

The Tahoe Environmental Research Center (TERC) is dedicated to interdisciplinary research and education to advance the knowledge of aquatic and terrestrial ecosystems and their interactions within natural and developed Earth systems, and to communicate science-informed solutions worldwide.

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.



**TERC Administrative Office**  
Watershed Sciences Building  
University of California, Davis  
One Shields Avenue  
Davis, CA 95616-8527  
Phone: (530) 754-TERC (8372)

**TERC Incline Village Laboratory**  
291 Country Club Drive  
Incline Village, NV 89451  
Phone: (775) 881-7560

**TERC Tahoe City Field Station**  
2400 Lake Forest Road  
Tahoe City, CA 96145  
Phone: (530) 583-3279  
<http://tahoe.ucdavis.edu>



**GSM members** pose with TERC researchers before embarking on the Research Vessel John LeConte to learn about the *Mysis* shrimp and witness current removal methods.

## RESEARCH UPDATES

### MUCH ADO ABOUT *MYSIS*

The UC Davis Tahoe Environmental Research Center (TERC) research team has partnered with the UC Davis Graduate School of Management (GSM) to address the invasive *Mysis* shrimp problem in Lake Tahoe. TERC is now wrapping up a promising two-year *Mysis* shrimp removal project to improve lake health and clarity.

This new partnership will help TERC continue their important work and research by proposing a commercial use

for the catch of *Mysis* pulled from Lake Tahoe each year, to help defray the cost of bringing back the native zooplankton species *Daphnia*.

The *Mysis* shrimp was introduced as a new food source for game fish in Lake Tahoe in 1963. This introduction failed to produce the intended effect of larger catch because *Mysis* evade predation by swimming to depths where darkness limits visibility. They began competing with these fish by feasting on populations of native zooplankton, resulting in

*Continued on Page 3*

## LETTER FROM THE DIRECTOR



**Geoffrey Schladow**  
Ph.D., Director, UC Davis Tahoe Environmental Research Center.

The end of a decade lends itself to reflection. Looking back on the past 10 years of newsletters has made me appreciate just how far TERC has come. At the end of 2009, our center was barely three years old. Lab equipment was new. We were in the midst of developing containment methods for non-native Asian clams as well as continuing the long-term monitoring of Lake Tahoe.

Fast forward 10 years, and the breadth and depth of TERC's undertakings have been totally transformed. Project teams are now comprised of experts from multiple disciplines and multiple institutions, and involve students, staff, and faculty. Visitors from other countries regularly come to TERC and our faculty and staff travel globally.

Beyond science, we are actively

engaged in the arts, landscape architecture, and entrepreneurship. The vision upon which TERC was founded has continued to grow over time.

This last year alone, TERC has:

- Initiated the raising and replanting of sugar pine seedlings that are genetically resilient to drought and beetle attack
- Deployed teams of researchers to field sites in the U.S., as well as Chile, Canada, Australia, and Antarctica
- Began a major upgrade of our Tahoe Science Center equipment
- Regularly attracted audiences of over 100 to our monthly lectures
- Hosted a record number of graduate and undergraduate students in our labs and in lakes
- Deployed research instruments on helicopters, drones, and submarines, as well as at stations throughout

the lake

- Revamped our researcher house in Tahoe City
- Developed a commercialization strategy for the control of one of Lake Tahoe's oldest non-native species introductions, the Mysis shrimp
- Completed the 60th year of UC Davis monitoring of Lake Tahoe

Part of what has made this possible is the seemingly limitless dedication, skill and enthusiasm of our faculty and staff. With a range of service from a few months to 35 years, they combine a tremendously diverse set of expertise, life experiences, and approaches to every challenge presented to them. Coupled with the outstanding students who we are able to attract and support, there is never a shortage of innovative ideas to discuss.

Another critical element is the financial support we receive from the public and from foundations. Every year this funding provides the springboard for testing new ideas and approaches. It enables us to upgrade our education centers and to keep the content up-to-date and relevant. Undergraduate and graduate students in need of support or who wish to travel to a workshop or conference, receive funding provided by donors. To all those who have helped support us with your gifts and with your time in 2019, a very sincere thank you.

To all of you, may 2020 be everything you wish it to be. Stay safe and healthy, and may we all continue to work together.



## RESEARCH UPDATES *(Continued from Page 1)*



*Mysis diluviana* in Lake Tahoe

irreversible alterations to the aquatic food web, and potentially resulting in a decrease in the clarity of the lake.

TERC field researchers have removed hundreds of pounds of shrimp since they began this pilot project in 2016. This equates to over 4 million shrimp, a small fraction of the estimated trillions—yes, trillions—of shrimp from the lake. During the course of this project, and as the removal process of shrimp continues, one question persists: “What do we do with all these shrimp?”

So far, *Mysis* have been used to feed the display fish at the Tahoe Science Center and Eriksson Education Center. The shrimp have also been spread across the Tahoe City Demonstration Garden as fertilizer, but mostly these shrimp have just taken up freezer space.

When the GSM looked at this TERC project, they not only saw the environmental benefits but also a potentially untapped resource. Members of the GSM performed extensive research targeting the use of *Mysis* shrimp, exploring every option from human health

supplements to aquarium fish food to gourmet culinary shrimp powder. The group took into account the size of the target markets, competition, and industry barriers in their analysis.

One of the GSM students Yuan Cheng said, “The *Mysis* project goes beyond sustainable—it’s regenerative. We’re harvesting to restore the environment. The unique challenge of business is finding a way to get it done in a way that creates value for everyone involved.”

The GSM has created a business plan and marketing strategy for utilizing the removed *Mysis*. However, it is ultimately up to TERC to decide on the feasibility of project options and how to implement any new methods to fund future research projects and education programs.

### FOREST HEALTH UPDATE

The TERC Forest and Conservation Biology Lab headed by Patricia Maloney was featured in the *LA Times* for efforts to restore Tahoe’s native sugar pine forests after repeated drought and pine bark beetle infestation.

Since 2016, members of Maloney’s lab have been collecting thousands of seeds from trees that survived these devastating events. In

the TERC lathe house, located at the Tahoe City Field Station, they have raised approximately 10,000 seedlings. These seedlings are part of a large planting effort referred to as “assisted regeneration.” These mighty little trees carry genetic information passed down from surviving trees, with the hope that this is the key to survival of impending future events of longer droughts and more intense infestations.

This past November, Maloney’s team planted between 4,000 and 5,000 of the seedlings raised for the project. Almost half of these trees were tagged to study how they fare in the future and whether the traits they were selected for have successfully prepared them for changes in our climate.

Check out the *LA Times* article here: <https://www.latimes.com/california/story/2019-11-18/sierra-trees-climate-change-adaptation-lake-tahoe>.



Americorps members plant sugar pine seedlings similar to the resilient species selected by Patricia Maloney.

## EDUCATION AND OUTREACH



ALISON TOY, UC DAVIS TERC

The 2019 Tahoe Film Fest benefited TERC and featured a series of environmental films.

### TAHOE FILM FEST

This year marked the 5th annual Tahoe Film Fest and a first-time partnership with UC Davis TERC.

Attendees had their pick of over 20 films, shown from December 5–8, 2019, at three locations in North Lake Tahoe. The event proved just as successful as years past, with attendees raising over \$7,000 to benefit TERC research and education programs.

There were several environmentally themed films ranging in topic from plastics to pollinators to fisheries to climate change.

TERC Education Program Associate Elise Matera said, “It’s great that the Film Fest featured so many environmental films. It’s exciting to see these issues highlighted on a broader stage, and TERC will use the proceeds from this event to help solve those very problems here at Tahoe.”

The headlining film *Marriage Story*

starring Scarlett Johansson and Adam Driver was shown at Incline Village Cinema, and seats were brimming with people. The film fest also featured several Latinx films and a series of music documentaries such as *Echo in the Canyon* at the Crystal Bay Club.

“My mom was really into the 60’s California rock music, which means as a child, I was also really into the Mamas and the Papas, The Beach Boys, and all the sounds that came out of Laurel Canyon,” said TERC education program manager Alison Toy. “This movie was a throwback to the days where I would sit and listen to an entire album start to finish. Music from that time was so compelling and it just made this documentary all the more soulful.”

With opportunities to mingle with producers, directors, and actors, this four-day event was over-the-top fun and TERC looks forward to partnering again next year!

### SCIENCE OF COCKTAILS

The 4th annual Science of Cocktails will be held on Friday, January 31, 2020. This annual fundraiser is a fun and engaging event that helps the UC Davis TERC education team continue their goal of inspiring conservation and stewardship at Lake Tahoe through experiences with science.

Science of Cocktails takes place in the UC Davis Tahoe Science Center in Incline Village, NV from 6:00–

8:00 p.m. and will feature a live DJ, cocktails, food, and science activities for a ticket price of \$35. Tickets include entry to the event, catered appetizers, tastings, two drinks, and access to exciting science activities.

Guests will enjoy fare with a scientific flare from local bars, vendors, restaurants, and organizations. Each cocktail or appetizer will have an accompanying theme or science lesson.

For example, one station will explore the botanical taxonomy and ecology of several common drink garnishes such as mint, basil, rosemary, pine, and lavender. A fun and delicious flaming cocktail provided by the Pioneer Cocktail Club will demonstrate the science of wildfires and defensible space protections.

Come imbibe as you investigate science at UC Davis TERC. Attendees must be 21 years of age or older. Visit <http://tahoe.ucdavis.edu/events> for more information and to buy tickets.



ALISON TOY, UC DAVIS TERC

A guest experiences a “vapor-tini” exploring cloud formation at the 2019 Science of Cocktails.



## EDUCATION AND OUTREACH *(Continued from Page 4)*

### TAHOE SCIENCE CENTER EXHIBIT REMODEL

The Tahoe Science Center, originally completed in 2006, is undergoing a much-needed exhibit equipment update over the holidays.

Thanks to the generous support from donors and a grant from the Parasol Tahoe Community Foundation for \$9,927, TERC successfully raised the \$75,000 needed to replace the antiquated video equipment for the virtual research vessel and virtual laboratory exhibits.

These updates will increase the visibility of environmental issues and the current research done at TERC. It will also help the education team better communicate with the public in engaging and informative ways.

The Tahoe Science Center will be closed through the remodel starting on December 16, 2019. The science center will reopen on January 7, 2020.

### Thank you to our Tahoe Science Center Exhibit Upgrade Donors:

- Anonymous
- James and Robin Beres
- Dennis and Alice Breen
- Allison and Stephen Chilcott
- Phyllis and Guy Conces
- Laurie Cotulla
- Bubba and Susan Crutchfield
- Madonna Dunbar
- John and Pamela Eisele
- Bill and Karen Fleming
- Priya Finnemore
- Jane Grossman
- Tim and Elizabeth Kosier
- Hank and Eileen Lewis
- Larry and Diane McComber
- Gerry and Carol Parker
- Gilbert and Janet Potter
- Ellen Quigley



**Science Center Equipment Updates** began by removing the old monitors and video equipment

- Douglas and Amy Strayer
- Gary Sturmer
- Paul and Vickie Twitchell
- Keith and Suzanne Williams
- Erwin and Stephanie Young

Special thanks goes to Tim Kosier for his assistance with this fundraising campaign.

Additionally, TERC has already raised more than \$20,000 towards the additional \$75,000 needed to update the videos in high definition. This will enhance videos and create new content with current data to highlight new and ongoing research projects.

If you would like to make a donation to help update the videos, visit <https://give.ucdavis.edu/Donate/YourGift/TERCGED>.

### 2020 SCIENCE EXPO: EXPLORING EARTH & SPACE SCIENCE

The 15th annual North Lake Tahoe Science Expo will be held March 9–13, 2020, at the UC Davis Tahoe Science Center in Incline Village. The 5th annual South Lake Tahoe Science Expo will be held March 31–April 3, 2020, in the gymnasium of the Lake Tahoe Community College in South Lake Tahoe. Family members will be invited to join the fun at the two evening public sessions on March 12 and April 2 in Incline Village and South Lake Tahoe, respectively.

The theme of the 2020 Science Expo is Earth and Space Science. Local third-, fourth-, and fifth-grade students will have the chance to choose their own learning experience as they engage with exciting and informative science activity stations that center

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**Students at the 2017 Earth and Space Science Expo** explore prescribed fire operations.

## EDUCATION AND OUTREACH *(Continued from Page 5)*



**This prototype shows different plastic types** by resin number. Even though the number is inside the “chasing arrows,” not all types of plastic get recycled!

on geology, climate and weather, and space science.

The TERC education team looks forward to this event as much as the students do, and they would love for you to get involved too! This is a great chance to give back to local schools and the community. For parents, volunteering is an excellent way to become actively involved in your child’s learning.

Sessions run for about two hours each, with a morning and afternoon shift. Each session needs about 30 volunteers to guide science activities. TERC education team members provide a brief training and instruction materials at each station, so no science background is necessary. Sign-ups are open now!

NLT Sign-up Link: <https://tinyurl.com/NLTSciExpo20>

SLT Sign-up Link: <https://tinyurl.com/SLTSciExpo20>

### MICROPLASTICS IN THE CLASSROOM

Both TERC and the Desert Research Institute were among the first to discover microplastics in Lake Tahoe, and now we will all work together to help eliminate them from our watershed.

The Nevada Division of Environmental Protection has provided funding for a pilot project to reduce sourcewater plastic pollution at Lake Tahoe. Together with the Tahoe Water Suppliers Association and Sierra Watershed Education Partnership, the UC Davis TERC education team will develop curriculum, activities, and exhibits on plastics and microplastics.

TERC will work with the Incline High School AP Environmental Science class to develop programs that reduce the use of single-use plastic such as water bottles which are among the top

item found discarded on Lake Tahoe’s beaches.

Plastic is not only a local problem, but also a global one. By taking action toward changing Tahoe’s relationship to plastic, we can be leaders in eliminating harmful microplastics in our environment.

### DOCENT APPRECIATION

The TERC team couldn’t be more grateful for the fantastic docents who generously donate their time to the TERC events, workshops, and education centers.

On Tuesday, January 7, the TERC education team will show their appreciation in the form of food and fun! Docents are responsible for leading public tours and helped TERC educate thousands of visitors in 2019. They are knowledgeable, friendly, and generous people. Because there is typically only one docent on duty each day, the annual appreciation event is one of the few opportunities that docents have to come together, share stories, and celebrate their service.

Contact Baylee at [bngoodwin@ucdavis.edu](mailto:bngoodwin@ucdavis.edu) to register for the event. Next time you visit the Tahoe Science Center, be sure to thank your docent!

### 2019 FIELD TRIPS IN NUMBERS

In 2019, the TERC education team hosted 51 field trips for students in the Tahoe Basin and beyond. Field trips are themed by different science topics such as Geology and Plate Tectonics, Water on Earth, and the Tahoe System. Field trips were recently aligned to the Next Generation Science Standards, and this information is available [on the TERC website](#).



## TERC TEAM UPDATES

### GEORGE MALYJ CELEBRATION OF LIFE AND MANOR UPDATES

Friends, loved ones, and community members gathered on October 5, 2019, for a celebration of life of George Malyj, our beloved program manager at UC Davis TERC, who passed away two years ago.

The event was well-attended by friends and family who took part in sharing many great stories about George and his amazing life. George was a unique and wonderful person and everyone at TERC misses him very much. We are all very grateful just to have known him.

The student and researcher “Blue House” was rededicated in his honor

as the “Malyj Manor” in 2017. The Malyj Manor Fund was also created in his memory and has received generous donations which have resulted in much-needed updates such as the installation of new cabinets, a new oven, upgrades to the flooring, and a fresh coat of paint on the garage, turning the final traces of the blue to green.

Thank you to everyone who donated to the Malyj Manor Fund. Your generosity have made these upgrades possible and also subsidized student housing for TERC graduate and undergraduate students to conduct their research projects at Lake Tahoe.



**George Malyj** watching the 2017 eclipse. Among his many talents and skills, George was knowledgeable about and interested in astronomy.

### GRADUATE STUDENTS

- Derek Roberts graduated from UC Davis in March and is now an environmental scientist at San Francisco Estuary Institute focusing on the hydrodynamics and nutrient cycling in San Francisco Bay.
- Ruth Thirkill started graduate school at UC Davis in Civil and Environmental Engineering and has joined the TERC team. She is currently working at Clear Lake, but is planning to study methane emissions from a lake in Spain.
- Nick Framsted transitioned from our field technician at Clear Lake to graduate school working with Dr. Steven Sadro studying sediment phosphorus dynamics in Clear Lake and periphyton metabolism and its responses to increasing temperatures at Lake Tahoe.
- Jasmin McInerney will present a paper, “Turbulence Signature of a

Cold-Water Plume from below the Nansen Ice Shelf” at the Ocean Sciences Meeting in San Diego in February 2020.

- Micah Swann and Samantha Sharp were awarded California Lake Management Society scholarships for their work at Clear Lake. Samantha is using remote sensing to detect harmful algal blooms. Micah is studying the effects of the Mendocino Complex Fire on the streams at Clear Lake before turning to study Chilean lakes for his Ph.D.
- Karen Atkins received the best poster award at the California chapter of the Society for Freshwater Science annual meeting. Karen’s PhD research is focusing on Tahoe’s periphyton
- Sean Trommer has been added to the Lake Tahoe climate change project. He is currently finalizing a nutrient model for Pyramid Lake, NV.
- Drew Stang has been studying the linkage between fish distribution and low oxygen levels in Clear Lake.

- Sergio Valbuena is studying the effects of boating at Lake Tahoe and also managing TERC’s Nearshore Water Quality Network.

### UNDERGRADUATE STUDENTS

- Ben Daniels has been working with the Mysis shrimp project writing code that enables our Sonar data to find the density of Mysis shrimp as they undertake their nightly migrations.
- Morgan Renner has been working in the hydraulics laboratory to develop an improved Mysis shrimp harvesting technique.

### INTERNS

TERC had three interns assisting with a variety of ongoing research projects this fall and winter. We appreciate their work and wish Megan Gaston, Angelina Ghilotti, and Addie Norgaard the best of luck at their respective colleges next semester!

## TERC TEAM UPDATES *(Continued from Page 7)*

### **CARMEN WOODS** **BUSINESS UNIT MANAGER**

Please help congratulate TERC's new Business Unit Manager, Carmen Woods. Carmen has been with UC Davis since 2015 when she started with the Genome Center as a contract and grant administrator. In June 2017, Carmen took a Financial Analyst position with the John Muir Institute for the Environment. She began her position solely supporting the Tahoe Environmental Research Center as their manager in May 2019.

In her new position, Carmen heads the department and manages all aspects of the business side of things, including administration, budget, human resources, contracts, grants, rates, funding—you name it!

Carmen graduated from California State University, Sacramento with a Bachelor's of Business Administration and Management.

She is located on the UC Davis campus in the TERC offices located in the Center for Watershed Sciences, but enjoys traveling to Tahoe often to work more closely with the TERC team.

"I most enjoy working alongside this incredible team," Carmen said. "Everyone is so excited and passionate about the research and educational programs; it is truly infectious!"

Carmen is also involved in the business side of the Mysis shrimp removal marketing project to create a business plan for the shrimp. Carmen will continue to be a liaison between the Davis and Tahoe sides of this

project.

If you see Carmen around the TERC office, or on campus, be sure to thank her for her hard work!



**Carmen Woods** is the new Business Unit Manager at UC Davis TERC.

### **BAYLEE GOODWIN** **& ELISE MATERA** **EDUCATION PROGRAM ASSOCIATES** **& AMERICORPS MEMBERS**

In October, the TERC education team welcomed two new Americorps members for the 2019–2020 year. The two lead field trips and assist with outreach projects at TERC.

Baylee Goodwin was born and raised at Lake Tahoe where her love for nature and wildlife developed at a young age. Her passion for animals followed her to Oregon where she graduated in 2018 with a degree in Zoology from Oregon State University.

Her plan has always been to work in wildlife conservation with the goal of saving endangered species. During her time at OSU, Baylee volunteered at the local wildlife rehabilitation

center, the OSU goat club, and a snake research laboratory on campus. After graduating, Baylee moved to Costa Rica for a wildlife conservation internship where she worked with jaguars, sea turtles, and primates. This internship taught her how important conservation and education are to preserving vital ecosystems. At TERC, Baylee heads marketing,



**Baylee (left) and Elise (right)** assisting on the research vessel.

docents, database, and citizen science.

Elise Matera is from Chapel Hill, NC and spent the first half of her life in Cleveland, OH. She graduated in 2019 from Vassar College in Poughkeepsie, NY with a degree in Environmental Studies with focuses in Biology, Women's Studies, and English, and is passionate about environmental and social justice. She spent a semester abroad in Zanzibar, Tanzania and studied human impacts on mangroves.

Elise comes most recently from a job in sustainability and zero waste near Vail, CO and is excited to move even farther west. She ran cross country and track in college and loves to run, hike, and camp. Here at TERC her specializations include field trips, special events, writing and editing, and microplastics.



UC DAVIS TERC BY THE NUMBERS

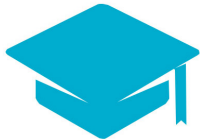
**6** DECADES OF MONITORING LAKE HEALTH



**84** MONITORED FOREST PLOTS ARE HELPING US UNDERSTAND FOREST RESILIENCE



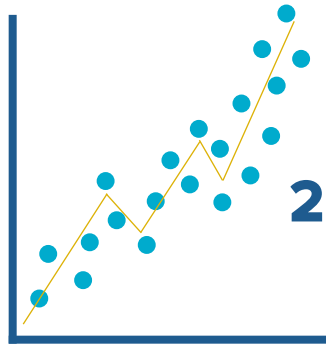
OVER **ONE-HUNDRED FIFTY** GRADUATE STUDENTS



OVER **600** SCIENTIFIC PUBLICATIONS

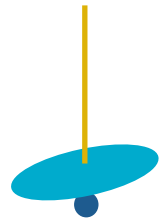


ADVANCED TECHNOLOGIES COLLECTING **20 MILLION** DATA POINTS ANNUALLY



# THOUSANDS

OF CLARITY AND WATER QUALITY SAMPLES MEASURED



**FIFTY** SCHOOL FIELD TRIPS AND OVER

**136,000**

PEOPLE REACHED BY EDUCATIONAL PROGRAMS



**FIVE THOUSAND** STUDENTS REACHED ANNUALLY



**2** SCIENCE CENTERS AT THE LAKE



**1** LAKE TAHOE

## GIVING TO THE TAHOE ENVIRONMENTAL RESEARCH CENTER

**Private Support** is critical to continuing the Tahoe Environmental Research Center's legacy of ground-breaking 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!

- 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*

All gifts are tax deductible. UC Davis is committed to providing excellent donor stewardship. To learn more about the University's gift policies, please visit <http://giving.ucdavis.edu/ways-to-give/disclosures>.

### 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

### Enclosed is my tax-deductible contribution.

Please make checks payable to UC Regents.

Name: \_\_\_\_\_

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TENVGFT

## MAKE A GIFT TAX-FREE WITH AN IRA

- Do you want to support TERC's Science at Lake Tahoe?
- Are you over 70 ½?
- Do you need all of your required minimum distribution from retirement assets?

» **Consider a gift via an IRA.** Visit <http://plannedgiving.ucdavis.edu/ira-charitable-rollover> for more details.

## UPCOMING EVENTS

**Jan. 7:** Tahoe Science Center Reopens for the year

**Jan. 7:** Docent Appreciation

**Jan. 16:** Monthly Lecture: Climate Change: Science and Solutions with John Henry Beyer

**Jan. 31:** 4th Annual Science of Cocktails (6–8pm)

**Mar. 9 – 13:** North Lake Science Expo

**Mar. 12:** North Lake Family Science Expo (4–6pm)

**Mar. 31 – Apr. 3:** South Lake Science Expo

**Apr. 2:** South Lake Family Science Expo (4–6pm)

For more information visit <https://tahoe.ucdavis.edu/events/>.