Tahoe

A LEGACY OF RESEARCH, EDUCATION & OUTREACH

2015

TAHOE SNOWPACK
an in-depth look at a record low winter

SPOTTING WILDFIRES
seeing farther, faster through HD camera network

WATER CLARITY
what's happening in the nearshore?

Academy for the Environment
University of Nevada, Reno

DRI Desert Research Institute
Center for Watersheds and Environmental Sustainability

United States Senate
WASHINGTON, DC 20510–7012

August 2015

Dear Friends:

Lake Tahoe provides unparalleled beauty in the Sierra Nevada Mountains and serves as a source of great pride for Nevadans and Californians. As stewards of "the jewel of the Sierras," it continues to be our responsibility to protect and preserve the biodiversity of this stunning treasure for generations to come.

When I convened the first Lake Tahoe Summit in 1997 to draw national attention to the declining health and clarity of the lake, the Summit set goals to improve the ecological well-being of Lake Tahoe and the entire Lake Tahoe Basin. Over the past 18 years, federal, state, and local stakeholders have continued to build on the tremendous progress we have already made in restoring the lake. Much of this progress has resulted from the remarkable scientific research performed throughout the Tahoe Basin. As in past years, the publication of the Lake Tahoe Summit Report documents the vital work of scientists from the University of Nevada, Reno, the Desert Research Institute, and other institutions.

The hard work and dedication of so many have contributed to our accomplishments in restoring Lake Tahoe, but there is more work to be done. For more than a decade, drought and wildfires have threatened the Lake Tahoe Basin. I continue to work with the Nevada and California congressional delegations to reauthorize the Lake Tahoe Restoration Act (S. 1724). This legislation would provide additional federal contributions over ten years to guard against pollution, wildfires, and invasive species. I am glad to be working alongside my colleagues to reauthorize this vital legislation so the lake can continue to have the attention and resources it needs and deserves.

One of the best legacies we can leave to our children is a healthy environment and a history of preservation of our nation's natural beauty and resources. I look forward to continuing to work with you to protect our national treasures and improve sustainability in the Basin communities.

My best wishes to you.

Sincerely,

HARRY REID
United States Senator

DEAN HELLER
NEVADA
(202) 224-6244

United States Senate

WASHINGTON, DC 20510

August 2015

Dear Friends and Colleagues:

Welcome to the 19th Annual Lake Tahoe Summit! This event is a great opportunity to reflect on past accomplishments and chart future efforts to protect and preserve the long-term health of Lake Tahoe – one of the most majestic and spectacular places in the world.

As this year's host, our theme and focus will be ***"Connecting Lake Tahoe's Environment and Economy through Innovation and Transportation."*** Anyone who has been to the lake understands the importance of its long-term environmental and economic health for future generations. The successes we have enjoyed since the first Presidential Summit in 1997 would not have been possible without the numerous public-private partnerships that have increased in number to this day. The collaborative efforts between California and Nevada are examples of what can be accomplished between state and local governments; private citizens; private businesses; non-profit organizations; and our research partners, the University of Nevada, Reno, the Desert Research Institute and UC Davis.

One of the initial goals of the first Summit was the passage of the Lake Tahoe Restoration Act. Last month, I, along with Senators Reid, Feinstein and Boxer, introduced the Lake Tahoe Restoration Act of 2015. This bipartisan legislation renews the Federal government's commitment as a partner in our efforts to improve water clarity, reduce the threat of wildfires, jumpstart innovative transportation and infrastructure projects and combat invasive species in the Basin. I look forward to working with my colleagues to ensure this piece of legislation becomes law so that Lake Tahoe continues to receive the resources it deserves.

I am committed to preserving and improving Lake Tahoe for future generations to enjoy, and am honored and privileged to join everyone who has come together for the benefit of Lake Tahoe and the Basin communities.

Sincerely,

DEAN HELLER
United States Senator

President Marc Johnson

President Stephen Wells

Dear Friends,

For more than 25 years scientists and students from the University of Nevada, Reno and the Desert Research Institute have collaborated to tackle the unique environmental challenges facing the Lake Tahoe basin.

One constant during the many research projects, presentations, hundreds of peer-reviewed papers and agency reports has been a focus on education – of both our next generation of great scientists and engineers, as well as the public.

For those lucky enough to interact with the lake daily and for those who only experience it occasionally, during such events as the annual Lake Tahoe Summit, the deep blue waters and pristine shoreline represent a treasure of unmeasurable value.

As you'll read in the exciting stories that follow, our talented cadre of scientists have developed a model for education and outreach that in concert with a highly collaborative, productive and ongoing research agenda, has produced a significant impact on the people and agencies tasked with Lake Tahoe's ongoing restoration efforts and continued management.

Our two institutions remain committed to communicating the innovative research and science happening in and around the Lake Tahoe basin; as well as to educating our scientific colleagues, our friends, our elected officials, our local and federal agency partners, and our donors about the need for a sustained, long-term approach to monitoring and subsequent action and policy in the basin.

We strongly support reauthorization of the Lake Tahoe Restoration Act to assist the Tahoe science community and agency managers in continuing their vital work to restore and maintain the lake's ecosystem amid a changing climate and an ongoing drought.

Through the sharing of knowledge and ideas, the creation of integrated data networks and a unified approach to new project proposals, faculty and students from both our institutions continue to drive innovation of new technologies, methods, and ultimately solutions to secure Lake Tahoe's future for many generations to come.

Sincerely,

MARC JOHNSON
President
University of Nevada, Reno

STEPHEN WELLS
President
Desert Research Institute

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Photograph by Shelbi Whitehead

what's up with the snowpack?

Dr. Adrian Harpold from the University of Nevada, Reno walks near the Truckee River in downtown Reno during July 2015. Harpold's research may help water managers make better decisions during times of drought.

Understanding the implications of changing snowpack patterns

by Kelsey Fitzgerald

In the Lake Tahoe Basin, the 2015 winter snowpack broke records, and not the kind of records that skiers appreciate. After four consecutive years of drought, winter 2015 brought record low precipitation, with maximum snowpack reaching only 22 percent of normal.

The Natural Resource Conservation Service measures snow levels at eight SNOTEL (snow telemetry) stations in the Lake Tahoe Basin, with records that date back to 1981. This year's snowpack, which peaked on Mar. 3, was the lowest since record keeping began.

The 2015 snow season in the Tahoe Basin was also one of the shortest on record, with the last day of snow cover at the measuring stations occurring on Apr. 13, more than two months earlier than the normal snow disappearance date of June 29.

"2015 has the dubious distinction of setting a new definition of what a low snow winter can be," Jeff Anderson, water supply specialist for the Nevada NRCS Snow Survey, said.

Two sites in the Lake Tahoe Basin, at Lake Lucille and Ward Creek, are part of a longer-running record of snowpack measuring stations, which were developed by the University's of Nevada Reno's Dr. James Church and date back to 1913.

On Apr. 1, when snowpack in the Sierra Nevada is traditionally at or near peak levels, both sites had the lowest snowpack of any year in the last century—and the ground at Ward Creek was completely bare of snow.

In a region that depends heavily on snowpack for recreation, tourism and water availability, many are wondering how the low snowpack will affect the economy, ecosystems and people who live in the region. Dr. Adrian Harpold, assistant professor at the University of Nevada, Reno, is investigating effects of changes in snowpack, and how to best help natural resource managers plan for extreme years such as 2015.

Harpold is head of the University's new Nevada Mountain Ecohydrology Lab, and interested in all things snow. In his research, Harpold combines remote sensing and modeling with field observations to answer questions about snowpack. In his free time, you can find Harpold out exploring the mountains on his telemark skis (well, at least when there's snow).

Many people in the basin appreciate mountain snowpack for the recreational opportunities it provides and the tourism economy it supports, but according to Harpold, there are other reasons why snowpack matters.

Snowpack releases water slowly, providing an essential source of water for forests during warmer and drier times of the year. Diminished snowpack and earlier snowmelt can lead to water-stress in trees, and increased risk of forest fires during dry

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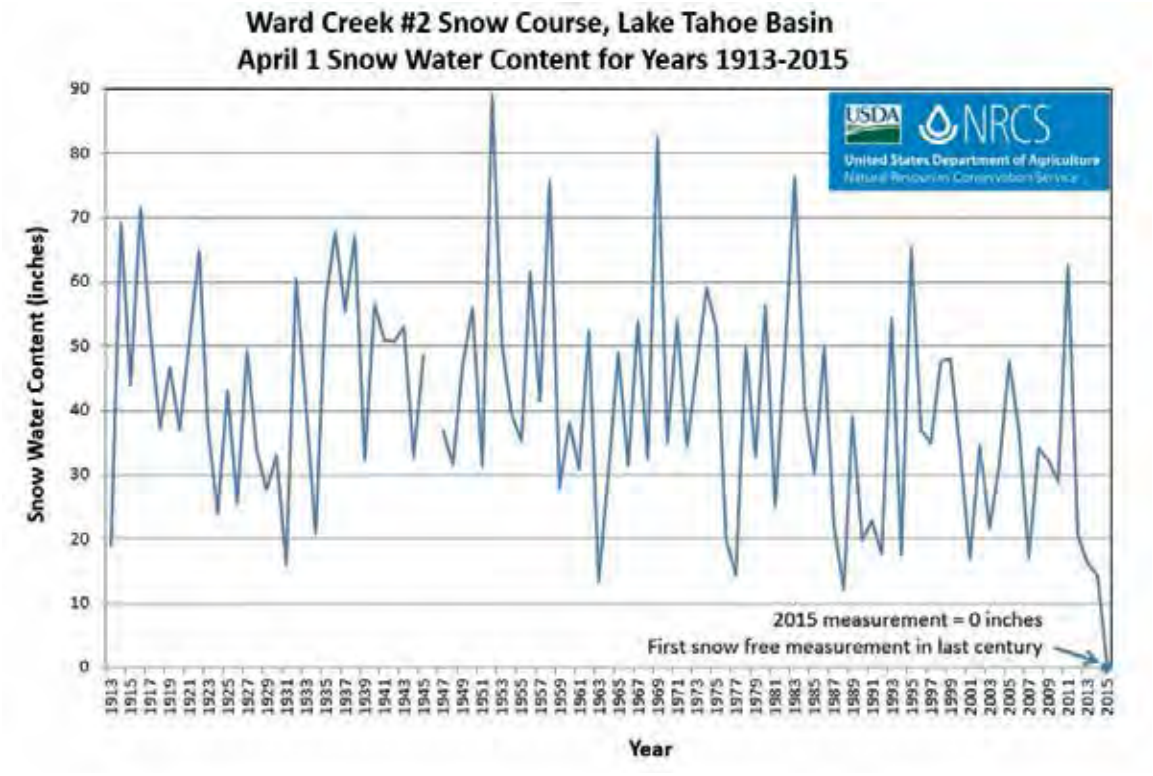
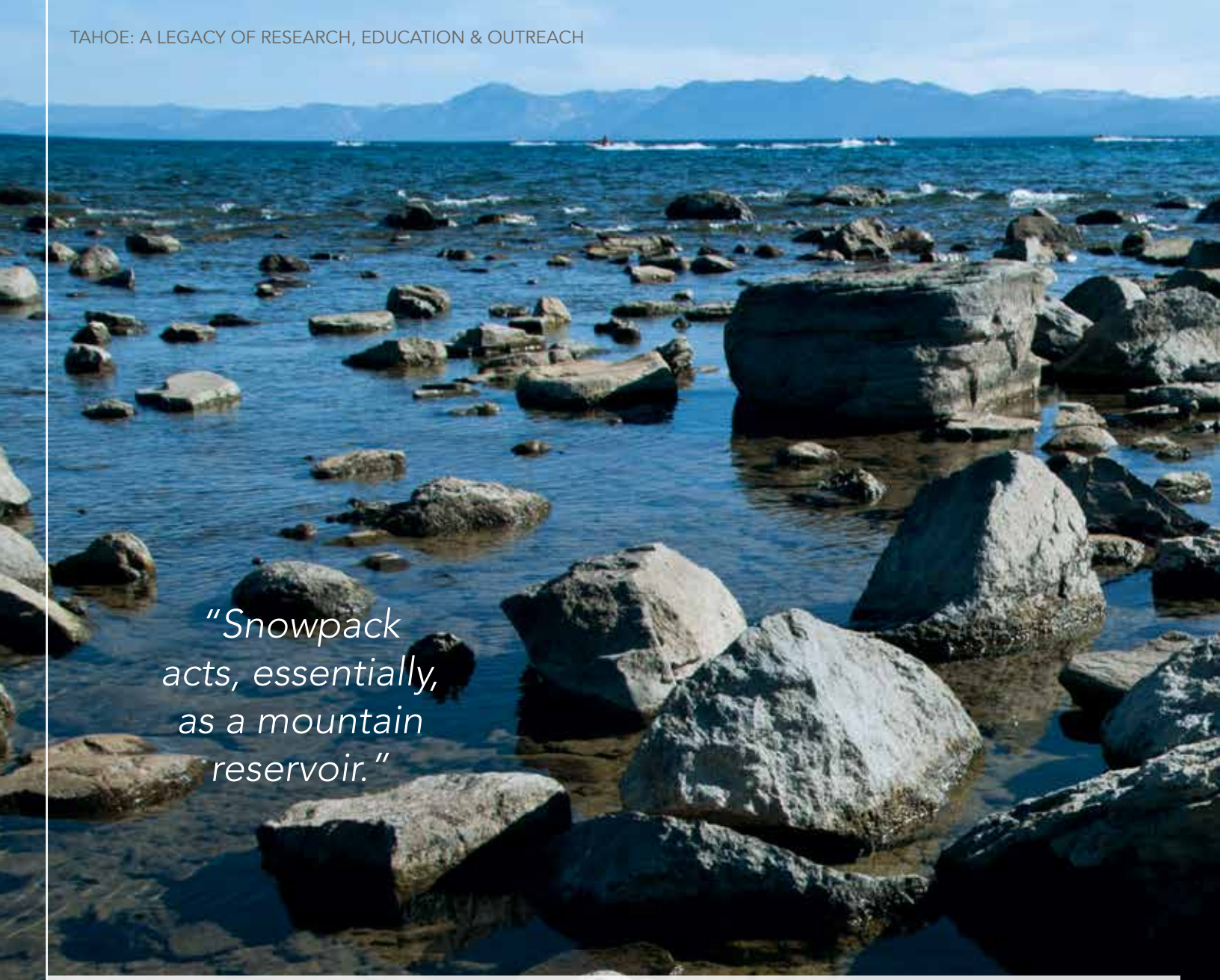


Photograph by Abbey Baker and Jairo Sosa



"Snowpack acts, essentially, as a mountain reservoir."

summer months.

Much of the local human infrastructure has been built around historic snow regimes, as well.

"Snowpack acts, essentially, as a mountain reservoir," Harpold said. "We store water in the mountains, and release it when we need it, which is generally the warmer times of year when water demand is higher."

Every day, water managers make decisions about how much water to keep in reservoirs, and how much water to release. To do this, they look to streamflow forecasts, which predict future water availability based on snowpack measurements and other hydrologic data.

This summer, Harpold is working with student Shareily Maria Vazquez as part of the National Science Foundation's ten week Research Experience for Undergraduate Program. Together, Harpold and Vazquez are investigating connections between snowmelt and soil moisture, and researching whether soil moisture data can be used to help improve the streamflow forecasts developed by the NRCS.

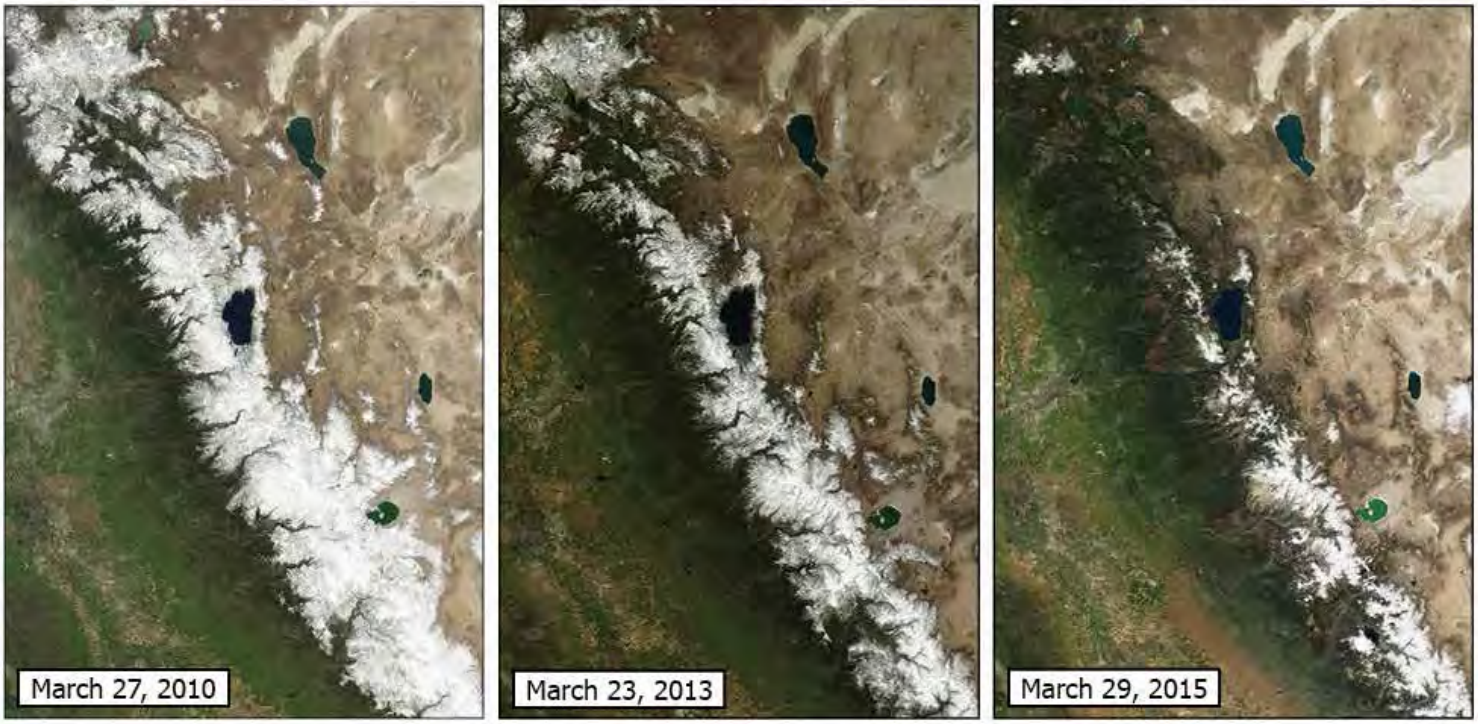
Traditionally, streamflow forecasts have been made using statistical models, however, recent climate extremes are beginning to put those models to the test.

"There's this idea in all of the statistical models that the past predicts the future," Harpold said. "But, when the snowpack starts to change in ways that it hasn't in the past, with 2015 in the Sierras being a very good example of that, it's hard to find an analog to this year."

NRCS has been installing gauges at SNOTEL stations to measure soil moisture, however, they have not yet begun to incorporate that data into streamflow forecasting. This is where Harpold and Vazquez hope their research will help.

When soils are very dry, they soak up more moisture, thus less water can be expected to move to the streams; when soils are very wet, the opposite is true.

Photograph by Shelbi Whitehead



Satellite imagery shows Sierra Nevada snowpack during late March of 2010 (an average year), and 2013 and 2015 (drought years). Sierra Nevada snowpack usually peaks around April 1. Imagery from NASA.

Incorporating soil moisture data could improve the accuracy of streamflow forecasts, helping water managers to make better decisions during times of extreme climate events, such as the ongoing drought.

"Even if this makes our forecasts five percent better, five percent of a reservoir is a substantial amount of water, both economically and in terms of how you manage and release the water," Harpold said. "Five percent could really change some of the actual, on-the-ground decision-making, especially in extreme years of drought and floods."

"Soil moisture is a very important issue," Greg Pohll, Research Professor of Hydrology at Desert Research Institute, said. "Anything that scientists can do to improve those forecasts will have a huge impact on our ability to manage the system."

Long-term climate predictions for the Lake Tahoe Basin include rising air temperatures and a shift from snowfall to rain, as warmer temperatures push the snowline higher up mountain slopes.

This means that years of low snowpack may become increasingly common, with potential for lowered soil moisture, earlier snowmelt runoff, and changes in flood frequency and magnitude—and it means that research such as Harpold's may become increasingly important.

This summer, Harpold will welcome the first two graduate students into the Nevada Mountain Ecohydrology Lab, and he looks forward to continuing his research on snowpack in the Great Basin and eastern Sierra Nevada.

"My favorite part of this job is working on issues that matter to science and society," Harpold said. "To step into a position that lets you work on problems that are directly relevant and important—it's really rewarding."

THESE CAMERAS SEE ALL

Crowdsourcing wildfire detection in the Lake Tahoe Basin with AlertTAHOE

by Kelsey Fitzgerald

Just after noon on a sunny Wednesday in early June, Dr. Graham Kent walked into a back room in Passaretti's Italian Restaurant in South Lake Tahoe, Calif., where a group of 15 engineers and architects were about to begin lunch. While waiters removed photographs from the white wall at the front of the room, creating a makeshift screen, Kent —seemingly accustomed to presenting in makeshift spaces—greeted the small crowd and set up his projector on a dining table, tilting it up on a stack of overturned salad plates.

Dimming the lights, Kent launched into a presentation about AlertTAHOE, a network of fire cameras and earthquake sensors that he and his team from University of Nevada, Reno's Nevada Seismological Laboratory are currently installing in the Lake Tahoe Basin. Raising public awareness is a major focus of his work right now, Kent says. That, and raising $2 million.

Kent, director of the Nevada Seismological Laboratory and professor at the University of Nevada, Reno, has spent much of his career studying earthquakes, tsunamis, megadroughts and extreme precipitation events called ARkStorms.

During the past six months, Kent has given 20 or 30 talks to different groups in the Tahoe region about AlertTAHOE,

Photograph by Krissy Clark

a system designed to prevent what he currently sees as one of the most serious and preventable threats to the Lake Tahoe Basin: wildfires.

"Lake Tahoe isn't going to be blue if the forests are gone," Kent said, referencing the League to Save Lake Tahoe's Keep Tahoe Blue campaign. "You actually want to keep the Lake Tahoe Basin green."

"You actually want to keep the Lake Tahoe Basin ***green****."*

By placing cameras on high peaks around the Lake Tahoe Basin and broadcasting a live video feed online, the AlertTAHOE system is designed to crowdsource the effort to detect wildfires before they become catastrophic.

Wildfires in the Sierra Nevada can be devastating to the environment and human infrastructure, and costly to fight. In June 2007, the Angora Fire burned 3,100 acres of South Lake Tahoe. The cost to fight the fire and property loss totaled approximately $160 million.

More recently, in 2014, the King Fire burned more than 97,000 acres in nearby El Dorado County, with a total cost of close to $150 million.

Kent's next slide showed a map of the 2014 King Fire overlaid onto the Lake Tahoe Basin. The resulting image was chilling: a burn of similar size would engulf Lake Tahoe's entire west and south shore.

"The cost to build and run AlertTAHOE for one decade is about $2 million," Kent said to the group. "If we get a King Fire up here, it not only ruins the basin, it takes down the Carson economy, the Reno economy, the Truckee economy. There is nothing about your life today that will exist if something like the King Fire happens here."

2014 King Fire burn area.

In 2013, Kent and his team put the first fire cameras online, tying in with a network of sensors already in place for measuring earthquakes. In 2014 they added two more.

AlertTAHOE cameras record high resolution HD video, with pan-tilt-zoom control and a near infrared channel for viewing fire at night. Certified fire

continued...

Fire camera installation at Homewood. Photograph provided by Graham Kent.

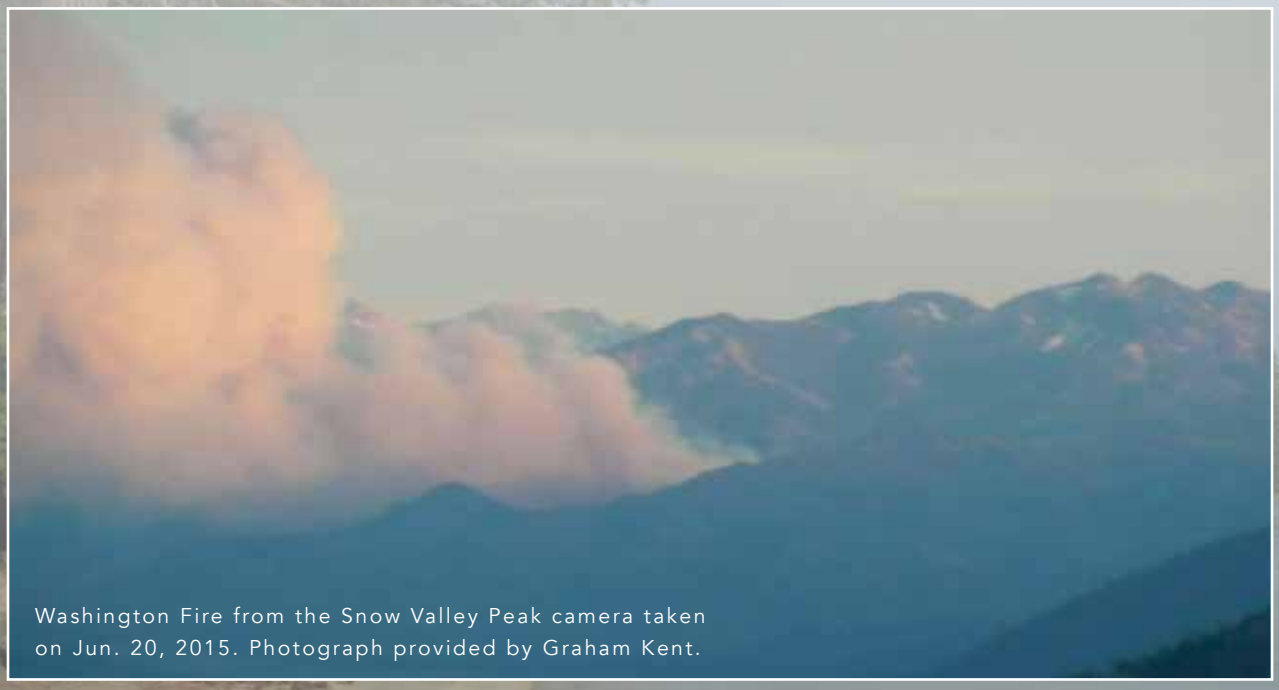
personnel control the direction and zoom of the cameras, however, the public can view the live-feed online, with on-demand time-lapse. During storms, a lightning overlay map allows viewers to monitor lighting strikes. Data are transmitted through the network via high-bandwidth microwave links, which use beams of radio waves rather than wires or cell towers.

"You don't want to build it on a system that's potentially going to fail during an emergency, like cell phones did during superstorm Sandy, because everyone is going to be Snapchatting videos," Kent explained.

In 2015, nine more cameras are scheduled for installment, and Kent is working with Dr. Raul Rojas at the University of Nevada, Reno to develop a pipeline for using machine vision. Once complete, the machine vision system will use computer programs to identify smoke without the aid of observers.

The goal is to go even bigger. AlertTAHOE has recently partnered with the Tahoe Prosperity Center to help raise funds for additional cameras and infrastructure. The current plan includes opportunities for more than 20 cameras, with updated seismological stations near and surrounding the basin—a system with no blind-spots, which could handle three or four fires at once.

The fire camera on Snow Valley Peak sits above the tree line, looking out over an open meadow area toward the dark green-forested slopes and snow-capped peaks of the Lake Tahoe Basin.



Washington Fire from the Snow Valley Peak camera taken on Jun. 20, 2015. Photograph provided by Graham Kent.

King Incident from the Homewood camera taken on Jun. 27, 2015. Photograph provided by Graham Kent.

On Aug 9, 2014, Mac Heller of the U.S. Forest Service used the Snow Valley Peak camera to spot a wildfire on Spooner Summit, the first success story of the AlertTAHOE program.

"He wasn't even there – he was in Fresno, and he could have been in Paris, France," Kent said. "We don't know if that would have been a three acre fire, or a 300 acre fire that would have burned into Carson City. The beauty is that when you put a fire down early, you don't know."

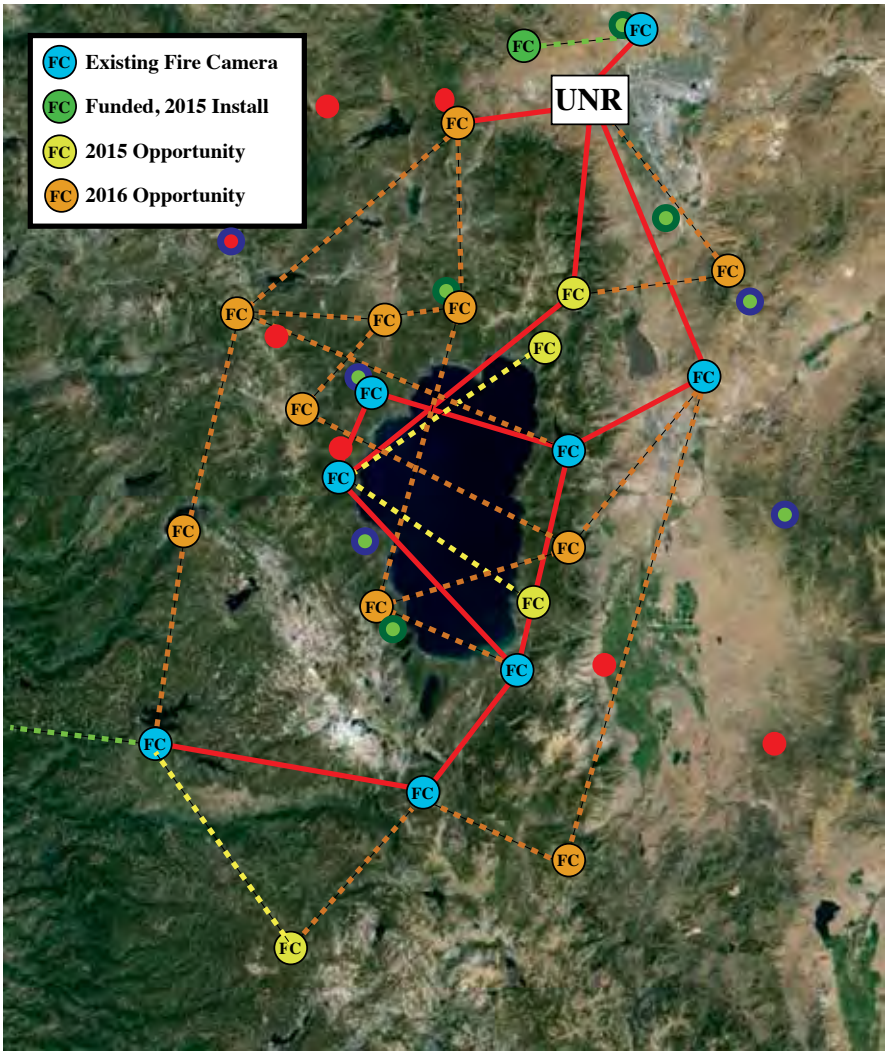
During June 2015, two AlertTAHOE cameras were used to monitor the Washington Fire, which started on June 19 near Markleeville, Calif. On June 27, the basin was hit by a severe "dry" lightning storm and the cameras were used to discover several small lighting-sourced fires—a resounding success for the new program.

With the Tahoe Basin in its fourth year of drought and 2015 winter snowpack measuring well below normal, fire risk going into the 2015 summer season was exceptionally high.

Kent's takeaway message to the group gathered at Passaretti's was one of awareness of fire danger, but also of empowerment—that perhaps it is the shared responsibility of everyone living in the Lake Tahoe Basin to participate in the effort to protect their homes and livelihoods from wildfires. The beauty of AlertTAHOE? Anyone can watch the cameras.

"You are in a historic drought," Kent said to the group as they finished lunch. "So, what as a community have you guys done? Everything that you value can be gone in two or three days. It's a historic time."

AlertTahoe Fire Camera Network Topology



Broadband Seismometer

Broadband Seismometer with Strong Motion

Short Period Seismometer with Strong Motion

Short Period Seismometer (Analog)

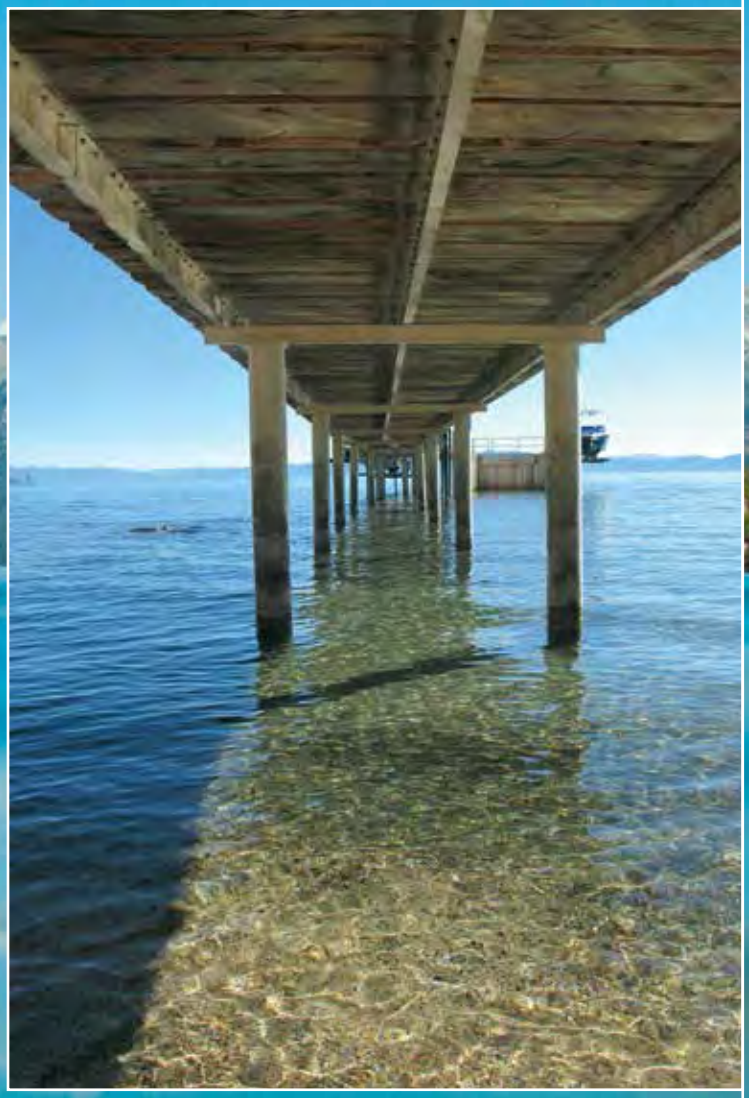
–seismic network topology not shown

Photograph by Scott Hinton

DRI's Mt. Rose Research Vessel is equipped with sensors and instruments to track water clarity; and can sample in as shallow as 12 inches of water thanks to its unique jet propulsion engine.

TRACKING NEARSHORE WATER CLARITY

Photograph provided by DRI



Photographs by E.S. Levy

Efforts to implement new integrated monitoring program underway

by Justin Broglio

Nearshore conditions at Lake Tahoe have been changing over recent years, with the appearance of aquatic invasive species, increasing periphyton (attached algae) and decreasing water clarity becoming more evident to both visitors and residents of the Tahoe Basin.

Since the completion of the Lake Tahoe Nearshore Evaluation and Monitoring Framework—a project funded during Round 10 of the Southern Nevada Public Land Management Act in 2010 and presented to the USDA Forest Service in 2013—scientists and technical advisors from the Desert Research Institute, the University of Nevada, Reno and the University of California, Davis - Tahoe Environmental Research Center have been working together to develop and implement a finer scale of evaluation and monitoring necessary in this unique zone of Lake Tahoe.

As part of this integrated monitoring program, DRI researchers are now utilizing their unique, nearshore research vessel to track nearshore water clarity characteristics around Lake Tahoe through an initial nearshore monitoring and evaluation grant funded by the Nevada Division of State Lands, through their Lake Tahoe License Plate program.

DRI's 21-foot jet boat, the Research Vessel (R/V) Mt. Rose, operates without a propeller and can continuously sample important nearshore characteristics in the shallow areas of the lake. The R.V. Mt. Rose is an ideal platform for studying changes in water clarity in these highly

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visible and trafficked areas of Lake Tahoe. The R/V Mt. Rose is equipped with sensors that assess water quality conditions, including turbidity, transmissivity, and chlorophyll. A customized system is used for navigation and the real-time display of sensor data.

Further, DRI scientists are also working with the Tahoe Resource Conservation District to quantify changing patterns of urban storm water runoff around Lake Tahoe.

"These are only the first steps of many needed to rehabilitate and sustain this complex area of the lake," said Alan Heyvaert, Ph.D., principal investigator on the multi-year project and acting senior director of the Center for Watersheds and Environmental Sustainability at DRI.

"Water clarity concern for deeper parts of the lake has driven a lot of the action and a lot of the success over the last several decades to preserve and restore Lake Tahoe," he added. "As mid-lake conditions begin to stabilize or improve, more of the focus and support will shift to a new monitoring strategy that is intended to help resource managers track the most meaningful physical, chemical, and biological indicators of healthy nearshore conditions."

The nearshore zone is where many visitors and local residents interact directly with the lake and is valued for its recreational and aesthetic qualities, as well as for the unique biological community it supports. It is also the zone where pollutants from the surrounding watershed are more concentrated and where people are most likely to notice such ecological changes as reduced water clarity and especially the nuisance blooms of attached algae found on rocks and other hard surfaces.

The nearshore environment is inherently more complex, since it is immediately adjacent to stormwater flows and runoff from the developed and undeveloped

Photographs provided by DRI

portions of the surrounding watershed.

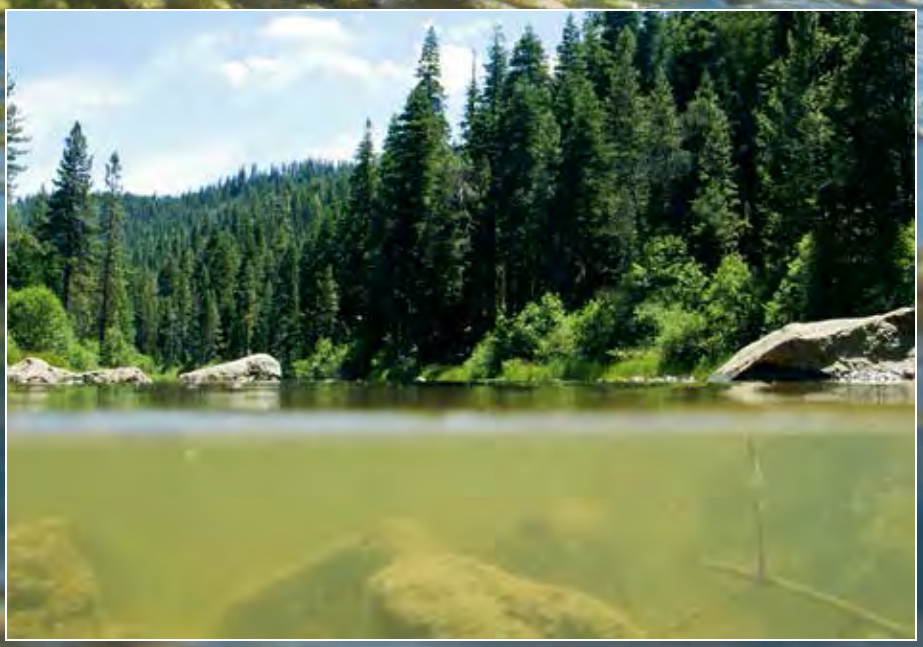
While the Lake's mid-lake clarity is expected to continue to improve from implementation of watershed best management practices, environmental improvement projects, and other actions, the monitoring and evaluation of nearshore conditions will be needed to fully understand why this part of the lake has deteriorated and what strategies are the most effective to address the problem.

"The introduction of aquatic invasive species has already produced some profound changes in the nearshore," said Sudeep Chandra, limnologist and director of University of Nevada Reno's Aquatic Ecosystems Analysis Laboratory. "Further establishment of aquatic invasive species in the nearshore has the potential to unravel the tremendous progress made toward protecting Lake Tahoe's clarity."

Chandra added that very little data currently exist on the nearshore community structure.

"We do not know the composition, distribution or abundance of most macro-organisms that inhabit the nearshore," he said. "Base data are urgently needed to describe these conditions before they change any further."

"The introduction of aquatic invasive species has already produced some profound changes in the nearshore."



Photographs by Shelbi Whitehead

FROM TAHOE

Applying our science and knowledge to save Central America's Lake Atitlan

by Justin Broglio and Mike Wolterbeek

Lake Atitlan, the deepest lake in Central America, is renowned by many as one of the most beautiful lakes in the world.

Similar to Lake Tahoe, Atitlan is nestled in the mountains with 10,000-foot elevation peaks surrounding it. The lake is 5,100 feet in elevation, 11 miles long, 1,150 feet at the deepest, about 50 square miles of surface with about 60 feet of clarity.

And… just as Lake Tahoe faces new and ongoing ecological and environmental challenges, so does Atitlan.

In 2009, the Global Nature Fund designated Guatemala's Lake Atitlan as its "Threatened Lake of the Year."

The lake's water is contaminated with watershed runoff and waste water, which contributes to increased algae growth and suitable conditions for bacteria and pathogens such as, E. coli and Giardia that can proliferate and enter untreated drinking water.

Former U.S. Vice-President Al Gore said, in his speech to scientists, elected officials, environmentalists, business leaders, fire department officials, students and others in the audience of

Photograph by Danielle VonLehe

TO THE WORLD

the 2013 Lake Tahoe Summit, that what we've learned at Tahoe can help inform the rest of the world to protect their resources and communities.

Sudeep Chandra, a limnologist at the University of Nevada, Reno and a leading Lake Tahoe scientist, has assembled a team of researchers and is doing just that—using the knowledge gained at Lake Tahoe in the past 40 years to help Guatemala repair and protect Lake Atitlan.

"Since 1968 Lake Atitlan has had an accelerated eutrophication process due to the algae and sewage particle loading from the watershed," Chandra said. "We know that there are three species of cynobacteria that contribute to the algae blooms and pathogens that have huge health concerns as this is the water supply for all of the residents.

"Our collaboration is helping move Guatemalan management forward by decades by adding to their work the lessons learned at Tahoe since water quality management of Tahoe began 40 years ago," Chandra said. "Atitlan is at a crossroads for management, and it needs it to happen sooner rather than later."

Recent scientific studies led by University of Nevada, Reno and partner Guatemalan institutions shows that the raw sewage being added to Lake Atitlan produces a 333 percent greater growth of algae in the lake. Furthermore, researchers have determined that the deep waters of Atitlan have an oxygen content near zero milligrams per liter…making it anoxic and contributing to more algae growth.

At Tahoe, sewage is exported out of the Tahoe basin. And controls on growth and construction practices have been implemented to protect the lake from sediment and other products from entering the lake.

"The solutions for Atitlan may not

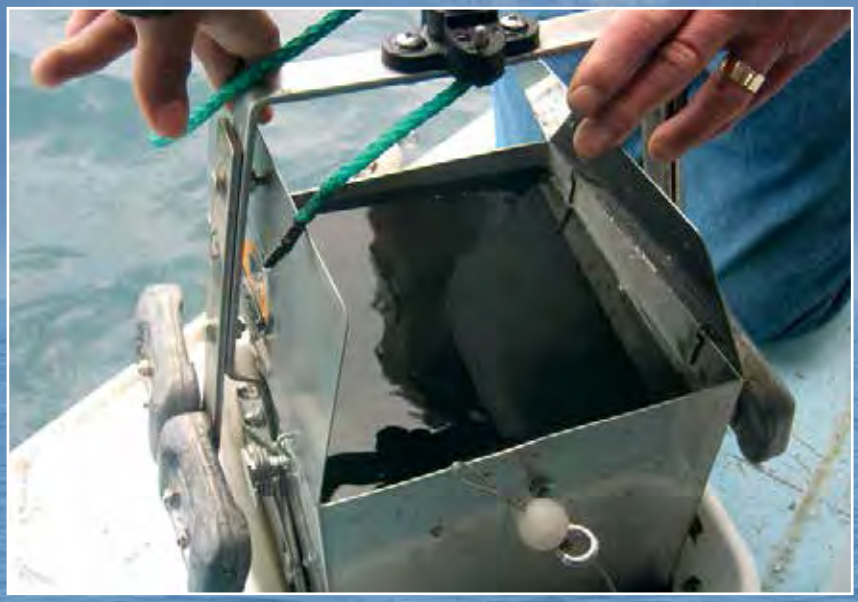
continued...

Photograph by E.S. Levy

exactly mirror those at Tahoe, but we hope to use the knowledge we've gained from studying Lake Tahoe to help clean and protect Lake Atitlan," said Chandra, whose Limnology Lab is in the University's College of Science. "We know that what we've done for 30 years at Tahoe, the management and watershed practices, have had positive outcomes for Tahoe. It could be a lot worse."

Thanks to the help of the USAID Office and the Guatemala Office of Economic Growth, Nevada scientists are continuing to help their international colleagues establish protocols and monitoring based on what is occurring at Lake Tahoe.

"The amount of energy that it has taken, and continues to take, to protect Lake Tahoe is an inspiration for us in Guatemala," Chesley Smith, from Amigos del Lago Atitlan, said. "With the information we have gained from our visit with our Tahoe counterparts, I am sure we can save Lake Atitlan."



Lake Atitlan bottom sample from 300 meters
Photograph by E.S. Levy

Plume from pueblo San Francisco at Lake Atitlan
Photograph by E.S. Levy

Representatives from Lake Atitlan in Guatemala, including Ivan Azurdia, executive director of the Lake Atitlan Management Authority, met with Joanne Marchetta, executive director of the Tahoe Regional Planning Agency during a 5-day visit to Lake Tahoe in 2013. The group from Guatemala met with scientists, policy makers, ranchers, wastewater engineers and community members to gather information that will help them save their Lake Atitlan from an accelerated eutrophication process due to the algae and sewage particle loading from the watershed.

Photograph by Jeff Cowen, Tahoe Regional Planning Agency

1916 Lake Tahoe

Shoreline Survey Rephotography

Photograph by Herford Tynes Cowling, Small bluff to the east of the Upper Truckee Marsh, 1916, Water Elevation 6229.80'

Photograph by Peter Goin, Small bluff to the east of the Upper Truckee Marsh, 2013, Water Elevation 6225.9'

by Kelsey Fitzgerald and Peter Goin

Of the dramatic mountain lake environments in the world, the Lake Tahoe basin—split between Nevada and California—has the greatest innate draw. A destination for excursion-goers and vacationers since the 1870s, Tahoe now is a mecca of sorts for retirement tax havens, second homes, skiing, summer visits, and spirited gambling. The Tahoe Basin's beauty rivals such glacial-origin waters as Lake Como or Canada's Lake Louise, but Tahoe is more than water, villas, ski runs, and tough forest management decisions; it's an ecosystem where the visual history precedes scientific study by more than 60 years.

In 1916, long before most scientific monitoring in the Tahoe Basin began, a photographer named H.T. Cowling

Photograph by Herford Tynes Cowling Small bluff to the east of the Upper Truckee Marsh, 1916, Water Elevation 6229.80'

Photograph by Peter Goin, Small bluff to the east of the Upper Truckee Marsh, 2013, Water Elevation 6225.9'

documented conditions along the Lake Tahoe's California shoreline in a set of 151 photographs. Almost a century later, Peter Goin and Scott Hinton from the University of Nevada, Reno, are working to locate and photograph Tahoe's shoreline from the same viewpoints.

Cowling's original photographs were taken a few years after the construction of the 1913 Lake Tahoe Dam, which added water storage capacity to Lake Tahoe by raising the maximum surface elevation from 6223 feet (the lake's natural rim) to 6229.1 feet. "Property owners around Lake Tahoe were concerned about losing property to the higher water," Hinton explained. "The Bureau of Reclamation put together a survey, and in 1916 they went around Lake Tahoe and made photographs from different property owners' shorelines."

Over time, the higher water level made possible by the Lake Tahoe Dam changed people's perceptions of what was "normal". Goin and Hinton's work documents landscape change, and helps put the change into context.

"It is important to note that the water level in the 1916 Shoreline Survey was at 6,229.98 feet, nearly a foot above the current legal limit of 6,229.1 feet," Hinton said. "Because of the drought, the lake level is now a little bit below the natural rim. It's fascinating seeing where the lake was, and how the varying lake level changes people's perception of what is the natural look of Lake Tahoe."

Photograph by Herford Tynes Cowling, Rubicon Bay, 1916, Water Elevation 6229.80'

Photograph by Scott Hinton, Rubicon Bay, 2015, Water Elevation 6,222.91'

Photograph by Herford Tynes Cowling, Emerald Bay, 1916, Water Elevation 6229.80'

Photograph by Peter Goin, Emerald Bay, 2014, Water Elevation 6223.98'

Summer research program provides memorable experiences for undergraduates *by Kelsey Fitzgerald*

For Jairo Sosa and Abbey Baker, the most memorable days on the job this summer were spent on a boat—a research vessel used by the University of Nevada, Reno's photography department.

"We are working with Peter Goin and Scott Hinton on a rephotography project they're doing around Lake Tahoe," Baker explained. "They take historical photos and recreate them in the same spots."

This summer, Sosa, Baker and 12 other students participated in the University's Research Experience for Undergraduates (REU) program, a ten-week National Science Foundation funded program in which students are paired with University faculty mentors on projects related to a locally important theme: "The Value of Snow".

Student projects addressed a variety of topics, including water resilience in a changing climate, sage-grouse habitat restoration and snowmelt modeling. Sosa and Baker, who both hope to pursue careers as practicing artists, focused on the rephotography of changing landscapes.

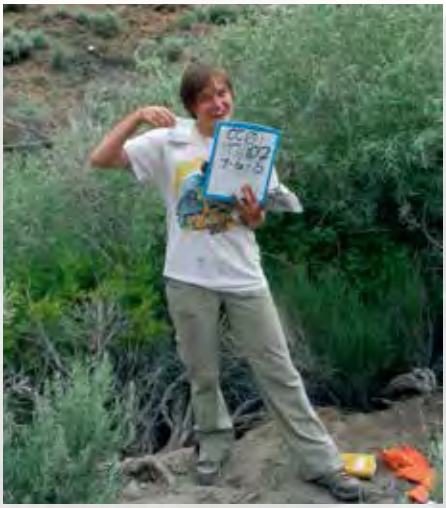
Sosa, 22, is a Fine Arts major at The Cooper Union in New York City. By examining historical photography, he investigated human impacts on the land at Lake Tahoe's Emerald Bay Camp during different times in history.

"The land was first occupied by the Washoe people, then became private residences, then a private resort area, and now a state park", Sosa said. "I'm focusing on how certain people were recorded in time, or not recorded, and engaging in comparison."

REU students come from universities located as far away as Puerto Rico, and as close as Reno. Baker, 27, is a photography major at the University of Nevada, Reno. Her summer project was a comparative analysis between state parks, national parks, national forests, and the effects that each had on the Lake Tahoe region.

"Being from this area, it's surprising how little I knew about Lake Tahoe and the different efforts that have been made to try to keep it in the condition that it is today," Baker said. "It's been interesting to learn a little bit more about the place that I live."

Information on the REU program can be found on UNR's undergraduate research website (ugresearch.unr.edu).



Photograph by Michael Babcock

Aisha Cissna

Environmental Science major,
Humboldt State University
NSF-REU "Value of Snow" Recipient
Mentor: Lee Turner, habitat ecologist,
Nevada Department of Wildlife

Letter from an Undergraduate Researcher

This summer, I've crouched down in a gully with a crew member as we waited for a lighting storm to pass over our plot, packed up camp in preparation for a wildfire evacuation, and helped dig our crew's truck out of a rut on a back country road as hail and rain poured from the sky.

My past internships revolved around environmental policy and legal work, which meant I was in front of a computer alone all day, every day.

Overall, this side of conservation work has been full of adventure, rewarding, and refreshing. Everyday in the field, I looked forward to waking up in the morning to do work with a crew who also was enthusiastic about their jobs. Essentially, we hiked all day, studied plants at numerous plots, and camped at night. Waking up to the sunrise in the wilderness was surreal.

When it came time to do the computer work (which I am currently in the midst of), it was much more meaningful to me since I helped collect the data myself and have a personal connection with it.

I am super grateful to have had the opportunity to conduct scientific research through UNR this summer. I think a huge issue with legislation today is that many politicians don't have a sound background in science. Dr. Turner has shown me how policy and science can reinforce each other. Plus, getting to explore the awesome city of Reno with the other REU students has been a blast!

Photograph by Shelbi Whitehead

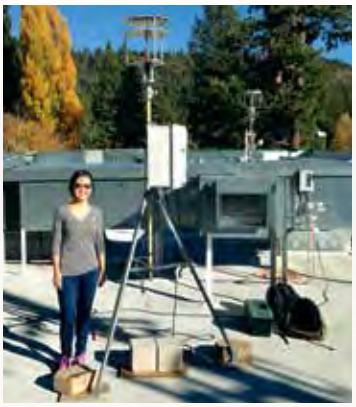
Graduate students share their research experiences working with UNR and DRI faculty in the Lake Tahoe Basin

It's a great honor to continue my graduate studies as a PhD candidate in the Hydrologic Sciences Graduate Program at the University of Nevada, Reno and DRI. I am a graduate research assistant on Water for the Seasons, an interdisciplinary NSF-USDA funded project composed of both physical and social scientists to assess drought resiliency in the Truckee-Carson River System. The most rewarding part of my project is being a part of a watershed-wide data collection process to understand climate change induced changes at the local scale. I look forward to interpreting the spatial variability of water supply challenges and what adaptation mechanisms could improve the adaptive capacity of the region.

Kelley Sterle (UNR mentor: Maureen McCarthy)

I have been working with crayfish, the largest benthic consumer in Lake Tahoe, to document changes in density over time and their impacts on the food web. I am extremely privileged to be working on a beautiful lake and in particular, sampling during the wintertime, when the lake seems to be all to yourself.

John Umek (UNR Mentor: Sudeep Chandra)



My thesis project investigated the annual estimate for atmospheric deposition of particulate matter in the Lake Tahoe Basin by conducting one-year land-based measurements of number deposition flux using a novel passive sampler developed at the Desert Research Institute. Working with professionals at DRI and having the opportunity to visit Lake Tahoe for sample retrieval and reload every week for a year was definitely a special experience I will treasure for a lifetime.

Ya-Chun (Anna) Tai (DRI mentor: Xiaoliang Wang)

My thesis project focused on diatom community changes as a result of anthropogenic and climatic influences on small sub-alpine lakes of the Lake Tahoe Basin. The most memorable moment of my research was when we collected a sediment core out of Gilmore Lake, because each trip to that lake was riddled with a different hardship; malfunctioning sampling and coring equipment, wind, thunderstorms, and deflating rafts. Completing research in the Tahoe Basin was not only an unforgettable experience that fostered my love of the outdoors and aquatic ecosystems, but it showed me that with the right tools and the right mind set, we can do anything we set our minds to!

Briana Johnson (UNR mentor: Paula Noble)

TSC TAHOE SCIENCE CONSORTIUM
ADDRESSING SCIENCE NEEDS IN THE LAKE TAHOE BASIN

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August 24, 2015

Dear Presidents Wells and Johnson,

Over the last decade, researchers the University of Nevada, Reno and the Desert Research Institute, along with their Tahoe Science Consortium (TSC) colleagues at the University of California, Davis, U.S. Forest Service, and U.S. Geological Survey, have been at the forefront of providing the scientific foundation needed to restore and protect the Lake Tahoe Basin. Scientists from your institutions have worked tirelessly in the field and laboratory to understand underlying processes responsible for the degradation of Tahoe's nearshore, changes in aquatic and terrestrial biodiversity, transport and deposition of airborne pollutants, ecosystem response and recovery following catastrophic wildfires, risks and impacts of naturally occurring extreme events, stream and meadow ecological functions, and the impacts of climate change. This reservoir of knowledge will continue to inform environmental managers, land-use planners, emergency response personnel, and the general public for many years to come.

Preserving Lake Tahoe will continue to be a transdisciplinary effort drawing upon expertise at your institutions and partner organizations in fields from limnology to forest ecology, soil science to photography, atmospheric science to paleoclimatology, environmental policy to seismology, hydrology to resource economics, and many more. Management of Lake Tahoe, our national treasure, remains challenged by the impacts of urbanization, climatic change, invasive species, droughts, wildfires, and other factors. Your institutions and researchers are to be commended for the diverse and in-depth research that continues to be undertaken to preserve Lake Tahoe. In addition to engaging in research, your scientists have also served as subject matter expert advisors to federal, state and local agencies, educated the next generation of environmental scientists, and shared their knowledge with communities around the world.

Science has underpinned major environmental and land-use planning decisions made by federal, state and local agencies, and has stimulated the adoption of ecologically sustainable development practices. Much of the research conducted in the Lake Tahoe Basin over the last decade was supported under the Lake Tahoe Restoration Act and funded through the Southern Nevada Public Lands Management Act (SNPLMA). Research projects supported by the SNPLMA Science Program, including Tahoe Science Consortium operations, will end in early 2016 when the Lake Tahoe SNLPMA Program sunsets. A strong, vibrant and resourceful scientific community will remain the linchpin of sustainable management of the Tahoe Basin in the future. Researchers from your institutions are critical to ensuring that we continue to protect our national treasure for generations to come.

Thank you for your commitment to the science that keeps Lake Tahoe blue, beautiful, and safe!

Sincerely,

Maureen I. McCarthy, PhD
Executive Director

DRI Desert Research Institute
University of Nevada, Reno
USGS science for a changing world
UCDAVIS TAHOE ENVIRONMENTAL RESEARCH CENTER

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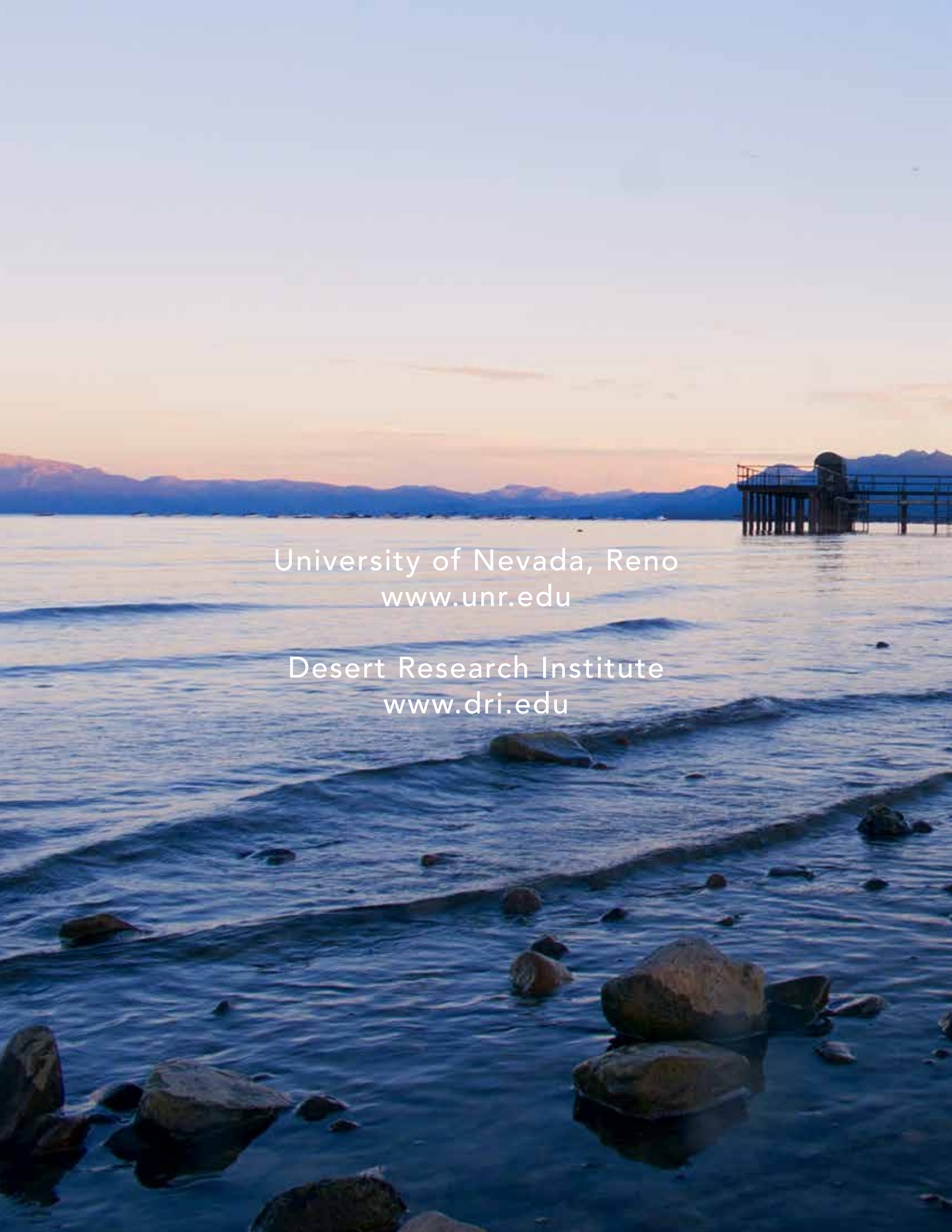
Photograph by Shelbi Whitehead



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