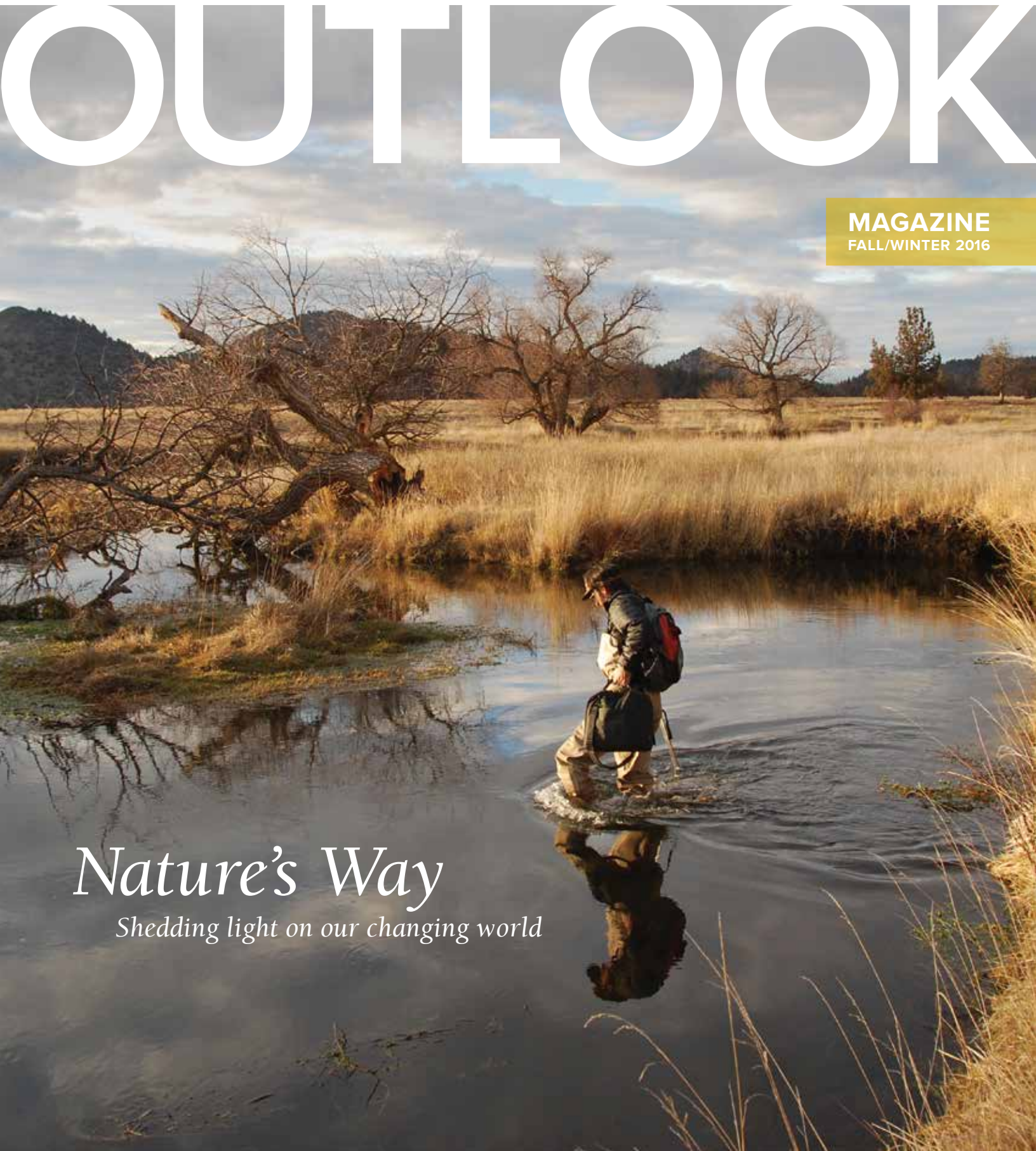
UC DAVIS
COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

OUTLOOK

MAGAZINE
FALL/WINTER 2016



Nature's Way

Shedding light on our changing world

CHRISTOPHER NICOLINI/UC Davis

Dean Dillard spent a day with a UC Davis crew tagging rainbow trout from the Fall River, California's largest spring-fed river. With her is Carson Jeffres, field and lab director for the Center for Watershed Sciences. The researchers developed a new genetic sampling technique that demonstrated the importance of spring-fed systems for cold water fish conservation.

From the Dean

Focus on Environmental Sciences

IT IS MY PLEASURE to present the latest issue of *Outlook*, which focuses primarily on environmental sciences within our college. In addition to being ranked second in the world and first in the nation in agriculture and forestry by *QS World University Rankings*, the *2016 US News and Global Subject Rankings* ranked UC Davis third in Environment/Ecology. High rankings in both the agricultural and environmental sciences confirm that our college—with its long-standing approach to addressing challenges in a cross-disciplinary, collaborative fashion—is a leading provider of solutions to both local and global problems.

This past year we asked a diverse faculty committee to develop a new strategic plan for our college that addresses many of the issues facing society. Entitled "Meeting the Challenges of 21st Century Global Change," it clearly reaffirms our commitment: to promote agricultural, environmental, and social sustainability through research, teaching, and public engagement. The plan is a roadmap for future investments in new programs, majors, faculty positions, and facilities. A major goal is to increase the level of collaboration across the college to address the need to both mitigate—and adapt to changes in the environment.

Through our departments, centers, and institutes, our college supports a wide variety of research activities in the environmental sciences—from physical and chemical to biological and societal aspects. In this issue of the magazine we highlight efforts to address crucial environmental challenges, including research on restoration ecology, air quality, forest fires, salmon habitat, and environmental justice.

We also have taken a hard look at the way our college shares information and have begun making changes in how we communicate. This magazine, for instance, has been reimagined with a fresher, more inviting design. Our motivation is to more effectively share the achievements of our faculty, staff, students, alumni, and donors throughout the college. We are top-ranked in the world because of the hard work of many individuals who are focused on creating a better future for our world. We take global change seriously and are addressing the challenges it presents head on.

Helene R. Dillard
Dean, UC Davis College of Agricultural and Environmental Sciences

OUTLOOK MAGAZINE
FALL/WINTER 2016

Dean
Helene R. Dillard

Director of Communications
Caren Weintraub

Managing Editor
John Stumbos

Associate Editor
Robin DeRieux

Writers
Charleen Floyd
Diane Nelson

Designer
Lisa Wells

This publication is partially funded through gifts from the James G. Boswell Foundation.

Published by the University of California, Davis. ©2016 by The Regents of the University of California, Davis campus.

College of Agricultural and Environmental Sciences Outlook magazine is available online at **outlook.ucdavis.edu**.

To update your address or to subscribe:
email:
outlook@agdean.ucdavis.edu
phone:
530–752–2120
mail:
Outlook Magazine,
Dean's Office, CA&ES,
One Shields Ave.,
Davis, CA 95616-8571

ON THE COVER
UC Davis Center for Watershed Sciences researcher Drew Nichols crosses the Shasta River on The Nature Conservancy's Shasta Big Springs Ranch, the site of a long-term restoration and research project on the importance of spring-fed rivers that provide crucial habitat for salmon and other species.

COVER PHOTO BY:
CARSON JEFFRES/UC Davis

GREGORY URQUIAGA/UC Davis

10
Nestbox Highway
The Museum of Wildlife and Fish Biology's Putah Creek Nestbox Highway is a combined research and conservation program for cavity-nesting birds that was established in 2000 to provide breeding and overwintering habitat. Pictured is a young Western Bluebird.

FEATURES

DEPARTMENTS

#1 UC Davis Department of Wildlife, Fish and Conservation Biology

Faculty in WFCB were recently ranked No.1 in the nation for research productivity and impact. Although a small department, WFCB emerged with the top ranking in a comprehensive analysis of 33 research-extensive universities in the United States that belong to the National Association of University Fisheries and Wildlife Programs.

UC Davis began offering a major in wildlife and fisheries in the early 1970s, and the division that eventually became the Department of Wildlife, Fish and Conservation Biology was established in 1973.

The State of Lake Tahoe

In 2015, Lake Tahoe experienced a year like no other, according to the UC Davis Tahoe Environmental Research Center (TERC).

In its annual "Tahoe: State of the Lake Report," scientists summarize how natural forces, long-term change, and human actions have affected Lake Tahoe's clarity, physics, chemistry, and biology over time. Warm and dry conditions continue to have an impact on the lake:

4th year in a row Lake Tahoe failed to mix to its full depth. Deep mixing is crucial for adding oxygen and redistributing nitrogen.

6.5 percent of the year's precipitation fell as snow, the lowest amount ever recorded.

53.3 degrees Fahrenheit—the lake's average surface temperature was the warmest on record.

73.1 feet was the average annual clarity, a 4.8-foot decrease from the previous year. However, clarity was still more than 9 feet greater than the lowest recorded average of 64.1 feet in 1997.

9 inches—the amount the lake level dropped because of the drought. Except for one day, the lake was below the natural rim all year.

UC Davis

BODEGA MARINE LAB CELEBRATES 50 YEARS

GALEN ROWELL

Professor Rick Karban of the Department of Entomology and Nematology in a 1984 photograph surveys insects on seaside daisy to try and understand what forces structure insect communities. Karban is still doing research at the 362-acre Bodega Marine Reserve.

The Bodega Marine Laboratory is celebrating 50 years of working on complex environmental problems in coastal and marine ecosystems. Managed by UC Davis, the lab is dedicated to understanding environmental processes at the land-sea interface on the California North Coast.

Scientists work on many issues—climate change, invasive species, marine protected areas, oil spills and pollutants, and sensitive species such as the critically endangered white abalone. To learn more about the Bodega Marine Laboratory, visit **bml.ucdavis.edu**.

GivingGarden creators (from left) Scott Kirkland, Josh Livni, Deema Tamimi, and John Knoll.

PAMELA S KAN-RICE

FIRST PLACE FOR PRODUCE-SHARING APP

GivingGarden won first place in the Apps for Ag Hackathon at this year's California State Fair in Sacramento. Along with supplying gardening information from the UC Master Gardener Program, the produce-sharing app also will allow backyard gardeners to connect with others who want to share their bounty. CA&ES application developer Scott Kirkland and CA&ES system administrator John Knoll, pictured above, are part of the GivingGarden team. For more information on GivingGarden, please visit their website at **givinggarden.io**.

College Celebration 2016

YOU ARE INVITED

Join us at College Celebration on Friday, October 14, 2016, from 5:30 to 8 p.m. at the UC Davis ARC Pavilion. At this celebration, we will bestow the Award of Distinction, the highest recognition presented by the college, to seven individuals. The event culminates with a food-and-beverage reception and Farmers Market displaying California produce to take home at the end of the evening. We invite you and your guests to attend and to reunite with old friends. Visit **collegecelebration.ucdavis.edu** for more information and to purchase tickets.

Go in style with CA&ES CLOTHING

Wear your Aggie pride on game day or any day with T-shirts and sweatshirts designed for the College of Agricultural and Environmental Sciences. CA&ES apparel is available at the UC Davis bookstore and online at **ucdavisstores.com** under the products menu.

Aggie Ambassadors model CA&ES clothing at the UC Davis Bookstore.

JOHN STUMBOS/UC Davis

Saving Salmon

BY JOHN STUMBOS

CARSON JEFFRES/UC Davis

The Nature Conservancy's Shasta Big Springs Ranch on the Shasta River (above) is the site of a long-term restoration and research project. UC Davis scientists are studying spring-fed rivers like the Shasta that provide crucial habitat for salmon and other species.

THE RIVERS AND STREAMS of northern and central California once teemed with millions of salmon, mostly Chinook and Coho. But these fish are in trouble—many salmon runs are listed as either threatened or endangered. A few scientists even predict the demise of wild salmon in the Central Valley by the year 2100.

"It's up to us as to whether we accept this or not," said UC Davis fisheries professor emeritus Peter Moyle. "We don't have to accept the idea that salmon are going to disappear from California."

Moyle believes there are reasons for optimism. From the slopes of Mt. Shasta to the rice fields and floodplains of the Central Valley, groundbreaking research and restoration efforts offer hope for the future of California salmon.

THE SECRET'S IN THE WATER

The Shasta River is a tributary of the Klamath River, supplying just 2 percent of the Klamath's water flow. Nonetheless, the river historically has contributed half of the Klamath's salmon.

UC Davis scientists and conservationists with The Nature Conservancy and California Trout (CalTrout) have been learning more about the Shasta and working to restore its salmon runs.

"The Nature Conservancy purchased a ranch along the river and asked us to come see what gives this place its intrinsic potential for salmon recovery," said Carson Jeffres, field and lab director with the UC Davis Center for Watershed Sciences.

The center, established by Moyle and geology professor emeritus Jeffrey Mount, conducted a full-scale effort to understand water quality, stream temperature dynamics, vegetation, bugs, geomorphology, and, of course, fish. Jeffres conducted 1,500 snorkel surveys over four years to observe salmon in their native habitat.

In 2008, The Nature Conservancy fenced off its part of the Shasta and adjacent Big Springs Creek to keep cattle out of the streambed. Since then, salmon habitat has grown from less than 60 feet to more than 10 miles.

"We've illustrated that very promising results

"We don't have to accept the idea that salmon are going to disappear from California."

can be achieved in only a short period of time while continuing to run 500 head of cattle on the property…a model for neighboring ranches and properties beyond the region," said project manager Amy Hoss in a Nature Conservancy article.

The key to understanding the Shasta River's productivity is in the water. It is a spring-fed system—water at a constant 70 cubic feet per second and a steady 52 degrees Fahrenheit bubbles up from the earth at the Big Springs headwaters. Professor Randy Dahlgren, a UC Davis biogeochemist, explained that the water picks up nitrogen and phosphorous as it travels beneath Shasta's snow-covered slopes, which nourishes aquatic vegetation and stimulates an abundance of bugs—nature's fish food.

"This is an amazing story of ecological resiliency," Dahlgren said. "Spring-fed rivers are refugia for cold water species and are important for salmon conservation and restoration activities."

Jeffres is upbeat about the prospects for the once little-known river. "What's happened with the Shasta is you have fundamentally changed the habitat to make it beneficial," he said. "I'm optimistic that there's ultimately going to be a sustainable run of salmon in the Shasta, but it's going to take time."

FLOURISHING ON A FLOODPLAIN

In recent years scientists have turned their attention to the floodplains of the Central Valley to find a way to rear young salmon on their migration out to the ocean. During the winter of 1997–98, Ted Sommer, lead scientist with the state Department of Water Resources, released juvenile Chinook into the Yolo Bypass and discovered that the fish grew significantly bigger than juvenile Chinook released into the Sacramento River.

Jeffres, Sommer, CalTrout's senior scientist Jacob Katz, landowner John Brennan, and others have since developed a long-term research project in rice fields at Knaggs Ranch in the Yolo Bypass. Begun in 2012, the "Nigiri Project" has demonstrated how critical habitat for fish—and birds—can be recreated on farm fields during winter when crops are not grown. The project has documented the fastest growth rates for juvenile salmon ever recorded in California.

Historically, the whole Central Valley was a floodplain. In winter and spring, storm runoff and snowmelt would spill over riverbanks, creating vast biologically productive wetlands where aquatic life flourished. "This incredible productivity supported a huge fishery in the Central Valley," Jeffres said. "We had one of the largest runs of Chinook in the world."

Today, more than 95 percent of the Central Valley floodplains are gone and three of the four native Chinook salmon runs are listed as threatened or endangered.

"Fish food is made on the floodplain. Our vision is to strategically reconnect floodplains to the Sacramento River and its tributaries during winter so fish can access these food resources," Katz said. "This strategy provides multiple benefits, including flood protection and aquifer recharge."

GREGORY URQUIAGA/UC Davis

Fisheries professor emeritus Peter Moyle (left) and UC Davis Center for Watershed Sciences researcher Carson Jeffres download data on a floodplain restoration located at the Cosumnes River Preserve in the Central Valley. Research on the Cosumnes River floodplains has helped guide salmon habitat management throughout the state.

"It's not farms versus fish," Jeffres said. "It's farms working with fish. The rice that we eat and the salmon that we eat can use the same land at different times of the year. People are realizing that this is the way forward if California is going to have both sustainable farms and runs of salmon."

Clearing the air

BY JOHN STUMBOS

UC Davis has one of the largest concentrations of experts on air pollution of any university in the United States. More than 70 faculty members are involved in air quality research. Meet three of them.

QI ZHANG

"The atmosphere is like a big reactor that's always cooking stuff," says Qi Zhang, a professor in the Department of Environmental Toxicology.

Zhang and colleagues study the chemistry and physical properties of aerosols—atmospheric particulate matter and aerial droplets—that cause poor air quality and affect human health. Her research has taken her all over the world to analyze air samples with sophisticated equipment.

"There's a lot of particulate matter being emitted into the atmosphere," she said. "We try to understand where the aerosols come from, what is the mechanism that contributes to the formation of particulates, and also what are their environmental and health impacts."

California's particulate matter problem occurs mainly in the winter, especially in the Central Valley. In the summer, the problem is ozone, but the two are related. "There are similar mechanisms that form ozone and secondary organic aerosols," she said.

In the winter, meteorological conditions favor the accumulation of pollutants. The stagnant air and humid conditions typical of a Central Valley winter promote the formation of secondary particulates. Increased emissions, especially wood combustion for heating, also occur during the winter.

While ozone concentration tends to be low in winter, high ozone episodes are frequently observed in summer in the Central Valley. This is caused mainly by intense solar radiation and high air temperatures that enhance chemical reactions. Secondary aerosols are usually co-formed during the formation of ozone.

"Summer meteorological conditions generally favor secondary aerosol production," Zhang said. "We often observe elevated secondary aerosol and ozone concentration in summer."

XINLEI GE/UC Davis

Qi Zhang (right) operates an aerosol mass spectrometer with Ph.D. student Shan Zhou (left) and project scientist Sonya Collier (center) during a 2014 field study in Nanjing, China.

STEPHEN CONLEY/UC Davis

LAWR Professor Ian Faloona (left) with research colleague and pilot Stephen Conley.

IAN FALOONA

The town of Arvin at the southern end of the San Joaquin Valley has, on some days, the worst ozone air pollution in the nation. Air pollution control district officials wanted to understand why, so they funded Department of Land, Air and Water Resources Professor Ian Faloona to investigate.

In a small plane packed with specialized monitoring equipment, Faloona and UC Davis research colleague and pilot Stephen Conley, took to the skies over the area to measure and map ozone and ozone precursors such as nitrogen oxides. "We do it in a very systematic way," Faloona said. "The chemistry is happening on a molecular level, but the concentrations are controlled in large measure by the fluid flow of the atmosphere."

The key is the "boundary layer"—the atmosphere closest to the earth up to approximately 3,000 feet—where pollutants can concentrate. "How polluted the boundary layer gets depends on how much the air above is mixing and cleaning out the air down below," he said.

The instruments in the plane enable the scientists to measure that aerial mixing in a precise manner. "We've made great progress because of the techniques we're using," Faloona said. "We're not just measuring the pollution. We're also measuring the meteorology. That's important."

Faloona and Conley have become the go-to guys for this kind of airborne air quality research. They were the first ones to document the extent of the huge Aliso Canyon natural gas leak in Southern California during 2015 and have flown similar missions to study gas leaks in the Four Corners region of the Southwest. Next summer they hope to venture into new territory, mapping methane emissions from thawing permafrost in Alaska.

"This type of research is really in its infancy," Faloona said. "We just hit the technology right at the perfect time."

TOM CAHILL

Professor Emeritus Tom Cahill of the Department of Land, Air and Water Resources (and the Department of Physics) is a pioneering scientist who has studied air pollution for the better part of five decades. His early research helped get the lead out of gasoline and reduce sulfur in fuel. In 1977, he conducted the first measurement of atmospheric aerosols and visibility in western national parks, a program that has grown into a national network that monitors visibility at parks, wilderness areas, wildlife refuges, and Native American lands.

Based on Cahill's work on the international transport of Asian aerosols, the National Science Foundation (NSF) asked him in 2003 to create a program in Greenland that measures fine particulate matter in the air and also on the snow and ice. NSF recently extended project funding for another five years.

"Our technology allows us to say where these particles come from—Europe, China, the Sahara desert," he said. "We can pick up a single nickel smelter in Siberia. We spot the plume crossing Greenland and then the data goes into models predicting how the earth handles the sun's light."

Even small changes in the earth's brightness affect its heating and cooling. "Our published data are the most sensitive measurements ever made in atmospheric aerosols for multiple elements," Cahill said. "Our job here at UC Davis has always been to be the best."

UC Davis

Professor Emeritus Tom Cahill and staff assistant Jeanette Martin prepare an aerosol sampler of the type developed for use on the Greenland ice cap.

BY DIANE NELSON

FIGHTING FIRE

in a warmer world

FIRES USED TO BE NATURE'S WAY of keeping forests healthy. They would burn slowly through the hills and forests of California every decade or so, clearing out underbrush and making room for more plants to grow and animals to roam. Forest fires seldom claimed mature trees, which were sturdy and hydrated enough to handle the heat.

Not anymore. Due to a century of aggressive fire suppression and the escalating effects of climate change, fires have become more destructive and frequent. In 2015, a record-setting 10 million acres in the United States were lost to fire, mostly in Alaska, California, and other western states.

Experts say the future could be worse.

"There are 66 million dead trees in the Sierras because of drought and an alarming increase in bark-beetle infestation," said Mark Schwartz, a professor with the Department of Environmental Science and Policy.

Catastrophic fires will change the landscape of California. Already, shrubs and grasslands are growing where forests used to stand. But UC Davis researchers are helping develop strategies to slow the transformation and give forests a chance to adapt to their warming world.

THE FOREST-CARBON CONNECTION

Forests are a carbon "sink." They absorb more carbon dioxide than they release and reduce atmospheric greenhouse gases by about 25 percent globally. But when forests are destroyed by fire, they return that stored carbon to the atmosphere, which increases the effects of global warming and the likelihood of more frequent, intense fires.

"It's a self-reinforcing loop," said Ben Houlton, a professor in the Department of Land, Air and Water Resources.

Wildfires consume more than forestland. Fueled by drought and winds, fires rage nearly year-round through shrub-covered chaparral in California and beyond. Chaparral supports valuable ecosystems, as well as thousands of homes, but those landscapes don't absorb carbon the way forests do. Also, chaparral regenerates more successfully than forests where many trees can't reseed if fire destroys their cones.

HOW FIRE SUPPRESSION BACKFIRED

Starting in the early 1900s, Americans became very good at fighting fires. Using engines, bulldozers, and aircraft, officials extinguished blazes before they spread. The result: dense forests.

"You had all these branches and needles piling up on the forest floor," said Andrew Latimer, a professor in the Department of Plant Sciences. "Plus, young trees that would have been killed in small fires were able to grow. Forests have become more dense and filled with fuel."

That fuel is even more combustible as temperatures rise and snowpack melts. After years of drought, trees are suffering from lack of water and falling victim to bark beetles, native pests that feed on weakened pine and other trees.

"A healthy tree can fight off bark beetles," said Jens Stevens, a former Ph.D. student in Latimer's lab who recently completed a postdoctoral position in the UC Davis John Muir Institute of the Environment. "Water-stressed trees are much more vulnerable."

That adds up to millions of dead trees in forests filled with dry debris during fire seasons that stretch several months. No wonder California is experiencing more supersized fires.

WHAT CAN BE DONE?

UC Davis researchers work with the U.S. Forest Service and other fire officials to try and manage the extraordinary fire risk. One strategy is to "zone" the forest to maximize resources.

"There's a huge backlog of forest that needs thinning and not enough resources to get to it all," Latimer said. "The idea is to let remote areas burn more freely and focus on protecting homes and high-value groves like the giant sequoias."

Researchers also study a vexing issue with regeneration. Not all, but many species of conifers need help reseeding themselves when wildfires scorch huge numbers of trees and the cones where they store their seeds. Latimer's lab is testing how weather affects regeneration to determine if seedlings perform better in moist soil.

"If so, that could help the Forest Service prioritize when to reseed areas affected by wildfire," Latimer said.

Sometimes, forest officials don't have the time, money, or workforce to treat charred land. In 2013, the Forest Service didn't have the budget to reseed the 250,000 acres the Rim Fire burned in the Stanislaus National Forest.

"Now shrubs and grassland are growing where the forest used to be," said Schwartz, who predicts more changes to come.

"In the face of drought, disease and catastrophic fire, we'll see more upslope migration of forest," Schwartz said. "But forests will survive. Nature is resilient. Our goal is to help slow the pace of climate change and give ecosystems time to respond, realign, and adapt."

Professor Andrew Latimer, second from the left, and his former Ph.D. student Jens Stevens, left, visit the Angora Fire site near Lake Tahoe with members of the U.S. Forest Service. The team traveled to 12 sites in California in 2013 to study the effects of fuel treatments and forest fire.

The Nestbox Highway

Kristen Zumdahl and Evelien De Greef, recent graduates of the Wildlife, Fish and Conservation Biology major, prepare to evaluate tree swallows during banding and measurement of birds in the Putah Creek Nestbox Highway research project. It is one of the most comprehensive songbird nestbox studies in the western U.S. To watch a slideshow about this project visit **tinyurl.com/nestbox-ucdavis**.

GREGORY URQUIAGA/UC Davis

RESTORING BACK TO THE FUTURE

BY DIANE NELSON

Restoration ecologists fight weeds, restore water flow, plant vegetation, and build healthy soil to renew land that has been damaged by human activities—like logging, mining, and development—or overrun by invasive species. They generally plant native species, which have adapted to their local environment and are usually well suited to thrive into the future.

Elise Gornish, Cooperative Extension specialist, surveys a potential restoration site on a ranch in Hollister.

DEVII RAO/UC Davis

CLIMATE CHANGE raises an important question for restoration ecology: What's the best way to heal the land when its future environment won't look like its past?

"It's a huge issue," said Valerie Eviner, a restoration ecology professor in the Department of Plant Sciences. "We look at our changing climate and ask, 'What will grow? What's even possible?' Should we be looking at local native species or species native to areas farther south with climates more like what we anticipate?"

Restoration ecologists fight weeds, restore water flow, plant vegetation, and build healthy soil to renew land that has been damaged by human activities—like logging, mining, and development—or overrun by invasive species. They generally plant native species, which have adapted to their local environment and are usually well suited to thrive into the future.

But climate change is altering the equation.

"In many cases, seeds from local plants are no longer a match to their environment because their environment is changing so quickly," said Truman Young, restoration ecology professor with the Department of Plant Sciences.

There are no easy answers. It's hard to know what will survive or become invasive in an unpredictable future. Introducing species that are not locally native is highly controversial in a field focused on restoring natural ecosystems.

But a few things are certain: Restoration ecology can help mitigate climate change, in part because plants sequester carbon from the atmosphere. And UC Davis researchers are providing the science and support Californians need to protect biodiversity, manage rangeland and other working landscapes, and adapt to a changing world.

CAPTURING CARBON

UC Davis researchers recently helped David Lewis, director of Cooperative Extension in Marin County, measure the impact of planting willows, oaks, and shrubs along 25 miles of streams in Marin County. They discovered that the plants and sediment trapped by the vegetation contain 80,000 metric tons of sequestered carbon, an amount equal to emission from 62,000 passenger cars in one year.

"That's very big bang for the buck," said Eviner, who co-authored the study with Toby O'Geen, Cooperative Extension soil specialist in the Department of Land, Air, and Water Resources, and Ken Tate, professor and Cooperative Extension watershed specialist with the Department of Plant Sciences.

"Restoration benefits wildlife and water quality, and mitigates climate change," Eviner continued. "Since we've destroyed about 95 percent of our wetlands and riparian areas in California, restoring these ecosystems provide a lot of potential for carbon sequestration."

NO ONE SIZE FITS ALL

With restoration ecology, everything is site specific. What flourishes in one setting may suffer next door. So ecologists already test a wide range of plant species in different locations under various conditions over many years.

"What's different is we're looking at what they call a 'non-analog' climate, where the future environment won't look like the past," Young explained.

No one knows for certain what the future climate will bring, but scientists predict the weather will be extreme, and evidence suggests it is already happening.

"There will be more wild swings—longer droughts and more intense flooding," Eviner said. "So to help our ecosystems survive, we need plants that can survive the dry years and maximize water during the wet years."

For 10 years, Eviner's lab tested a variety of plants under manipulated conditions, simulating "normal" seasons along with drier and wetter growing seasons.

"The native, perennial grasses and native wildflowers did pretty well under those changing weather conditions," Eviner said. "But it's very uncertain which species have the resilience to cope with what's to come."

EXPANDING THE POOL

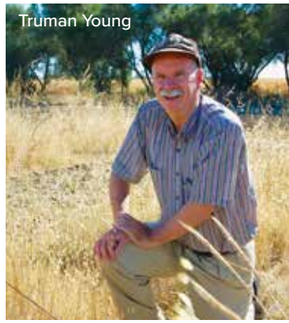
Elise Gornish, a Cooperative Extension specialist in restoration ecology with the Department of Plant Sciences, works closely with ranchers and other private-property owners to help find the right vegetation for goals like managing weeds, reducing soil erosion, and producing forage. She finds that native species are having a hard time coping with climate change.

"Strategies that worked in the past are no longer working," she said.

Gornish has begun small, controlled field tests with "non-local natives," varieties of species that are native to nearby, hotter regions. She is also producing a database of plants with traits like resilience to drought to analyze which plants could be good candidates for various restoration goals.

"I understand the risks of introducing non-local natives, and it needs to be studied very carefully," Gornish said. "But to my mind, the situation is so dire we need to consider unconventional approaches to restoration."

Valerie Eviner



Truman Young

Elise Gornish

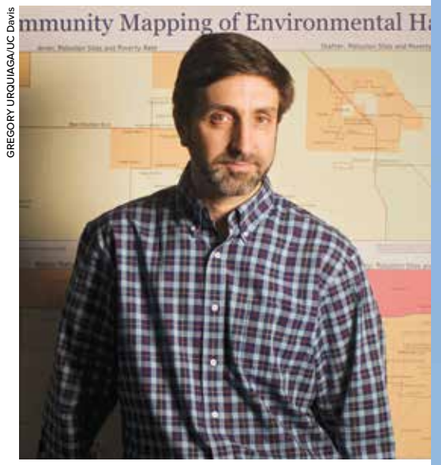
Putting Environmental Justice on the Map

MAPS TELL POWERFUL STORIES. At the UC Davis Center for Regional Change, Professor Jonathan London of the Department of Human Ecology uses maps to convey information about communities and environmental justice.

Environmental justice (EJ) refers to the distribution of environmental burdens, with EJ advocates seeking to ensure that communities of color and low-income communities don't bear the brunt of pollutants or other conditions that compromise the health of a region and its residents.

In a recently issued report, London and a team of researchers and community collaborators included maps to help tell the story of disadvantaged neighborhoods in the six-county capital area. "Our report is the first of its kind to put environmental justice issues in the Sacramento region on the map and to provide a blueprint for local leaders to begin addressing those issues," said London.

Through the use of computer mapping tools (ArcGIS by Esri), the report highlights the distribution of environmental burdens that include particulate matter in the air, drinking water contamination, hazardous waste cleanup sites, and vacant lots.



GREGORY URQUIAGA/UC Davis

Professor Jonathan London at the Center for Regional Change uses maps to analyze community issues.

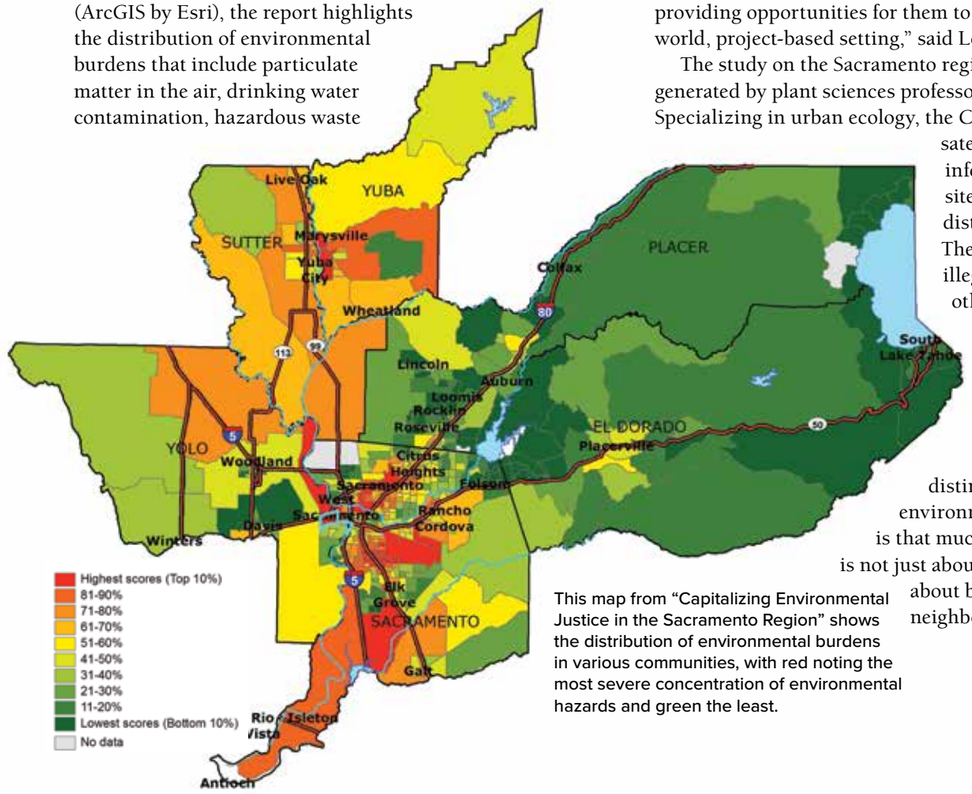
Community development students from UC Davis played a role in the early stages of the report. Graduate students enrolled in CRD 250—Professional Skills for Community Development taught by Professor David de la Peña—conducted interviews with regional leaders to explore key issues and did some of the initial mapping. Two recent community development graduates now working in their field also participated as neighborhood liaisons.

"A really important part of the community development master's program is teaching students research skills and providing opportunities for them to use these tools in a real-world, project-based setting," said London.

The study on the Sacramento region also includes maps generated by plant sciences professor Mary Cadenasso. Specializing in urban ecology, the Cadenasso lab combines satellite imagery with information gathered on site to map empty lots in distressed neighborhoods. The lots tend to harbor illegally dumped items and other unsafe materials, and they represent a lost opportunity for recreational space or job-generating businesses.

"A key feature distinguishing Sacramento's environmental justice movement is that much of the emphasis here is not just about stopping pollution, but about building vibrant, healthy neighborhoods," said London.

—Robin DeRieux



This map from "Capitalizing Environmental Justice in the Sacramento Region" shows the distribution of environmental burdens in various communities, with red noting the most severe concentration of environmental hazards and green the least.

Remote Sensing Pioneer

Sometimes the clearest view is the one from far away

WHEN PROFESSOR SUSAN USTIN wants to learn more about invasive aquatic plant species in the Sacramento–San Joaquin Delta, she studies the problem from afar.

A plant ecophysiologist, Ustin analyzes data captured by remote sensors. Her Center for Spatial Technologies and Remote Sensing (CSTARS) lab devises complex algorithms that help computers convert data from different spectral bands into colorful images, which identify what plants are growing in the Delta waterways, in what quantity, and how their distributions compare to previous years.

"The field of remote sensing has changed a lot over the past few decades, and Susan has been there from the ground up," said Professor Ben Houlton, one of Ustin's colleagues in the UC Davis Department of Land, Air and Water Resources. "She started developing the technology when virtually no one else was working on it. You really can't say enough about her impact."

Remote sensors encompass a suite of scientific instruments that scan the earth from satellites, airplanes, and drones. The sensors record reflected energy, and the data is converted into images. "When I first started doing this in the early 1980s, most of my colleagues thought of remote sensing as just pretty pictures," said Ustin, "not as real data."

Over the decades, environmental scientists have come to appreciate the applications of remote sensing. By making observations and taking measurements on a scale that can't be captured by the human eye, remote sensing helps researchers understand the climate system, the carbon cycle, changes in land-use, changes in water quality, and more. It can help scientists predict the impacts of drought and climate change on ecosystem services.

"I always thought that getting measurements across a whole landscape would be the best way to understand what was going on in the environment," said Ustin, who has tackled research on five continents using the technology she helped pioneer.

—Robin DeRieux

Professor Susan Ustin (right) and postdoctoral researcher Shruti Khanna demonstrate how to calibrate a field spectrometer, an instrument that helps investigators interpret the remote sensing data retrieved from satellites.

JASON SPYRES/UC Davis

BREEDING A BETTER "POPPER"

AN INGENIOUS GROUP of UC Davis students are proving you can create a jumbo, organic, jalapeño "popper," perfect for stuffing with rice, vegetables, protein, and cheese. For the last four years, the young scientists have been making crosses and developing a new variety of pepper with the taste and texture of a jalapeño, an extra-large cavity, and the right traits to thrive on organic farms.

What do you get when you cross a jalapeño pepper with a bell pepper?

"Many pepper varieties don't do well in organic farming systems because they weren't bred for those systems," said Ph.D. student Saarah Kuzay, current team leader of the project. "Our variety will be able to produce high-quality peppers with fewer inputs of things like fertilizers, pesticides, and water."

The popper project began in 2012 when Ph.D. student Jorge Berny wondered if a new breed of pepper could solve issues farmers faced with sun damage, yield, and size.

"The jalapeño peppers growing at the UC Davis Student Farm were supposedly large enough for poppers, but they weren't really that big," said Berny, who studies bean genetics with Professor Paul Gepts. "The idea was to start a small breeding program that would give students hands-on experience in field breeding, as well as develop cultivars adapted to low-input organic production."

The first generation of the bell-and-jalapeño offspring looked a bit strange—lots of pointy-topped bell peppers. The second generation looked very different from each other. Some resembled bell peppers; others looked more like jalapeños. Each year, more students joined the effort and helped make crosses with the peppers they liked best in terms of size, shape, texture, taste, and production.

"It could be another three years before we have a cultivar ready for release," said Kuzay, who studies wheat genetics with Professor Jorge Dubcovsky. "But we're getting there."

The student-run project has become a model for other programs. UC Davis received a $1 million USDA grant to help fund the pepper project along with two new student-led organic breeding efforts with tomatoes and beans. The students produced a short film, "How to Breed Plants, as Told by Students," which illustrates the science and purpose of plant breeding. You can find it at *plantbreeding.ucdavis.edu/news/whatisplantbreeding*.

"It's interesting to watch the peppers develop, year after year," Kuzay said. "It shows that students and farmers alike, not just seed companies, can develop new varieties to suit their needs."

—Diane Nelson

JASON SPYRES/UC Davis

Professor Charlie Brummer, director of the UC Davis Plant Breeding Center, and students Randi Jimenez, Saarah Kuzay, and Mengyuan Xiao, study a new breed of pepper growing in the UC Davis Student Farm.

Call her River

"RIVER" is the name that schoolchildren call Joni Gore when she visits as a classroom volunteer to teach kids to be good stewards of the environment.

A senior from San Mateo, Gore is a hydrology major who is deep into rivers. She interns in the laboratory of Professor Gregory Pasternack, a watershed hydrologist. The Pasternack lab conducts research to help restore rivers and improve the health of altered freshwater ecosystems.

Gore is working on a project to analyze a stretch of the Yuba River in the Sierra Nevada watershed. She uses the mapping program ArcGIS to categorize river characteristics, called geomorphic units, at different flows. Finding a pattern in how rapids, riffles, pools, and other river features are altered by changes in water flow helps researchers predict the impact of water management on river ecology.

Why hydrology?
I applied to Davis as an environmental science and management major. During freshman orientation, a hydrology professor came and spoke to us. The field sounded very interesting and more math-based. So I decided to change to hydrology because it required more hard-science skills.

Why rivers?
Once I opened my eyes to rivers, I was just so fascinated by how they function. I didn't realize how important they were—not only to the natural world, but to humans as well. People have always lived near rivers and really rely on them. Once I started to understand this, I realized rivers were a very useful thing to study.

Why whitewater rafting?
I took whitewater rafting guide training through Outdoor Adventures my sophomore year. Since then I've been a whitewater river guide on weekends, and I get to share my love of nature with people who have a really great time. Not only do I study rivers, but I also get to play in them on the weekends.

—Robin DeRieux

MEGAN DEGELSMITH/UC Davis

Supporting clean grapevines

Foundation Plant Services receives gift to create endowed chair

YOU NEED EXCELLENT GRAPES to make world-class wine.

John Dyson, owner of Williams Selyem Winery, lives by that principal.

"Our motto has always been to make the best wine from the best grapes from the best growers," said Dyson, who along with his wife, Kathe, owns the winery in Healdsburg, California. "Growers need virus-free grapevines to produce the best grapes from healthy vines."

KARL KRIST/UC Davis

Deborah Golino, John Dyson and Helene Dillard gather at Foundation Plant Services.

Scientists at UC Davis Foundation Plant Services have been distributing virus-tested, professionally identified grapevine, fruit, and nut-tree propagation stock to horticultural nurseries since 1958. In his ongoing commitment to agricultural stewardship and clean grapevine materials, Dyson has given $500,000 to help create an endowed chair for Foundation Plant Services.

"I am giving this gift to honor the deanship of my friend, Helene Dillard, and to recognize Deborah Golino, director of Foundation Plant Services, who has taken on a challenging position and has instituted rigorous science to give wineries clean vines," Dyson said.

A New York native, Dyson worked closely with Dean Dillard when she was director of Cooperative Extension and a plant pathology professor at Cornell University, where she worked until coming to UC Davis in 2014. Dyson's relationship with Foundation Plant Services dates back to 1982 when he purchased cuttings for "a nickel apiece" to plant his first vineyards. Since then, Dyson has relied on scientists like Golino to provide healthy, virus-free planting material and to help tackle grower challenges, such as plant and soil disease.

Dyson's gift is the first toward a larger $1.5 million campaign. Ultimately, the endowed chair will serve as director of Foundation Plant Services and become faculty in the Department of Plant Pathology.

"This is an incredible investment in our program," Golino said. "An endowed chair will ensure UC Davis will always be able to recruit a

"Our motto has always been to make the best wine from the best grapes from the best growers."

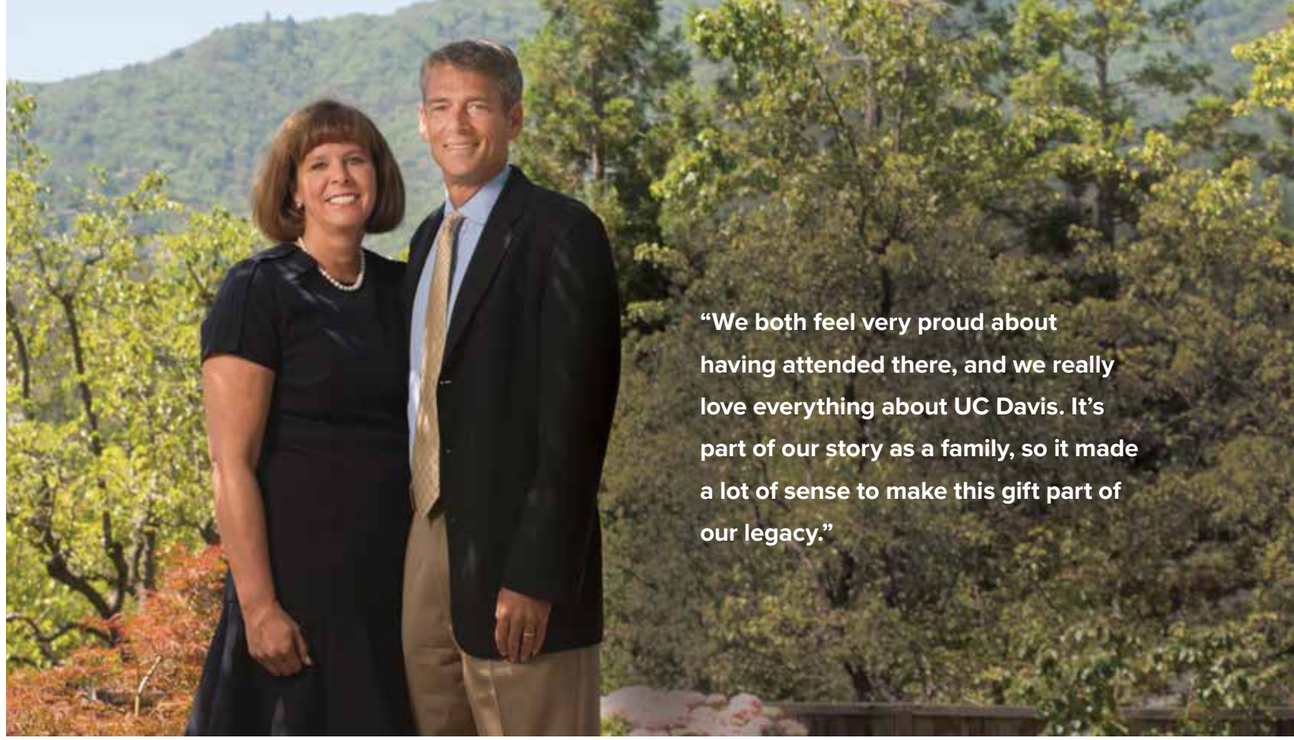
top scientist to lead Foundation Plant Services and continue to provide exceptional plant materials to the grape, fruit and nut-tree, rose, strawberry, and other industries that rely on us."

For more information about making a gift to the endowed chair, contact Christine Schmidt, assistant dean of college advancement, at *cmschmidt@ucdavis.edu*.

—Diane Nelson

KARL KRIST/UC Davis

John Dyson tours facilities at Foundation Plant Services.



GREGORY URQUIAGA/UC Davis

Endowing Excellence

Hurlston presidential chair will support faculty who inspire students

UC DAVIS ALUMNI JOELLE AND MICHAEL HURLSTON understand the power of partnerships. The couple has pledged $1.5 million to establish a first-of-its-kind, endowed chair position that will rotate between the three colleges and schools where the Hurlstons earned their degrees—the Graduate School of Management, the College of Agricultural and Environmental Sciences (Department of Environmental Science and Policy), and the College of Engineering.

"Since my husband and I are both graduates of UC Davis, it didn't seem fair to support only one program," said Joelle, who majored in environmental policy analysis and planning (B.S. '89). Michael Hurlston earned a B.S. and M.S. in electrical engineering at UC Davis and completed an M.B.A. with the Graduate School of Management in 1990.

The Michael and Joelle Hurlston Presidential Chair will be used to recruit or retain outstanding faculty. Faculty named to the chair can use the funds to support teaching, research, graduate fellowships, and outreach in their department. After five years, the chair will rotate to a different recipient.

In 1989, Joelle Hurlston was one of only eight students who graduated in environmental policy analysis and planning. "The environmental program was established, but still very small when I was a student," said Joelle. "The professors knew your name and were free with their time."

Her advisor, Professor Sy Schwartz, was surprised when Joelle decided to enter environmental consulting after graduation rather than work with a government agency because she had done a lengthy internship with the U.S. Geological Survey as a student. While all of her classmates took government jobs, Joelle left California for work with a firm in Boston. After a year, she ended up in Silicon Valley developing health and safety programs and hazardous materials management protocols. She now works part time as a hazardous materials consultant, where her assignments include inspecting new facilities at Silicon Valley manufacturing companies.

Michael Hurlston has made a successful career, first as an electrical engineer and then as a business leader at Broadcom, a worldwide semiconductor company headquartered in the Silicon Valley.

"Joelle and I share UC Davis in common," said Michael. "We both feel very proud about having attended there, and we really love everything about UC Davis. It's part of our story as a family, so it made a lot of sense to make this gift part of our legacy."

—Robin DeRieux

Courtesy of LA Metro

Alumna Therese McMillan (center), once a top transportation official in the Obama administration, visits with representatives of the Federal Transit Administration and the Los Angeles County Metropolitan Transportation Authority. She is now the chief transportation planning officer for Los Angeles.

ON TRACK

Therese McMillan leads LA's transportation planning renaissance

EARLIER THIS YEAR THERESE (WATKINS) MCMILLAN ('81 environmental planning and management) accepted what may be her most challenging assignment yet: chief planning officer for the Los Angeles County Metropolitan Transportation Authority.

"Yes, we have lots of cars in LA," she said. "But we can and do envision a future with real, viable options for moving to and through the huge, diverse, and dynamic county that is again my home."

McMillan is no stranger to LA transportation, and she recalls riding the bus there as a child with her grandma and great auntie. "Like any good Angelino, I prided myself in being able to get anywhere in the city without having to take a freeway."

McMillan comes well prepared for her new job. It was during her senior year at UC Davis that an internship with the California Transportation Commission cemented her passion for transportation policy—and a long career in public service. She went on to graduate school at UC Berkeley and became the first student to complete its dual degree program in transportation, receiving master's degrees in city planning and civil engineering.

She spent the next 25 years with the San Francisco Bay Area's Metropolitan Transportation Commission, working on critically important long-range plans. "She brought to her work an understanding of community and environmental issues that had been lacking before she got involved," said UC Berkeley Professor Emerita Elizabeth Deakin. "She worked tirelessly to engage the many interest groups whose lives and livelihoods would be affected by the plans and to find feasible and equitable solutions to the problems they brought to the table."

"She brought to her work an understanding of community and environmental issues."

In 2009, President Obama appointed McMillan deputy administrator of the Federal Transit Administration (FTA). She later served as acting administrator. The agency provides funding and regulatory guidance to transportation systems in rural, suburban, and urban areas throughout the country. McMillan led reforms in transit safety, emergency response, and resiliency investment.

She also learned about the sad state of the nation's bridges, roads, and other transportation facilities. "There is a huge and chronic lack of investment in this country in every sector of public infrastructure," she said. "The estimated 'deferred state of good repair,' as defined by FTA, tops $8 billion for public transportation."

McMillan hadn't lived in Los Angeles for 30 years, but from what she's observed since she moved back, she believes public transit is on the right track. "It validates my belief that with good planning and smart investments, we can really turn around what many folks think of as 'the car capital of the world.' That's really exciting."

—John Stumbos

CA&ES AWARD RECIPIENT
Therese McMillan will be awarded a CA&ES Award of Distinction at College Celebration on Oct. 14. See page 3 for more information about College Celebration.

LESLIE ROCHE/UC Davis

Rustici Tour

Aspen trees are an important part of many mountainous areas in the western United States, providing ecological services such as biodiversity, forage, and conservation of soil moisture. However, aspen stands are in decline because of changing fire regimes and excessive grazing pressure. During a summer 2016 tour of the Warner Mountains in northeastern California, ranchers, public land permittees, agency personnel, and others learned about aspen restoration, management, and monitoring efforts, as well as other rangeland issues. The tour was made possible by the Russell Rustici endowment. Learn more about the tour and related work at the UC Rangelands website: **rangelands.ucdavis.edu**.

UCDAVIS
COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

University of California, Davis
One Shields Avenue
Davis, CA 95616-8571
#986H

Non-Profit Org
US Postage
PAID
Davis, CA
Permit No. 3

KARIN HIGGINS/UC Davis

Because of you,

UC Davis had its most successful fundraising year in history, and we are grateful for your generosity.

Your gift to the college can help us transform our labs and facilities into state-of-the-art learning spaces and our students into practitioners and academics, while enhancing the ability of our world-class researchers to make the world a better place.

Join us and help transform the College of Agricultural and Environmental Sciences with a gift today.

caes.ucdavis.edu/giving