss Chris for his dedication, loyalty and, of course, his southern humor," said Stephen Wells, DRI President. "Chris always had the institute's best interests at heart and I wish him only the best in his new endeavor."

During his time at DRI, Maples worked closely with Wells, and Cleve McDaniel, Senior Vice President of Finance and Administration and Chief Operations Officer, to position DRI for success with federally funded projects. He also worked with the executive division directors, Mike Auerbach, Kent Hoeckman and John Warwick, to position DRI for growth in these three fundamental areas of science at DRI. Maples also served NSHE as well as DRI, serving as the DoD EPSCoR program director for three years in addition to his DRI duties. Maples also served as acting deputy director for the Nevada EPSCoR program and served as interim director at the NSHE Sponsored Projects office for a year.

"DRI is a wonderful organization, and the collaborative spirit is amazing. But, I have to say I will miss the people at DRI the most," Maples said. "I really enjoyed working for everybody at DRI."

Grzyski hired as DEES Assistant Research Professor

Joseph Grzyski joins DEES as an Assistant Research Professor in bioinformatics. Grzyski has been as a DRI postdoctoral fellow, as well as a temporary research professor at DRI. Before joining DRI, Grzyski was a postdoctoral researcher at Rockefeller University after receiving his PhD from Rutgers University. Grzyski's research focuses on life in extreme environments, and his current work is based on looking at life in the harsh environments of the Antarctic.

Page promoted to Assistant Research Archaeologist

David Page is now an Assistant Research Archaeologist after serving as an archaeological technician in DEES for the past eight years. Page received his MA in Anthropology from UNR in May of 2008, and conducts research at the U.S. Army's Dugway Proving Ground.

DEES senior publications technician promoted

After serving as a senior publications technician in DEES for three years, Lisa Wable has become the Scientific Illustrator, Graphics and Web Administrator for DEES. Before coming to DRI, Wable was a biomedical communications research assistant at the University of Texas Southwestern Medical Center at Dallas, where she received a MA in Biological Communications.

Stephan Ross new Webmaster

Stephan Ross is DRI's new Webmaster. Ross comes to DRI after two years as Webmaster at Renown Health in Reno, where he oversaw their public and Intranet sites, including managing content, training and supporting content contributors, developing Web designs to coordinate with Renown's marketing and branding activities, and creating and deploying video and multimedia. He also worked in computer support and as Web Manager for Westminster College in Salt Lake City for seven years. Ross' educational background includes a BA in English, with minors in chemistry and German, and a MA in English.

Chapman succeeds Shafer as DRO Program Manager

After nearly a decade at DRI as its Department of Energy program manager, David Shafer has stepped down to focus on his CERM-director duties, research and manuscript preparation. Shafer also has assumed new duties as DRI's DOE EPSCoR program manager.

Jenny Chapman is serving in an interim capacity as the DOE Program Manager. Shafer worked with Chapman to ensure a smooth transition, and will continue to focus on major-program development with DOE as part of his CERM-director duties, while Chapman will focus on the program-management side of the DOE contract position.

Oxner, Zielinski join Environmental Health and Safety

Andrew Oxner has been hired as a new Chemical Safety Officer for DRI. Oxner will provide guidance to help reduce lab risks associated with chemical, biological, physical and other laboratory hazards, and will conduct safety training for DRI personnel. He previously worked for the UNR Department of Physics and as a development technician for the Nevada Terawatt Facility in Stead.

Through a memorandum of understanding and agreement with UNR, AnneMarie Zielinski has joined DRI in Las Vegas. She will support DRI's EH&S department in emergency situations and will assist with occupational safety training for DRI in Las Vegas campus. In addition, she will provide EH&S support for DOE-funded projects at DRI.

Hartwell continues as DEES Deputy Division Director

Ted Hartwell has agreed to serve another term as DEES deputy division director from July 1, 2008, to June 30, 2010. Hartwell has been serving as DEES deputy division director for the last two years.

Bartella named DEES Business Manager

Petra Bartella has joined DRI as the new business manager for DEES, and will take over when current DEES business manager, Linda Piehl, retires at the end of the year. Prior to her arrival, Bartella was a grants and projects analyst in the Office of Sponsored Projects at UNR. She has a BS in Business Administration from UNR and is working on an MBA in Accounting.

Remembering David Fulstone



A great friend and champion of DRI, David Fulstone, passed away on October 23, 2008 after a hard-fought battle with cancer. A native of Lyon County, Nevada, David believed wholeheartedly in DRI's mission and the Institute's unbiased approach to science. In 1999, David joined the DRI Research Foundation board (DRIRF), served as co-Chair of the DRIRF from December 2001–December 2002, then served as Chair of the DRIRF for two terms, stepping down in 2005. During his time as DRIRF Chair, he helped shape the DRI Foundation by building its first strategic plans, and helped garner support to see those plans to fruition.

David was very active in protecting farming interests in Nevada and the United States, and was appointed by President Reagan to the National Board of Agriculture Finance. He served as Lyon County Commissioner for eight years, and was Nevada Farm Bureau President for ten years. David, or Davy as he was known to his friends, was a genuine, humble man who will be missed in his native Lyon County, political circles throughout Nevada and by those lucky enough to know him and receive his generous help and advice. Davy is survived by his wife, Diane, two sons, Joshua and Jeffrey, his father, David, and his sister DeeAnn Fulstone.

Remembering Fred Davis, Jr.

On November 15, 2008, a remarkable individual and devoted friend of DRI, Fredrick (Fred) Arthur Anthony Davis, Jr., passed away at 81 due to complications from a stroke suffered in October. Fred served as DRI's Legislative and External Affairs Officer from 1991 until his retirement in 2004.

Fred was born in Denver and grew up in Reno. He served in the U.S. Navy from 1945–1948, and was a graduate of the University of Nevada, Reno. Fred spent more than 50 years in the public relations field in the Reno-Sparks area, working for John Ascuaga's Nugget as well as the Reno Chamber of Commerce prior to working at DRI. Fred not only was DRI's Legislative and External Affairs Officer, he also was an assistant and adviser to DRI presidents Jim Taranik and Stephen G. Wells, and remained very involved with DRI until his passing.

Fred also gave his time generously to many other organizations over the years, including St. Mary's Foundation Board of Directors, the Reno National Championship Air Races, the American Cancer Society, Junior Achievement and Little League. Fred loved the Reno-Sparks area and will be missed greatly by all who knew him. Fred was preceded in death by his wife, Mary, in 1990, and is survived by his son, Dan, and daughter, Judy.



Redmond wins AMS Applied Climatology Award

At the American Meteorological Society's Conference on Applied Climatology in August 2008, DRI's Kelly Redmond, a faculty member in the Division of Atmospheric Sciences, was honored with the AMS Applied Climatology Award. In the citation for this award, it was noted that, "Kelly Redmond has become one of the most influential figures in applied climatology...he has demonstrated an unparalleled ability to explain and discuss complex western and national climate issues effectively with a wide spectrum of stakeholders, including farmers, the media, land managers, politicians, scientists, large corporations, and federal agencies. His work...has been critical in laying the groundwork for identifying and planning for drought in the West." Additionally, a topical session at the applied climatology conference was named in Redmond's honor.

Hauger Executive Director of Drylands Collaboratory

J. Scott Hauger, a faculty member in DRI's Division of Hydrologic Sciences, has been elected to a two-year term as executive director of The Global Collaboratory for Drylands and the City, a joint venture of six internationally known research institutes concerned with sustainable living on drylands. Besides DRI, the Collaboratory includes research institutes in Argentina, China, Egypt, Israel and Namibia, and was established to provide an organizational vehicle for more effective research and problem solving on a global scale.

Tappan chosen President-Elect of Lake Mead Chapter

Jeff Tappen has been chosen as President-Elect of the Lake Mead Chapter of the Health Physics Society. The Health Physics Society is a scientific and professional organization whose members specialize in occupational and environmental radiation safety. The Lake Mead Chapter of the Health Physics Society was founded in 1961 in part to improve public understanding of radiation issues and hazards; to promote and improve Health Physics as a profession; and to promote the activities of the Health Physics Society.

DRI Faculty Senate IPA grants announced

The DRI faculty senate institute project assignment (IPA) committee recently reviewed faculty research proposals for funding. Ross Edwards in DHS was funded for his proposal "Accretion of Extra-terrestrial material: high temporal resolution records from polar ice cores." Xavier Fain in DAS was awarded funding to study the fate of mercury in mountain ecosystems, specifically conducting a mercury mass-balance study at the watershed

scale in the Sierra Nevada. Alexandra Lutz in DHS also had her proposal, entitled, "The effect of climate change on groundwater resources in the Bani study area of Mali, West Africa with emphasis on reduced precipitation," funded.

Shanafield to attend annual Nobel Prize Winners meeting

Margaret Shanafield, a UNR PhD graduate student studying hydrology with DRI faculty members, participated in the 58th Meeting of Nobel Prize Winners in Physics in Lindau, Germany. The Lindau Nobel Laureate meetings provide a globally recognized forum for the exchange of knowledge between 25 Nobel Laureates and more than 550 young scientists from 66 countries. Criteria for selection are strict, and include: students must show a genuine interest in science and research, have a strong commitment both to a principal field of study and to interdisciplinary dialogue with an international academic community, be familiar with societal impacts of scientific knowledge and its applications, and belong to the top 10 percent of their class. Shanafield said she enjoyed the conference, and that "it was the experience of a lifetime."

DRI produces UNR Outstanding Grad Student Researcher

Rajan Chakrabarty, a PhD student in the Chemical Physics program at University of Nevada, Reno, was recognized at UNR's "Honor the Best" ceremony as the 2008 "Outstanding Graduate Student Researcher" at UNR. During the last two years, Chakrabarty has been supported by an NSF EPSCoR fellowship working with Hans Moosmüller at DRI in the Division of Atmospheric Sciences. He also was the recipient of DRI's Colin Warden Memorial Award in 2006.

Ehram awarded Undergraduate Research Fellowships

Mary Ehram, who is working with Duane Moser in the Division of Earth and Ecosystems Studies, was awarded an Undergraduate Research Fellowship from the American Society for Microbiology to continue her work at Devils Hole in Death Valley National Park. She also won an NSF EPSCoR award for summer 2008 for this work.

Storm Peak Lab Awards High School Scholarship

This year, DRI's Storm Peak Laboratory awarded a \$500 scholarship sponsored by Randy Borys and Melanie Wetzel to Bryce Peters. Peters graduated from Steamboat Springs High School with a 4.0 GPA, and plans on earning a degree in Materials Science at the University of Washington. Peters focused his senior-year independent research project on artificial muscles and carbon nanotube technology.

Green artificial turf may be too hot for summer use

DRI Division of Hydrological Sciences faculty member Mike Young aided in a study showing that surface temperatures of green artificial turfgrass can be up to 69°F higher than that of irrigated natural grass, and 62°F higher than air temperatures. Artificial turfgrass is used extensively in Nevada on athletic fields and parks both for ease of maintenance and water savings, and green is a popular color because it resembles natural grass. This study, led by UNLV scientist Dale Devitt and including UNLV graduate students Malika Baghzouz and Brian Bird, was conducted between August 2006 and March 2007. While excluding the two hottest months of the year, the researchers still recorded maximum surface temperatures as high as 169°F on green-colored turfgrass fields. These high surface temperatures exceed the threshold for safe, extended use of these fields, and could preclude use of these fields during hotter summer months.

Results of this research show that heating of green artificial-turf surfaces primarily is due to solar radiation, and that the plastic turfgrass blades did not transfer much heat to underlying fill material. Green artificial turfgrass reacted more quickly to solar radiation than did any other surface in the study, including concrete, asphalt, natural grass, and white artificial turfgrass.

Despite the possible heat danger green artificial turfgrass fields present, water savings still warrant use of artificial turf. By helping to quantify heating in green artificial turfgrass, Young and the UNLV scientists have shown that park managers may want to investigate using different-colored artificial turfgrasses in recreational and athletic fields and parks.

Science study on Mono Lake hot-springs bacteria

Research conducted in Mono Lake, California, demonstrates how bacteria use arsenic in the process of photosynthesis in the absence of oxygen. Jenny Fisher, a post-doctoral fellow in the Division of Earth and Ecosystem Sciences at DRI, was part of a study published in the August 15, 2008 issue of *Science*. Thomas Kulp from the U.S. Geological Survey was the lead author of the report, and Ron Oremland from the USGS was the principal investigator.

"This research is particularly interesting because we have identified a potentially ancient process," Fisher said. "Mono Lake is often considered an analog for early Earth environments, which means that conditions for this type of photosynthesis may have existed during the Archean Eon (more than 2.5 billion years ago)." The research was conducted on Paoha Island in Mono Lake, where scientists isolated a bacterium that fuels its growth with light and arsenite in the absence of oxygen. Fisher investigated the genetic basis for this process, specifically looking for genes that encode for enzymes capable of transforming arsenic from one



Mono Lake

form to another. "This organism (strain PHS-1) does not have the typical arsenite oxidase genes that other organisms have; preliminary evidence suggests that PHS-1 may oxidize arsenite using an arsenate reductase operating in the reverse direction," Fisher said. These organisms shed light on a potentially ancient process that may have helped life colonize harsh environments on early Earth.

DRI research presented at Tahoe Summit

Several DRI faculty members and students contributed to the eleventh annual Tahoe Summit held at the historic site of Tallac in South Lake Tahoe this August. Kelly Redmond, a faculty member in DAS, as well as Alan Heyvaert and Jim Thomas, faculty members in DHS, presented posters at the event. This year's Tahoe Summit summarized many of the gains made to preserve Lake Tahoe and the surrounding Tahoe Basin.

Topics presented by these DRI researchers at the Tahoe Summit included monitoring water quality and watershed processes associated with the 2007 Angora Fire at South Lake Tahoe, as well as climate change in the Tahoe basin. Also presented at the Tahoe Summit was a compendium of papers, concentrating on work done by graduate students at Lake Tahoe over the last decade, including several graduate students who have worked with DRI faculty members at Lake Tahoe.

New federal legislation to protect Lake Tahoe was unveiled at the Tahoe Summit by U.S. Senator Dianne Feinstein and U.S. Senator and Senate Majority Leader Harry Reid from Nevada. In a press release, Reid said, "I am proud to have helped found the Tahoe Summit, and the health of Lake Tahoe and its surrounding areas is hugely important to me. We have accomplished a lot in the past 11 years, but we need to continue work on lake clarity and restoration, and implementing the environmental improvement program so we can all enjoy Lake Tahoe for years to come." Secretary of the Interior Dirk Kempthorne approved more than \$140 million under Southern Nevada Public Lands Management Act Round Nine, including \$24 million for Lake Tahoe restoration projects, and \$30 million for continuation of the Environmental Improvement Program.

Cablk presents mine-detection research in Norway

DRI Division of Earth and Ecosystem Sciences faculty member Mary Cablk's Department of Defense-funded Desert Tortoise K9 (DTK9) Program attracted the attention of the Genève International Centre for Humanitarian Demining, which invited Cablk to speak at a June conference on mine detection in Oslo, Norway. "The research we've conducted over the past five years, fielding dogs to find desert tortoises, has contributed significantly to the scientific body of knowledge about odor detection and capability," said Cablk. "Because this research requires collaboration between experts from different disciplines, this conference is a great opportunity to share knowledge and experience, which ultimately helps build stronger programs, such as the DTK9 Program."

Cablk presented a talk on the research challenges in developing animal-detection systems that search for novel target odor, including designing rigorous experiments to test these systems. Designing field experiments is particularly challenging because dog handlers have to be trained as observers at the same time as the dogs are learning to find their targets. Observers must note and record all reactions of the dogs to odors in the field, other behaviors and even the type of reward the dog gets, such as a pat or a treat, for finding a target.

A common theme running through the demining conference was the use of dogs and rats as detectors of landmines in humanitarian demining efforts. Although some of the presentations related specifically to humanitarian demining, the majority of presentations described research findings applicable across a range of animal species searching for a range of target odors. Cablk's DTK9 research contributes greatly to this field, and her methods will help in training dogs for this important, dangerous task.

DRI hosts NASA Academy Student Presentation

The NASA Ames Academy Class of 2008 made a visit to DRI in August, as well as meeting with members of the University Rover Challenge team from UNR. Chris Fritsen, a faculty member in DRI's Division of Earth and Ecosystems Science, as well as director of Nevada NASA Space Grant and NASA EPSCoR, showed the students around DRI and involved them in informal talks with DRI faculty members. In addition, Fritsen showed students some examples of DRI's NASA-related research, leading students on a tour of the cold-brine lab/freezer research area where research is conducted on life from extreme environments. Students also spent time in the CAVE facility, virtually visiting some of Fritsen's Antarctic study sites as well as Mars.

This year, the Academy undertook a project related to the Mars Phoenix mission, and gave a presentation on their work at DRI about their project, entitled, "Fundamental Analysis Work on Extraterrestrial Soil." This project analyzed cohesive properties of soils with differ-

ent salts under different temperature regimes. The students chosen to participate in the NASA Academy are among the brightest students in the nation. By showing these students DRI's involvement with NASA-related research, it is hoped that these students may want to return to DRI in the future to continue their research, or to ultimately join DRI to explore new research areas.

China air-pollution studies

Becoming well known for their research on China's terra-cotta warriors, John Watson and Judy Chow's research on how air pollution may be affecting these ancient treasures was featured in a recent issue BLVDS Magazine, published in Las Vegas. Watson also gave an overview of the Terra-Cotta Warriors project and Chow gave a presentation on the sustainability of cultural heritage that described progress on the Terra-Cotta Warriors project at the University of North Dakota's Earth Day program.



A small sample of the thousands of terra-cotta warriors unearthed in China.

Watson was the U.S. Chair of the National Academy of Engineering National Research Council Committee on energy futures and air pollution in urban China and the United States, which was co-chaired by Zhao Zhongxian from the Chinese Academy of Sciences. Chow also was a member of this committee, making DRI the only United States institute with two members on this committee. The results of this cooperative study were published recently in a report entitled, "Energy Futures and Urban Air Pollution, Challenges for China and the United States." Committee members, all leading experts in their fields of air quality and energy, examined data from cities in the United States and China, toured industrial facilities and met with many officials, academics and other stakeholders in both countries. This study also addressed greenhouse-gas emissions and how to limit these gases, an area of great global concern.

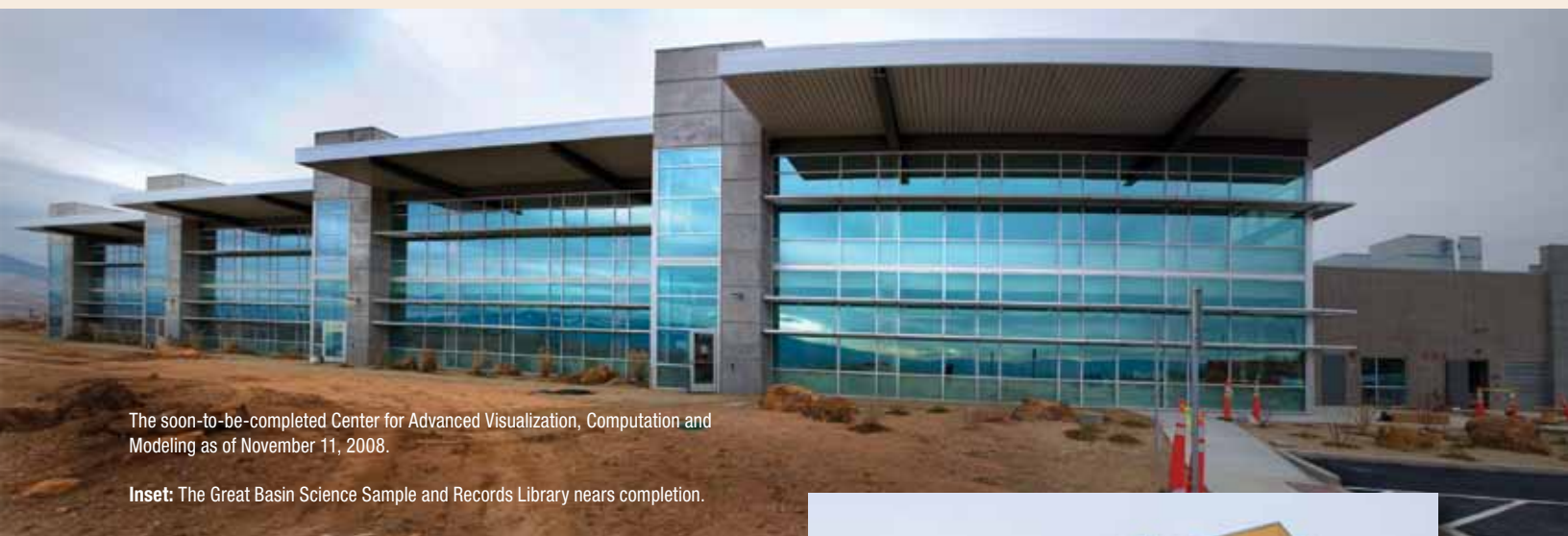
DRI is growing again—building updates

On the heels of the recently opened Maxey Addition on DRI's Reno campus, two new buildings are going up that will be completed and occupied within the next year. In addition, plans for the Phase III expansion in Las Vegas are being prepared for approval. On the Reno campus, the almost-completed CAVE (CAVE Automated Virtual Environment) facility will house DRI's new visual lab, as well as adding needed office space. The second building going up is the Great Basin Science Sample and Records Library (GBSSRL), which is part of the University of Nevada, Reno.

One question that DRI faculty and visitors alike have asked is, "What will the Computational Research and Visualization building have in it when it is done?" Besides providing more office space, the new building will have a six-sided, virtual-environment CAVE facility that will allow users to immerse themselves in a virtual world. This facility will have

The idea for DRI's CAVE was proposed in a federal initiative to Nevada's congressional delegation as a joint proposal with ACES director, Vonda Grubišić. After review, an award was granted through the U.S. Army's Simulation and Training Technology Center (STTC). Phase I began in July 2004, and Bill Sherman joined DRI in September 2004 as interim director of the project. In December 2005, the CAVE project became a part of CAVCaM, with Sherman named Technical and Acting Director. As part of the CAVE project, a Visbox-P1 portable, large single-screen immersive display and a larger four-sided CAVE-like display (a Fakespace FLEX) were installed on the Reno campus. In January 2006, the second phase of this project began. This phase includes construction of the CAVE building, funded primarily through the state of Nevada, also includes STTC Phase II funds.

The second building taking shape on the DRI Reno campus is the Great Basin Science Sample and Records Library (GBSSRL), run by



The soon-to-be-completed Center for Advanced Visualization, Computation and Modeling as of November 11, 2008.

Inset: The Great Basin Science Sample and Records Library nears completion.

computers projecting images on all four walls, the ceiling and the floor of the CAVE room, allowing multiple users to feel as if they are actually in an environment such as a landscape, a weather system or even a building. Ultimately, the goal of the CAVE facility is to allow users to manipulate data and to interact with their data in new ways using this facility.

The effort to bring virtual-reality technology to DRI was initiated by Tim Brown, Western Regional Climate Center director, who visited a six-sided CAVE-like display at Iowa State University. Brown saw the potential of this kind of system to help visualize wildfires all the way from ignition through spreading into different types of terrain and vegetation. Simulations could then be created using different scenarios and planners and emergency responders could then have a visual model of how a fire would react given a set of circumstances, such as wind speed, vegetation type or terrain. These scenarios can be used for training firefighters, developing management decisions, planning, mitigation and public education.



Jonathan G. Price, State Geologist and Director of the Nevada Bureau of Mines and Geology at UNR. GBSSRL will house samples ranging from rock cores to archaeological artifacts, and will be used by UNR for storage of these resources. DRI has generously given UNR space on its campus to build this much-needed facility to protect these archival materials representing natural resources and archaeological finds from Nevada.

NSC, DRI partner to study prehistoric Anasazi sites

DRI faculty are working in partnership with Nevada State College to augment NSC's archaeological field-school sessions by adding in a remote-sensing component to help search for prehistoric Anasazi agricultural fields and seasonal dwellings in Arizona.

DRI received a three-year, \$291,000 grant from the National Aeronautics and Space Administration (NASA) to use remote sensing to estimate soil, vegetational and geomorphological characteristics to determine if prehistoric maize agriculture was sustainable in the Mount Trumbull region of northwest Arizona. DRI faculty involved in obtaining the NASA grant were Don Sabol and Dave Rhode. Paul Buck, who is on the faculty at both NSC and DRI, leads the NSC portion of this grant.

Previous research shows a high density of prehistoric Anasazi habitation sites in the Mount Trumbull area, part of the Grand Canyon-Parashant National Monument. "This year, we will be conducting archaeological survey and site recording; the session includes instruction in basic laboratory procedures and analyses of artifacts collected in previous years as well," said Buck. "We will record archaeological sites near Uinkaret Pueblo at the foot of Mount Trumbull. A number of C-shaped pueblos and field house are known but not formally recorded, and it is likely many other sites will be found and recorded."

NSC students work as assistants at the site, gaining experience with technical archaeological skills such as excavating and surveying as well as remote sensing. "Our model will provide some predictive capability in the region for prioritizing subsequent survey intensity," Buck said. "The research proposed here may also allow planners of the new Grand Canyon-Parashant National Monument, where the Mount Trumbull study area is located, to avoid particularly sensitive areas when designing recreation and other facilities for the national monument." DRI is helping NSC students learn use the most modern remote-sensing technology to examine possible archaeological sites, and this partnership should have benefits for both institutions as well as planners for this area.



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