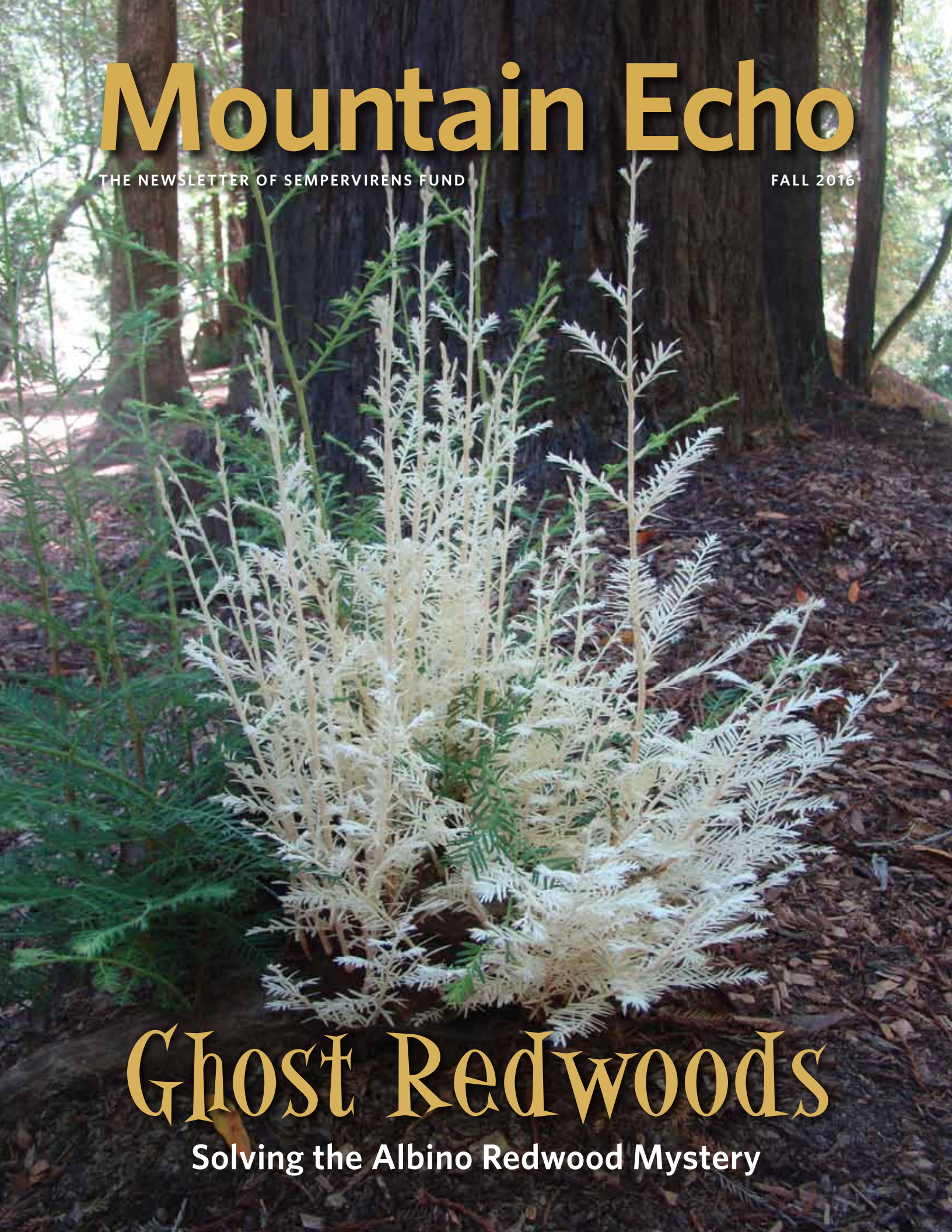
Mountain Echo

THE NEWSLETTER OF SEMPERVIRENS FUND

FALL 2016



Ghost Redwoods

Solving the Albino Redwood Mystery

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LETTER FROM THE EXECUTIVE DIRECTOR

New Opportunities and Approaches


SVF

In this Mountain Echo, we present a diverse sample of Sempervirens Fund's current projects. This work ranges across our efforts to persuade President Barack Obama to establish a new national monument to provide permanent federal protection to important habitat along California's coast; create a modern, new, inviting park entrance for Castle Rock State Park; organize volunteer restoration events to bring back more native plants in the Santa Cruz Mountains; and expose high school kids from underserved communities to redwood forests they might otherwise never visit. In addition, we fund scientific research that will help us better understand what redwood forests need to not only survive, but thrive.

Some of this work may seem very different from the efforts we have traditionally undertaken over the last 116 years — namely the acquisition of lands important to the preservation of California's extraordinary redwood forests. To be sure, we still acquire lands and purchase easements to protect and connect important redwood groves and their surrounding ecosystem. As our current projects demonstrate, however, we are also embracing new opportunities and approaches to further our mission.

In the course of our organization's history, the world has changed considerably. Now, some of the most significant threats to the Santa Cruz Mountains redwoods come from climate change and habitat fragmentation caused by development pressure. These threats require a very different response than the prior dominant threat — excessive logging. The size and make-up of the communities that impact our redwood forests have also changed considerably, even in the last decade.

I am proud that Sempervirens Fund's response has been the nimble pursuit of innovative means for responding to these changing conditions. So, while our mission remains unchanged (it is as important and compelling as ever), we will continue to seek new and ever more effective means of delivering on that mission. By combining the gravitas that comes from over a century of experience with the pioneering and bold mindset of a start-up, we are ready with responses that ensure redwoods remain protected in today's complex and fast-paced world.

Last, but definitely not least, we want to thank Fred Keeley for his great leadership and dedication during his two-year term as our Board President, and we are pleased to announce Jacqueline Wender as his successor. Learn about Jacqueline's deep personal connections to our organization and the redwoods on page five.

Sincerely,

Sara Barth

Sara Barth, Executive Director

Audrey Moore

Ghost Redwoods

Solving the Albino Redwood Mystery

By Zane Moore

Dale Holderman, a Big Creek Lumber forester, discovered an albino redwood in Soquel that produced pollen after the 1976 drought. He decided to cross-pollinate green cones and the results astonished him. Some were green, others white, but some were variegated half-and-half — the first known chimeric redwoods.

Zane Moore

Cross section of La Honda white (top) and green (bottom) needle cell structure under a light microscope using a toluidine blue stain.

Coast redwoods are the pinnacle of tree species in regards to height, volume and biomass. They're masters at removing carbon from the atmosphere and adding it to their massive trunks. Like huge solar panels, a large redwood tree has enough needles to cover over an acre, sometimes over two and a half, and is the fastest growing plant on the planet, with large trees adding around 1,500 pounds of wood every year. Their efficiency at capturing sunlight is unmatched.

Sometimes, however, redwoods produce branches or sprouts that are entirely white. These sprouts cannot photosynthesize, stifling a redwood's photosynthetic efficiency, because they have little to no chlorophyll (the pigment that gives foliage its green hue). They are called "albino redwoods" because of their lack of pigmentation and ghostly white appearance. They vary in size from a few inches to a few dozen feet in height. Researchers know of about 390 of these albinos world-wide.

The first display of an albino branch was at the California Academy of Sciences August 1866 meeting. Those present noted that "no explanation or theory was offered to account for this curious, abnormal blanching of the foliage of a single species…not having been noticed…in any other species than the redwood."

The first scientist who attempted to solve the mystery was George James Peirce, a plant physiologist from Stanford University. In 1898, he studied albino sprouts growing in the Santa Cruz Mountains near La Honda and Gilroy and determined that the needle anatomy and chemistry were slightly different from adjacent green tissues. Peirce also showed that the albino sprouts could not survive or be propagated on their own.

Fast forward to the early 1960s, when Rudolf Becking, a Humboldt State University forestry professor, started working with albino redwoods. He conducted grafting experiments, attaching white

When the white foliage did not turn green, even after a few years, his experiments proved that albino redwoods are not a physiological phenomenon but rather a genetic one.

branches to green rootstock and attaching green branches to albino rootstock, to see if the chlorophyll would travel from green shoot to white shoot. When the white foliage did not turn green, even after a few years, his experiments proved that albino redwoods are not a physiological phenomenon but rather a genetic one.

Studies of chimeric redwoods offer further understanding. A chimera is an organism that has two different genotypes—two sets of DNA—in one. In redwoods they occur with variegated foliage, half green and half white. Arborist Tom Stapleton first discovered a naturally occurring chimeric redwood in 1996. "Chimeras are basically like two trees in one," Stapleton explains. Green tissues act as surrogates to the white ones, gathering the sun's energy and sharing it with the white tissues. Redwoods are so efficient at photosynthesis that a green branch can provide enough food for a white one over five times its size.

Hexa-what?!

Did you know that coast redwoods are the most genetically diverse conifers? Redwoods are **hexaploid,** meaning they have six sets of DNA, whereas most organisms are diploid with only two sets. This allows redwoods to store a wide variety of genetic information, increasing adaptability, likely a significant factor in their great longevity. Albino redwoods are an example of the redwood's vast genetic diversity.

So why do green redwoods keep these albino sprouts and trees alive and flourishing even though they are a drain on resources?

Remember Peirce's tissue comparison study? In 2013, I expanded upon his experiment, both with the La Honda albino redwoods that were the focus of his experiment and trees from Santa Cruz and Sonoma counties. I tested the chemical compositions of the foliage and found that green needles were at the threshold of heavy metal toxicity (basically the equivalent of lead poisoning in humans). Adjacent white leaves, however, had more than double the toxic concentrations of the green leaves and were able to survive. In other words, the green leaves were at the point of dying, but the albino leaves sequestered and removed toxins saving the green leaves from a toxic demise.

Albino redwoods are nature's beautiful toxic waste dumps. While there still isn't a definitive cause to what initiates these mutations, research has found that there is a high proportion of albino redwoods in areas of high UV light exposure and increased human activity. Albino redwoods are a sign of amazing adaptability.

Often called "ghosts of the forest" due to their ghostly hue, albino redwoods literally cling to life—eternally ephemeral—sacrificing themselves for the good of the other trees around them in their endless struggle for existence.

Discover more about these mysterious "ghosts" and where you can visit them here: www.sempervirens.org/ghosts

Zane Moore is a Plant Biology Ph.D. student at U.C. Davis studying mutations in plant cells. He received his B.S. in Botany from Colorado State University. Zane is a California State Parks docent and researcher at Big Basin Redwoods State Park, where he discovered the tallest redwood on earth south of San Francisco (the location is a secret).

Audrey Moore

Mélanie Galand/Hilltromper

New board president Jacqueline Wender has drawn solace and inspiration from the redwoods for decades.

The Heart and Science of the Wender Group Grove

All members past, present and future

The first time Jacqueline Wender planted a memorial redwood tree, it was the late 1970s. A fellow student at Stanford had just died of cancer, and when a family friend suggested memorializing him with a redwood tree planted by Sempervirens Fund, a light went on.

"The idea that you are creating a lasting, long-living tribute to someone is tremendously comforting and satisfying," says Jacqueline, who took the helm as president of Sempervirens Fund's Board of Directors in July. "This is a memorial that's full of life and hope."

During a distinguished career in administration at Stanford and Santa Clara universities, Jacqueline led efforts to dedicate many more redwoods for friends and family members through Sempervirens Fund. In 2002, graduate students from her husband Dr. Paul Wender's chemistry research group at Stanford approached Jacqueline for holiday gift ideas for their mentor. Redwood inspiration struck again.

Mélanie Galand/Hilltromper

Dr. Paul Wender with students in the Wender Group lab at Stanford.

One of the Wender Group's landmark achievements has been the successful laboratory synthesis of taxol, a potent cancer-fighting compound found in the bark of the Pacific yew tree. Taxol's success in treating breast and ovarian cancer was unprecedented, but an entire 75-year-old tree had to be sacrificed to treat a single patient. Taxol is now obtained through semi-synthesis using a compound obtained by pruning a different, and renewable, yew tree source.

"In my mind there was this immediate connection between Paul's work and the preservation of trees," says Jacqueline. When she suggested dedicating a Wender Group Grove, the students agreed it was the perfect tribute.

In June the research group hiked to the Wender Group Grove in Castle Rock State Park for a picnic under the stately redwoods. Speaking to his students, Dr. Wender put things in perspective. "3.8 billion years of chemical evolution on Earth has created this laboratory that we have a lot to learn from," he said, gesturing up at the towering trees around him, "and it's just nice to be part of it."

Watch the inspiring video about the Wender Group Grove on our website: www.sempervirens.org/wender

Leave Your Forever Legacy

Celebrate your friends or family by dedicating a redwood tree or grove.

Learn more at www.sempervirens.org/dedicate or contact Amanda Krauss: (650) 949-1453 x204, akrauss@sempervirens.org

Scott Peden

At the June celebration in the Wender Group Grove.

PROJECT HIGHLIGHT

Volunteer Restoration Events

Sempervirens Fund ramped up its efforts to restore the native forests it protects throughout the Santa Cruz Mountains, hosting a number of successful volunteer events this year. Dedicated groups of volunteers pulled non-native weeds from San Vicente Redwoods, Lompico Headwaters Forest and the Whalen property, the future site of the new Robert C. Kirkwood Entrance to Castle Rock State Park. This spring alone, over 45 volunteers spent 150 hours removing debris and eliminating invasive species. This work allows supporters to connect with land they helped protect and to play an ongoing role in preserving these vital ecosystems. If you'd like to get involved with upcoming restoration workdays, please contact Stewardship Associate Ian Rowbotham: (650) 949-1453 x208 or irowbotham@sempervirens.org

Lance Millbrand

Earth Day volunteers remove invasive French broom.

SVF

Google volunteers at a collaborative event with HandsOn Bay Area, State Parks, and Portola and Castle Rock Foundation.

PROJECT HIGHLIGHT

Dan Quinn

A New National Monument on the Horizon

Our Campaign for Cotoni-Coast Dairies National Monument is focused and fast moving. With the help of our Campaign manager, partners and volunteers we have gathered the support of more than 15,000 local residents, visitors, business leaders, city governments and elected representatives. We also are working in Washington D.C. to ensure that Campaign sponsors, including Representative Anna Eshoo and Senators Barbara Boxer and Dianne Feinstein, continue to gather allies at the national level. With this strong chorus of local, state and national supporters, we are optimistic that President Obama will sign the California Coastal National Monument Expansion Act before he leaves office. This will establish the Cotoni-Coast Dairies National Monument and provide a new and permanent layer of federal protection for the 5,800-acre Coast Dairies property, a coastal gateway to the Santa Cruz Mountain redwoods. If you haven't already signed the petition to show your support, please do so now! Visit www.sempervirens.org/ccdnm

Illustrations by Callander Associates

Robert C. Kirkwood, Jr. (1909–1964) was a Bay Area attorney, rancher, philanthropist, member of the State Assembly and State Controller. His family made the lead gift to purchase land that will become Castle Rock's new entrance dedicated to his legacy.

The Kirkwood Connection to Castle Rock

New Park Entrance Honors a Family's Legacy

When the ribbon is cut at the new Robert C. Kirkwood Entrance to Castle Rock State Park, it will be the culmination of a dream for the Kirkwood family. The Kirkwood's connection to Castle Rock dates to the 1940s, when Robert C. Kirkwood, Jr. — along with farmer and business partner Emmett Whalen — acquired Partridge Ranch, a beautiful apple and pear ranch located off Hwy. 35 adjacent to the land that would later become Castle Rock State Park. Just a short drive "up the hill" from the family home in Saratoga, Kirkwood, his wife Jean and their four children spent many happy hours at the ranch, hiking and climbing on the spectacular tafoni rock formations for which the adjacent Castle Rock State Park is named. Kirkwood's eldest son, Bob, worked harvests at the ranch and was often given the challenging (and slightly dangerous) task of collecting fruit from trees in steep gullies accessible only with a surplus Army Jeep. It was a wonderful, formative time that shaped the family's deep connection to the landscape.

Years later, Kirkwood and Whalen sold their interest in Partridge Ranch and the fruit trees were replaced by various evergreen species as the ranch became a commercial Christmas tree farm. In 1981, the State of California purchased the ranch, adding 246 acres to the State Park. Then in 2010, through a collaborative arrangement with POST and the Kirkwood Family Fund, Sempervirens Fund purchased 33 acres of the Castle Rock Christmas tree farm. The vision was that a modern, user-friendly entrance would be created there to enhance public access and enjoyment of the park — something that Bob Kirkwood and his mother believed to be an ideal tribute to Robert's service to the people of Santa Clara County and the state of California. The Kirkwood Family's lead gift of $1.5 million kick-started the campaign to build Castle Rock State Park's new entrance complex.

Bob Kirkwood and his wife, Edie, were present for the groundbreaking ceremony at the entrance site on May 14, 2016. Bob remarked, "We enjoyed this area so much as kids that we want future generations to enjoy it as we did. The improvements that Sempervirens Fund will be making — the trails, the amphitheater, the picnic areas and so forth — will make that possible. That's why we're here."

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History in the Making

Students in the Redwoods

Despite the fact that the Santa Cruz Mountains redwoods are just a bus ride from Silicon Valley, many youth have never spent time in a redwood forest. Each year we invite underserved youth for a day of science and fun in the redwoods. This spring we sponsored a trip for 45 students to Big Basin Redwoods State Park. Our goal is to encourage new roots and lasting connections between local youth and our local redwoods — the kind of connections that make history.

(top) Andrew Hill High School 2016 Big Basin Fieldtrip at the Auto Tree.
(bottom) Sempervirens Club Founders in front of the same tree, circa 1900.

Mike Kahn/SVF

Andrew P. Hill/SVF

Mike Kahn/SVF

Saving Historic Photos

With the help of professional archivist Lori Lindberg, Sempervirens Fund volunteer historian Scott Peden and others, we are digitizing hundreds of historic film and glass plate negatives for educational and archival purposes.

At left, Lori and Scott check the quality of a F. Roy Fulmer photo taken circa 1925 at Big Trees Park, which is now part of Henry Cowell Redwoods State Park.

Front cover: Albino redwood "ghost" photo by Zane Moore.