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.

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KARIN HIGGINS

Professor and Director Dr. Geoff Schladow is retiring after 20 years of service and is now Director Emeritus.

RESEARCH UPDATES

DIRECTOR GEOFF SCHLADOW IS RETIRING

After nearly 20 years of being the director of the UC Davis Tahoe Environmental Research Center, Geoff Schladow has now become Director Emeritus.

Professor S. Geoffrey Schladow has contributed to freshwater sciences around the world. Dr. Schladow has been a friend, mentor, and colleague to all of us at the Tahoe Environmental Research Center for the past two decades. Geoff's greatest legacy is the development and growth of TERC. Since he became Director in 2004, the team of researchers and educators have nearly tripled to 17 full time staff at TERC actively working on issues surrounding aquatic ecosystems. A fundamental problem with understanding how aquatic ecosystems will respond to global climate change, is the multidisciplinary nature of the issues and solutions. Dr. Schladow reaches out and engages across all fields, from engineering

UCDAVIS
Tahoe Environmental Research Center

Science to Save the Lake

LETTER FROM THE DIRECTOR

KARIN HIGGINS, UC DAVIS

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

At the end of December, 2023, I stepped down as the founding Director of TERC, an amazing organization that has had a transformative impact on Lake Tahoe. Over the last 19 years, the research conducted at Lake Tahoe has both deepened and broadened, with much of it being led by TERC often in collaboration with Agency and research partners. As new challenges emerged – from climate change, new invasive species, shoreline algae and microplastics, to name a few – TERC's scientists were either at the forefront of discovery or exploring solutions and mitigations. That research preeminence will undoubtedly continue, albeit with new leadership and the new ideas that will bring. As the 6th ranked public University in

the nation, UC Davis has the intellectual capital to meet the evolving needs at Lake Tahoe across a broad range of disciplines.

Public science education in the Tahoe basin was largely absent before TERC's establishment. Since then, our Education Centers in Incline Village and Tahoe City have taught well over 100,000 thousand school children and visitors the importance of environmental stewardship both at Tahoe and ecosystems everywhere. Our monthly lectures have grown from a handful of attendees at the beginning, to over 150 in-person attendees and an equal number joining remotely. The technology developed as part of the education program, such as the Augmented Reality Sandbox, has been replicated at over 1,000 science centers and museums around the world, and been on display at the White House!

The last 19 years have been the richest, most fulfilling and unquestionably the most fun part of my professional career. Not all of that derives from the scientific opportunities that Lake Tahoe has presented. Much of it comes from the people I have had the opportunity to interact with. They include long-term and seasonal residents; small business owners around the lake; teachers and their students;

Senators, Congressional and State representatives, and Governors; and visitors from around the world who have come to TERC to learn how science is used to guide and advance environmental stewardship.

It also includes the many people who financially supported our mission. The vast majority of TERC's support comes from UC Davis and from grants and contracts for specific projects that our staff have competed for. However, the funding to support things such as student internships, exploration of new monitoring ideas, graduate student research, and most of our educational offerings, have come from this special group. It is that funding that has allowed TERC to grow and to shine, and it has been the catalyst for securing public funding down the line.

While I have stepped down, I am continuing to work on a number of projects at Tahoe and remaining engaged with TERC, albeit in a different capacity. So don't be surprised if you continue to see me at Tahoe. There is so much that has been accomplished and yet so much more remaining to be done. I am hoping to be a part of that continuing success.

Thank you for the opportunity to serve, and all the best for 2024 and beyond.

Geoff

GEOFF SCHLADOW, CONTINUED

to ecology to remote sensing, in order to address the driving questions. This approach has helped stakeholders, from scientists to watershed managers, to adapt to emerging issues. In addition to specific research questions, education and outreach is also an integral component of TERC activities. The TERC education staff interacts with more than 11,000 people annually including nearly 4,000 K-12 students each year. Dr. Schladow works tirelessly to fund both small- and large-scale projects to grow awareness of the issues facing lake science within the Lake Tahoe Basin. With that said, he believes strongly that this model

isn't limited to Tahoe and can be exported around the world.

Dr. Schladow helped secure funding for a multiyear project through the California Department of Fish & Wildlife to conduct research aimed at improving the environmental quality and economic outcomes for the communities surrounding Clear Lake in Lake County, California. At Clear Lake, he has led the effort to understand the processes in the watershed and in the lake itself that are preventing rehabilitation of the lake water quality and ecosystem health. Using this knowledge, the California Department of Fish & Wildlife aims to create a set of numerical models that can be used

HEATHER SEGALE

Geoff Schladow proudly displays the LEED Platinum plaque from the U.S. Green Building Council after the TCES building achieved this designation in 2007.

SPECIAL THANK YOU TO DIRECTOR GEOFF SCHLADOW FOR YOUR YEARS OF SERVICE: FROM MEMBERS OF THE TERC ADVISORY BOARD

Laurie Byren: Wishing Geoffrey a satisfying and exciting retirement after directing an amazing team of scientists, research center associates, students, and volunteers for 20 years. His leadership has inspired generations of residents (like me!) and visitors dedicated to preserving our beautiful Lake Tahoe.

Roger de Lusignan: I was impressed that Geoff was able to think outside the box about the Mysis problem. He engaged a muti-disciplinary group of graduate students and advisers that created the business plan to turn *Mysis shrimp* into dog treats, and then use the proceeds to fund continued

Mysis population control over time. Not your typical academic. I know we have not seen this happen yet, but it will!

Debi Fitzgerrell: Under Geoff's leadership TERC has grown into the leading scientific organization at work at Lake Tahoe. His scientific knowledge as a limnologist and his personal ability as a leader have been key factors in TERC's ascendance. Among his many accomplishments, TERC has become a partner with Lagos Limpios in Chile, working to preserve the many pristine lakes in the south of that country. Also, under his leadership TERC is working at Clear Lake in California, leading

an effort to clean up this ironically named lake. One of his biggest gifts to the Tahoe environment has been getting all the disparate environmental organizations to work with TERC with the potential to do great things for the lake. This includes his outreach to the Washoe Tribe in the last year that will bring the tribe's knowledge and history to bear in the effort to preserve and protect Lake Tahoe. Finally, his charm, humor, and charisma in public speaking and in one-on-one encounters alike are great assets of his that have done a lot to bring TERC into the spotlight and create a favorable impression everywhere. As he leaves his post, he leaves TERC stronger, more

GEOFF SCHLADOW, CONTINUED

to inform local and State decision-making and policy formation. Data and a long-term monitoring strategy to measure status and trends in the future will allow tools to be developed to help better predict harmful algal blooms and associated toxicity for human health.

Chile Lagos Limpios was formed in 2018 to help protect lakes in Northern Patagonia, Chile (https://chilelagoslimpios.cl/). Advised closely by Dr. Schladow, the non-profit foundation aims to use the same model as TERC to work with all local stakeholders to ensure that the 23 lakes of the Araucania region are able to balance economic development, community and natural resources conservation through a science-based approach. As these lakes are currently relatively pristine, the foundation

is aiming to minimize the human influences as the area undergoes rapid economic development similar to what was seen in Lake Tahoe in the 1950s and 1960s. However, unlike Tahoe, there is an opportunity to avoid costly clean-up efforts of an impacted ecosystem. Dr. Schladow regularly advises the team, conducts research on site, funds students to participate in the research in Chile, and continues to be an advocate for lake science on an international stage.

Another part of his legacy is creating infrastructure for data gathering. Schladow embraces new technologies and their application in lake science to determine how a changing global climate is forcing changes in lake ecosystems. This includes working with techniques and platforms developed for ocean applications (e.g.

autonomous underwater vehicles or gliders), remote sensing techniques, real-time monitoring stations, new sensor development, and many others. Through collaborations with NASA–JPL, UC Berkeley, Stanford University, and others, he has formed the infrastructure developing a suite of tools at Tahoe which can be applied anywhere in the world.

In addition to his ability to make connections on a technical level, Dr. Schladow also has an innate ability to connect people to the science behind the problems. From public lectures to facilitating education programs for students, he has worked tirelessly towards disseminating knowledge to the scientific and public community equally. From being featured in National Science Week in Washington D.C. to ongoing projects in countries such as New Zealand, Spain, and Korea, his work in public education in watershed sciences continues to be recognized globally. Protection of lakes is essential to support local communities and the people who live in them and, while it is difficult to count the number of people impacted by Dr. Schladow's work, it is clear his work highlights UC Davis on both a national and international stage. While parts of each of the projects he works on are funded, a large portion of his time outside of the technical components is uncompensated public service.

We thank you Dr. Schladow for your tireless efforts to keep our lakes safe and educate all along the way.
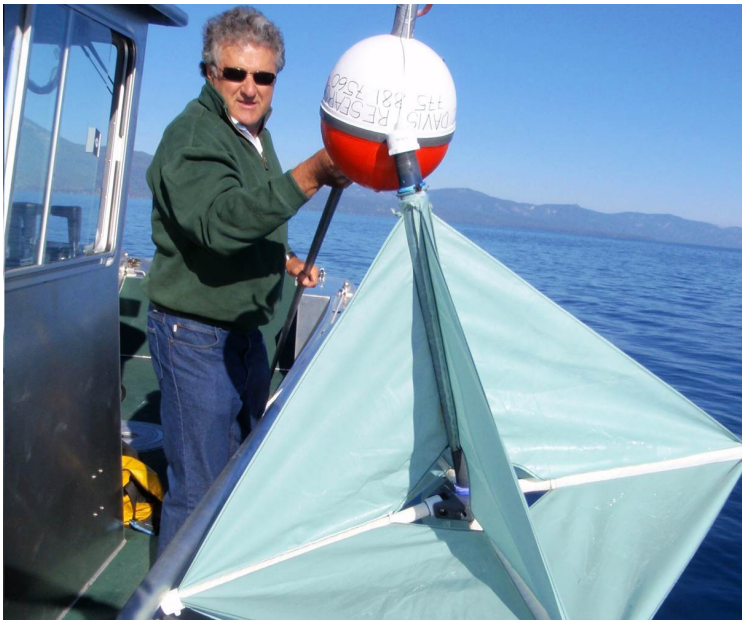
Dr. Geoff Schladow on Lake Tahoe releasing a drogue to measure surface currents.

SPECIAL THANK YOU TO DIRECTOR GEOFF SCHLADOW FOR YOUR YEARS OF SERVICE: FROM MEMBERS OF THE TERC ADVISORY BOARD

vibrant, and poised to continue making the vital difference in protecting and preserving not only Lake Tahoe, but lakes worldwide.

Veronica Kaufman: I can only say that I have a deep affection and admiration for Geoff and for his commitment to the health and clarity of not only Lake Tahoe, but also for lakes worldwide!

Tim Kosier: I have had the privilege of working with Geoff for over 11 years as a docent and TERC Advisory Board member/chairperson. Geoff is Mr. Science of Lake Tahoe. His leadership at TERC and the team of scientists, chemists, and educators he assembled are second to none. Geoff has been so easy to work with, his dedication to success has him responding to questions late at night and early in the morning. His well-crafted teases and self-effacing humor made even the most serious challenges manageable. I'm going to miss our frequent contact as he moves into well-deserved retirement.

David Loury: I met Geoff not long after moving to Incline Village in 2014. Geoff has a down-to-earth manner and Australian accent that makes you want to listen to what he has to say. Mix that in with a wry wit and an encyclopedic knowledge of Lake Tahoe and you have a world-class science communicator. Geoff established the Thursday evening science lecture series at

TERC. My wife, Dana and I have fond memories of those lectures and always enjoyed interacting with Geoff before each talk. One Thursday event that stands out in my mind was the State of the Lake presentation given by Geoff about 8 years ago. That evening, Dana and I attended a delightful after-lecture party hosted by Geoff and his wife Sharon at their home. Over the years, Dana and I have had the privilege of getting to know Geoff and Sharon. Geoff and I share interests in science, a good glass of wine, and making a difference for the better. My best wishes to Geoff as he begins his next chapter.

Steve Pardella: My first introduction to Geoff was at the 2019 State of the Lake presentation. One lecture and he hooked me. After that presentation, I was shocked at the complexity of the lake's ecosystem. The gyres, mixing, Mysis shrimp, Daphnia, and algae were just a few things that are studied at TERC. To get TERC to where it is today, Geoff had to wear many hats. A scientist, professor, director, entertainer, negotiator, and diplomat are a few of the skills Geoff has employed over his tenure. The momentum that TERC has generated with Geoff at the helm will continue because of the great staff he has put together. Geoff may be paddling off into the sunset, but TERC will continue its mission. Thank you Geoff for all your hard work and dedication to the field of limnology, Lake Tahoe, and

lakes around the world. You will be missed, but not forgotten.

Gerry Parker: Geoff has led the research efforts at Lake Tahoe for over 20 years and contributed significantly to our understanding of many factors that influence the health of the lake. A tribute to his work is that he and TERC are engaged in work and data collection on other lakes ranging from Chile, to Clear Lake, to the Salton Sea. He is recognized as an expert in the dynamics of water systems.

Frances Pierce: I became a TERC docent about 11 years ago and knew that Geoff Schladow was a TERC person of importance, but didn't have much interaction with him. Since joining the TERC Advisory Board three years ago, I have come to appreciate his dedication to TERC's goals, his scientific understanding of Lake Tahoe's delicate ecosystem, and his humor. It has been a pleasure to work with him.

Phil Stump: I have often said that Geoff is the Jacques Cousteau of Lake Tahoe. I think of Geoff as a unique visionary explorer who approaches research with care and precision to ensure that there is a solid foundation on which conclusions can be built. His upbeat, positive, and fun-loving outlook is engaging and inspiring. Throw in an accent from down-under and you've got the perfect combination of insightful and irresistible.

INTERIM DIRECTOR ALEX FORREST

Dr. Alexander Forrest (Associate Professor, UC Davis) will be acting as the TERC Interim Director as the Director search gets underway in early 2024. Based in Civil & Environmental Engineering at UC Davis, Dr. Forrest works in Environmental Fluid Mechanics where he is interested in how flows interact with their natural and built environments. He has been involved with research at TERC since 2008 when he initially came here as a postdoctoral fellow working on understanding the spread of invasive species in the lake and has now focused on the application of autonomous robotics to the broader field of limnology.

Alex Forrest has nearly two decades of experience working

Autonomous glider "Storm Petrel" in Antarctica.

ALEX FORREST

with autonomous robotics as data collection platforms to address environmental issues. With a background in Civil and Environmental Engineering, his

research examines the influence lakebed and seafloor features have on localized hydrodynamic flow and uses acoustic mapping techniques and environmental fluid mechanics to interpret the dynamics of a system. Dr. Forrest applies his expertise to issues affecting water quality and ecosystem health in Lake Tahoe and other Sierra lakes including analyzing sedimentation, invasive species, etc. His work also extends globally as he's interested in studying how fast ice melts in polar regions and he works to send teams to both the Arctic and the Antarctic. The main focus of his teaching at UC Davis is environmental fluid mechanics at the undergraduate and graduate level.

ADRIENNE WHITE

Alex Forrest, Ph.D., becomes TERC Interim Director.

LAKE TAHOE AS A BASIS FOR ANTARCTIC EXPLORATION

By Alex Forrest, Ph.D.

This austral summer (January 2024), TERC will be joining an international team from five nations to visit the Thwaites Glacier in Antarctica. This team will be led by TERC Ph.D. student Kenneth Larrieu and TERC postdoc Oscar Sepulveda Steiner. They will be joined by Ph.D. student Jérémie Bonneau from the University of British Columbia (Canada).

The Thwaites Ice Shelf is one of the biggest ice shelves in West Antarctica, though it is highly unstable and disintegrating rapidly. The Thwaites Glacier has been referred to as the 'Doomsday Glacier' in mainstream media because of its potential contribution to global sea-level rise. The goal of this visit is to quantify meltwater discharge coming off of the floating ice shelf using underwater robotics. They will be joining a team from the University of Gothenburg (Sweden) who will use a long-range autonomous underwater vehicle to go beneath the ice shelf while the TERC team uses an autonomous underwater glider to collect data in the open water at the acting calving front. This will be a return to the system where they were previously collecting data in 2022 with collaborators from the Korean Polar Research Institute (KOPRI).

For the past few months, the TERC team has performed extensive testing at Lake Tahoe in preparation for this deployment. They will collect temperature, salinity, and dissolved oxygen data to understand the fate of the meltwater. This year additional measurements of particles will be collected using a sensor that was developed while measuring deposited smoke from the 2021 Caldor fire. The team will use this data to explore the idea of microplastics in the Southern Ocean. This is something that there is currently little to no data on.

Lake Tahoe is an amazing natural laboratory to develop skills and techniques to apply to the farthest corners of the planet. Our continued participation in large, international work groups in polar science is a testimony to the quality of work that TERC brings to the global stage of understanding freshwater systems.

ALEX FORREST

In 2017, TERC researchers conducted similar research off the Nansen Ice Shelf located in the Ross Sea, Antarctica.

NEW COLLABORATIVE PROJECT FUNDED BY THE NATIONAL SCIENCE FOUNDATION WILL PEER INTO FROZEN LAKES TO UNDERSTAND IMPACTS OF CLIMATE CHANGE

By Steve Sadro, Ph.D.

Winter is the fastest warming season in the northern hemisphere. For millions of the world's seasonally-frozen lakes, this warming means shorter and thinner ice cover and changing patterns of snow accumulation on the ice. Because ice and snow affect many fundamental physical, chemical, and biological properties of lakes, changes in winter conditions can disrupt lake ecosystems and the services they provide to humanity. However, our understanding of winter lake dynamics and how they vary across different types of lakes is limited, in part because of the challenges that winter conditions impose on sampling. This leaves scientists ill-prepared to predict how changing winters will impact lakes and mitigate negative impacts.

The National Science Foundation recently awarded a grant to support a collaborative, winter-focused project between the University of Minnesota, Michigan Technological University, Carnegie Institution for Science, the University of California–Davis, and the University of Wisconsin–Madison. The project is called "Advancing a comprehensive model of year-round ecosystem function in seasonally frozen lakes through networked science." It aims to broaden our understanding of winter dynamics and develop a predictive understanding of how winter conditions affect the ecological populations, communities, and food webs of diverse types of lakes.

The study combines two approaches: 1) detailed seasonal studies of ecological processes in 12 lakes by the core research team; and 2) research across at least 60 other lakes by a network of collaborators. In the first part of the effort, the investigators are focusing on 12 lakes with contrasting water quality characteristics and winter severity. The lakes are being instrumented with sensors continuously-recording temperature, light, and oxygen measurements. The investigators are also studying water, bacteria, phytoplankton, and zooplankton throughout the year to determine how plankton populations and communities evolve through seasons in different lake types. Using stable isotope and fatty acid analysis, the investigators are assessing the way food web structure changes across seasons and the production and cycling of organic matter. For the second part of the study, the investigators are recruiting a network of researchers to collect samples from at least another 60 lakes. These collaborators are trained in winter research methods and are provided with sampling kits and instructions for sample collection. Collaboration between the core research team and their network will allow for broad participation in the interpretation of data and testing of hypotheses about the way winter severity interacts with water quality to affect lake ecology. This "team science" approach will develop a network of winter-hardy aquatic researchers with the goal of advancing understanding of year-round ecosystem function in the face of climate change.

The project is set to begin in 2024. One of the first outcomes will be a Limnology Winter School. This training and collaborative research workshop to be offered in March will train aquatic scientists interested in learning how to conduct winter research and expand their professional networks. Participants in Limnology Winter School will join a team of experienced winter limnologists and outreach specialists at UW-Madison's scenic Trout Lake Biological Station for a week of hands-on field work and discussions. Topics will include: planning and executing winter field operations; working on ice safely; collecting standard limnological data and samples under ice; planning and conducting public outreach during winter; discussing key open questions and novel hypotheses in winter limnology; and best practices in team science. Lake sampling will commence in the summer of 2024 and continue through 2026.

(Photos on Page 14, bottom)

NEARSHORE ALGAE MONITORING

By Adrianne Smits, Ph.D.

In April 2023, TERC began a new monitoring study of near-shore algae in Lake Tahoe. In recent years there has been concern that blooms of attached algae (periphyton) and floating algae (metaphyton) are increasing along Lake Tahoe's shoreline, where most of the public interacts with the lake. Nearshore algal blooms are increasing in clear-water lakes globally, but there are typically multiple causes of these blooms, and quantifying changes in algae is difficult due to its patchy spatial distribution.

TERC's innovative new monitoring program combines multiple methods to track algal coverage at 15 locations around the lake, including visual surveys, sample collection by divers, and classification of aerial images from drone flights. Additional imagery captured during monthly helicopter flights around the entire shoreline of Lake Tahoe is also being used to identify blooms outside fixed sampling areas and to compare with drone images. By combining these different ways of tracking algae growth, the new monitoring program will allow TERC researchers to quantify seasonal, inter-annual, and spatial patterns in algal biomass and to identify if conditions are changing in response to stressors such as nutrient inputs or warming temperatures.

USGS CLEAR LAKE NEW SOILS PROJECT

As part of TERC's Clear Lake research, the TERC chemistry lab is currently working on a project called "New Soils" with the United States Geological Survey (USGS) and Lake County. To better understand the processes controlling lake water quality, phosphorus, nitrogen, and particle analysis are being conducted on soil cores from Clear Lake and inflowing streams. These data provide insight into the amount of nutrients stored in soil beneath the water, which can influence algal growth and water clarity.

PENELOPE HOLLAND

TERC Chemists Aaron Vanderpool and Keeley Martinez sort through soil samples from Clear Lake.

HAL SLOANE

Drone monitoring of nearshore periphyton monitoring site.

NEARSHORE WATER QUALITY MONITORING NETWORK

By Mike Cane, TERC Field Team

In 2014, TERC established a network of water quality monitoring stations at the perimeter of Lake Tahoe. This network aims to improve understanding of water quality variability in the nearshore zone and provide data used to guide restoration and future stewardship. Nearshore monitoring has become increasingly important as nearshore algal growth has increased in recent years (https://tahoe.ucdavis. edu/algae).

As of January 2024, there are 10 stations installed around Lake Tahoe, with Cedar Point being the newest location. Each station consists of an optical instrument—measuring turbidity (clarity), algal concentration, and dissolved organic matter concentrations—and a Conductivity Temperature Depth (CTD) sensor that measures water temperature, conductivity, lake level, and wave height.

Why are these nearshore data so important? The nearshore is the area of the lake most people come into contact with and as home to the greatest concentrations of biodiversity, it plays an essential role in the lake ecosystem. Unlike the center of the lake, the nearshore is subject to erratic changes in water quality. These changes occur in response to storms, inflows from streams and storm drains, local erosion, and drift from other parts of the lake. The Nearshore Network allows scientists and agencies to better understand the causes of degradation, to better implement projects to mitigate degradation, and to determine appropriate and meaningful threshold standards for nearshore conditions.

A real-time data feed is currently available to the public through the Lake Tahoe In Depth touchscreen display located at TERC's Tahoe Science Center and other locations around the basin.

Funding for this project (along with dock access) is provided through a unique partnership between lakefront property owners, private donors in the Tahoe basin, instrument manufacturers, and TERC. Each donor supports the operation of one nearshore sensor for a minimum of four years.

INVASIVE ASIAN CLAM AND UNATTACHED FILAMENTOUS ALGAE MONITORING

By Mike Cane, Field Lab Director

The introduction of Asian clams into Lake Tahoe in the early 2000s has led to some significant changes to the nearshore ecosystem. Localized increases in concentrations of nitrogen and phosphorus in areas with large clam populations have contributed to unprecedented amounts of unattached filamentous algae (metaphyton) growth.

The TERC field team, in collaboration with Nevada State Lands, has been assessing Asian clam populations and the linkage to metaphyton growth along the east shore of Lake Tahoe in collaboration. The research includes conducting helicopter surveys along broader areas of shallow water around Lake Tahoe, drone surveys to map metaphyton, underwater surveys to map and quantify clam presence in key areas, and laboratory studies to determine potential management strategies for reducing Asian clam populations and algal growth.

Goals of this study are to understand the extent of clam invasion in Lake Tahoe and to help advise management actions that would help alleviate the negative impacts of this growing problem.

CLEAR LAKE BATHYMETRY

Erik Young (TERC field team) and a team of UC Davis graduate and undergraduate students are completing a bathymetric survey of Clear Lake to provide an updated, high resolution, map of the lakebed to UC Davis scientists in order to help improve model accuracy for the Clear Lake hypolimnetic oxygenation project.

2023 CLIMATE RESILIENT REFORESTATION – TERC & CALIFORNIA CONSERVATION CORPS PARTNERSHIP

By Tricia Maloney, Ph.D.

Over the last decade, climate-driven weather patterns have devastated California's wildlands through wildfires, pest outbreaks, and prolonged drought. Given the scale and extent of habitat loss, a combination of genetics, remote sensing, geospatial datasets, and traditional monitoring methods are needed to improve resilient ecosystem restoration outcomes.This combination of restoration strategies

guided by a better understanding of how native plants evolve in response to climate impacts can amplify population resiliency to these pressures. Resilient approaches steered by advances in technological and scientific understanding can equip land managers with effective adaptive restoration tools to respond to extraordinary changes in forested landscapes and facilitate ecosystem recovery. TERC comprehensively characterized the environment of different restoration sites by employing remote sensing technologies, geospatial datasets, advanced algorithms and deploying an unmanned aerial vehicle (UAV) to identify site conditions (e.g., late-lying snow patches, soil properties, canopy, solar radiation, and soil water status)

to select appropriate microsites for planting locally-sourced and diverse seed material.

Building upon past work, TERC is improving project outcomes by strengthening an existing partnership with the California Conservation Corps (CCC) with the goal of fostering a diverse and equitable workforce around forestry, restoration, and climate change initiatives. In 2023, TERC's Forest & Conservation Biology Lab and the CCC planted 6,000 sugar pine seedlings at Colorado Hill in the Monitor Pass region, devastated by the 2015 Washington Fire, and two sites on the North Shore of Lake Tahoe impacted by drought and a severe mountain pine beetle outbreak between 2012 and 2016.
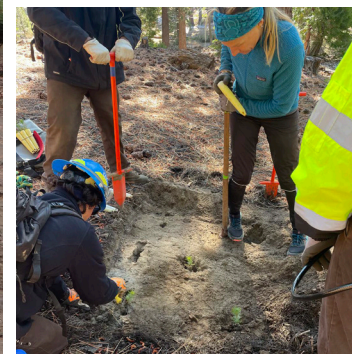
Great group photo on the last day with the California Conservation Corps (CCC) team after working to plant 6,000 sugar pine seedlings.

EDUCATION AND OUTREACH

9TH ANNUAL TAHOE FILM FEST

The Tahoe Film Fest returned for its 9th year and featured a number of documentaries and international films as well as several thought-provoking environmental works. The film festival kicked off with Maestro, a biographical drama about celebrated American composer Leonard Bernstein and his wife Felicia, portrayed by Bradley Cooper and Carey Mulligan, respectively. The film played to a sold out audience of 180 people at the Incline Village Cinema and was met with rave reviews by many in attendance. Film festival attendees also enjoyed the three international films—The Taste of Things, Perfect Days, and The Shadow of the Sun—all of which are official submissions for an academy award for best international feature, representing France, Japan, and Venezuela. Be sure to look out for them when academy award nominations are announced! Two films from the festival—Maestro and May December—were nominated for the 2023 Golden Globes. Festival goers also had the chance to hear from Tom Donahue, the writer and director of the polarizing movie The Great Divide as well as the director and producers of The Shadow of the Sun in an illuminating panel discussion mediated by TERC's own Heather Segale. Overall, the festival saw over 1,100 attendees over the course of two weekends and was the highest-grossing Tahoe Film Festival to date. Next year, the 10th-anniversary festival promises to be bigger and better still and will feature a visit from academy-award-winning writer/director/producer of films such as Contagion and The Bourne Ultimatum, Scott Z. Burns.

CANDY CANE LANE

For the second year in a row, our Tahoe Science Center participated in Candy Cane Lane, a community holiday event put on by the Incline Village Crystal Bay Community and Business Association as part of their annual Northern Lights Festival. The TERC education team along with two volunteer docents Sonnet and Charlene facilitated a number of winter-themed science activities for community members, including waterless snow globes, phase change poppers, colorful patterns in melting ice, and more! This year saw around 200 community members of all ages visit the science center and engage in science learning fun!

A young visitor learns how to make waterless snow globes using static electricity.

Shadow of the Sun producers Alvar Carretero de la Fuente and Maritza Carbajal and director Miguel Angel Ferrer.

From left to right: Sarah Harry, Charlene Mattos, Sonnet Van Doren, and Logan Witt set up snow science activity stations.

EDUCATION AND OUTREACH

WASHOE STORY-TELLING LECTURE

On December 7th, TERC hosted a lecture with Herman Fillmore and Helen Fillmore: Washoe Storytelling and Watching Science Catch-Up. This was among our most well-attended monthly lectures. Nearly 100 guests braved the snowy weather to be there in person and another 25 participants joined online to hear Herman and Helen share stories of the Washoe tribe and how these relate to the geomorphological understanding of the Tahoe Basin. Helen also created a timeline illustrating how long the Washoe people have been present in the Tahoe Basin, which she generously donated to the TERC education team.

KATHARINE HAYHOE LECTURE

On January 23, we had the opportunity to hear from the remarkable Katharine Hayhoe, chief scientist of The Nature Conservancy, Distinguished and Endowed Professor of Public Policy and Public Law at Texas Tech University, and the lead author of the Second, Third, and Fourth National Climate Assessments. Her best-selling book, *Saving Us: A Climate Scientist's Case for Hope and Healing in a Divided World* was available for purchase.

UC Davis Tahoe Environmental Research Center, University of Nevada Reno at Lake Tahoe, and the Tahoe Regional Planning Agency partnered to bring Dr. Hayhoe to the Tahoe Science Center for this exciting event which was

an extension of Operation Sierra Storm Television Meteorologists' Conference organized by the Lake Tahoe Visitors Authority. The 27th Annual Operation Sierra Storm brings 30 television meteorologists and science leaders together for discussions on important climate topics. The event also drove broadcasts and social media content that reinforces the Visit Lake Tahoe brand as a leading, stewardship-driven year-round destination.

The educational and inspirational recorded presentation is available on the TERC YouTube channel at https://www.youtube.com/c/ucdavistahoe.

Presenter's Helen and Herman Fillmore showing the 15,000-year timeline of the Washoe tribe and other notable historical events in the Tahoe Basin.

Katharine Hayhoe, photographed for the New York Times.

UPCOMING EVENTS

February 8, 2024: Infrastructure Resilience in the Face of Extreme Flooding, with Dr. Michael Gardner

May 23 – 24, 2024: Science Expo: Physical Science https://tahoe.ucdavis.edu/science-expo

May 30, 2024: Options for Feeding Healthy Pets, with Dr. Jennifer Larson, UC Davis Vet Med

Jun 17 – 23, 2024: TERC CIRC(umnavigation) of Lake Tahoe

For more information: https://tahoe.ucdavis.edu/events/

NEW STAFF: MICHAEL CANE, FIELD LAB DIRECTOR

Michael Cane has worked as an environmental scientist conducting research and managing multidisciplinary teams for large environmental research projects for over 20 years. His diverse career has focused on invasive species management and how this management could benefit State and Federal Threatened and Endangered species in various California ecosystems. Some of the work that he has led includes biotelemetry research to understand how differing migration corridors within the Sacramento-San Joaquin Delta influence survival of out-migrating juvenile salmonids; non-native predator population manipulation research to understand how predation from non-native fish species influences native fish populations; and research on invasive plant growth and how to best conduct management actions to reduce the growth and spread of problematic invasive plant species. In his spare time, he can be found outside climbing, biking, SCUBA diving, or exploring mountains around the globe.

New field lab director and boat captain Michael Cane.

PEERING INTO FROZEN LAKES, CONTINUED (FROM PAGE 8)

Late winter sampling at Emerald Lake, a long-term research site in Sequoia-Kings Canyon National Park that has been studied since the early 1980's. In years with deep snowpack, lake "ice" can be over 5 meters thick.

TERC TEAM UPDATES

TERC WELCOMES NEW AMERICORPS MEMBERS

SARAH HARRY

Sarah Harry is excited to be a part of the Sierra Nevada AmeriCorps team and the TERC education team, where she can combine her passion for wildlife conservation with her enthusiasm for environmental education. She recently graduated from UC Davis where she double majored in wildlife, fish, and conservation biology and marine and coastal science. While living in Davis, she worked in fish labs, ocean climate labs, and coffee shops. She enjoys volunteering at the San Diego National Wildlife Refuge and working on multiple restoration projects in the area. In her free time, she likes to surf, paint, read, and walk her dogs. Sarah will be helping with interpretation and theme planning, docent coordination, and visitor tracking.

PENELOPE HOLLAND

Penelope Holland grew up in Boston, Massachusetts and recently graduated from Brown University, where she studied ecology, evolution, and organismal biology. Throughout her undergraduate degree she pursued conservation research, collecting data for a long-term biodiversity monitoring project in Mexico during summer 2021. She also contributed to a wildlife nutrition project in Yellowstone National Park as a research assistant. In addition to research, she is passionate about environmental education and communicating science to the general public. She was involved with online outreach and social media for Bahamas Plastic Movement, an anti-plastic pollution non-profit, and Biodiversity for a Livable Climate, an ecosystem restoration organization based in Cambridge, MA. She is excited to continue making science accessible and engaging while learning more about informal environmental education. Penelope will be helping with marketing and social media, event coordination, and writing and editing.

LOGAN WITT

Logan Witt was born and raised in a small town in Iowa where he had a profound interest in nature, especially with plants and animals. After high school, he attended Iowa State University where he obtained a bachelor's degree in Environmental Science. Post-graduation, he accepted a position as a raptor intern at Acadia National Park in Maine. One of his main duties in Acadia was to educate visitors about raptors and the importance of their conservation through interpretive programs. He applied to SNAP because it would be the perfect way to gain more experience with environmental education while living in a beautiful environment. His goals while working here at TERC are to gain more knowledge about educating communities in different ways and also to try different things that are out of his comfort zone. Logan will be helping to coordinate school field trips, summer internship program, and exhibit and aquarium maintenance.

ALISON TOY

From left to right: Logan Witt, Sarah Harry, Penelope Holland, Pepper, and Willie visit the Tahoe City field station.

SARAH HARRY

The three new AmeriCorps members hiking at Chickadee Ridge.

6 **DECADES** OF MONITORING LAKE HEALTH
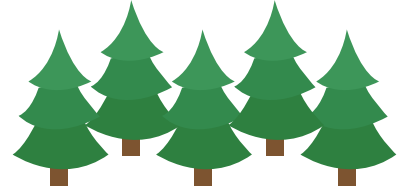
OVER **ONE-HUNDRED FIFTY** GRADUATE STUDENTS
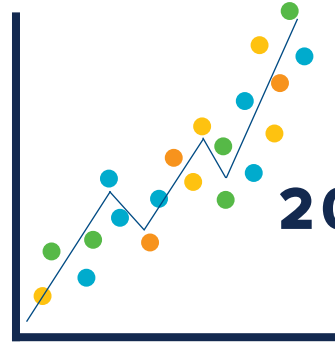
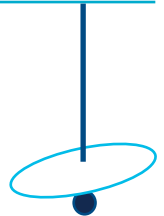OVER **600** SCIENTIFIC PUBLICATIONS

84 **MONITORED FOREST PLOTS**

ARE HELPING US UNDERSTAND **FOREST RESILIENCE**

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

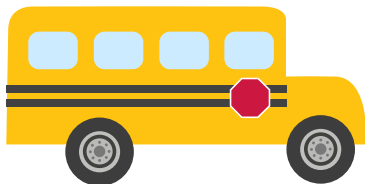# THOUSANDS

OF CLARITY AND WATER QUALITY SAMPLES MEASURED

EIGHTY SCHOOL FIELD TRIPS

3 THOUSAND STUDENTS REACHED ANNUALLY

187,000 **PEOPLE REACHED** BY EDUCATIONAL PROGRAMS

2 **SCIENCE CENTERS** AROUND

Incline Village, NV

Tahoe City, CA

1 LAKE TAHOE

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