

Research for a Balanced Future

ANNUAL REPORT 2013

DRI
Desert Research Institute

SCIENCE. ENVIRONMENT. SOLUTIONS.

LETTER FROM THE PRESIDENT



STEPHEN G. WELLS, PH.D.
DRI PRESIDENT

As the Earth's environment continues to change, the need for creative scientific solutions and the application of innovative technologies becomes increasingly important to ensure a balanced future, one that recognizes the need to utilize and maintain those natural systems that sustain humanity around the globe.

Since 1959, DRI has stood at the forefront of understanding our earth's complex environmental systems, promoting preservation of diverse ecosystems, advancing responsible natural resource management, and improving human health and welfare in Nevada and around the world.

Fulfilling that global leadership role is a critical objective at DRI. The key to achieving such an ambitious mission has been, and remains, the aptitude, ingenuity, and diligence of DRI's faculty and staff. Whether by collaborating with our colleagues and institutions around the world to understand our planet's changing polar regions; working with our agency partners to integrate a monitoring plan to maintain Lake Tahoe, one of the West's greatest natural treasures; improving our understanding of the complex relationships among climate, weather, fire, and ecosystems to preserve our rangelands and forests; or offering a wide-range of high-quality services from our more than 60 cutting-edge environmental laboratories to establish national air pollution standards or to address invasive species along the Colorado River.

In addition to delivering rapid, high-quality environmental science in a businesslike fashion, DRI has recently taken on an important role in supporting our State's focus on Innovation-Based Economic Development and Governor Brian Sandoval's actions to integrate higher-education into a sustainable economic development model throughout Nevada.

Through fostering our research talent and leveraging our basic science, we are creating new intellectual property, strengthening commercialization efforts, building industry partnerships, and providing innovation-based services. DRI is not only helping the citizens here in our state and across the nation, but is extending its reach to citizens around the world.



Stephen G. Wells

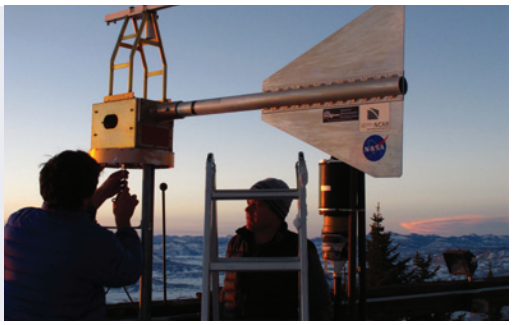
A MESSAGE FROM DRI —

AIR



MARC PITCHFORD, PH.D.
EXECUTIVE DIRECTOR

Conducting fundamental and applied research and providing services related to the atmosphere on a wide range of topics including air quality, cloud and aerosol physics, atmospheric chemistry, climate, renewable energy, fire weather, and atmospheric dynamics.



LAND & LIFE



BRUCE JONES, PH.D.
EXECUTIVE DIRECTOR

Studying the complex interactions of geological processes, organisms, biological communities, and human societies on the earth's surface; and contributing to a greater understanding of the history and processes affecting landscapes.



WATER



JIM THOMAS, PH.D.
EXECUTIVE DIRECTOR

Improving society's fundamental knowledge and understanding of hydrologic systems and encouraging more effective water resource management; and researching the natural and human factors that influence the availability and quality of water resources in arid and developing regions.





Transforming science at 10,500-feet

Honoring an extraordinary relationship and celebrating $1 million in improvements at Storm Peak Laboratory

DRI presented the President's Medal in 2013 to the Steamboat Springs Ski & Resort Corporation for its significant dedication and support of the Institute's Storm Peak Laboratory – a very rare, mountain-top atmospheric research facility that sits high atop the ski resort in Colorado. Since 1995, resort ski patrol, mountain operations, and administrative staff have assisted DRI scientists and students with year-round access to the laboratory site to advance discovery and understanding within the field of atmospheric science.

DRI also recognized the efforts of the National Science Foundation (NSF) in supporting a portion of the $1 million in renovations to the laboratory that were completed in 2013. Over a span of three years, DRI and the NSF made significant improvements to the both the physical structure of the lab and the ability to sample and analyze chemical and biological species under up-to-date conditions in all warm and cold laboratories, including the new Gary Franc Chemistry Lab and the newly updated Randy Borys Instrument Laboratory.



NASA's Terra satellite captured this image of the smoke plume from the Rim Fire in Yosemite National Park in 2013. Credit: NASA image by Jeff Schmaltz, LANCE/EOSDIS Rapid Response

The applied science of climate, wildfire and weather forecasting

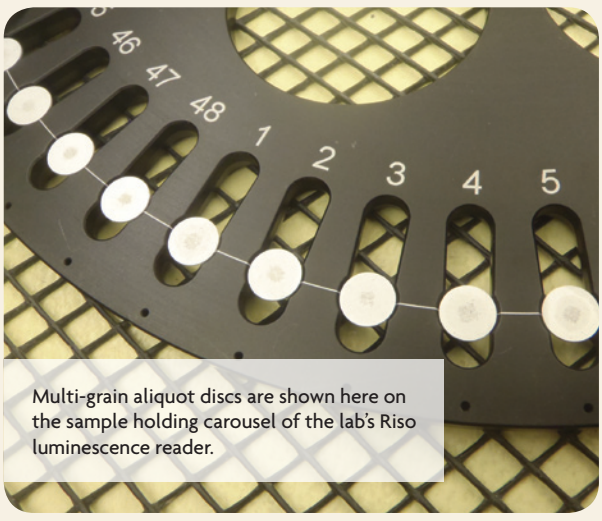
The program for Climate, Ecosystem, and Fire Applications (CEFA) on DRI's Reno campus performs studies and applied research to improve the understanding of relationships between climate, weather, fire, and ecosystems. With experimental fire weather, fire danger, fire behavior, and smoke dispersion/transport forecasting products, CEFA provides climate and weather information directly to interagency wildfire managers for better decision-making and strategic planning and acts as a liaison between the fire, natural resource, and scientific research communities.

Adam Watts, Ph.D., who joined CEFA in 2013, is DRI's first Fire Ecologist and is working on new techniques and technology for fire prediction and monitoring, including investigating the use of unmanned aircraft systems (UAS) for wildland firefighter situational awareness, fire detection and monitoring, and post-fire mapping and rehabilitation monitoring.

SCIENCE

DRI names new leadership for E.L. Cord Luminescence Laboratory

Amanda Keen-Zebert, Ph.D., joined DRI in 2013 as director of the E.L. Cord Luminescence Laboratory on DRI's Reno campus. This unique lab is fully equipped to conduct the latest luminescence methods (a suite of radiometric dating techniques used to measure the time elapsed since the last exposure of sediment to heat or sunlight) and offers a wide range of services for contract work and for research collaboration. Keen-Zebert came to DRI from the Watershed Studies Institute at Murray State University in southwest Kentucky where her interests included surficial processes, specifically fluvial processes over the Quaternary Period, optically stimulated luminescence, and other geochronologic techniques.



Multi-grain aliquot discs are shown here on the sample holding carousel of the lab's Riso luminescence reader.



Graduate student Angela Stevens aboard DRI's jet-propelled nearshore research vessel on Lake Tahoe.

A clear view of Lake Tahoe's nearshore

An integrated approach for evaluating the lake's nearshore ecology and aesthetics

The nearshore is that part of Lake Tahoe where both residents and visitors most often interact directly with the lake. It is an important zone of relatively shallow water around the lake's perimeter that is valued for its recreational and aesthetic qualities, as well as for the unique biological community that it supports.

A team of scientists, led by DRI's Alan Heyvaert, Ph.D., presented research findings and recommendations in 2013 to the Tahoe Regional Planning Agency Governing Board that addressed Lake Tahoe's aquatic nearshore environment in the context of heightened interest by stakeholder groups and the public in understanding factors contributing to changes evident in the zone.

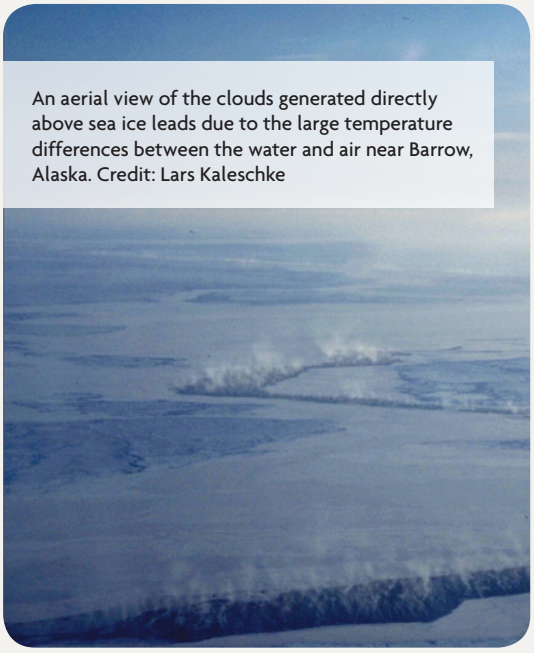
The Lake Tahoe Nearshore Evaluation and Monitoring Framework project was funded by the Southern Nevada Public Land Management Act, and represents the combined efforts of more than a dozen scientists and technical advisors from the Desert Research Institute; University of Nevada, Reno; and the University of California, Davis. The report from this project integrates available research on this important zone, explains its unique and complex ecological aspects, and presents an initial collaborative framework developed by the science community and the resource management agencies to implement a coordinated approach for monitoring and evaluating the nearshore ecology and aesthetics of Lake Tahoe. It is an example of how science and natural resource management can work collectively to sustain the important environmental qualities that support local communities.

ENVIRONMENT

A new link between changing sea-ice and mercury deposition in the Arctic

A study published in *Nature* and co-authored by Drs. Chris Moore and Daniel Obrist established, for the first time, a link between Arctic sea-ice dynamics and the changes in the region's atmospheric chemical cycling. The opening and closing of sea-ice leads (large cracks in the ice that expose warmer seawater to the cold polar atmosphere) create a pumping effect, which in turn causes atmospheric depletion events to cease. The depletion events are coupled with the destruction of ozone and ultimately the deposition of atmospheric mercury onto snow and ice, a portion of which can enter Arctic ecosystems during snowmelt.

Moore and his colleagues, including researchers from NASA's Jet Propulsion Laboratory in Pasadena, California, measured increased concentrations of mercury near ground level after sea-ice leads opened near Barrow, Alaska, in 2012, during the NASA-led Bromine, Ozone, and Mercury Experiment (BROMEX) field project. They also used images from the Moderate Resolution Imaging Spectroradiometer instrument on NASA's Terra satellite to observe sea-ice and a National Oceanic and Atmospheric Administration model of air transport to gain insight into what was upwind of their mercury measurements.



An aerial view of the clouds generated directly above sea ice leads due to the large temperature differences between the water and air near Barrow, Alaska. Credit: Lars Kaleschke



PBS NewsHour features DRI's patented dust detection device and Valley Fever research

DRI scientists, Vic Etyemezian, Ph.D. and George Nikolich were featured on PBS NewsHour on June 26, 2013, in a report on the spread of a resilient fungus that causes a deadly infection known as Valley Fever. The report highlighted the role of dust in the dramatic rise of Valley Fever and showcased how a device called the PI-SWERL (Portable In-Situ Wind Erosion Lab), patented by Etyemezian, Nikolich and colleagues, is helping scientists detect and understand how the spores travel regionally.

SOLUTIONS

Integrating unmanned aircraft systems

Researchers developing modern platforms and applications following FAA test site designation

The face of aviation is changing across the United States. The Federal Aviation Administration (FAA) selected Nevada in late 2013 as one of six locations to be a test site for conducting critical research on how unmanned aircraft systems (UAS) can be integrated into our National Airspace System (NAS).

Scientists and engineers at DRI have utilized manned and unmanned aerial acquisitions since the early 1970's to meet research goals associated with atmospheric, hydrological, ecological and cultural assessment, and monitoring. Many of the Institute's early unmanned efforts employed various balloon platforms to measure a number of atmospheric properties along a vertical profile.

DRI faculty and students have been actively developing modern UAS platforms and exploring ways in which UAS are increasingly being used in civil, commercial, public, and private sectors for scientific applications as diverse as cloud seeding to monitoring forest fires. Examples of DRI efforts include the design, fabrication, and deployment of sensors and sensor packages, real-time and post data collection analytics, and data visualization utilizing DRI's state-of-the-art, six-sided Virtual Reality Immersion Laboratory.



DRI has partnered with private industry and academic institutions to conduct research on scientific and civilian applications of UAS.

DRI scientists complete 68,000-year climate record from Antarctic ice core

A team working in DRI's unique ultra-trace ice core analytical laboratory completed a high-depth-resolution chemical analysis of the bottom 700-meters of a 3,405-meter (more than two mile) long ice core in 2013. The ice core was extracted from the Western Antarctic Ice Sheet (WAIS Divide). The full aerosol record contained information on emissions and transport of dust, sea salt, volcanic sulfate, and biomass burning tracers during the last 68,000 years. In combination with the measurements of greenhouse gas concentrations (e.g. methane), analyzed at DRI in collaboration with colleagues from Oregon State University, these results give scientists around the world new insights into climate evolution and the drivers of natural climate variability.



A piece of the WAIS Divide ice core melts in DRI's ultra-trace ice core analytical lab in Reno, Nevada. Credit: Sylvain Masclin



Applied Innovation Center offers services for innovation in data and computational analysis

DRI's proposal to create an Applied Innovation Center (AIC) for Advanced Analytics received the first vote of support from the Knowledge Fund Advisory Council in late 2013. The new AIC builds on existing expertise in data analysis and information technology at DRI to enable a critical mass of experts in new knowledge technologies to help differentiate regional businesses and attract new ones. The AIC will partner with businesses to help translate scientific ideas into practical solutions using a fee-based business model called contract innovation services. Established industries, as well as start-ups and entrepreneurs, will be targeted for these services as the AIC aids businesses within Nevada and around the world.



In Reno, solar arrays generate 635kW with 2,360 individual panels.

Breaking the one megawatt barrier

Four new solar photovoltaic systems were brought online in 2013, boosting DRI's total clean electrical power-generating capacity to more than one megawatt. Together, the Institute's six solar arrays combined include more than 4,200 individual solar panels and generate nearly 20 percent of the electrical power requirements needed for DRI's facilities statewide. The arrays save DRI more than $156,000 in electricity costs annually and reduce CO_2 emissions by an estimated 3.6 million pounds per year.

DRI also has an additional 1.15 MW (AC) of solar power generation under construction on its campuses, scheduled to be completed by Fall 2014, increasing the total annual electrical savings to an estimated $336,000. DRI's solar-generation projects were made possible thanks to the financial incentives provided through NV Energy's Solar Generations program, the Governor's Office of Energy revolving loans program, and the State Public Works Division.



In Las Vegas, solar arrays generate 448kW with 1,856 individual panels.

RENEWABLE ENERGY



Free electric vehicle charging on campus

DRI now has two public electric vehicle charging stations (supporting four electric vehicles) located on its Las Vegas campus and one private, employee-only charging station (supporting two electric vehicles) on its Reno campus. The Las Vegas stations are part of the Chargepoint network and are available 24 hours a day, seven days a week. A Chargepoint RFID card is required to activate one of the four vehicle plugs in Las Vegas.

Supporting Nevada's preK-12 educators in science-based, environmental education

GreenPower successfully launched the all-new Green Box program in August 2013, offering hands-on, science-based curriculum and materials for teachers to utilize in the classroom.



Educators at a GreenPower Teacher Training interact with the materials provided in a GreenBox.

GREEN BOXES BY THE NUMBERS

- 2,641 students reached in the first four months of the program
- 31 individual Green Boxes distributed to Nevada schools
- 14 additional Green Box titles scheduled for the 2014 school year

GreenPower also hosted DRI's first-ever, summer STEM academy in Reno and Las Vegas focused on energy and climate. In 2013, GreenPower partnered with NV Energy, Southwest Gas, U.S. Green Building Council, EnergyFit Nevada, and others to promote energy efficiency and conservation through STEM focused environmental education to more than 1,142 teachers throughout the year.

FINANCIAL REPORT FISCAL YEAR 2013

FOR THE INSTITUTE

TOTAL REVENUE $50,945,000



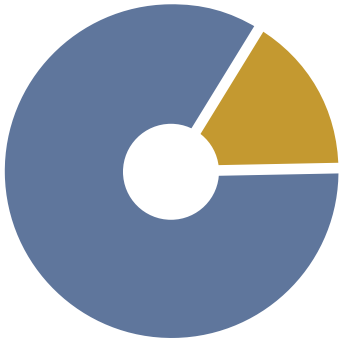
Grants & Contracts	**$35,644,000**
Federal	$23,279,000
Service Contracts (Federal & other)	$10,106,000
Private	$1,176,000
State & Local	$712,000
Other Revenue	$371,000
State Appropriations	**$7,817,000**
State General Fund	$7,421,000
Other Appropriations	$395,000
Other Resources	**$7,484,000**

TOTAL OPERATING EXPENSES $47,819,000



Employee Compensation & Benefits	$32,214,000
Supplies & Services	$9,743,000
Depreciation	$4,821,000
Utilities	$1,041,000

GRANTS AND CONTRACTS FUNDING SOURCES — TOTAL $35,644,000



FEDERAL $30,097,000

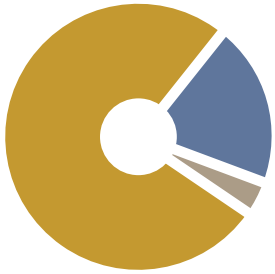
Dept. of Energy (DOE)	22.3%
Dept. of Defense (DOD)	19.5%
National Science Foundation	12.7%
Dept. of Interior	9.0%
Dept. of Commerce (DOC)	6.8%
Environmental Protection Agency	5.4%
NASA	3.9%
USDA	3.2%
Other	1.6%

NON-FEDERAL $5,547,000

Private	6.4%
Other State Government Agencies	4.5%
Local Government	3.5%
Foreign	1.0%
State Government	0.2%

FOR THE FOUNDATION

TOTAL REVENUE $1,239,000



Gifts, Contributions & Events	$947,000
DRI Support	$249,000
Other Revenue	$43,000

TOTAL OPERATING EXPENSES $1,182,000



Gifts to DRI	$640,000
Supplies & Services	$295,000
Contributed Salaries & Wages	$247,000

ADDRESSING A CHANGING PLANET

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2014 NEVADA MEDALIST
ALBERT "YU-MIN" LIN

The search for Genghis Khan

Technology-enabled exploration and the power of the crowd

For 27 years we have awarded the DRI Nevada Medal, sponsored this year by Switch, to acknowledge outstanding achievement in science and engineering. Our 2014 recipient, Dr. Albert "Yu-Min" Lin, is a pioneer in a new era of technology-enabled exploration. His work has motivated thousands of people to engage their curiosity, and he epitomizes DRI's mission to apply new technologies to improve people's lives throughout the world.

As an Emerging Explorer of the National Geographic Society and the Principal Investigator of the Valley of the Khans Project, Dr. Lin is leading an international multidisciplinary effort to locate the tomb of Genghis Kahn. Together with his research team, he is pioneering new methods for data analysis through innovative crowdsourcing techniques and data visualization methods similar to those being developed at DRI.

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