Lakes

UC DAVIS TAHOE ENVIRONMENTAL RESEARCH CENTER
WINTER 2016-17

THE TAHOE ENVIRONMENTAL RESEARCH CENTER (TERC) is a global research leader providing the science for restoring and sustaining Lake Tahoe and other treasured lakes worldwide for over 50 years.

TERC educates the next generation of leaders and inspires environmental stewardship in thousands of students, community members and visitors annually through its outreach centers in Incline Village, Nevada and Tahoe City, California.

UCDAVIS TAHOE ENVIRONMENTAL RESEARCH CENTER

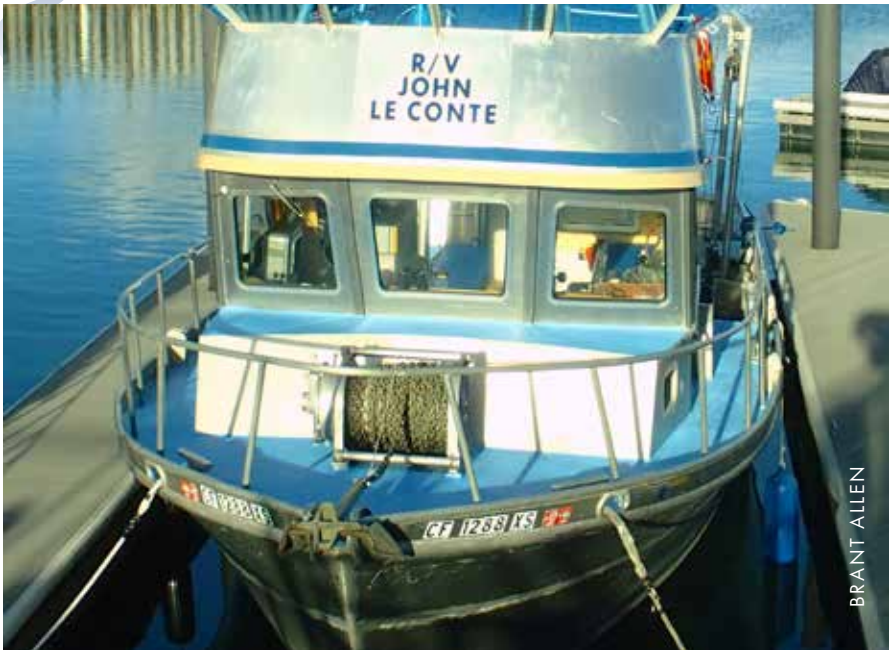
TERC ADMINISTRATIVE OFFICE
Watershed Sciences Building
University of California, Davis
One Shields Avenue
Davis, CA 95616-8527
Phone: (530) 754-TERC (8372)
Fax: (530) 754-9364

TERC INCLINE VILLAGE LABORATORY
291 Country Club Drive
Incline Village, NV 89451
Phone: (775) 881-7560
Fax: (775) 832-1673

TERC TAHOE CITY FIELD STATION
2400 Lake Forest Road
Tahoe City, CA 96145
Phone: (530) 583-3279
Fax: (530) 583-2417

HTTP://TERC.UCDAVIS.EDU

SCIENCE TO SAVE THE LAKE



RESEARCH VESSEL John LeConte gets a facelift

RESEARCH UPDATES

TERC RESEARCH VESSEL GETS A FACELIFT

By Brant Allen

In 1976, Dr. Charles Goldman received a grant from the National Science Foundation to build a scientific laboratory for the limnological research at Lake Tahoe. Appropriate land for the building site had been donated, plans had been prepared, but approval for the construction could not be obtained. With a limited time remaining to spend the grant money, Dr. Goldman received approval to redirect the funds to Freeman Marine in Gold Beach, Oregon for the construction of a "floating laboratory." The result of this quick thinking became the Research Vessel John Le Conte. Fittingly, the new vessel was named after the first president of the University of California who made some of the earliest clarity measurements at the lake.

Since its arrival, the R/V John Le Conte has plied the waters of the lake carrying scientific sampling equipment and the researchers who deploy them. The iconic profile of the Le Conte has become synonymous with understanding how the lake functions and the measures needed to preserve its famed clarity. The large back deck has served as a classroom for thousands of school children, resource agency staff, and

Continued on Page 3

LETTER FROM THE DIRECTOR

We often talk about Lake Tahoe being "The Smartest Lake in the World." What makes it so smart?

The hundreds of sensors and cameras that TERC has deployed from the mountain peaks down to the very deepest points of the lake are part of it. New sensors mounted on an underwater glider will be part of the mix in 2017. Among other things, these sensors are telling us how the wind patterns over the lake are constantly changing, how and when waves breaking on the shoreline are stirring up sediments that cloud the water, and how life-sustaining oxygen is changing from the lake surface down to the very bottom. These are all important issues that we strive to better understand.

Predicting the future state of the lake using state-of-the-art computer models is important and allows us to provide decision-makers with the information they need. TERC's lake current, algal growth, and water temperature models have changed the way we now view Lake Tahoe. How a future pollutant may affect our drinking water and how climate change will alter shoreline algae growth are questions we are answering with these models.

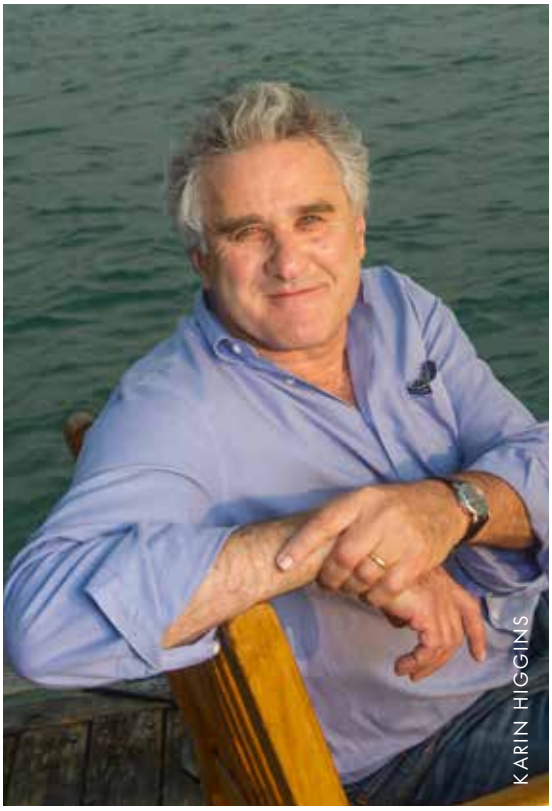
Taking all the knowledge we are gaining and transferring it into materials suitable for teachers and students ensures that the smartest lake in the world is providing critical lessons for school kids in the greater Lake Tahoe area. Research also supports programs at our two visitor centers. New displays in 2016 allow visitors to see data from around the lake in real-time.

Undoubtedly, the most important factor is the people. Between them, TERC's scientists and staff have almost 300 years of combined knowledge of Lake Tahoe. When we add in the five new UC Davis and TERC faculty who started working at the lake in 2016, this number will keep growing.

This institutional knowledge and memory provided by a University research center is critical for keeping Lake Tahoe smart. Universities serve a unique role – both because of the objectivity they bring and the fact that they tend to stay around for a long time. The knowledge and understanding they accrue is not always intended to support preconceived notions. Rather, it is intended to challenge old ways of doing things with new ideas combined with long-term experience. Sometimes the old ways turn out to be right, but often our advancing knowledge points to better ways of meeting our shared goals.

To all the members of the public who have contributed to TERC's accomplishments this year – both through philanthropic gifts and through sharing of resources – I am truly grateful. We trust we have surpassed your hopes. Similarly I want to thank our incredibly hard-working staff, our volunteer docents, the many students and interns that work at TERC, our partners in other research institutes, and our colleagues in the various Tahoe agencies.

I wish you all a safe and peaceful holiday season,



GEOFFREY SCHLADOW, Ph.D., Director,
UC Davis Tahoe Environmental Research Center

RESEARCH UPDATES, CONTINUED *(Continued from Page 1)*

politicians at the highest level of government. Inevitably with this much activity, the vessel began to show its age.

The R/V John Le Conte is now running on its third engine, a clean emission Cummins diesel, purchased with a supporting grant from the Sacramento Metropolitan Air Quality Management District and support from community donors. With the mechanical aspects of the vessel taken care of, it was time to improve the vessel's overall aesthetic. This past summer TERC staff stripped and painted the old deck, polished the aluminum, and applied new decals.

With its new look and power system, the R/V John Le Conte is ready to continue for the next 40 years, carrying current and future researchers to help them meet their goals of understanding how Lake Tahoe is responding to both cultural and climatic impacts.

FOREST HEALTH UPDATE

By Patricia Maloney

Drought stress is a major contributing factor to tree mortality in many forest types throughout the US. For 2016, the USDA Forest Service aerial surveys identified 100 million dead trees in California. In the Lake Tahoe Basin tree mortality doubled from 35,000 in 2015 to 72,000 in 2016. Much of the extensive mortality being observed in the Lake Tahoe Basin covers an area from Crystal Bay to Tahoe City on state, federal and private lands. Drought stress can significantly predispose trees to bark beetle attack. Sugar pine mortality has been relatively high for the past couple of years, but white fir and Jeffrey pine are also beginning to see the effects of 5 years of drought in some parts of the Lake Tahoe Basin.

The objectives of forest restoration throughout the Lake Tahoe Basin are to manage tree densities (via thinning and/or prescribed fire) and promote stands to be more fire and drought resilient. These management activities are central in mitigating the effects of prolonged droughts and climate change. There are many parts of the Lake Tahoe Basin where forest treatments (e.g., less dense) appear to be mitigating drought-related mortality. Yet some stands of high tree mortality reside in both treated and untreated areas. Biogeographic factors (slope, aspect, soil type, and bark beetle dynamics) may in part explain the high mortality on the north shore of Lake Tahoe.

In the context of climate change and shifting hydrologic patterns understanding the physiological status and variation of tree species will have important implications for identifying population resiliency or vulnerability. Our lab has cored over 200 sugar pines with the aim to elucidate the physiological mechanisms of tree susceptibility and/or resilience to bark beetle attack during drought episodes. We are doing this by determining water-use efficiency and basal area growth from annual rings in live and dead (bark beetle killed) sugar pines, to retrospectively analyze tree physiology over the last 100 years.

LIVE AND DEAD sugar pine trees within the same stand at Crystal Bay

PITCH TUBES of the red turpentine beetle on a dying sugar pine tree

EDUCATION AND OUTREACH

ARE YOU FOLLOWING US?

TERC is ramping up its efforts to increase our public outreach through social media. There are several ways you can stay in touch with the latest discoveries from our scientists, upcoming events, and the exciting lives of our staff:

Facebook (https://www.facebook.com/terc.ucdavis/): The TERC Facebook page post details of upcoming lectures and events. Learn about our scheduled events for both youth and adults in time to put them on your calendar.

Instagram (http://www.pictaram.com/user/ucd_terc/1904955392): Our scientists who regularly spend their days in the field have started sharing their experiences on Instagram. Follow TERC and learn about their research efforts, new research equipment, and any interesting discoveries as they happen.

Twitter: There is currently a battle between TERC director Dr. Geoff Schladow (https://mobile.twitter.com/professortahoe) and one of our newer faculty members Dr. Alex Forrest (https://mobile.twitter.com/fluidlakes), to see who can gain the most followers. You can cast your vote by following one or both of these scientists and travel the world with them as they conduct their research.

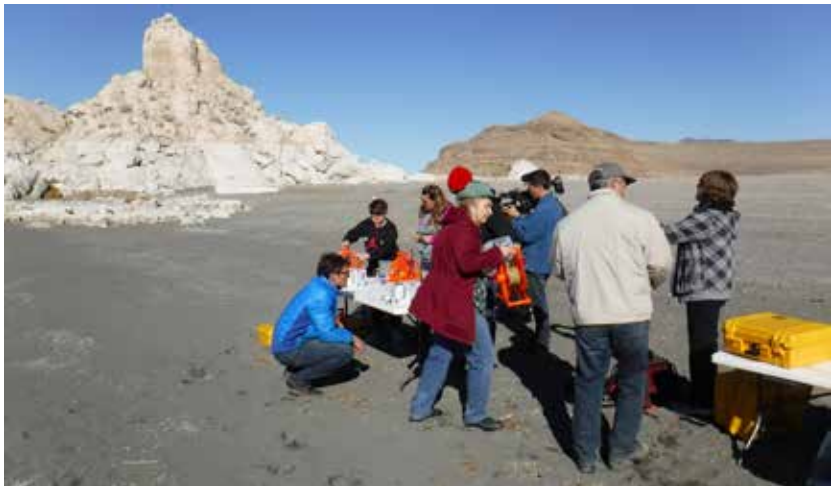
UNDERWATER ROBOTICS FOR HIGH SCHOOL STEM EDUCATION

By Alex Forrest

In 2015, just over a third of Nevada eighth graders failed to meet proficiency in science and by high school graduation only 37% of graduates met the science benchmark on the America College Test (ACT). While large variation exists nationally, these statistics are indicative of a growing issue within STEM education: in an increasingly technology-driven society, we are failing to produce high school graduates to address society's needs. Technology is constantly evolving and it is difficult for high school curriculums to adapt and for educators to be provided with current resources and training. To address this issue, the UC Davis Department of Civil Engineering and TERC teamed with Nevada's Northwest Regional Professional Development Program (NWRPDP) to create the underwater robotics portion of the Nevada STEM Underwater and Aerial Vehicle Computer Science Institute. The Institute was created in 2016 with the goal of developing STEM skills and content knowledge for middle and high school educators.

Over the summer and fall of 2016, Nevada middle school and high school teachers took part in the Nevada STEM Underwater and Aerial Vehicle Computer Science Institute (NSUAVCSI), a workshop series hosted at TERC. The workshops trained educators in building, programming, and using unmanned systems (both aerial and underwater) so that they can use this technology as a classroom learning tool to inspire the next generation of scientists and engineers. Nevada is an ideal location for aerial drone research as it is one of five states where regulations have been lessened to encourage research and education. It is also an ideal location for underwater robotics due to the clarity, depth, and interest in Lake Tahoe.

The workshop also included computer programming for aerial vehicles and underwater robots. Equipping teachers with these tools also provides new resources for their students. During the underwater

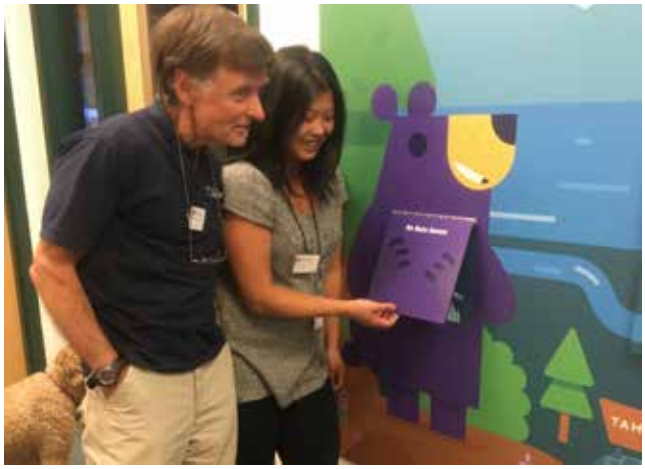


TEACHERS prepare to launch underwater ROVs at Pyramid Lake

EDUCATION AND **OUTREACH**, CONTINUED

component of the Institute, seven OpenROV 2.8 robots were assembled. by the teachers, led by Dr. Alex Forrest who guided the teachers through the process by drawing upon his expertise in underwater robotics.

The long-term goal of this project is for this knowledge to be transferred in the classroom in a way that highlights how accessible the technology is and makes it less daunting for students to choose a career path in this industry. Funded by the Nevada State Department of Education, this was an excellent opportunity to foster both engineering and science in and outside the classroom.



NEW TAKE CARE EXHIBIT on display with interactive flip panels recently installed in the Tahoe Science Center in Incline Village, Nevada

TAKE CARE EXHIBIT

TERC's newest exhibit is up! The Take Care Exhibit is part of a marketing campaign, Take Care™, that was developed by the Lake Tahoe Outreach Committee. The Lake Tahoe Outreach Committee is comprised of the TERC, the Tahoe Regional Planning Agency (TRPA), Tahoe Resource Conservation District (TRCD), The League to Save Lake Tahoe (Keep Tahoe Blue), and the Tahoe Fund. The committee was formed with the goal of working together towards a greater sense of community and environmental responsibility in the Tahoe region. The campaign is a series of small reminders that poke fun at the mistakes we all make when we're not paying attention. TERC's hope is to inspire a culture of caretaking amongst those who visit the exhibit.

YOUTH SCIENCE INSTITUTE

We are pleased to announce that our Youth Science Institute (YSI) is now accepting applications. YSI is an after-school program that enables high school students (grades 9-11) to interact with scientists and engineers. From fish dissections to building robots, students gain hands-on experience and learn about potential careers in different Science, Technology, Engineering, and Math (STEM) fields. This is an outstanding program that will benefit any college-bound student. Information and applications are available at http://tahoe.ucdavis.edu/ed-outreach/ed-programs/y-s-i.html. Applications are due Wednesday, January 11, 2017. For more information, contact Teagan Dolan at tdolan@ucdavis.edu.

UPCOMING **EVENTS**

JAN. 11, 2017: Youth Science Institute (YSI) applications are due

JAN. 19: The Tahoe Natural Year with Dr. Will Richardson, TINS

FEB. 2: Aggravated Divisions: Political Polarization and Policymaking after the 2016 Election with Dr. Christopher Hare, UC Davis Department of Political Science

FEB. 9: Climate Change and Lake Temperature in the Sierra Nevada: There's No Business Like Snow Business, with Dr. Steve Sadro, UC Davis Department of Environmental Science and Policy

MARCH 13-17: North Shore Science Expo for students grades 3 – 5

MARCH 15: Public event: North Shore Science Expo 4 – 6 p.m.

APRIL 6: Recovering the Endangered Mountain Yellow-legged Frog in the Sierra Nevada, with Dr. Roland Knapp, Sierra Nevada Aquatic Research Laboratory

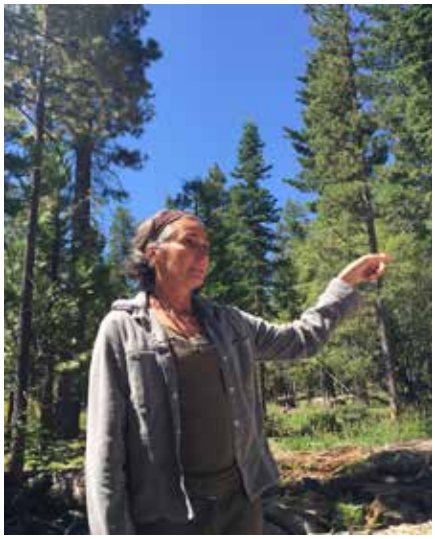
For more information visit http://tahoe.ucdavis.edu/events/.

FACULTY AND STAFF HIGHLIGHTS

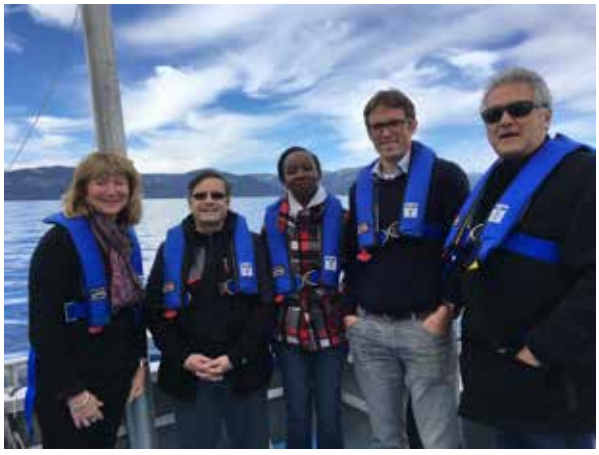
STAFF HIGHLIGHT: TRICIA MALONEY

We are excited to announce that Tricia Maloney is the new Associate Director/ Academic Coordinator at TERC. Tricia has been affiliated with TERC for the last eight years. Prior to accepting this position, she was on staff as a Project Scientist. During her time here thus far, she has worked to establish a strong forest and conservation biology program. Her research addresses a variety of important topics in the Lake Tahoe Basin—forest ecology and genetics, forest health, conservation, species restoration, and understanding the role of natural and anthropogenic disturbances in montane ecosystems. Throughout her years of dedicated research in the basin, she has developed valued working relationships with federal and state agencies. She has worked alongside scientists and resource managers to identify knowledge gaps and sought advice and information in hopes of devising appropriate and timely management and conservation strategies.

As the new Associate Director and Academic Coordinator, Tricia is uniquely poised to work with TERC staff and faculty to collaboratively study and integrate terrestrial and hydrological processes in the Lake Tahoe Basin. Her strong research background in forest ecology and conservation paired with TERC's institutional knowledge of Tahoe's unique freshwater ecosystem can foster more research regarding the entirety of forces that influence the health of Lake Tahoe. This position will also allow her to continue to engage and foster new relationships with key stakeholders in the Basin. This will bridge the gap between on-the-ground science with decision-making and policy formation.



TRICIA MALONEY teaches about forest ecology and tree genetics



COLLEGE OF ENGINEERING DEAN visits TERC (Dean Jennifer Curtis, Professors Fabian Bombardelli, Maureen Kinyua, Alex Forrest, and Geoff Schladow)

TERC IN JAPAN

TERC's work with children has earned it a reputation that extends well beyond the Lake Tahoe Basin. In October, TERC director Dr. Geoff Schladow travelled to Otsu, on the shores of Lake Biwa in Japan, to advise junior high students who were being funded by the Japan Science and Technology Agency to explore their own limnology projects. The students, some of whom had worked for three years, were making fundamental discoveries including major shifts in the algal community of Lake Biwa. It all goes to prove that you are never too young (or too old) to do science.

GRADUATE STUDENT NEWS

Derek Roberts continued his work this summer maintaining and improving the Nearshore Network; there are now eight nearshore stations around the Tahoe basin collecting data every thirty seconds. In August, he ran a continuous twenty-hour experiment on a west-shore dock to improve interpretation of nearshore network chlorophyll-a (algae) data. He is currently working to better quantify the impacts of

FACULTY AND STAFF HIGHLIGHTS, CONTINUED

wave re-suspension and deep-water upwelling events on the nearshore of Lake Tahoe. He presented on additional research, investigating how climate change may alter the way snowmelt mixes in mountain lakes, at the California Lake Management Society Conference in Davis, CA and at the Mountain Climate Conference in Leavenworth, Washington.

Amelia Jones began her research on dissolved oxygen (DO) in Lake Tahoe this summer. So far, she has set up eight DO sensors at different depths to model oxygen production and uptake in the lake. This is a way of understanding lake metabolism. Amelia will use historic and recent DO data to see how rates have changed over time. This will allow her to assess the impact of climate change on metabolism in Lake Tahoe. To insure accurate data reception, Amelia ran a series of test on the sensors to determine how often they need to be cleaned of algal growth and to become better familiarized with their performance under different conditions. She has also met with researchers from UCSD Scripps to investigate new modelling techniques for the future.

NEW AMERICORPS MEMBERS 2016-17

TERC welcomes our three new AmeriCorps members for the 2016-2017 year! Teagan Dolan, Gabe Griffiths, and Denise Tran will serve as Education Program Assistants and help with science education and programming at the TERC.

Teagan Dolan grew up in eastern Kentucky between the Daniel Boone National Forest and coal country. She attended the New York College of Environmental Science and Forestry (SUNY-ESF) in Syracuse, NY where she gained a B.S. in Environmental Policy, Planning and Law with a minor in Water Resources. She's worked in water quality testing and mapping, soil labs, mine-land reforestation, recreation planning, and in land acquisition and protection. She loves reading legal cases and trail running around beautiful Lake Tahoe in her free time.

Gabe Griffiths hails from the northern California beach town of Pacifica. He grew up exploring the Sierras and has gained a deep connection with the amazing and diverse natural environment found in the range. In college, he studied Physical Geography and GIS. He has a passion for educating others about our amazing natural environment. You might find Gabe pondering the subtleties of microclimates, or stand up paddle boarding around Lake Tahoe.

Denise Tran is from Los Angeles, California and has recently graduated from Cal Poly San Luis Obispo, with a degree in Environmental Management and Protection. She minored in Industrial Technologies and has always had a passion for social justice, climate change awareness, and conservation. One fun fact about Denise is that she is trilingual; she can speak English, Spanish, and Vietnamese!

AMERICORPS MEMBERS Denise Tran, Gabe Griffiths, and Teagan Dolan joined TERC in October 2016

THANK YOU 2015-16 AMERICORPS MEMBERS

Thank you to Emily Frey, Bree Lewis, and Evan Portier for their term of service as AmeriCorps Education Program Assistants during 2015-2016. We are incredibly grateful to all three of them for their hard work!

GIVING TO THE TAHOE ENVIRONMENTAL RESEARCH CENTER

PRIVATE SUPPORT is critical to continuing the Tahoe Environmental Research Center's legacy of groundbreaking work in restoring and sustaining Lake Tahoe. Gifts at every level support research, education and outreach, and give the flexibility to address emerging needs and opportunities. Every gift makes a difference and there are many ways to give. Thank you!

SCIENCE SUSTAINER

There are two easy options for giving:

1) Make a secure online gift at https://give.ucdavis.edu/TERC
2) Fill out the information below and mail with a check payable to UC Regents

☐ **YES**, I wish to support the Tahoe Environmental Research Center with the gift amount shown below.

☐ Please contact me about how I can make a deferred or estate gift to UC Davis.

☐ I wish this gift to remain anonymous.

Mail to: *UC Davis Tahoe Environmental Research Center*
Watershed Sciences Building
One Shields Avenue
Davis, CA 95616-8527

Enclosed is my tax-deductible contribution.
Please make checks payable to UC Regents.

Name:_____

Spouse/Partner:_____

Address:_____

City, State, Zip:_____

Phone:_____

Gift Amount:_____

TERCGFT

UC DAVIS TAHOE ENVIRONMENTAL RESEARCH CENTER
Watershed Sciences Building
One Shields Avenue
Davis, CA 95616-8527