



2010 ANNUAL REPORT



MISSION

We excel in basic and applied research and the application of technologies to

improve people's lives throughout Nevada and the world. We implement that mission by fostering scientific and engineering talent. We apply scientific understanding to the effective management of natural resources while meeting Nevada's needs for economic diversification and science-based educational opportunities.

CONTENTS

Letter from the President	3
Interview with EVPR, Dr. Terry Surles	4
GreenPower	5
NSF EPSCoR	5
Division Overviews	
Division of Hydrologic Sciences	6
Division of Earth and Ecosystem Sciences	8
Division of Atmospheric Sciences	10
Center Overviews	
Center for Advanced Visualization, Computation and Modeling: CAVCaM	12
Center for Environmental Remediation and Monitoring: CERM	13
Center for Watersheds and Environmental Sustainability: CWES	14
Clean Technologies and Renewable Energy Center: CTREC	15
DRI Researcher Profiles	
DAS: Dr. Eric Wilcox	17
DHS: Dr. Rina Schumer	18
DEES: Dr. Joseph Grzymiski	19
Awards and Recognitions	20
Financial Summary	22

DRI Annual Report
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LETTER FROM THE PRESIDENT

We had an exceptionally successful celebration of our 50th anniversary year, and, DRI's next 50 years has begun during a profoundly challenging economic climate. Despite the reality of today's economy, DRI is uniquely poised to be a global leader in the environmental sciences such as climate science, renewable energy research, and in enhanced water-and air-quality management. All of our efforts serve humanity in the broadest sense as well as to create economic opportunities here in Nevada and the nation.

Despite state budget reductions, DRI has been able to make hires in critical personnel areas. After a national search, we have hired a new Executive Vice President for Research, Dr. Terry Surles. Dr. Surles comes to DRI after serving as the Technology Integration and Policy Analysis Program Manager at the Hawaii Natural Energy Institute, and has extensive experience with renewable energy research. Dr. Surles, who began in August, is strategizing and working with our incredible faculty to leverage their knowledge and talents into large-scale, multidisciplinary grants, as well as identifying projects where potential commercialization and technology transfers can be made.

I also offer my profound thanks to Dr. John Warwick for his exceptional and dedicated service as Interim Executive Vice President for Research. As John resumes his duties as Executive Director of the Division of Hydrologic Sciences, he has my deep appreciation for stepping into the EVPR role for almost two years.

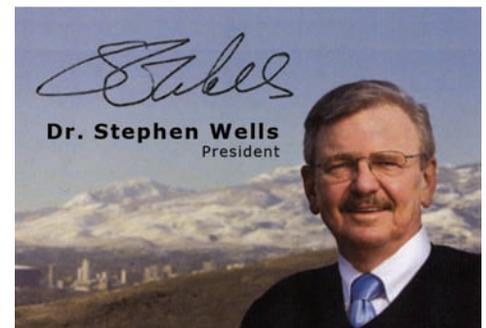
Another critical hire is Dr. Tom Jackman as the Interim Senior Director of the Center for Advanced Visualization, Computation and Modeling (CAVCaM), an interdisciplinary center within DRI. Dr. Jackman is planning to expand CAVCaM capabilities, focusing on problem-solving projects in many technical areas.

DRI has the unique ability to look at the needs of Nevada, the nation, and the world, and change and adapt quickly to what is needed. With the approval of the Nevada System of Higher Education (NSHE), DRI has created a new interdisciplinary Center, the Clean Technologies and Renewable Energy Center (CTREC). CTREC will serve to bring together DRI's renewable-energy and clean-technology research projects, and will be the home at DRI for developing integrated research initiatives in these areas. Dr. Alan Gertler, a research professor in the Division of Atmospheric Sciences, has agreed to serve as CTREC's Director, and I look forward to his strong leadership.

I want to thank Mike Benjamin, our Foundation Board President, for his wonderful leadership during his term as Chair of the DRI Foundation. His work to strengthen DRI's relationship with our benefactors will facilitate Dan Barnett's success during his term as Chair. DRI staff, who have been working with reduced hours due to state funding cuts, have stepped up to the plate and maintained their level of service achievements. I also extend my sincere thanks to each and every one of the Trustees for helping DRI achieve a new level of excellence even in these challenging times. Together, we have set new goals for achievement for the coming years, and identified and prioritized areas for targeted fund-raising to help our faculty help Nevada, the nation, and the world.

In addition to our competitive grants and contracts, DRI enhanced its solid record of federal support through the efforts of Nevada's Congressional delegation. US Senator Harry Reid, through his leadership position, has been instrumental in obtaining millions of dollars of research funding from defense to renewable-energy to water-development programs. I would like to applaud our state legislature in particular for the support they have provided DRI and the rest of the NSHE during the worst economic crisis since the Great Depression. We are lucky to have many good friends in Carson City, but I need to single out Senator Bill Raggio, who has been absolutely critical to the growth and success that DRI has enjoyed during my time at DRI. I look forward to working with new Governor Brian Sandoval, Senate Majority Leader Steven Horsford, and new Speaker John Ocegüera.

Thank you all for believing in DRI and supporting our remarkable institution. We continue to grow even in these economically challenging times, and with your support, DRI will continue to achieve excellence in our next 50 years. I am profoundly grateful, and thank all of you who share in the vision of DRI as a leader in science and innovation in Nevada, the nation, and the world.



MEET DRI'S EXECUTIVE VICE PRESIDENT FOR RESEARCH

Dr. Terry Surles, who has a distinguished background in energy development and research, joined DRI last August as the new Executive Vice President for Research. Surles comes to DRI after having served as the Program Manager for a number of large-scale renewable energy and Smart Grid projects at the Hawaii Natural Energy Institute. He also was the senior adviser to the University of California's California Institute for Energy and Environment for five years, and has served as a consultant to Booz, Allen, Hamilton; the State of Victoria, Australia; and the Korean Energy Economics Institute. He serves as Director of the Pacific International Center for High Technology Research, and has spent more than 25 years in leadership positions within the Department of Energy national laboratory system.

Q: What attracted you to DRI?

A: DRI is a nationally and internationally recognized research institution. I chose to be here because of the stellar scientific research reputation. Based on more than 35 years of work, primarily in leadership positions in scientific research and technology development, I believe DRI has the scientific firepower to address environmental and energy concerns on a regional, national, and worldwide scale. The legislators who created DRI in 1959, a stand-alone educational and research institution of the Nevada System of Higher Education, really were forward-thinking. This provides the basis for a unique and mutually beneficial partnership between academia and industry.

Q: What has been the focus of your first 90 days in office?

A: I'm assessing the skill sets of DRI's scientists (of which there are many) and tactically and strategically lining them up with the needs of the region and the nation. For example, DRI's Division of Atmospheric Science's (DAS) expertise is extensive. Researchers are working on air quality, climate change, and atmospheric processes, and we can leverage that expertise into additional contracts. In the Division of Hydrologic Sciences (DHS), we have extremely strong intellectual capital to answer the questions of availability, quality, and delivery of water given the growing scarcity of the resource. Particularly in the desert southwest, this will be a critical issue in the coming years. In our Division of Earth and Ecosystem Sciences (DEES), we are an excellent resource as we have scientists that fully understand the ecosystems of the desert southwest and the impact climate change has on those systems.

Q: Where do you see some potential growth opportunities and program development?

A: I think there's a great opportunity to build on the work being done in Las Vegas for the Department of Energy (DOE) and the Department of Defense. DRI has a proven track record at the Nevada National Security Site (formerly the Nevada Test Site) and working with the DOE on community environmental monitoring. I also believe we can develop significant public/private partnerships at the nexus of water and energy needs. In most cases, it takes a lot of water to develop new energy technologies and to generate electricity; and it takes a considerable amount of energy to obtain, transport, and treat water and wastewater. Scientists working in DHS and The Clean Technologies and Renewable Energy Center at DRI are using their knowledge to provide answers in this important new area.

Q: What do you like about living in Reno?

A: I'm enjoying living in Reno. Everything is accessible, plus I plan on getting in a lot more skiing this winter.



Dr. Terry Surles

GREENPOWER



Students from Jim Bridger Middle School in Las Vegas show off the school's recycling bins donated by NV Energy.

DRI's primary energy outreach program is GreenPower, sponsored by NV Energy and the Robert S. and Dorothy J. Keyser Foundation. GreenPower supports and promotes educating Nevada's K-12 students in renewable energy and incorporates conscious living practices into their daily lives. GreenPower recently changed its focus from renewable energy installation to providing teachers in more than 74 participating schools with hands-on teaching tools. Educators also receive a variety of professional development options – including annual training, monthly workshops, biannual hydroponics training, and energy audit training – some of which provide professional development credits for participants.

DRI PART OF \$15 MILLION NSF EPSCoR GRANT

In September 2008, DRI became part of a consortium of Nevada educational institutes awarded a \$15 million grant from the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR). The Nevada System of Higher Education also provides support of over \$6.5 million to the project.

This five-year award supports research, education, and outreach on the effects of climate change on ecosystems in Nevada and the Mountain West. Dr. Gayle Dana, a DRI faculty member, is the Nevada NSF EPSCoR Project Director/Principal Investigator for this large-scale grant.



DRI is working with scientists at other NSHE campuses to study climate change in the Southwest and Great Basin. Red Rock Canyon near Las Vegas, Nevada.

WATER: DIVISION OF HYDROLOGIC SCIENCES (DHS)

Researchers in DRI's Division of Hydrologic Sciences (DHS) work to improve society's knowledge and understanding of hydrologic systems, and to encourage more effective and efficient management of water resources. This includes the study of complex interactions between the water cycle and climate, and past hydrologic records of climate change.



Dr. Kendrick Taylor examines layers in an ice core from West Antarctica for clues to Earth's past climate.

This year, DHS scientists took crucial steps in defining the influence of changes in greenhouse gases on climate. Dr. Kendrick Taylor was again selected to be chief scientist for the West Antarctic Ice Sheet Divide (WAIS) Ice Core Project by The National Science Foundation (NSF). This major, multiyear project involves 23 scientific organizations and more than 100 scientists and technicians on a project to collect ancient ice from deep within the Antarctic ice sheet. Composition of gas bubbles trapped within the ice, which are samples from Earth's ancient atmosphere, will be used to help reconstruct Earth's past climate.

Dr. Joseph McConnell was granted more than \$3.2 million in NSF funding to study ice cores from the Arctic and Antarctic, searching for clues regarding Earth's past and future climate. McConnell received funding for five projects; one of the projects will provide a better understanding of how short-lived aerosols, including those generated by wildfires, affect Earth's climate.



Dr. Joseph McConnell's research focuses on understanding the role of human activities on global climate and sea-level change.

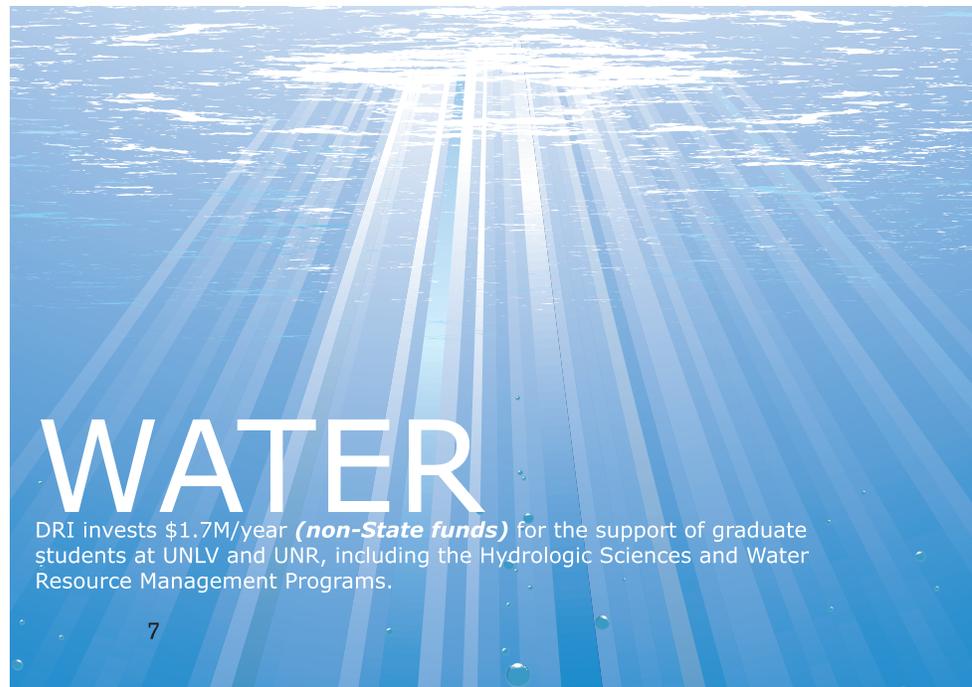
Dr. William Albright, a DRI research hydrogeologist in DHS, authored a book that provides engineers, designers, and regulators with the basic principles behind the selection and design of an innovative new method for final closure of solid-waste landfills. The book, *Water Balance Covers for Waste Containment: Principles and Practice*, details how new cover designs for landfills offer reduced cost, excellent environmental performance, and improved end-land use.

This year, DHS reviewed and honed its research themes and programs, and reaffirmed its commitment to education. In addition to their research, many DHS faculty hold joint appointments in water-resource-related academic departments at the University of Nevada, Reno (UNR), and the University of Nevada, Las Vegas (UNLV), where they teach, advise students, and direct graduate student theses.

And, just this year, two DRI researchers completed their doctoral programs in hydrology: Rosemary Carroll, Ph.D. and Ronald Hershey, Ph.D. This is a perfect example of DRI's commitment to lifelong learning and career development.



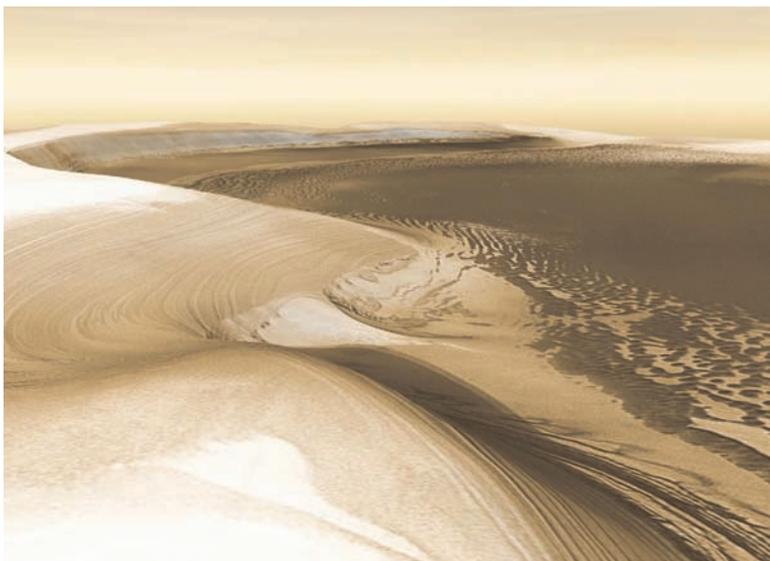
Incline Village, Lake Tahoe



WATER

DRI invests \$1.7M/year (**non-State funds**) for the support of graduate students at UNLV and UNR, including the Hydrologic Sciences and Water Resource Management Programs.

LAND AND LIFE: DIVISION OF EARTH & ECOSYSTEM SCIENCES (DEES)



Mars Odyssey All Stars - Chasma Boreale
Image credit: NASA/JPL-Caltech/ASU

Researchers in DRI's Division of Earth and Ecosystem Sciences (DEES) examine all kinds of life – simple and complex, past and present, pristine and polluted – to help gauge the health of our environment.

Is there life on Mars? In collaboration with the NASA Ames Research Center, DRI's Dr. Henry Sun is helping to answer that question through studying the biology, ecology, and genetics of life in extreme environments in Earth's polar regions as an analogue to Mars.

Another DEES faculty member, Dr. Giles Marion, is working with NASA using his FREZCHEM model to simulate and predict the behaviors of chemical substances in extremely cold environments. These modeling efforts will help NASA scientists determine if life could exist in extremely cold environments such as Mars.

Helping the U.S. military understand global terrain in order to save lives of US troops is the mission of DRI's Dr. Eric V. McDonald, who manages the Terrain Analysis Program at DRI. As part of the program, DRI scientists provide the Department of Defense (DoD) with a wide range of science-based information in support of military objectives. Efforts range from improving technology to detect and defeat IEDs (Improvised Explosive Devices) to evaluating the suitability of DoD military testing and training installations as realistic analogs for deployment areas in Iraq and Afghanistan.



U.S. Air Force Capt. Rick Vermillion, a civil engineer assigned to Provincial Reconstruction Team Zabul, inspects a bridge in Zabul province, Afghanistan, for improvised explosive devices or traces of tampering. U.S. Air Force photo by Staff Sgt. Angelita Lawrence/Released.



DEES graduate student Jessica Newburn takes samples in the Las Vegas Wash to be analyzed in the Environmental Microbiology Laboratory.

Nevada’s abundant solar and geothermal resources are ideal for growing algae for biofuels. Researchers Christian Fritsen, Duane Moser, and Henry Sun are working on tailoring temperature, light, and nutrient conditions for specific algae strains, which may help minimize future costs and optimize production of biofuels from these strains. Systems engineering for different strains in different seasons may help in reducing water requirements, enhance carbon-capturing capacities, and help to mitigate potential environmental effects associated with large-scale bio-processing operations.

LAND & LIFE

DRI’s Community Environmental Monitoring Program monitors for radiation in the region surrounding the Nevada Test Site.

AIR: DIVISION OF ATMOSPHERIC SCIENCES (DAS)

Researchers in DRI's Division of Atmospheric Sciences (DAS) conduct fundamental and applied research into natural atmospheric processes and air-quality issues of regional, national, and planetary interest. To understand the links between climate change and natural and man-made sources of atmospheric particles (aerosols) and gases, DAS is positioning itself to tackle this problem on many fronts. DAS faculty are working on development of new instruments to determine how atmospheric constituents affect transfer of radiation through the atmosphere; examining the potential for modifying cirrus clouds to modulate the global radiative transfer process; continuing to document current climate-related data; and characterizing physical and chemical properties of aerosols and gases in the atmosphere.



Environmental chemist Mark McDaniel analyzes air quality samples in DRI's Organic Analytical Laboratory.



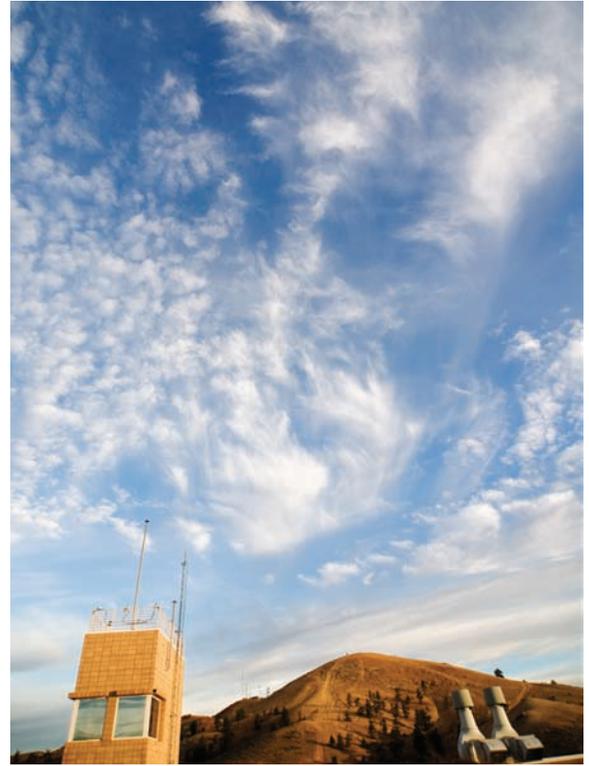
DRI's Storm Peak Laboratory, located at 10,500 feet on a mountain top in Steamboat Springs, Colorado.

Researchers Drs. Hans Moosmüller and Pat Arnott (University of Reno, Nevada) were awarded a National Science Foundation Major Research Instrumentation Award to support further development of the patented DRI Photoacoustic Instrument. This instrument combines measurements of how light absorption and reflection in the atmosphere are affected by aerosols. This instrument will open up opportunities to quantify how aerosols in the atmosphere affect the flow of radiant energy into and out of the atmosphere, which has important effects on regional and global climate.

DAS faculty members Dr. Gannet Haller and Ian McCubbin are hosting the Storm Peak Laboratory (SPL) Cloud Property Validation Experiment (STORMVEX) from September 2010 through spring 2011. This major research initiative involving DAS, the U.S. Department of Energy, and the Stratton Park Engineering Corporation (SPEC), will improve the representation of clouds in global climate models.

DAS, TMCC, and UNR faculty have combined their talents and secured a NASA EPSCoR grant to build research and educational capabilities in satellite remote sensing of aerosols. This grant also will support the establishment of a UNR course on satellite remote sensing of the atmosphere to contribute to development of Nevada’s science, technology, engineering, and mathematics (STEM) workforce.

The U.S. Department of Interior (DOI) has approved the development of eight Regional Climate Science Centers, one of which, the Southwest Climate Science Center, will be a consortium that includes DRI; University of California, Davis; University of California, Los Angeles; University of Colorado, Boulder; and The Scripps Research Institute. Key DAS personnel that will be directly involved are Drs. Tim Brown and Kelly Redmond. The Southwest Climate Science Center will lead to more research opportunities and partnerships with the DOI and its agencies.



Northern Nevada Science Center, Reno, Nevada.

AIR

DRI scientists estimate that annual augmented snow water from cloud-seeding efforts have averaged 64,000 acre-feet during the last 15 years. That’s enough to supply 140,000 households with water annually.

EXPLORING DRI'S INTERDISCIPLINARY CENTERS CENTER FOR ADVANCED VISUALIZATION, COMPUTATION AND MODELING



DRI's Steve Koepnick and Dr. Dan Coming demonstrate the technology of the six-sided, virtual environment with a virtual tour of DRI's Research Park.

human activity. High-performance computing (HPC) leverages advanced computing hardware to simulate and analyze complex systems, especially involving large, numerically-intensive or time-critical problems. Advanced visualization (AV) involves the use of interactive technologies by combining the human element and computing to enable discovery, training, outreach, and remote presence. Together, HPC and AV enable researchers to model systems, synthesize virtual environments, validate theories, predict phenomena, or explore large databases populated from field sensors.

Jackman is planning to expand CAVCaM capabilities by focusing on problem-solving projects in selected technical areas: (1) researching and developing technologies in scientific computing, imaging, data analytics, cyber/data systems, physically-based graphics, and computer interfaces for the enhancement of environmental science research; (2) leveraging state-of-the-art hardware and software for computation, visualization, and virtual reality; (3) providing technical expertise and outreach in computing, visualization, and virtual-reality software and techniques; and (4) establishing collaborative efforts with other DRI and NSHE faculty as well as Nevada's business community.

One recent example of a CAVCaM project is the creation of a virtual tour of DRI's Research Park. Researchers designed a three-dimensional virtual environment of the Park as a marketing and sales tool. The Research Park Board now has the ability to tour prospective tenants and business partners through the facilities without ever setting foot on the physical site.

The Center for Advanced Visualization, Computation and Modeling (CAVCaM) has a new interim director and a new, expanded approach. Dr. Thomas Jackman joins DRI after working for IBM since 1990. While at IBM, he did research in computational chemistry and materials science, and later led a research program that developed scientific visualization and graphics technologies for supercomputing applications within the world's largest corporate research center.

CAVCaM scientists focus and increase the institute's proficiency in high performance and visual computing—using it as an investigative instrument for understanding and explaining natural processes and the influence of



Derek Norpchen, visualization scientist, in DRI's state-of-the-art server room, which provides computational power for DRI's six-sided virtual-reality environment.

CENTER FOR ENVIRONMENTAL REMEDIATION AND MONITORING

The Center for Environmental Remediation and Monitoring (CERM) was established in 2003 through a gift to DRI in honor of Frank H. Rogers, the first chief operating officer of the Nevada Test Site. CERM was designed to promote and build on successful interdisciplinary research in environmental remediation, monitoring, and public-health protection for the U.S. Department of Energy (DOE) and other research sponsors around the world.

Currently, the Environmental Protection Agency (EPA) believes that radon gas is the second-leading cause of lung cancer (after smoking), accounting for about 20,000 premature deaths in the United States per year. In collaboration with Campbell Scientific and Genitron, DRI researchers are using an instrument called the AlphaGuard™ to measure and transmit radon concentration data by satellite and wireless internet. Linking these technologies allows radon monitoring in remote areas.

This year, researchers earned a two-year grant from the National Oceanic and Atmospheric Administration (NOAA) to use four Community Environmental Monitoring Program (CEMP) stations as demonstration sites for the Remote Community Alert System of the Warning, Alert and Response Network (WARN) Act. CEMP, managed by DEES faculty member Ted Hartwell, is a network of 29 monitoring stations located in a three-state region surrounding the Nevada Test Site (NTS), monitoring the airborne environment to ensure that no off-site releases of radiological materials occur from current or past activities at the NTS. NOAA initiated the Remote Community Alert System program in 2005 following Hurricane Katrina to provide near-real-time information on severe weather or other life-threatening events to areas of low population density and poor cell-phone coverage.

Depleted uranium (DU) poses toxicological and radiological risks. To better understand the fate and transport of DU and DU oxides in surface water, DRI models their transport during flow events of different magnitudes. The results have application to both remediation of sites where DU has been used for military testing, as well as where DU munitions have been used in combat.

Assessing the effects of wildfires and creating a plan for long-term stewardship of areas that have burned is an important role for CERM scientists. In the western U.S., climate change and exotic plants are two factors that have increased the frequency of fires, threatening the stability of radionuclide-contaminated surface soils and potentially increasing exposure to these contaminants. DRI faculty are examining the effect of fires on runoff and suspension properties of contaminated soils in different arid and semi-arid environments to better understand how to protect people living in proximity to these burned areas.



DRI's Portable Environmental Monitoring Station was deployed to measure emissions from the Upper Gleason Controlled Burn east of Ely, Nevada.

CENTER FOR WATERSHEDS AND ENVIRONMENTAL SUSTAINABILITY



Dr. Alexandra Lutz takes water samples in the Truckee River, near downtown Reno.

The Center for Watersheds and Environmental Sustainability (CWES) at DRI focuses on management and long-term sustainability of aquatic environments and watersheds, and the overall health of ecosystems associated with these watersheds. CWES has active research programs in the Lake Tahoe and Walker Lake watersheds in Nevada, and conducts international research projects in the Nabogo and Bani River watersheds in Ghana and Mali, West Africa.

In the Lake Tahoe Basin, researcher Dr. Alan Heyvaert has developed protocols for monitoring, reporting, and evaluating the performance of storm-water management and erosion-control projects. Dr. Rick Susfalk has created more efficient

lake-monitoring programs by developing a new buoy-based monitoring system in Lake Tahoe to study impacts of pollution in near-shore habitats. DRI researchers also led the effort in monitoring the effects of fine sediment and nutrient loading on Lake Tahoe following the devastating Angora Wildfire. These projects are aimed at keeping Lake Tahoe's famed clarity from degenerating.

Results of an exceptional collaborative research program by DRI and the University of Nevada, Reno, in the Walker Lake Basin are providing the hydrologic, ecologic, economic, and agricultural data needed to inform decisions related to water acquisitions to maintain the health of the Walker Lake ecosystem. This past year, DRI's Dr. Donald Sada expanded his previous studies to understand differences in river environments and aquatic communities under precipitation regimes from drought to wet years. This information will be used to evaluate the health of the Walker River ecosystem as more water flows in the river from water rights purchased for Walker Lake. These research efforts also will generate a model predicting distribution of game fish as a result of variations in stream temperature under different flow scenarios.

In Ghana and Mali, West Africa, DRI researchers are conducting watershed studies to evaluate the sustainability of water resources. Current studies indicate that well production, primarily for domestic use and livestock watering in rural watersheds, will be sustainable in the near future. This past year, four of DRI's World Vision hydrology colleagues from Ghana, Mali, and Niger, came to DRI for training in geophysical survey techniques for locating well-drilling sites, water-quality analysis, database management, and GIS mapmaking.



Women from Northern Ghana can now access water closer to their village instead of walking miles for clean water.

CLEAN TECHNOLOGIES AND RENEWABLE ENERGY CENTER



Dr. Henry Sun collects algae from an experimental plot in an urban waste-water-filled stream, Las Vegas, Nevada.

To further promote and coordinate renewable-energy research, development, demonstration, and deployment activities, DRI initiated a new interdisciplinary science center, the Clean Technologies and Renewable Energy Center (CTREC), in June 2010. CTREC operates with interdisciplinary and inter-institutional research teams that explore emerging areas in renewable energy, and the development and application of clean technologies. The Center also provides for a neutral forum for the evaluation of new technologies, and an

organizational umbrella under which all of DRI's renewable-energy research, education, and outreach activities are conducted.

CTREC is partnering with private industries to implement technology development, resource assessment, and impact monitoring/modeling programs. Partners have included: Sierra Nevada Corporation, Great Basin Wind, NV Energy, Sierra Geothermal Power, the Gas Technology Institute, Changing World Technologies, and the Renewable Energy Institute International. CTREC also is linking with the Nevada Institute for Renewable Energy Commercialization (NIREC) to pursue development of products based on the findings of their research programs. In addition, researchers work with the UNR/DRI Technology Transfer Office (TTO) to spin off research products, such as the energy monitoring and conservation system currently being commercialized by IBUCS (Intelligent Building Utility Conservation Systems, LLC).



Growing and testing teff, a grass with potential use as a biofuel, in the EcoCELLS at DRI.

- Using atmospheric models to predict solar-energy potential, and wind speed and direction for wind turbines.
- Creating and developing pretreatment methods which will allow more efficient use of biomass fuels. Biomass is heated up and carbonized, thereby increasing the energy density of the product. The resulting product could replace coal in existing power plants.
- Application of remote-sensing technologies to assess the amount of biomass available in Nevada for use as a biofuel feedstock.
- Estimation of the impact of biofuels on diesel vehicle emissions. Research has found that depending on the blend, using a biofuel leads to a significant decrease in many kinds of emissions, but can also create the need for additional nitrogen oxide control.
- Creation of more efficient and rapid analytical techniques for characterization of lipid profiles of algae. Lipids include fats and waxes that are critical for production of biofuels.
- Development of a monitoring device to determine operational costs of many appliances from a single measurement location to promote energy conservation.
- Use of many kinds of data, including high-resolution remote-sensing data, shallow temperature measurements, and soil-gas techniques to identify areas with the potential to develop geothermal wells for green-power production.
- Testing use of solar energy to produce synthetic gas.
- Design of a renewable-energy experimental facility (REEF) to serve as a platform to test and evaluate renewable-energy and energy-conservation systems.

DRI RESEARCHER PROFILES:

Dr. Eric Wilcox



What effect do clouds have on climate? What is the climate effect of tiny particles such as aerosols, soot, and dust, in the atmosphere? Dr. Eric Wilcox, a world-class sailor and researcher, is exploring the answers to these questions linking the ever-changing composition of Earth's atmosphere and climate change. Wilcox recently joined the Division of Atmospheric Sciences (DAS) at DRI as an assistant research professor. His research is highly interdisciplinary, with an emphasis on examining clouds and aerosols, and the complex interactions these have with climate on local and global scales.

Earth's atmosphere can be thought of as a very complicated mix of aerosols and water vapor that changes over time. One of Wilcox's research areas is examining clouds, and how the reflection of sunlight from different kinds of clouds can cool Earth's atmosphere. Almost as a counterpoint, another aspect of his research looks at how dust and soot, which can be darker than clouds, can absorb sunlight, which can contribute to heating of the atmosphere. Because there are so many variables in these natural systems, Wilcox also creates models to test hypotheses about the effects this atmospheric mix of reflection and absorption of sunlight has on both local and global climate.

One of Wilcox's recent studies looked at how dust plumes from the Saharan desert affect rainfall patterns over the Atlantic Ocean. Dust absorbs sunlight, which heats the atmosphere, but has a shadowing effect on the surface, which cools down. These physical parameters all ultimately add up to creating more rainfall just south of the dust plumes over the Atlantic Ocean. Wilcox currently is examining the effect that smoke from burning of the savanna has on African climate. He also would like to determine the effect smoke from fires in the western US has on the regional climate of North America.

Wilcox previously was employed as a Physical Scientist at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center in Greenbelt, Maryland. Wilcox says he came to DRI from NASA in part because, "There is a diversity of expertise at DRI, and there are possibilities of linking up with other experts. DRI is a good place for larger-scale studies, and DAS has a lot of potential collaborators to work with. I thought that I could come to DRI and contribute to a project immediately, collaborate immediately."

At DRI, Wilcox says he has begun working with collaborators including Dr. Darko Koracin, a faculty member in DAS, and Dr. John Mejia, a DAS post-doc. Benjamin Hatchett, a DAS Graduate Research Assistant, is working on scaling some of the global models Wilcox helped develop down to apply to a finer-scale, regional setting. Wilcox also is working with an interdisciplinary team funded through the National Science Foundation's EPSCoR grant to look at effects of climate change in the Great Basin, and how these ecosystems recover from fire.

Dr. Rina Schumer

A faculty member in DHS, Dr. Rina Schumer is interested in scaling. She is a parent and an avid outdoorswoman who, along with skiing, snowboarding, and kiteboarding, scales rock cliffs. Her current research at DRI focuses on the science of scaling and mathematical modeling of earth systems. Schumer says, "Issues of scale pervade and confound studies of particles moving through the Earth, over the Earth's surface, and in the atmosphere." It is difficult to model the extremely complex interactions found in nature at all scales, but Schumer enjoys that challenge.



One of the areas Schumer is interested in is making predictions of how streams and rivers change through time by modeling the dynamics of stream systems. This includes things such as examining how pollution and sediments are transported in streams and rivers; how they are deposited, or accumulate, or erode within the system; and the recurrence of extreme events, such as floods. Data are collected in the field to test predictions generated by mathematical models to see how well the models can capture the actual field conditions.

When confronted with differences in field data and model predictions, scientists go back to the model to examine assumptions and parameters used in the model. Many times, parameters used in the model are inaccurate, and should be changed to account for the differences in scale between laboratory and theoretical models and natural systems. Schumer says, "A new school of thought suggests that it's not the model parameters that are scale-dependent, it's that we are choosing the wrong models. The mathematical models I work with specifically include treatment of variation in [and] over many time and space scales. Using these models helps us refine our understanding of underlying physical processes. I am also trying to understand how we can accurately measure effects of external change, whether from climate or humans, on the systems we model."

Schumer became interested in applying mathematical models to groundwater contaminant transport during her Ph.D. research at the University of Nevada, Reno. She and her collaborators have found that models can help us understand many environmental systems. While much of her research is concerned with creating and testing mathematical models, she has also done work on flood frequency for ephemeral streams, and changes in form and timing of precipitation in the eastern Sierra related to a changing climate. Another project Schumer has been involved in is examining the water balance on the Truckee River in a project for the U.S. Bureau of Reclamation.

Schumer says one of her goals as a new DRI faculty member is to secure funding "to work on interesting scientific questions"—making accurate scientific models that work in the real world, Schumer's work helps prepare planners for what happens when earth systems change.

Dr. Joseph Grzymiski

An increasing number of bacteria and viruses are becoming resistant to antibiotics. In partnership with pharmaceutical companies, DRI researchers are developing new ways to study and hopefully treat these potential infection-causing organisms before they become drug resistant—and deadly. Dr. Joseph Grzymiski is exploring with computer models and statistics the links between drug resistance and the biology of microbes, and bridging the gap between research and innovation and commercial value.

Grzymiski has partnered with Dr. Adam G. Marsh from the University of Delaware to develop Evozym Biologics, a company that has created technology to be used in synthetic biology and drug-target development. Evozym's proprietary platform technology utilizes evolutionary biology combined with multi-core computation, proprietary algorithms, databases, and biological engineering to transform the evolution of known gene profiles into novel proteins.

"Evozym's computational platform optimizes the structure and function of proteins and enables rapid output of a broad portfolio of next-generation genomics products for applications in renewable energy, human health, industrial green chemistry, and environmental remediation," said Grzymiski, founding partner of Evozym and an Assistant Research Professor at DRI.

His desire to understand the relationship between human health and microorganisms started early on his career. Grzymiski earned a bachelor's degree in philosophy and biology from Bowdoin College in Brunswick, Maine. During his undergraduate studies, he soon realized that he loved living on the water, and "would rather spend time on the ocean thinking about the meaning of life than pulling my hair out in a small office while contemplating Kant."

While on a Fulbright Scholarship, Grzymiski spent more than a year living in Trondheim, Norway, working in Egil Sakshaug's lab. Upon returning to the United States, he started working in Oscar Schofield's lab at the Institute of Marine and Coastal Sciences at Rutgers University.

In 2004, Grzymiski joined DRI as a postdoctoral associate working with colleagues in Antarctica, and examining hydrothermal vents to answer questions about life in extreme environments. On these projects, he began to develop tools to analyze the massive amount of DNA sequence information that was being generated.

"Understanding the code of life, DNA, may lead to cures for many diseases, such as cancer and help solve problems in energy and environmental clean-up," Grzymiski added. "My research has taken me to six continents and I have shared these adventures and collaborations with incredibly interesting and bright people. The combination of adventure and intellectual stimulation is intoxicating and makes for a great day in the "office."



HIGHLIGHTED AWARDS AND RECOGNITIONS 2009-2010

DRI Post-Doc Wins 2010 American Indian Science and Engineering Society Professional of the Year Award

Dr. Karletta Chief, a post-doctoral researcher in the Division of Hydrological Sciences (DHS) at DRI was one of three awardees for the 2010 American Indian Science and Engineering Society (AISES) Professional of the Year Award at the 32nd AISES Annual National Conference in Albuquerque. AISES' Professional of the Year Awards commemorate outstanding contemporary accomplishments by American Indians and Alaska Natives as leaders, innovators, and role models in Science, Technology, Engineering, and Mathematics. Chief grew up on the Navajo Nation, and from 2000-01, she served as Miss Navajo Nation. She received her Ph.D. from the University of Arizona in 2007, and her research interests include exploring the dynamic processes that control movement of air, water, gases, and contaminants in arid soils.

DRI Researcher Named to National Committee

Dr. Duane Moser, a faculty member in the Division of Earth and Ecosystem (DEES), has been elected to the Executive Committee for the Deep Underground Science and Engineering Laboratory Research Association (DuRA), which helps to run the Deep Underground Science and Engineering Laboratory (DUSEL). Located at the former Homestake Gold Mine in South Dakota, DUSEL will be the largest and deepest facility of its kind in the world, and will address the underground needs of major scientific fields such as particle and nuclear physics, geology, hydrology, geo-engineering, biology, and biochemistry. Dedicated access and heterogeneous geology at Homestake will make it an excellent place for studying microbiological life at extreme depth, a research field in which Moser is an expert.



Dr. Duane Moser inside the former Homestake Gold Mine, Lead, South Dakota.

Chow and Watson Help Organize, Lead International Conference

Dr. Judith Chow and Dr. John Watson, both faculty members in DAS, served as the Technical Chair and Scientific Steering Committee Chair, respectively at the 2010 Air and Waste Management Association's (A&WMA) International Specialty Conference held in Xi'an, China. A&WMA is a not-for-profit, nonpartisan professional organization that enhances knowledge and expertise by providing a neutral forum for technology exchange, professional development, networking opportunities, public education, and outreach to more than 8,500 environmental professionals in 65 countries.

The Speciality Conference, held in May, focused on air-quality management in Asia and on the opportunities Asian countries have in enacting new, efficient, and effective air-quality management practices to set a higher standard than countries with more established air-pollution controls. This conference brought together scientists, regulators, and industrialists with experience in different aspects of air-quality assessment and management. Conference proceedings will be published in a dedicated issue of the Journal of the Air and Waste Management Association.

Jianting Zhu Named Maki Chair in Hydrologic Sciences

Dr. Jianting "Julian" Zhu was named the Maki Chair in the Division of Hydrologic Sciences at DRI. DHS created the Maki Chair of Hydrologic Sciences as a rotating position with duration of one to three years, and an annual budget of \$50,000 using a donation from Sulo and Aileen Maki. Zhu, who earned his Ph.D. in civil engineering at Dalhousie University in Halifax, Nova Scotia, Canada, and his master's degree in fluid mechanics at Peking University in Beijing, China, has been with DRI since 2004. He studies scale issues in hydrology related to ecosystem functioning, including upscaling of hydrological and ecological processes, evapotranspiration estimates, and remote-sensing applications. Zhu hopes to use the award to fund interested students from UNLV and UNR to work on these problems.

NSHE Board of Regents Names Daniel Obrist 2010 Rising Researcher

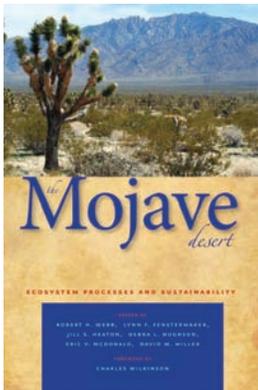
Dr. Daniel Obrist, an Associate Research Professor in the Division of Atmospheric Sciences (DAS), is a recipient of the 2010 Nevada System of Higher Education Rising Researcher Award. Obrist earned a master's degree in plant ecology at the University of Basel, Switzerland, and a Ph.D. in hydrogeology from the University of Nevada, Reno, and his research interests include atmospheric chemistry, transport, and biogeochemistry of pollutants, and quantification of interactions and exchanges of pollutants and gases between soils, plants, and the atmosphere. Obrist has focused on cycling of mercury in the environment, from examining mercury found in the atmosphere to deposition of mercury in the oceans. He has been awarded a grant from the National Science Foundation to work on chemical interactions of mercury in the Dead Sea with Dr. Menachem Luria, a professor at Hebrew University and an adjunct professor at DRI. Obrist also is working with Dr. Hans Moosmüller, a faculty member in DAS, on a funded EPA STAR grant to evaluate the impact of climate change on mercury levels and sequestration. In addition, Obrist has been awarded a NSF Major Research Instrumentation grant to develop a state-of-the-art sensor to measure atmospheric mercury at high temporal resolution.



Dr. Daniel Obrist, 2010 Nevada System of Higher Education Rising Researcher recipient. From l to r: Stephen Wells; Regent William Page; Dr. Daniel Obrist; Regents Dorothy Gallagher; William Cobb; and Board of Regents CEO Scott Wasserman.

The Mojave Desert — Book Earns 2009 PROSE Award

The Mojave Desert, a nonfiction book edited by the organizing committee for the Mojave Desert Science Symposium, earned an honorable mention in the Earth Sciences category of the 2009 PROSE Awards, the American Publishers Awards for Professional and Scholarly Excellence. DRI faculty members Drs. Lynn F. Fenstermaker and Eric McDonald, both in DEES, contributed to the book.



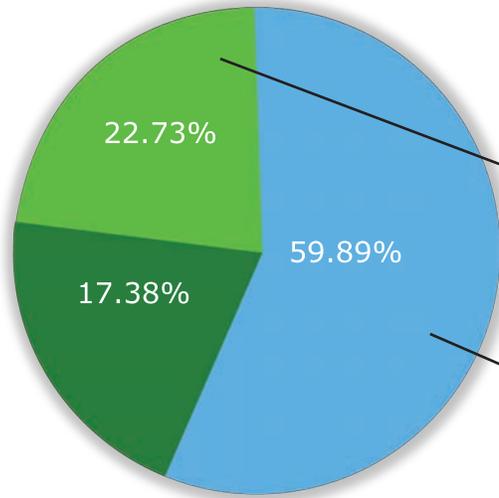
The PROSE Awards recognize the very best in professional and scholarly publishing, and bring attention to distinguished books, journals, and electronic content. In *The Mojave Desert*, scientific papers discuss the desert from many perspectives, including threats to the desert ecosystems such as expanding human populations and climate change, how desert soil and plant communities function, and the monitoring and sustainability of this fragile ecosystem. There also are suggestions as to how to enhance the understanding of processes of change in the Mojave Desert, and to advance the preservation and restoration of its fragile resources.

Public Relations Awards for DRI

At the 24th Annual Silver Spike Awards, hosted by the Sierra Nevada Chapter of the Public Relations Society of America (PSRA), DRI and the University of Nevada, Reno won two "Awards of Excellence" in the printed publications category. The joint publications that won were a poster and an annual report created for the 2010 Tahoe Summit hosted by Nevada Senator Harry Reid. DRI also won a 2009 PRSA Silver Spike Award of Excellence for a brochure created for the DRI Foundation by DRI PIO Kelly Frank.



2010 FINANCIAL REPORT



TOTAL NET ASSETS - \$108,353,000

- Total Liabilities - \$18,215,000
- Total Assets - \$126,568,000

OTHER REVENUE - \$11,835,000

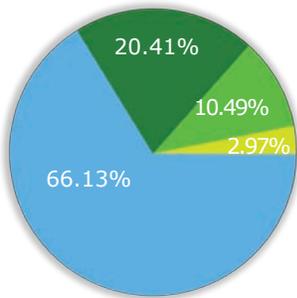
- Addition to Endowment - \$15,000
- Gifts - \$556,000
- Other Operating Income - \$9,193,000
- Non-Operating Income - \$2,071,000

GRANTS AND CONTRACTS REVENUE - \$31,179,000

- Federal - \$28,242,000
- Private - \$1,697,000
- State and Local - \$493,000
- Other - \$747,000

TOTAL REVENUE - \$52,063,000

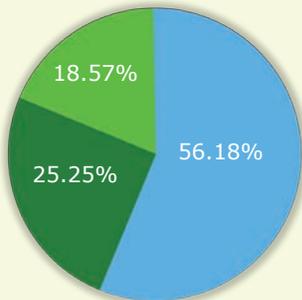
- Grants & Contracts - \$31,179,000
- State Appropriations - \$9,049,000
- Other Revenue - \$11,835,000



TOTAL OPERATING EXPENSES - \$47,402,000

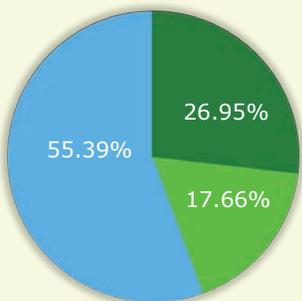
- Employee Compensation & Benefits - \$31,348,000
- Supplies & Services - \$9,675,000
- Depreciation - \$4,972,000
- Utilities - \$1,407,000

FOR THE FOUNDATION



TOTAL REVENUE - \$1,109,000

- Gifts and Contributions - \$623,000
- DRI Support - \$280,000
- Special Events & Other Operating Revenue - \$206,000



TOTAL OPERATING EXPENSES - \$1,002,000

- Contributed Salaries & Wages - \$270,000
- Supplies & Services - \$177,000
- Payments to DRI - \$555,000

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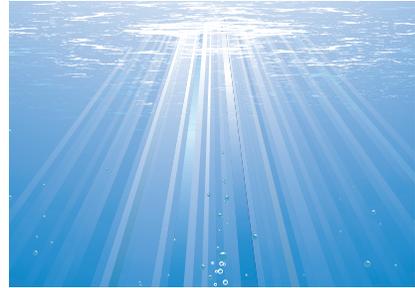
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