

REDWOODS

The Magazine of Save the Redwoods League

Spring | Summer 2019

Redwood Forests' Climate-Change Resilience

Scientists Share New Insight

Community Voices

*Can Redwoods Survive
a Hotter Planet?*

Grove of Titans

*Heroes Unite to Protect
Superhero Trees*

Protecting Forests and Communities

*New Grants Support
Wildfire, Carbon Projects*

CLIMATE CHANGE EDITION

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Since 1918, Save the Redwoods League has protected and restored redwood forests and connected people with their peace and beauty so these wonders of the natural world flourish. Your donations help us purchase redwood forests and the surrounding lands needed to nurture them; regenerate logged forests so they become spectacular havens for future generations; study how to best protect and restore these global treasures; and introduce people to these magical places.

CLIMATE CHANGE EDITION

Save The Redwoods

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VISIT

Introduce your friends and family to more than 100 coast redwood and giant sequoia parks by using our new trip-planning tool.

[ExploreRedwoods.org](https://www.exploreRedwoods.org)

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Contributor photos: deSilva by Paolo Vescia; Forster by Forster; Hertsgaard by Francesca Vektor; Shive by Paolo Vescia; Silllett by Paolo Vescia; Stephens by Richard Cue; Machado by Fig & Olive Photography. This page, Max Forster.

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Writer Amanda Machado recounts how visiting the redwoods with her family and friends made the outdoors feel culturally like home.

LETTERS TO THE EDITOR



Voting for Redwoods

I really liked reading about the current legislation so I can vote for things that support our environment – I trust Save the Redwoods to endorse sound environmental policy. I also like seeing maps of new land that is preserved, and the vacation ideas make me want to head up there.

—Shawna Brynjegard-Bialik

Learning How to Protect Forests

All the articles in the issue are amazing. The magazine does a terrific job at describing issues that redwoods face and what we as citizens can do to help protect such beautiful and vital species of trees.

—Marcos Cervantes

COVER Fog, an important water source, envelops coast redwoods. Fog frequency has changed in recent decades with climate change. Learn more about redwoods and climate change in this special edition.

Photos Stir Fond Memories

The photos were awe-inspiring. Perhaps you could publish photo journeys of some of the hikes you have highlighted. I live in Pennsylvania and had the chance to be absorbed in the wonders of the sequoia and redwood forest a few years back. The magazine brought back those memories and appreciation of our local forests in the Pennsylvania wilds.

—Steve Skok

Correction

The map area on page 9 of our 2018 edition was misplaced. The map area square should have been positioned farther north.

CONTRIBUTORS

Top row, from left

Shelana deSilva is the League's Director of Government Affairs and Public Funding. She has a strong record of helping national and statewide nonprofits lead campaigns and secure public funding.

Max Forster is a coast redwood enthusiast and photographer based in Humboldt County, California. His work has been published by *American Forests* and various online outlets.

Mark Hertsgaard is the environment correspondent for *The Nation* magazine and the author of seven books that have been translated into 17 languages, including *Earth Odyssey* and *HOT*.



Middle row, from left

Kristen Shive, PhD, joined the League as the organization's Senior Scientist in 2018, bringing decades of experience in fire management and ecological research in national parks, including Yosemite.

Professor Stephen C. Sillett, PhD, is the Kenneth L. Fisher Chair of Redwood Forest Ecology in the College of Natural Resources & Sciences at Humboldt State University.

Scott Stephens, PhD, is a professor at the University of California, Berkeley, who studies fire ecology; forest ecology, policy, and management; and how climate change will affect fire.

Bottom row, from left

Amanda Machado is a writer and facilitator whose work has been published in *The Atlantic*, *The Washington Post*, *Harper's Bazaar*, *Outside*, and other outlets.

Glen Martin was an environmental reporter for the *San Francisco Chronicle* for many years, and has contributed to more than 50 magazines, including *Discover*, *Audubon*, *Forbes*, and *Outside*.

Dana Poblete is a Los Angeles-based writer who covers sustainable lifestyles and natural history for publications including *Condé Nast Traveler* and *Audubon*.





Dear Save the Redwoods League Friends,

Welcome to this edition of *Redwoods*, featuring insights from leading scientists on redwoods and climate change.

In a world increasingly defined by the deterioration of global natural treasures — receding glaciers, dammed and dying rivers, unprecedented rates of species extinction — Save the Redwoods League has a story of hope and resilience to tell. The League's Redwoods and Climate Change Initiative (RCCI) has led to incredible discoveries in California's old-growth coast redwood and giant sequoia forests over the last decade. We have learned that because of ancient redwoods' extraordinary growth rate and life span, immense size, and singular resistance to decay, they store more carbon per acre than any other forest type in the world. That is worth writing again. The California forest whose fate is in our hands is the best in the world at storing carbon — by a long shot. As such, the redwoods are a tremendous resource in mitigating climate change and building resilience into our ecosystems. But most of the coast redwood forest that remains today — 93 percent of the range — is young and recovering from decades of logging. So we are now studying second-growth forests, the landscape of young redwood trees growing back after commercial harvesting, the young redwood forests that now dominate the Northern California coast.

In terms of carbon storage, we know old-growth coast redwood and giant sequoia forests are first and second on the global list. Remarkable early RCCI results show that the largest second-growth forest we've studied has recaptured about 25 percent of the biomass — and therefore carbon storage — of the world record-holder for biomass, the forest of Jedediah Smith Redwoods State Park. Redwood biomass includes a high component of decay-resistant heartwood, which means it's more likely to hold onto carbon longer than other tree wood can. These discoveries should dramatically change how we think about and steward these forests.

As we learn how second-growth redwood forests are among the extraordinary performers in helping to reduce greenhouse gases, we are starting work to accelerate their recovery, and we are renewing our investment in their restoration. Together, we can set in motion the restoration of the world's superlative forests, and regenerate the redwood ecosystem that will sustain and inspire future generations. And in so doing, we have an extraordinary opportunity to leave the world better than we found it.

Sam Hodder
President and Chief Executive Officer
Save the Redwoods League

Read Sam's blog at
[SaveTheRedwoods.org/SamsBlog](https://www.savetheredwoods.org/SamsBlog)

Connect with Sam on Twitter
[@SamH4Redwoods](https://twitter.com/SamH4Redwoods)

Photos: top, Paolo Vesecia; right, Jon Parmentier.





LEAGUE PROJECT UPDATES *IN BRIEF*



SAN VICENTE REDWOODS



In San Vicente Redwoods this year, logs were placed in San Vicente Creek to restore pools for endangered coho salmon and threatened steelhead trout.

RIGHT San Vicente Redwoods is so vast that wide-ranging mountain lions have established several nurseries here. A remote camera took this photograph of one of the big cats on the property. Researchers are studying the elusive predators here and elsewhere in the Santa Cruz Mountains.

SAN VICENTE REDWOODS

WHAT

The project to conserve San Vicente Redwoods is pivotal because it includes various land uses in designated parts of the property. Since 2011, the League and partners have protected the forest's old redwoods, endangered wildlife, and clean drinking water, while restoring the historically logged areas, working to open the forest to public recreation, and allowing sustainable harvesting of young trees.

TRAIL

An initial trail segment is expected to open in 2021.

LEARN MORE

[SaveTheRedwoods.org/svr](https://www.savetheredwoods.org/svr)

Multiuse Forest of the Future

Public Access Plans, Restoration Move Forward at San Vicente Redwoods

In just two more years, another awe-inspiring redwood forest will open to the public — San Vicente Redwoods west of Santa Cruz. Hugging its namesake — the gurgling San Vicente Creek — this 8,532-acre protected area is the largest privately held property between Silicon Valley and the Pacific Ocean. Save the Redwoods League holds a conservation easement on the property, which was purchased from commercial owners by Peninsula Open Space Trust and Sempervirens Fund in 2011. The easement permanently protects San Vicente Redwoods from subdivision and development, while allowing sustainable timber harvesting on portions of the property, as well as public access, restoration work, and scientific research. The League directs restoration projects, monitors timber harvests, and ensures protection of features such as old-growth redwoods. Save the Redwoods also works with partners to repair roads and provide public access.

Restoration activities have proceeded apace. Phase one of the Deadman Gulch project has been completed, which entailed thinning 110 acres of young, overcrowded forest — a consequence of past clear-cutting. “The forest responds really positively to thinning,” said Anthony Castaños, the League’s Land Stewardship Manager. “This work gives bigger trees the room and resources to reach their potential as grand, old-growth forests, and it also helps reduce the risk of severe wildfire by eliminating excess fuels.”

Progress with the San Vicente restoration owes much to local community involvement. The Amah Mutsun Tribal Band participated in the partners’ recent prescribed burn, and volunteers have assisted in invasive plant removal.

In addition, scientists are studying San Vicente, including Chris Wilmers of the University of California, Santa Cruz, who has been researching mountain lions.

The Public Access Plan for the forest is a grand vision for hiking, equestrian, and mountain biking trails. Land Trust of Santa Cruz County has been leading community conversations to hear feedback on public use, safety, outdoor education, and involvement of youths. Groundbreaking for phase one is expected in 2020, and the initial trail segment is expected to open in 2021.

Through these multiple uses, San Vicente Redwoods will meet ecological, social, and economic needs, advancing shared goals on a single property that serves people and wildlife of the region. 🌿

—Ben Young Landis



Photos: this page, POST and Sempervirens Fund; opposite page, Nadia Hamey.

LEAGUE PROJECT UPDATES IN BRIEF

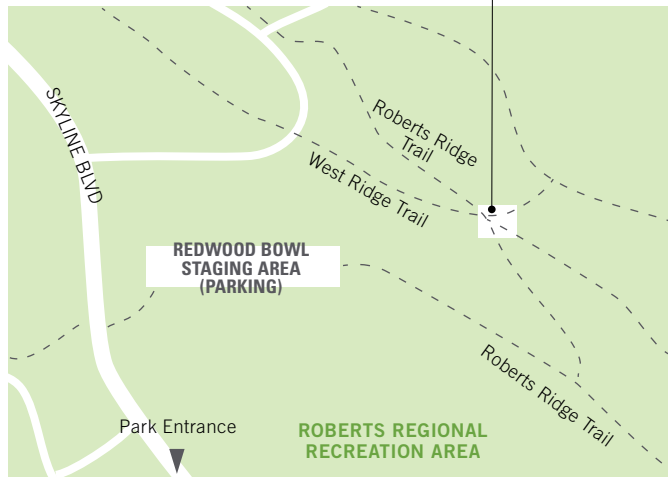


ROBERTS REGIONAL RECREATION AREA



ROBERTS REGIONAL RECREATION AREA

MAP AREA



NEW DECK AND EXHIBIT

ROBERTS REGIONAL RECREATION AREA

ABOVE Visitors view the moss-covered footprint of an ancient redwood almost as wide as a city street. The deck is part of a new exhibit in Roberts Regional Recreation Area.

RIGHT An interpretive panel by Save the Redwoods League identifies the plants and animals of the forest.

ROBERTS REGIONAL RECREATION AREA

WHAT

The Old-Growth Redwood Heritage Viewing Deck and Interpretive Exhibit allows visitors to view the footprint of an 18-foot-wide redwood.

WHERE

At Roberts Ridge and West Ridge trails in Roberts Regional Recreation Area — a short walk from the Redwood Bowl parking area — in Oakland.

LEARN MORE

Read about visiting Roberts Regional Recreation Area on page 14.

History on Deck

New Oakland Exhibit Reveals Story of Area's Once-Ancient Forest

The ancient coast redwoods that once stood in the San Francisco Bay Area's East Bay were thought to have been some of the largest, possibly reaching 30 feet across. They blanketed the hills of Oakland and some were used by ships to navigate through the bay. But, as is the story with 95 percent of the coast redwood range, the ancient Oakland redwoods were cut from the 1840s to the 1860s. Little remains of the once mighty redwoods that stood hundreds of years ago.

At Roberts Regional Recreation Area in Oakland, a few old-growth redwood footprints remain among the sea of second-growth redwoods. Recognizing the importance of these footprints and the story they can tell about the history of the area, Save the Redwoods League partnered with East Bay Regional Park District to protect an 18-foot-wide footprint and educate the public.

We created the Old-Growth Redwood Heritage Viewing Deck and Interpretive Exhibit, a platform with benches that allows visitors to view the footprint from a safe and elevated location. Additionally, a two-sided interpretive panel explains the history of the area through the rings of a redwood tree, reminding us that the first people to live on this land, with the redwoods, were the Ohlone and Bay Miwok people.

The hope is that this new interpretive exhibit will not only protect this remaining footprint, but also remind the public that historically logged forests need our help to become the old-growth forests of the future. —

—Deborah Zierten, Education & Interpretation Manager, Save the Redwoods League

An Affirmation of High Standards

League Earns National Accreditation for a Second Time



As the glow fades from the 100 candles atop the League's Centennial birthday cake, we have a new milestone to celebrate. The Land Trust Accreditation Commission has accredited Save the Redwoods League for a second time — a status that is the gold standard for land trusts.

With accreditation comes recognition that the League has the resources, processes, and leadership to succeed in land conservation. Accreditation is granted for five-year periods.

"It is exciting to recognize Save the Redwoods League and its continued commitment to national standards by renewing this national mark of distinction," said Tammara Van Ryn, Executive Director of the Land Trust Accreditation Commission. "Donors and partners can trust that the more than 400 accredited land trusts across the country are united behind strong standards and have demonstrated sound finances, ethical conduct, responsible governance, and lasting stewardship."

Thank you, Land Trust Accreditation Commission, for recognizing that we are worthy of this honor. We pledge to continue to satisfy your accreditation requirements and to continue to earn the trust of our members every day. —

—Harry Pollack, General Counsel, Save the Redwoods League



Photos by Fig & Olive Photography; photo next page by Anthony Castañeros.

LEAGUE PROJECT UPDATES *IN BRIEF*

CLIMATE

REDWOODS-TO-THE-SEA-CORRIDOR FOREST RESILIENCE PROJECT



The League lowered the threat of severe wildfire by reducing vegetation buildups in this Humboldt County forest as part of the Redwoods-to-the-Sea-Corridor Forest Resilience Project.

CAL FIRE GRANTS

WHAT

Two grants are supporting the League's work to protect coast redwood and giant sequoia forests from severe wildfires by reducing fuels, or buildups of combustible vegetation.

WHERE

Humboldt, Calaveras, and Tuolumne counties.

LEARN MORE

Read about the League's crucial work to restore coast redwood and giant sequoia forests and protect them from severe wildfires.

[SaveTheRedwoods.org/restore](https://www.savetheredwoods.org/restore)

Protecting Forests and Communities

New Grants Support Wildfire, Carbon Projects

Two new awards from the California Department of Forestry and Fire Protection (CAL FIRE) are supporting work by Save the Redwoods League to increase the carbon sequestration potential of redwood ecosystems, while protecting them and surrounding communities from the threat of severe wildfires. The projects are part of a statewide program to cut greenhouse gas emissions, strengthen the economy, and improve public health and the environment, particularly in disadvantaged communities.

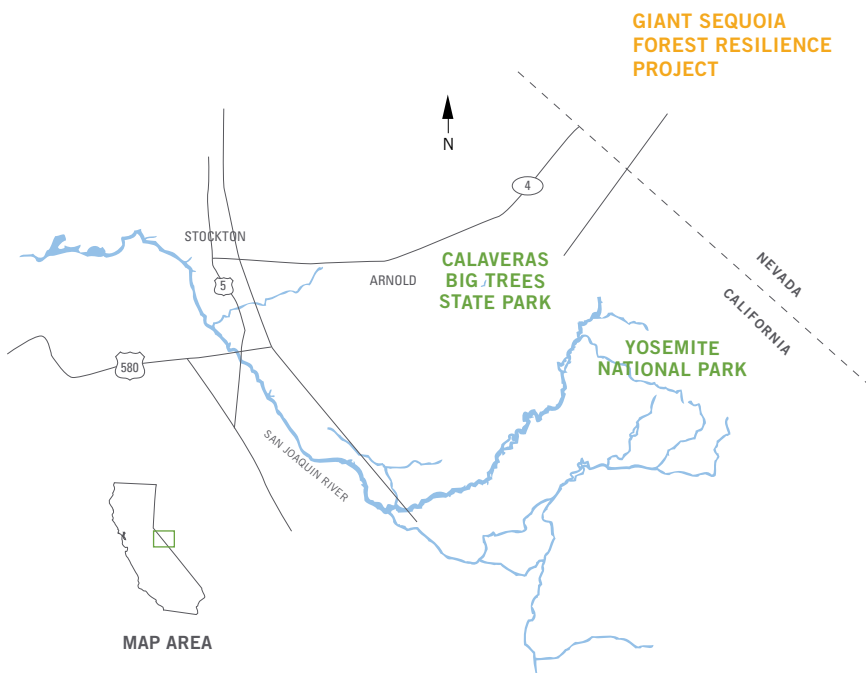
Restoring our coast redwood and giant sequoia forests and protecting them from severe wildfires requires managing buildup of combustible vegetation, or fuels, that result from years of fire suppression. The work involves thinning dense stands of young trees and reducing the accumulation of vegetation and woody debris on the forest floor, either through prescribed fire or by using machines. Such efforts help make coast redwood and giant sequoia groves less vulnerable to severe wildfires and also accelerate the development of old-growth forest characteristics, such as greater carbon sequestration, in younger stands.

The League is reducing fuels in partnership with the Bureau of Land Management, California State Parks, local groups, and private landowners. One of the CAL FIRE-supported efforts is the Redwoods-to-the-Sea-Corridor Forest Resilience Project in Humboldt County, which won a \$1.3 million award. The other is the Giant Sequoia Forest Resilience Project in Calaveras and Tuolumne counties. This effort, on our Beaver Creek property and the adjacent Calaveras Big Trees State Park, won a \$2.4 million award.

These projects are part of California Climate Investments, a statewide program that puts billions of cap-and-trade dollars to work reducing greenhouse gas emissions. The cap-and-trade program creates a financial incentive for industries to invest in clean technologies and develop innovative ways to reduce pollution.

Save the Redwoods League thanks CAL FIRE for this investment in the health of California's redwood forests. We will continue our science-based forest management practices in the giant sequoia and coast redwood ranges to increase fire resilience and improve ecosystem benefits so that these treasured places will flourish for generations to come. 🌿

—Shelana deSilva, Director of Government Affairs & Public Funding, Save the Redwoods League



REDWOODS IN THE CITY

Explore the many ways to play
in an Oakland forest oasis



Hikers experience the redwood forest in Roberts Regional Recreation Area.

Enjoy dog-friendly hiking, mountain biking, a new tree exhibit, panoramic views, and more

Visiting ROBERTS REGIONAL RECREATION AREA

In the hills of Oakland, California, a lush forest of young redwoods rises among the footprints of ancient giants that were logged in the mid-1800s to build area cities. The 82-acre Roberts Regional Recreation Area offers easy access to the 150-foot-tall redwoods just steps from the parking lot.

Opened in 1952 and named in honor of Thomas J. "Tommy" Roberts, longtime secretary of the East Bay Regional Park District Board of Directors, the park is an oasis of green — a breath of crisp, fresh oxygen in the bustling city of Oakland.

Bring along a snack or a lunch, as the park's scenic picnic spots are perfectly inviting for a day of forest bathing. Near the Madrone picnic area, two giant redwoods once stood, so massive that in the 1800s, sailors in San Francisco Bay used them as landmarks to avoid crashing into the underwater Blossom Rock.

Roberts is also a wonderland for play, with an archery range, a baseball field, and a sand volleyball court. Wheelchair users can enjoy features such as a playground, picnic areas, and the Roberts Pool complex, open from mid-April through the end of September.

Four miles of trails are popular with hikers, dog walkers, mountain bikers, and horseback riders. On a clear day, face east at the top of the 0.2-mile Manzanita Loop trail, and you'll see Mount Diablo in all its glory. The West Ridge Trail extends into the 1,830-acre Redwood Regional Park, which features nearly 40 miles of trails through a canyon shaded by redwood forests, as well as chaparral and grasslands. Home to the largest coast redwood forest in the San Francisco Bay Area's East Bay, these two adjacent parks are more than worthy of a trip. —

—Dana Poblete



HIGHLIGHT: Check out the 18-foot-wide footprint of a redwood that stood before the area was logged in the mid-1800s. You can learn about it at the Old-Growth Redwood Heritage Viewing Deck and Interpretive Exhibit, completed in 2018 by Save the Redwoods League and East Bay Regional Park District. The deck, at the intersection of Roberts Ridge and West Ridge trails, is a short walk from the Redwood Bowl parking area. Learn more on page 11.

HIDDEN GEM: Take the West Ridge Trail to the Redwood Peak Trail, where sandstone is carved with dates as far back as the 1800s — a sign that the area has attracted visitors since long before the park was established.

TRAILS: Four miles of trails with connections to neighboring Redwood Regional Park.

DOGS: Off-leash in undeveloped areas, leashed in developed areas such as parking lots and picnic areas.

BEST TIME TO VISIT: Year-round.

LOCATION: 10570 Skyline Boulevard, Oakland, California.

LEARN MORE: Call East Bay Regional Park District at 888-327-2757. For more information on these parks and more than 100 others, visit ExploreRedwoods.org, our mobile-friendly tool for discovering redwood parks through your favorite activities.

NEARBY: In neighboring Redwood Regional Park, Chabot Space & Science Center features a planetarium, interactive exhibits, a theater, and telescopes.

TRANSIT: AC Transit serves the area. Call 510-891-4777, or visit actransit.org.

ASK AN EXPERT

Q: What are the best ways to promote redwood forests' resilience as the climate changes?



Giant sequoia are highly adapted to fire. Their cones (pictured) require heat to open and release seeds, and giant sequoia seedlings thrive in the bare soil exposed after a fire. However, wildfire suppression has resulted in buildups of woody debris and combustible vegetation. These fuels can cause fires that are too severe, even for these giant trees.

The 2018 wildfire season was the deadliest and most destructive wildfire season on record in California, partly because of buildups of combustible vegetation and compounding atmospheric conditions linked to climate change. Coast redwoods didn't sustain great damage during the 2018 fire season. In contrast, at least 50 large, old-growth giant sequoia were killed in the 2017 Pier Fire in Black Mountain Grove, part of which lies in Giant Sequoia National Monument. Although historically frequent fires resulted in the death of some of these giants from time to time, the staggering number killed in the Pier Fire is likely a new phenomenon. This fire highlights the urgent need for restoration.

COAST REDWOODS

Even during California's recent drought, rather than exhibiting signs of stress, the coast redwoods were still growing vigorously. However, as the climate continues to warm, reductions in fog could impact growth. Warming also could elevate fire risk by increasing temperature and reducing moisture in fuels (buildups of combustible vegetation). For old-growth forests, the best management strategy to increase resilience to the warming climate is to buffer them by restoring the surrounding, previously logged stands. Using tools such as restoration thinning and prescribed burning, this strategy will not only put them on a trajectory to becoming old-growth forests again, but it can also reduce the risk of severe fire. Restoration also connects habitats for species that rely on old-growth coast redwoods, such as the Humboldt marten.

GIANT SEQUOIA

In giant sequoia forests, the greatest threat to the persistence of the large-diameter trees is severe wildfire. Ironically, with its thick bark, the species is among the best adapted to wildfire — its cones are even primed to open during fire, resulting in a flurry of new seedlings. However, more than a century of fire exclusion has allowed fuels to build up, changing how fires burn in these ecosystems. Using active forest management techniques, including prescribed fire and restoration-based thinning, we can reduce fuels and increase the forest's resilience to wildfire. Allowing naturally ignited wildfires to burn under moderate conditions, where they don't threaten homes or other infrastructure, can be another important tool. For example, in 2018 there was a late-season wildfire in Giant Sequoia National Monument that burned into the Wishon Grove. Because it was burning during relatively mild weather conditions, it was restorative, essentially acting as a prescribed burn.

UNFORSEEN CHALLENGES

For both species, new and unpredicted challenges likely await us during this time of dramatic change. Continuing to monitor and evaluate these ecosystems will be required to protect them in the future. —

—Kristen Shive, PhD, and Scott Stephens, PhD



WHAT

Practices to increase redwood forests' resilience include, among others, reducing buildups of combustible vegetation and thinning overcrowded forests.

THE EXPERTS

Kristen Shive joined the League as the organization's Senior Scientist in 2018, bringing decades of experience in fire management and ecological research in national parks, including Yosemite.

Scott Stephens is a professor at the University of California, Berkeley, who studies fire ecology; forest ecology, policy, and management; and how climate change will affect fire.

LEARN MORE

Read about our restoration projects, and why and how the League restores redwood forests.

[SaveTheRedwoods.org/restore](https://www.savetheredwoods.org/restore)

DO YOU HAVE A QUESTION ABOUT REDWOODS?

Send your questions to us!

Email: Redwoods@SaveTheRedwoods.org

Mail: Send a note to our address on the back cover.

Phone: 415-820-5856

Charred giant sequoia were killed in the 2017 Pier Fire.

STAND FOR
THE
REDWOODS
STAND FOR THE FUTURE

100 YEARS IS JUST THE BEGINNING

100 A SPECTACULAR CENTENNIAL

140,000 new fans and devoted supporters celebrated the League's 100th anniversary in 2018

At places ranging from the ancient redwood forests to San Francisco and Los Angeles, 140,000 forest fans joined Save the Redwoods in 2018 to celebrate the League's Centennial and its legacy of conservation leadership. Founded in 1918 in the wake of extensive logging, the League brought ancient redwood forests back from the brink of extinction by buying and protecting groves for future generations to experience.

Our Centennial celebrations were about more than admiring the League's accomplishments; they also built hope and momentum for our new era of conservation leadership in which we work to achieve our new vision. We envision vibrant redwood forests of the scale and grandeur that once graced the California coast and the Sierra Nevada, protected forever, restored to grow old again, and connected to people through magnificent parks and protected areas that inspire all of us with the beauty and power of nature.

Thank you for being a part of the League family and for celebrating with us. All of us at the League have enjoyed meeting so many of you. Here is a look at the most recent Centennial celebration highlights.

See more photos of these events at SaveTheRedwoods.org/highlights.





Photos on this spread by Max Forster.

FESTIVAL IN HUMBOLDT COUNTY LAUNCHED CELEBRATION WEEK

The League kicked off Centennial Celebration Week with the Stand for the Redwoods Festival in Humboldt County near the world's tallest forest in Redwood National and State Parks. Honoring the League's Centennial and the 50th anniversary of Redwood National Park, we offered the free festival with the National Park Service and Redwood Parks Conservancy. About 650 redwoods fans enjoyed kids' activities, birthday cake, and live music by Saritah, Monophonics, and Marty O'Reilly & The Old Soul Orchestra.

Stand for the Redwoods Festival in Humboldt County

Orick, California
October 7, 2018

The League's matching game at the Stand for the Redwoods Festival in Humboldt County offered amazing facts about the forest. Play a version of the game on page 76 of this magazine!

OPPOSITE PAGE, TOP Redwoods fans of all ages join a puppet parade of forest animals.

OPPOSITE PAGE, BOTTOM Saritah (pictured), Monophonics, and Marty O'Reilly & The Old Soul Orchestra entertained the crowd.

DISTANCE LEARNING PROGRAM BRINGS GIANT SEQUOIA TO STUDENTS NEAR AND FAR

A new, free League program launched during Centennial Celebration Week introduced K-12 students from around the world to the magic of giant sequoia using live, interactive videoconferencing. Since then, more than 8,000 students have participated in digital field trips to Calaveras Big Trees State Park with California State Parks educators. The Parks Online Resources for Teachers & Students (PORTS) program virtually transports children to the park in the Sierra Nevada to learn about the world's largest tree species. Learn more about the program at SaveTheRedwoods.org/PORTS.



Parks Online Resources for Teachers & Students (PORTS) Program
Worldwide
Launched on October 8, 2018

DOCUMENTARY STARS THE LEAGUE AND AN ANCIENT REDWOOD

Our partner Oakland Trails hosted 750 viewers at the premiere of its 20-minute documentary about the only ancient coast redwood remaining in the Oakland Hills after timber harvesting. Starring League staffers, the film is a terrific story with many heroes, from the nonprofit partners and public agencies that steward our parks to the redwoods themselves. Visit SaveTheRedwoods.org/OldSurvivor to learn about upcoming screenings, and see the trailer.



Premiere of *Old Survivor*
Chabot Space & Science Center, Oakland
October 9, 2018

SOUTHERN CALIFORNIA MEMBERS EXPLORED HISTORY'S WONDERS

Our closest supporters in Southern California joined the League for our Centennial Celebration Member Event and special access to the renowned Natural History Museum of Los Angeles County. Members learned about our vision for our next century of redwood forest conservation, and we shared our appreciation for their ongoing support.

Centennial Celebration Member Event
Natural History Museum of
Los Angeles County, Los Angeles
October 10, 2018

TOP In the new PORTS program, interpretive specialist Jenny Comperda teaches students about giant sequoia in Calaveras Big Trees State Park.

BOTTOM Students interact with PORTS educators in a videoconference.



Photos: opposite page, California State Parks; this page, Alan Beymer.

STARGAZING WAS STELLAR AMONG GIANT SEQUOIA

Astronomy fans partook in a celestial League Centennial among giant sequoia, peering into space from one of the best viewing sites in the Sierra Nevada: Calaveras Big Trees State Park. Our Centennial partner, Calaveras Big Trees Association, hosted Stand for the Redwoods, Reach for the Stars, providing telescopes, astronomical binoculars, and special League gear.

The League's Centennial was out of this world for those who joined League Centennial partner Calaveras Big Trees Association for a night of stargazing.

Stand for the Redwoods, Reach for the Stars

Calaveras Big Trees State Park, Arnold, California
October 11, 2018



GALA RAISED \$2 MILLION FOR EDUCATION, PARKS SUPPORT

Our Centennial Celebration Gala brought 730 patrons together, raising \$2 million for the League's education and parks support programs. These programs will serve 18,000 students this year and millions of park visitors with improved access and amenities in our redwood state parks. Guests took delight in an elegant dinner and a live auction featuring unique redwoods adventure packages. The evening concluded with a benefit performance by Mickey Hart, Bob Weir, and friends with special guest John Mayer.



Centennial Celebration Gala
Union Square, San Francisco
October 13, 2018



2019
REDWOODS GALA
SAVE THE DATE

for our 2019 gala on
Saturday, October 12, 2019,
in San Francisco.

For more information,
contact Luz Perez,
Special Events Manager,
at 415-820-5833 or
Lperez@SaveTheRedwoods.org.



THIS PAGE Revelers enjoyed
a glorious evening at the
Centennial Celebration Gala.

OPPOSITE PAGE, TOP Mickey
Hart, Bob Weir, and friends
with special guest John
Mayer entertained guests in
a gala benefit performance
at August Hall.

OPPOSITE PAGE, BOTTOM Guests
at the Centennial Celebration
Gala savored an elegant
dinner under a Union
Square tent inspired by
the redwood forest.



Photos in this spread by Drew Allizer Photography.

PROGRAM CONNECTED 30,000 VISITORS TO REDWOOD PARKS

The redwood forests are among the Diaz family's favorite places. Jami, her husband Xavier, and their sons, Nolan, 8, and Hollis, 4, love to take trips from their San Jose home to decompress among the giant trees. So when they learned on Facebook about the League's Free Second Saturdays in redwood parks, they jumped at the chance to explore different forests.

The Free Second Saturdays program marked the League's Centennial in 2018, thanks to the generous support of Oracle and League members. With California State Parks, the program offered free day-use admission to 46 redwood state parks on the second Saturday of each month. In October, the League and 25 park agencies offered a special birthday edition of the program in 100 redwood parks, providing free day-use parking to those parks where there are usually parking fees.

The goal of the program was to draw thousands of new visitors to our parks, inspire a love of nature, and establish a strong conservation ethic across diverse generations and communities. More than 30,000 people participated, and 70 percent of them visited those parks for the first time.

Jami, who's studying energy and vibrational healing, and Xavier, who works for the City of San Jose Parks Division, used their free passes to discover Portola Redwoods, Henry Cowell Redwoods, and Samuel P. Taylor state parks, and return to Big Basin Redwoods, Wilder Ranch, and Pfeiffer Big Sur state parks.

"We find the redwood forests extremely grounding and nourishing," Jami said. "And we cherish this unstructured time in nature with our boys when they can run, jump, and simply lose themselves in their imaginations. I love the energy of these ancient trees. Free Second Saturdays provided my family a reason to commit to being among the redwoods in 2018. It's been so enjoyable, I'm pretty sure our visits are going to remain a tradition."

Free Second Saturdays in Redwood Parks
Parks throughout the redwood range in California
Monthly in 2018





Photos: this page, Paolo Vescia; bottom left, Ashley Boorman; opposite page, Fig & Olive Photography.

CLOCKWISE FROM TOP LEFT
Nahko wowed the crowd at the Stand for the Redwoods Festival in San Francisco.

San Francisco Giants mascot Lou Seal leads a puppet parade.

Forest fans captured the grandeur of a giant sequoia grove at the League's booth.

Visitors stop by the National Park Service booth to learn about wildlife in redwood parks.

OPPOSITE PAGE The Diaz family of San Jose discovered Samuel P. Taylor State Park and other redwood parks through the League's Free Second Saturdays program.

FESTIVAL IN SAN FRANCISCO CULMINATED CELEBRATION WEEK WITH 3,000 FANS

Stand for the Redwoods Festival in San Francisco

Yerba Buena Gardens
October 14, 2018

Humboldt Redwoods Marathon, Half Marathon, and 5K

Humboldt Redwoods State Park
Humboldt County, California
October 14, 2018

The free Stand for the Redwoods Festival in San Francisco brought Centennial Celebration Week to a joyous conclusion, drawing 3,000 redwoods fans. San Francisco Giants mascot Lou Seal and stilt-walkers joined kids in the puppet parade. The live artists Nahko; Ron Artis II & The Truth featuring the Saeeda Wright Gospel Singers; and Jazz Mafia entertained the enthusiastic crowd.


RUNNERS RACED PAST REDWOODS ON RENOWNED COURSE

More than 500 runners competed in the League-sponsored Humboldt Redwoods Marathon in Humboldt Redwoods State Park. The course followed the famed Avenue of the Giants, winding through ancient redwood groves that Save the Redwoods has protected over the decades.

CLIMATE

HEROES UNITE

TO PROTECT
SUPERHERO
TREES AT
THE GROVE
OF TITANS

A large, moss-covered tree trunk in a forest. The tree trunk is the central focus, showing a rough, textured bark with patches of green moss and lichen. The background is a dense forest of tall, thin trees with green foliage. The lighting is soft and natural, suggesting a shaded forest environment.

**The League, members,
and partners support a
campaign to mitigate
the impacts of off-trail
hikers in the Grove of
Titans, a gem and
champion carbon sink.**

Redwood National and State Parks (RNSP) are the heart of the Northern California coast redwood forests, and in some ways are like a set of Russian nesting dolls. These four parks protect 45 percent of the world's old-growth redwoods, the tallest living things in existence. Surrounding these expansive wilds of ancient giants are young forests recovering from timber harvests that were conducted before the land was protected.

The parks offer beauty and wildness that has been millions of years in the making, providing an experience of the forest primeval like none other on Earth. Jedediah Smith Redwoods State Park is among the most precious of these incomparable treasures.

No roads or trails mark the core of this 10,000-acre forest, which contains 7 percent of the world's remaining old-growth redwoods. The park is one of the wettest places in the United States, contributing to a forest with more biomass (wood, bark, and leaves) and carbon storage per acre than anywhere on the planet. That biomass, including massive fallen giants of centuries past and ferns that tower overhead, is so dense that it's almost impenetrable. Small wonder, then, that a stand of uniquely extraordinary redwood giants growing just a short distance from a hiking trail was known only to the Native Americans who have lived in this rugged region for millennia. Then in 1998, a team of research scientists from Humboldt State University stumbled upon the giants and dubbed the area the "Grove of Titans." In this majestic grove stand some of the world's largest and oldest coast redwoods. Researchers and RNSP staffers agreed to keep the precise location of the grove secret due to concerns of adverse environmental impacts from excessive and uncontrolled visitation.

OFF-TRAIL VISITORS DAMAGE GROVE

Unfortunately, those worries turned out to be fully justified. Word of the grove spread, inquisitive explorers ultimately determined the location of the Titans, and the grove was soon on the cusp of being loved to death by visitors venturing off of the designated trails. As a result, a tangled network of unofficial "social" trails wending to and around the grove is compacting the soil, exposing the root systems of the ancient monarchs, and tempting hikers to wander unconstrained across the wild and delicate forest floor. Traffic on nearby Howland Hill Road, the main access route to the area, is sometimes gridlocked. Because there are no restrooms near the grove or on nearby roads, the human waste problem has reached crisis proportions, impacting wildlife habitat, undermining





Photos in this story by Max Forster.

Brett Silver, California State Parks Acting Sector Superintendent, points to the base of a Titan where visitors have stripped vegetation and exposed the gigantic tree's roots.



the visitor experience, and menacing the water quality in a nearby stream that supports imperiled salmon.

“There were thousands of people visiting, and we were seeing some really serious environmental impacts,” says Victor Bjelajac, the California State Parks Superintendent for the North Coast Redwoods District. “There was also the matter of visitor safety. People can easily become lost or injured when going off established and sanctioned trails.”

In response, Save the Redwoods League, California State Parks, the National Park Service, and Redwood Parks Conservancy have partnered to mitigate the damage and ongoing threats to the Grove of Titans, while allowing for an unforgettable experience in this magnificent grove. Work will begin in the fall of 2019 to remove unsanctioned trails and rehabilitate the damaged habitat and compacted and eroding soil. The project will also include construction of elevated walkways to and around the grove to guide visitors safely without damaging the understory, and installation of restrooms and trash receptacles along Howland Hill Road. In addition, interpretive materials and signage will tell the story of the grove’s restoration, the ecosystem’s sensitivity, and the global importance of this truly special place.

The project got a tremendous boost in the fall of 2018 from Ms. Josie Merck. An artist and conservationist from Connecticut, Josie heard about the urgent need to restore the forest and offered

Visitors have created unofficial trails and trampled plants in Jedediah Smith Redwoods State Park to get to the Grove of Titans, home to some of the world’s largest coast redwoods. Scientists stumbled upon the grove in 1998, and people eventually learned the location despite efforts to protect the area by keeping it secret.

GROVE OF TITANS

WHAT

The remote Grove of Titans contains some of the largest and oldest coast redwoods in the world. The grove wasn't publicized officially because of concerns about visitor impacts, given the lack of designated trails.

PROBLEM

People eventually learned about the grove through word-of-mouth, news reports, and social media. Creating unofficial trails, visitors have trampled the grove.

SOLUTION

California State Parks, Save the Redwoods League, National Park Service, and Redwood Parks Conservancy will remove unsanctioned trails, restore damaged habitat, build elevated walkways to and around the grove, install restrooms and trash receptacles, and provide interpretive materials.

TIMING

Construction is to start by fall 2019 and end by summer 2021.

PROJECT COST

\$3.5 million; more than \$1.33 million has been raised.

DONATE

[SaveTheRedwoods.org/Titans](https://www.savetheredwoods.org/Titans)

LEARN MORE

See a video about the project.
[SaveTheRedwoods.org/got](https://www.savetheredwoods.org/got)

a challenge to match all contributions to the Grove of Titans project dollar-for-dollar up to \$500,000. Thanks to more than 4,800 passionate League members, Save the Redwoods raised over \$837,000 in response to the challenge. Funds raised now total \$1.33 million toward the estimated project cost of \$3.5 million.

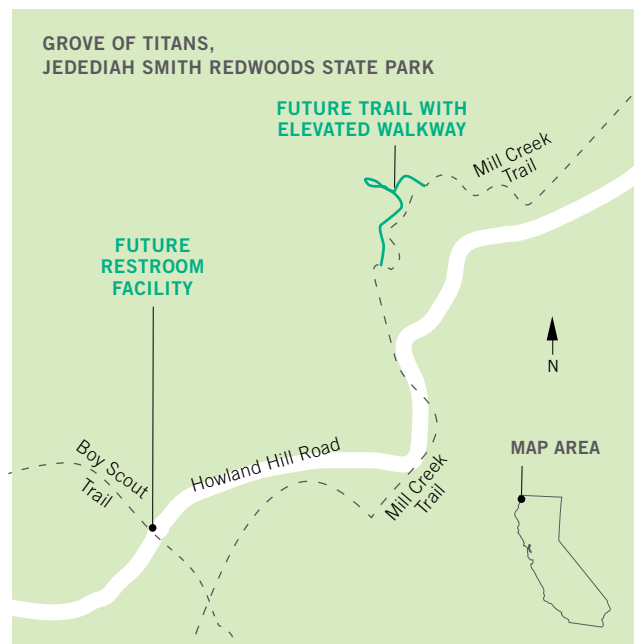
RECORD-HOLDING CARBON STORAGE

The Grove of Titans is noteworthy for more than the awe-inspiring dimensions of its namesake trees. Research by Save the Redwoods League scientists confirms that the redwoods at Jedediah Smith store more carbon than any other forest on the planet. That's a big deal. At a time when the world is struggling to reduce the proliferation of carbon in the atmosphere, we now know that California's redwood forest is a powerful tool for capturing atmospheric carbon and mitigating climate change.

"As part of the Redwoods and Climate Change Initiative (RCCI), the League has established 11 study plots in old-growth forests across the range of the species, and Jedediah Smith definitely holds the record," said Emily Burns, the League's former Director of Science. "The RCCI found that old-growth trees in the park — including the Grove of Titans — help the forest store about 1,000 tons of carbon per acre aboveground. Each acre stores an amount of carbon that is roughly equivalent to the annual emissions of 1,700 cars."

In an era of unprecedented environmental change, when the headlines about our environment are dominated by the deterioration of our natural systems and the loss of biodiversity, the redwood forest offers a story of hope. People have responded with such generosity to the effort to protect and restore the Grove of Titans and other redwood forests because that work represents such a unique opportunity to strive toward a more resilient and sustainable future. We save this forest because it will help to save all of us. 🌲

—Glen Martin



STAND FOR THE
REDWOODS
STAND FOR THE FUTURE



Mrs. J. Thorne Mrs. H. Marshall E. Leuce Mrs. Johnson Mrs. G. Johnson

Photo this page by Freeman Art Company from Humboldt County Historical Society Collection; photo opposite page by Max Forster.

A LEAGUE OF THEIR OWN

THE WOMEN WHO STARTED SAVING THE REDWOODS



Members of the Women's Save the Redwoods League pose in 1919 during a tour of Humboldt County. The women leveraged their positions in society to raise support for redwoods conservation.

It was August 8, 1919, when Save the Redwoods League founders Madison Grant and Stephen Mather spoke to a packed auditorium in the Northern California town of Eureka. They had driven up from San Francisco, where the first League board called for Eureka-area support to protect the redwoods. To their surprise, they received a wildly enthusiastic response.

Their reception in Humboldt County, the epicenter of redwood logging operations, was largely because local women had been rallying for years to protect ancient redwoods in Northern California, despite their families' ties to the timber industry.

Back then, there were few ways for women to engage outside the domestic sphere. So all across the country, women formed clubs to find creative ways to lead their communities.

In 1900, when the California Federation of Women's Clubs was founded, it had education and forestry committees. The women's interest in forestry was critical to the success of the early conservation movement, providing much of the grassroots momentum by connecting conservation to

gardening and botany. The Garden Club of America amplified this connection in the 1930s, when its women from across the country helped save thousands of acres of old-growth redwoods in what is now Humboldt Redwoods State Park.

In 1908, members of the Humboldt County Federation of Women’s Clubs sent a children’s petition to the US Forest Service asking President Theodore Roosevelt to create a national redwood park. Roosevelt said he was “exceedingly anxious” to assist. In the following years, the women circulated petitions and pursued legislation to establish a “National Redwood Forest Park.” Despite their hard work, the legislation stalled.

That brings us back to 1919, when Mather and Grant came to town. Within hours, the local women revived their efforts. The next day, on August 9, 1919, the women formed a club that came to be known as Women’s Save the Redwoods League. This club was an influential local force in the growing movement to protect the redwoods.

Before the redwoods conservation movement, before their communities approved or even understood, these women spoke to the national imperative to save the iconic ancient forests. And they took action, persisting for years in the face of apathy, obstruction, and their own families’ self-interest, and helped to save some of the world’s most special places. —



Women of Humboldt County sparked the earliest action for protecting ancient coast redwoods like these in Humboldt Redwoods State Park.



WHAT
Women’s clubs in the early 1900s were leaders in the new movement to protect the redwoods.

LEARN MORE
SaveTheRedwoods.org/WomensHistory

CLIMATE



An aerial photograph of a vast forest landscape. The foreground is filled with dense, green trees, likely redwoods. In the middle ground, a valley is visible, with a small town or village nestled in the distance. The background features rolling mountains, some of which are partially obscured by low-hanging clouds and mist. The sky is overcast with grey clouds.

DISCOVERING THE CLIMATE CHANGE RESILIENCE OF COAST REDWOOD FORESTS

After a decade of research studying the impacts of climate change throughout redwood forests, the Redwoods and Climate Change Initiative (RCCI) shares new insight into how coast redwood trees are growing today.

Earth's climate is changing rapidly, and redwoods are responding.

Mature trees alive today have already experienced centuries of climatic fluctuations, including extreme weather predicted to become more frequent. The Redwoods and Climate Change Initiative (RCCI), a research program led by Save the Redwoods League and Humboldt State University, takes a comprehensive look back in time, using tree rings to see what happened when these trees survived droughts and fires. The study compares trees living in northern rainforests with those living in drier forests farther inland and south. Our research began in old-growth forests and is now expanding into second-growth (previously logged) forests encompassing the full geographic range of coast redwoods (*Sequoia sempervirens*) (FIGURE 1). In every part of the forest, our findings show the tremendous carbon sequestration capacity of redwoods, their ability to resist fire, drought, and disease, and where they grow fastest.

Understanding how redwoods respond to climate change begins with the fundamentals of their biology — how trees of different sizes and ages produce biomass (leaves, bark, and wood), and how different environmental conditions influence rates of production. At Humboldt State University, we developed an innovative approach to quantify aboveground dimensions and annual growth histories of standing trees, showing that redwoods are exquisitely responsive to drought, fire, and adjacent logging. To create these windows into the past, we venture into the canopy to measure crowns and collect tree-ring samples from trunks at regular height intervals. Each year of growth is recorded in a discrete band of wood. These rings range from small rings (< 1 mm) made after fire or during drought, to much larger rings made when trees are uninjured, with plentiful access to light, water, and soil nutrients. Using newly developed equations and annual growth increments measured from tree rings, we can now accurately predict production rates of biomass in redwoods of all sizes (FIGURE 2).

Reconstructed growth histories document how individual trees gain height and accumulate biomass with increasing age. Redwoods gain height rapidly in second-growth

Photos: this page by Save the Redwoods League; intro spread by Stephen Sillett; photo on page 39 by Stephen Sillett and Marie Anoline.



The Redwoods and Climate Change Initiative studies tree rings to research impacts of climate change on coast redwood and giant sequoia forests.

Previous spread: This view from atop a 90-m-tall redwood on Peavine Ridge shows the unbroken old-growth forest canopy of Humboldt Redwoods State Park. Redwoods of Peavine Ridge exhibited unusually rapid growth during the 21st century.

GLOSSARY

BARK: an outer nonliving layer and an inner living layer through which sugars travel from leaves to the rest of the tree, including its roots.

BIOMASS: the amount of organismal material expressed as dehydrated (oven-dried) weight. In the case of trees, biomass includes leaves, bark, and wood.

HEARTWOOD: older, denser, nonliving central wood of trees that has chemical protection from decay in some species.

SAPWOOD: young and partially living wood beneath the inner bark of a tree through which water and dissolved nutrients travel from roots to leaves.

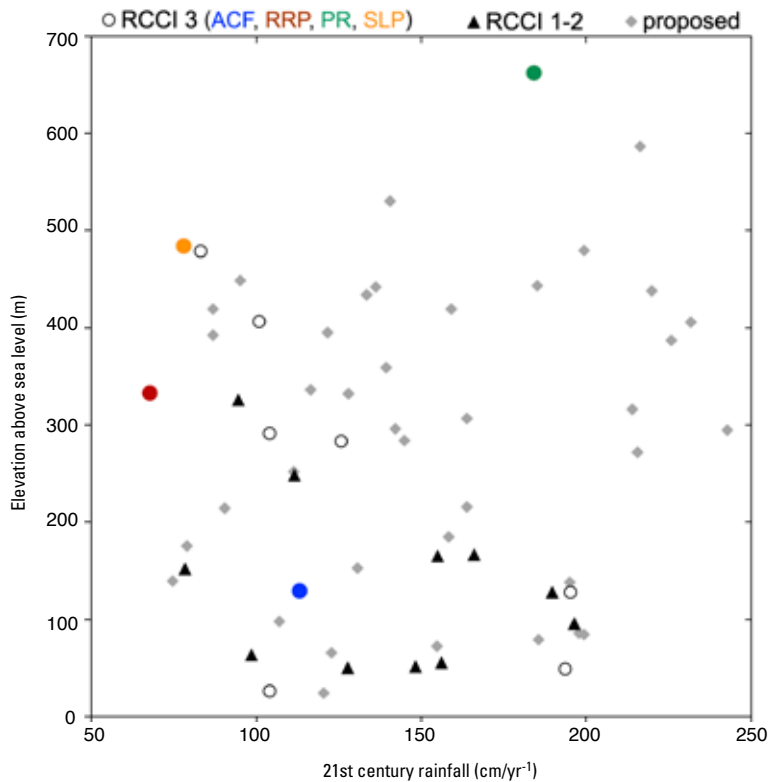


FIGURE 1

FIGURE 1: ELEVATION AND AVERAGE RAINFALL

The coast redwood forest ecosystem spans a significant climate and elevation gradient along the coast from extreme southwestern Oregon to central California. Shown here are elevations and average annual rainfall (2001-2018) for RCCI locations. Black triangles indicate 1-ha plots established 2009-2012 and remeasured 2015-2017 (RCCI 1-2). Circles indicate recently studied locations completed in 2018 (RCCI 3) with four highlighted in color, including two second-growth forests (ACF = Arcata Community Forest, RRP = Redwood Regional Park) and two old-growth forests (PR = Peavine Ridge, Humboldt Redwoods State Park, SLP = Santa Lucia Preserve). Note that RRP and SLP are two of the driest forests, while PR is one of the wettest. Gray diamonds indicate locations being considered for sampling in 2019 and 2020.

FIGURE 2: MEASURED AND PREDICTED BIOMASS

Climbing and measuring main trunks and all branches of 99 coast redwoods allowed us to develop robust allometric equations for the species in second-growth and old-growth forests. These equations can accurately predict aboveground quantities of leaves, bark, cambium, sapwood, and heartwood in standing trees from simple measurements of trunk and crown size. With the power to accurately predict biomass from simple measurements taken from the base of redwoods, climbing will no longer be necessary to estimate tree biomass and carbon storage in forests with any size trees — saving both time and money in future studies.

Shown here are the best equations to predict aboveground biomass (total dry mass, metric tons) in second-growth and old-growth forests (Silllett et al. 2015, 2019) using ground-based measurements. Equations are stepwise power functions of *allometric predictors*: trunk diameter at top of buttress (DTB, cm), tree height (m), or trunk functional diameter at breast height (f-DBH, cm) with goodness of fit indicated by R^2 . Diagonals are lines of perfect prediction. The gray box in lower-left corner of chart b shows scale of chart a.

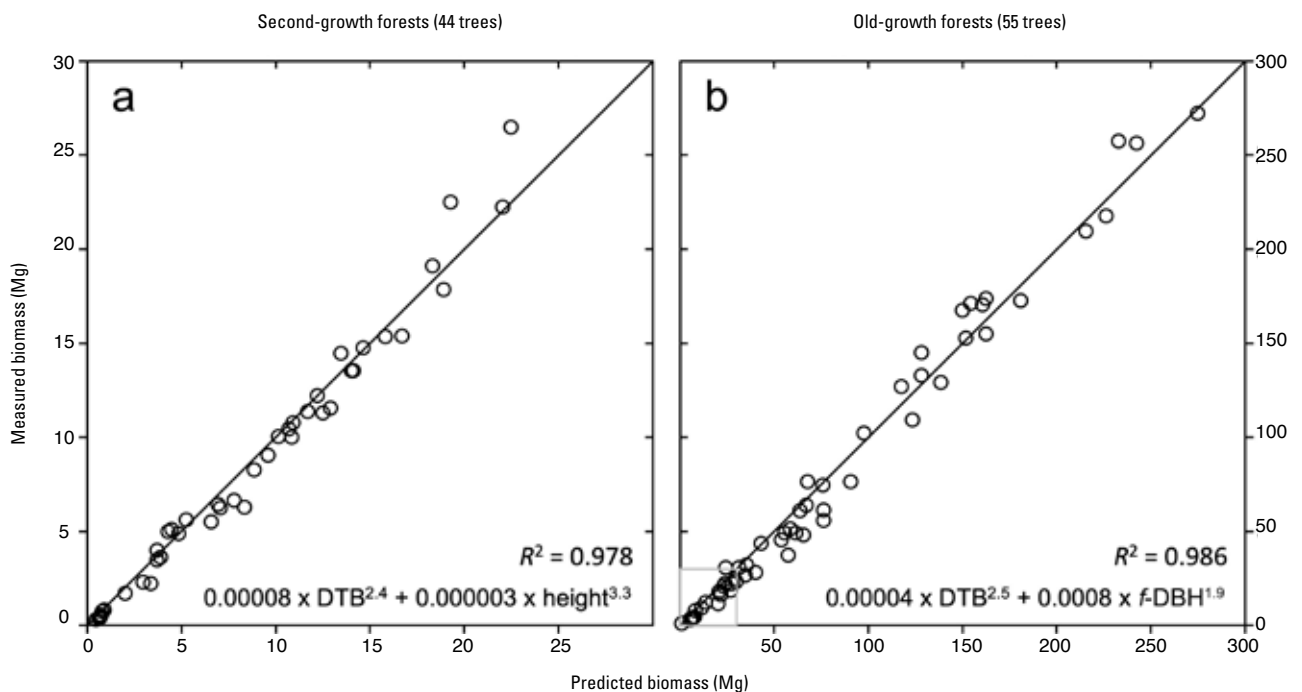


FIGURE 2

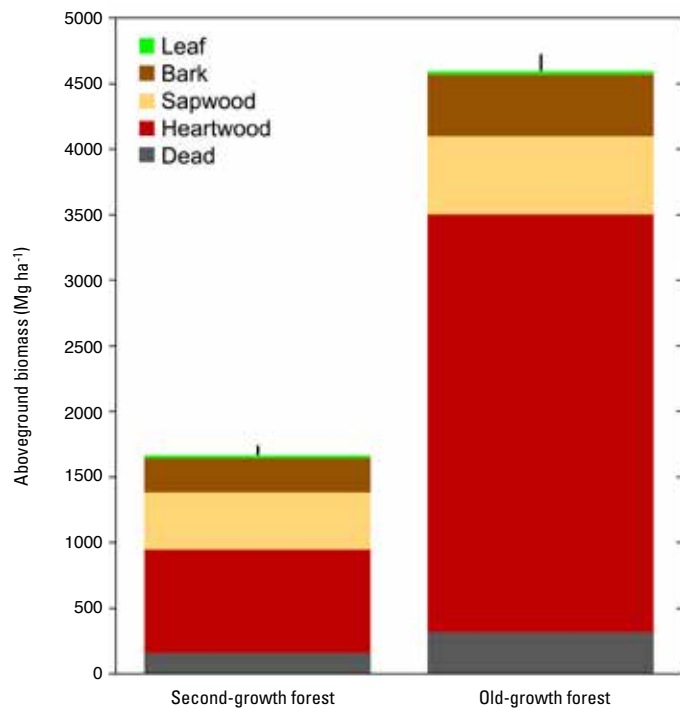


FIGURE 3

forests, reaching 87 m (287 ft) tall in 135 years, but biomass accumulation in the tallest second-growth forests is much lower than in the tallest old-growth forests (FIGURE 3). Older redwoods gain biomass rapidly simply because they have large crowns full of leaves conducting photosynthesis and an expansive surface area of cambium for production of bark and wood (Sillett et al. 2015b). Cumulatively over centuries, this results in incredible biomass storage in individual trees and the forest as a whole. Rainforests in California's Del Norte County, which borders Oregon, hold the world record for aboveground biomass, at more than 5,000 Mg ha⁻¹ (2,023 metric tons per acre; Van Pelt et al. 2016), which means in an area nearly the size of two football fields, there is enough heartwood to build 212 homes! With red heartwood capable of resisting decay for millennia, individual coast redwoods can live over 2,500 years and accumulate over 400 Mg of aboveground biomass, the bulk of which is heartwood (Sillett et al. 2015b). While logged forests lost their major carbon stock when the original trees were cut, our research shows that the oldest second-growth redwood forests alive today have accumulated as much as 1,667 Mg ha⁻¹ (675 metric tons per acre, Sillett et al. 2019). In other words, second-growth redwood forests can accumulate about a third as much aboveground biomass as comparable old-growth forests in much less than 200 years, though the proportion of decay-resistant heartwood is considerably lower (56% vs. 76%, FIGURE 3).

If the future climate and our stewardship continue to support recovery of second-growth forests, then these redwoods will increasingly provide measurable benefits in greenhouse gas reduction as they regain the stature of old-growth forests. However, comparison of historically wet and dry forests reveals that redwoods produce biomass at highly variable rates as

climate changes. For example, forests exhibited different responses to the severe drought of 2012-2015 with redwoods in wetter forests maintaining high productivity through the drought, and those in old-growth forests producing the most wood by far. To illustrate these major differences in productivity across the coast redwood ecosystem, we highlight two exemplary northern locations in Humboldt County – Arcata Community Forest (second-growth) and Peavine Ridge at Humboldt Redwoods State Park (old-growth) – as well as two southern locations – Redwood Regional Park (second-growth in Alameda and Contra Costa counties) and the Santa Lucia Preserve (old-growth in Monterey County). In the second-growth forests, dominant trees gained height and biomass rapidly with rates varying by location (that is, trees gained height faster in wetter Arcata Community Forest). Growth trajectories in the old-growth forests were more variable, with some currently dominant trees suppressed by taller neighbors during previous centuries (FIGURE 4).

Redwoods of Peavine Ridge exhibited unusually rapid growth during the 21st century, and their main trunks produced much more wood than expected for their size (FIGURE 5). Dating back to the 1300s, growth was relatively sluggish in this ridgetop forest until higher light availability – presumably from improving air quality and reduced summer cloudiness (Carroll et al. 2014, Sillett et al. 2015b) – triggered increasingly wide annual rings starting about 1960 (FIGURE 6). Redwoods in the old-growth forest of the Santa Lucia Preserve (SLP), however, did not exhibit such a growth surge in recent decades. These trees endured the Soberanes Fire in 2016 immediately after the drought, and as a result exhibited negligible growth in 2017 while recovering damaged leaves and roots, as well as producing a massive crop of seed cones. Note that the

These iconic trees are growing at faster-than-expected rates, thereby enhancing arboreal habitats for other species and playing an outsized role in global climate mitigation.

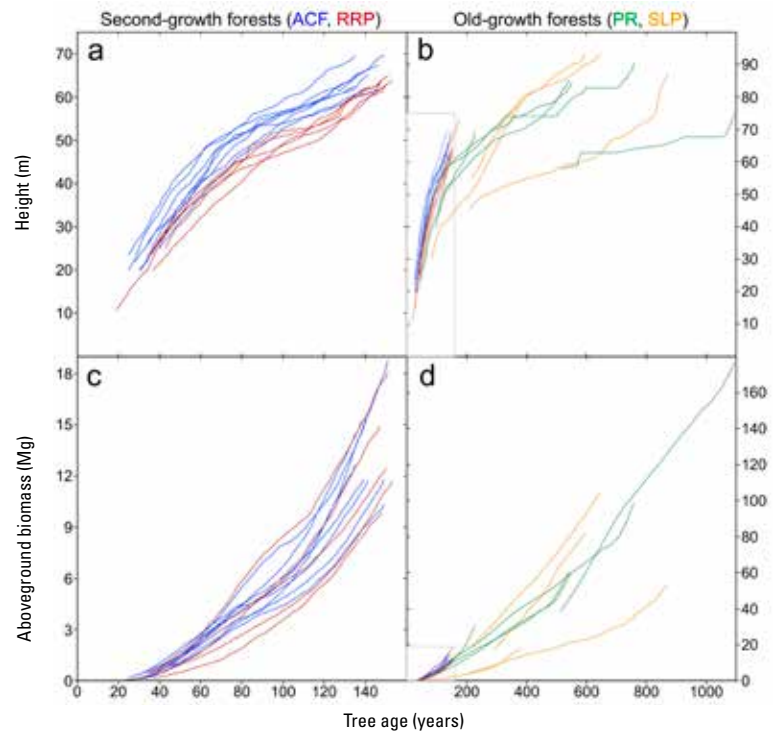


FIGURE 4

FIGURE 3. BIOMASS ACCUMULATION

Redwoods gain height rapidly in second-growth forests, but biomass accumulation (and therefore, significant carbon storage) in the tallest second-growth forests is much lower than in the tallest old-growth forests. This figure compares biomass estimates expressed as metric tons per hectare for a mature, second-growth forest (logged 1858) in Mendocino Headlands State Park and an old-growth forest in Humboldt Redwoods State Park (Sillett et al. 2019). Both are low-elevation, alluvial forests overwhelmingly dominated by coast redwoods, which hold more than 99.8% of aboveground biomass. Vertical black lines above each column indicate measurement uncertainty expressed as one standard error of total biomass.

The sawed cross-section on the right shows bark, sapwood, and heartwood tissues of a trunk from a second-growth forest in Sonoma County. Between the bark and sapwood layers is the small tissue layer called the **cambium**, which creates both new bark and wood as the tree grows and recovers from injury.

Right: Second-growth forests such as this one can regain height in a relatively short time after logging, but they take longer to reaccumulate biomass, and therefore, significant carbon storage.



FIGURE 4: BIOMASS RECOVERY

Intensive trunk measurements, including core-sampling at regular height intervals, permits examination of tree growth histories, showing that tree height increases much more rapidly than aboveground biomass. This illustrates that while forest height might recover relatively quickly in second-growth forests, biomass accumulation, and therefore significant carbon storage, takes much longer to recover. Shown here are time series for 23 coast redwoods in relatively wet and dry second-growth and old-growth forests, respectively. The wet forests are both in Humboldt County (ACF = Arcata Community Forest, PR = Humboldt Redwoods State Park), and the dry forests are in Alameda and Contra Costa (RRP = Redwood Regional Park) and Monterey (SLP = Santa Lucia Preserve) counties. Each line represents an individual tree, whose height is reconstructed via diameter measurements combined with dendrochronology.

Biomass is predicted as a function of main trunk wood volume decremented at annual increments. Age is calculated by subtraction from year of measurement. Tree age at year of measurement is estimated by regressing trunk ages at 10-m-height intervals against height and predicting age at ground level (Sillett et al. 2015, 2019). The gray boxes in lower-left corners of charts b and d show scales of charts a and c, respectively.

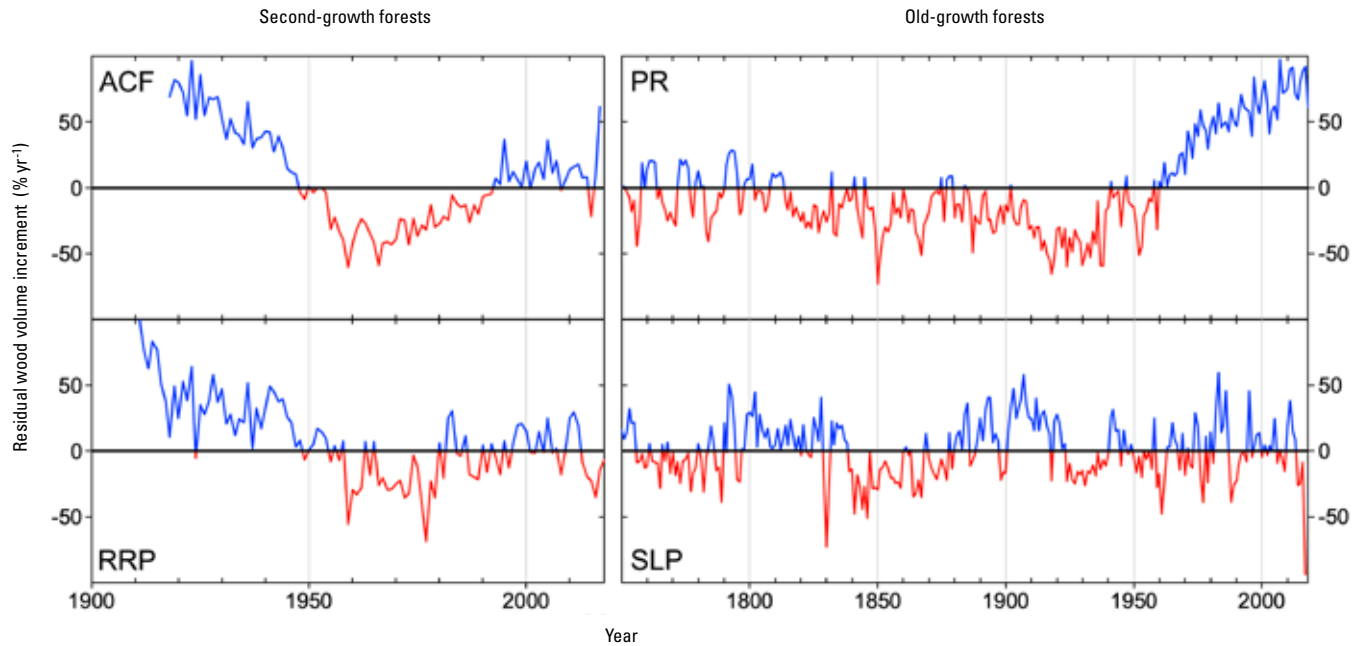


FIGURE 5

SLP growth history suggests a similar event in 1829 with very little wood production in 1830 (FIGURE 5).

Wood production in mature second-growth forests differed from what was observed in old-growth forests. Following logging in the mid- to late 19th century, redwoods reclaimed these forests as stump sprouts and newly established seedlings and grew quickly until the late 1940s when growing

After more than a century, redwood forests recovering from 19th-century logging have accumulated more biomass than nearly any forest ever measured.

space was largely reoccupied (FIGURE 5). Competition for resources and poor air quality may explain lower-than-expected growth during the second half of the 20th century in both second-growth forests. Note that redwoods in Arcata Community Forest (ACF) exhibited higher wood production during the recent drought than those in Redwood Regional Park (RRP). Moreover, in 2017, the year after drought ended, wood production at ACF increased dramatically in contrast to RRP.

Two trees in particular exemplify the remarkable resilience of the species to withstand disturbances and recover high rates of productivity (FIGURE 7). A lone redwood (tree 13) in Arcata survived 19th-century logging but was damaged and suffered from poor growing conditions as the town was built. Within the last few decades however, this veteran tree dramatically increased its rate of growth, resulting in higher-than-expected wood production during the 21st century. Aboveground biomass of this 285-year-old individual is now increasing by up to 500 kg yr⁻¹, because it recovered a full crown with nearly 2,900 m² of leaves and virtually no shade from neighboring trees. Similarly, in Del Norte County, a 704-year-old redwood (tree 49) with nearly 7,700 m² (1.9 acres) of leaves in Redwood Experimental Forest witnessed logging of an adjacent forest during the 20th century. Now

FIGURE 5: REDWOOD GROWTH TRENDS

This time series of coast redwood productivity in second-growth and old-growth forests, with wetter forests on top, shows how redwood growth trends in different forests vary significantly. Redwoods at Peavine Ridge (PR), a wet old-growth forest, exhibit a remarkable growth surge since the 1950s that was not observed in the second-growth or drier old-growth forest. Shown here are residual wood volume increments (RWVI) of 4 to 8 trees combined at each location. RWVI is expressed as a percentage and computed as measured trunk wood volume increment (m³ yr⁻¹) divided by the amount expected under a null hypothesis of uniform growing conditions, where cambium expands at the mean annual rate and wood production is proportional to trunk size. In each time series, blue indicates years when trunks produced more wood, and red indicates years when trunks produced less wood than expected for their size.

Old-growth redwood forest canopies in (TOP) wet, northern (Humboldt Redwoods State Park) and (BELOW) dry, southern (Santa Lucia Preserve) parts of the coast redwood range.



Photos by Stephen Sillett.

FIGURE 6: CORES

These are scanned images of increment cores collected 30 m above the ground from four coast redwoods (trees 39 to 42) in an old-growth forest (PR = Humboldt Redwoods State Park). Black dots mark 10-, 50-, and 100-year intervals on cross-dated annual rings spanning California state history through 2018 (rings farthest to right). Colored bars above cores span 56-year intervals, highlighting unusually rapid growth since 1960 due to higher light availability – presumably from improving air quality and reduced summer cloudiness (see PR in Figure 5).

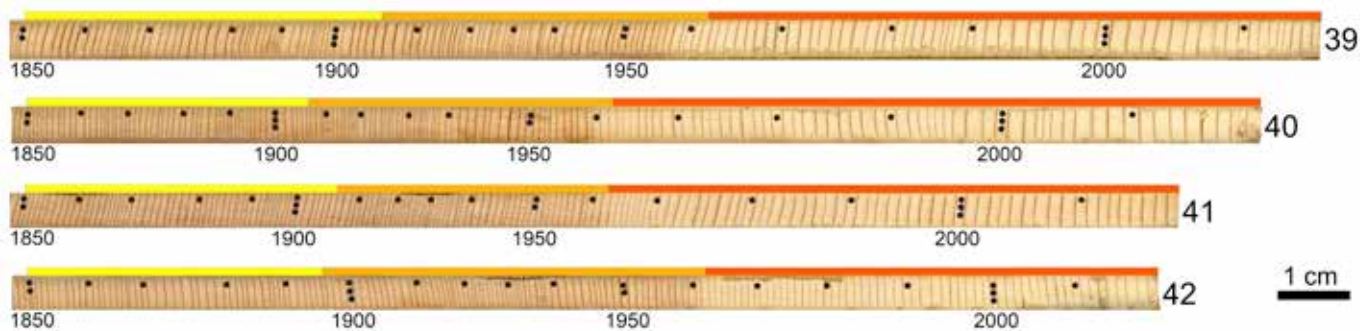


FIGURE 6

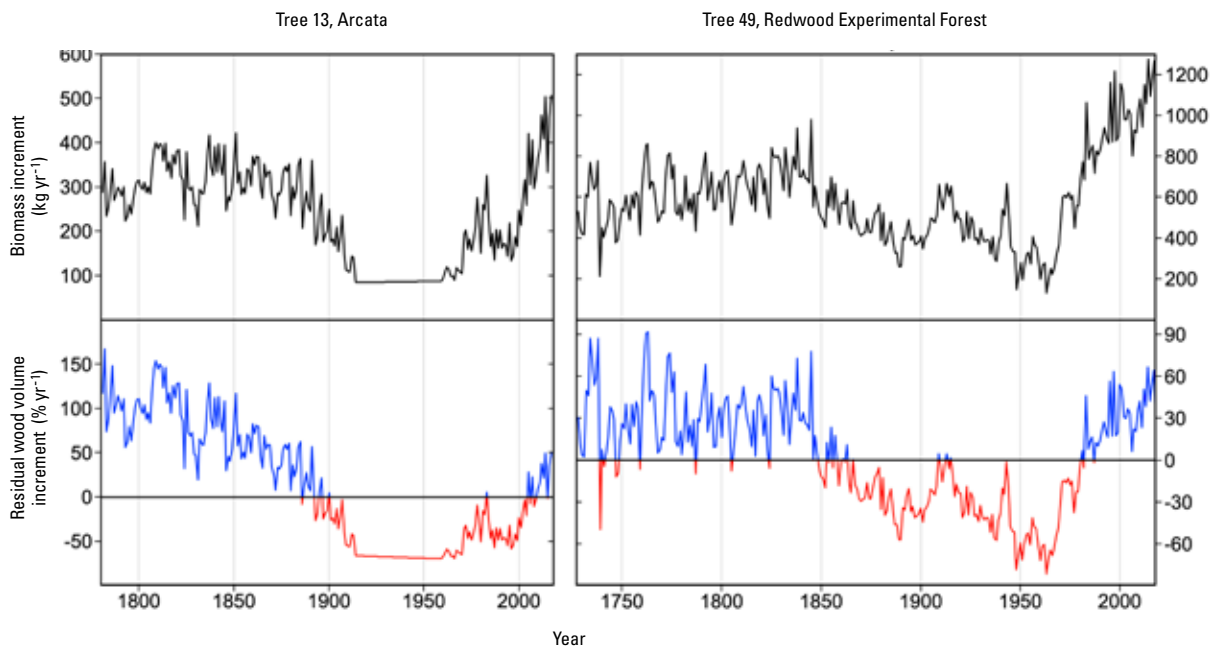


FIGURE 7

tree 49 is exhibiting exceptional growth, producing over 1,000 kg yr⁻¹ so far during the 21st century. In 2014, its aboveground biomass increased by an astonishing 1,275 kg (2,811 pounds), which is the fastest growth rate known for any tree worldwide.

Stories of individual trees and redwood forests continue to emerge through the RCCI, and so far, they clearly demonstrate the responsiveness of the species to environmental change. Logging eliminates carbon stores when trees are removed, setting forests back to a young state of rapid growth. After more than a century, redwood forests recovering from 19th-century logging have accumulated more biomass than nearly any forest ever measured. Only superlative old-growth forests dominated by coast redwoods, giant sequoia (*Sequoiadendron giganteum*), Douglas-fir (*Pseudotsuga menziesii*), and the species of eucalyptus, *Eucalyptus regnans*, have higher aboveground biomass (Sillett et al. 2015a, 2018; Van Pelt et al. 2016). In both old-growth and second-growth forests across California, redwoods continue to thrive and exhibit resilience to disturbances, including drought and fire, even though productivity is significantly lower in drier forests and immediately after fire (Carroll et al. 2018ab).

In the years ahead, we will extend RCCI research across the landscape and track growth of coast redwoods and giant sequoia under a variety of land-use histories, topographic positions, and climatic conditions. All of our data confirm the vital importance of protecting and restoring these forests throughout their natural range, not least because of their incredible carbon storage capacity and proven viability as a long-term carbon sink. As of 2019, we find no evidence of redwoods retreating from native forests as the climate changes. These iconic trees are growing at faster-than-expected rates, thereby enhancing arboreal habitats for other species (Sillett and Van Pelt 2007) and playing an outsized role in global climate mitigation despite their limited geographic distribution. ←

—Emily Burns, PhD, and Stephen Sillett, PhD

FIGURE 7: REDWOOD PRODUCTIVITY

This time series shows coast redwood productivity for two veterans that survived logging and exhibit exemplary growth rates in recent decades. It took more than a century for 285-year-old tree 13 in the city of Arcata to recover from damage inflicted during the city's construction. In Del Norte County, the 704-year-old tree 49 in Redwood Experimental Forest is the fastest growing tree known worldwide, producing over 1,000 kg yr⁻¹ of biomass. Upper panels chart biomass increments (kilograms per year). Lower panels chart residual wood volume increments (see Figure 5 for RWVI definition) with blue indicating years when trunks produced more wood than expected for their size and red indicating years when trunks produced less wood than expected for their size. Note that the apparently stable growth period in tree 13 is an artifact of this period not being cross-dated. The sum of measured ring widths from 1914 to 1959 is divided evenly such that main trunk wood radii change at a constant rate.

All of our data confirm the vital importance of protecting and restoring these forests throughout their natural range, not least because of their incredible carbon storage capacity and proven viability as a long-term carbon sink.

Stephen Sillett ventures into the redwood canopy to measure tree crowns and collect tree-ring samples from trunks as part of the Redwoods and Climate Change Initiative.



Photo by Marie Antoinette.

ABOUT THE AUTHORS

Emily Burns, the League's former Director of Science, led the research program that includes the Redwoods and Climate Change Initiative. She holds a PhD in Integrative Biology on the impacts of fog on coast redwood forest flora from the University of California, Berkeley. Professor Stephen C. Sillett is the Kenneth L. Fisher Chair of Redwood Forest Ecology in the College of Natural Resources & Sciences at Humboldt State University. Learn more at humboldt.edu/redwoods.

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WHAT

The Redwoods and Climate Change Initiative (RCCI) is a collaborative research program launched in 2009 to study past, present, and future impacts of climate change on coast redwood and giant sequoia forests. The results guide Save the Redwoods League in deciding where to protect and restore redwood forests facing climate change impacts.

WHO

Save the Redwoods League and Humboldt State University lead the RCCI.

PHOTOS: RCCI scientists study redwood forest sites annually, measuring tree structure and growth rates, as well as biodiversity. **LEFT:** Stephen Sillett and Marie Antoine refer to a map of a study site that shows the relative

locations of trees and fallen logs on the forest floor. **CENTER:** Scientists take samples of trunk cores to examine trees' growth histories. **RIGHT:** Jim Campbell-Spickler and field assistants record plant species growing on the forest floor.



REDWOODS & CLIMATE CHANGE INITIATIVE

Save The Redwoods
LEAGUE®

HUMBOLDT
STATE UNIVERSITY

WHERE

Each year, the RCCI studies the health of redwoods across the landscape, measuring tree structure and growth rates in a monitoring network spanning 18 sites in the coast redwood and giant sequoia ecosystems. In 2019 and 2020, researchers will study redwood growth rates in 20 new forests. These new studies will yield a better understanding of how climate change is uniquely affecting old and young, coastal and inland, and low- and high-elevation redwood forests across California.

HOW

44 acres of redwood forests, (the equivalent of 33.7 football fields) are monitored each year for change across a plot network spanning 18 sites.

More than **7,000 trees** are tracked annually.

1.2 million tree rings from wood core samples have been measured to track trends in redwood growth.

KEY DISCOVERIES

RECORD-BREAKING CARBON STORAGE DOCUMENTED IN COAST REDWOOD FORESTS

Aboveground biomass (5,190 Mg ha⁻¹) and carbon (2,600 Mg ha⁻¹) in old-growth coast redwood forests is the highest recorded globally for terrestrial ecosystems and is composed of 62%-77% decay-resistant *Sequoia sempervirens* (coast redwood) heartwood (Van Pelt et al. 2016, *Forest Ecology and Management*).

REDWOODS OF ALL AGES EXHIBIT UNPRECEDENTED GROWTH RATES

Wood production has increased phenomenally in coast redwoods over recent decades throughout the species' range, concurrent with anthropogenic climate change and higher light availability from improving air quality and reduced summer cloudiness (Sillett et al. 2015, *Ecological Monographs*).

NORTH COAST REDWOOD FORESTS ARE BUFFERED FROM REGIONALLY INTENSE DROUGHTS

Tree rings of coast redwoods throughout the ecosystem show that for centuries of California history, these trees recover from drought conditions repeatedly, and northern coast redwood trees are highly buffered from statewide drought impacts (Carroll et al. 2014, *PLOS ONE*).



PART OF THE CLIMATE CHANGE SOLUTION

Because of their extraordinary carbon storage ability, redwoods can play an outsized role in slowing climate change.

Second-growth redwood forests can accumulate about a third as much aboveground biomass as comparable old-growth forests in less than 200 years.

If the future climate and our stewardship continue to support recovery of second-growth forests, then these redwoods will increasingly provide measurable benefits of greenhouse gas reduction as they regain the stature of old-growth forests.



HISTORIC FUND REAUTHORIZATION WILL BOLSTER LEAGUE PROJECTS

Save the Redwoods League recently celebrated a resounding and historic win for land conservation from coast to coast and for our redwood forests. Your voices made a difference in the permanent reauthorization of the Land and Water Conservation Fund (LWCF), our nation's most successful conservation and recreation funding program.

Muir Woods National Monument and Sequoia and Kings Canyon National Parks have all been enhanced by the LWCF. The fund, leveraged with support from our members, also helped the League expand Redwood National Park. From these world-renowned jewels of the national park system to our local reserves, the LWCF has provided critical funding for the League and many others to safeguard the public lands we all love.

The LWCF was reauthorized in March 2019 as part of the bipartisan-supported John D. Dingell, Jr. Conservation, Management, and Recreation Act (S.47), which was the most comprehensive conservation legislation to be considered by federal legislators in a decade. The public lands package protects more than 2 million acres, creates new national monuments, and preserves our wild and scenic rivers, among other benefits. Most importantly, the extraordinary support in the House (363 to 62) and Senate (92 to 8) establishes a consensus, perhaps more than any other substantive issue in our public discourse today: The dedication of these funds for the protection of our natural resources is a shared priority for all Americans. Now there is no lingering doubt about the mandate to protect our treasured public open spaces, forests, and wildlands — from small city parks and playgrounds to our majestic redwood forests.

Save the Redwoods and our coalition of conservation colleagues are grateful to our congressional champions for working hard to pass S.47 with such resounding support. We thank our dedicated supporters who called their members of Congress and helped spread the word to get the LWCF permanently reauthorized, and we thank the American public for supporting this bill and making sure that it passed decisively. With the LWCF permanently reauthorized, we can fulfill our commitment to expand Headwaters Forest Reserve with the transfer of our Westfall Ranch property, and to protect Mailliard Ranch, permanently safeguarding the incredible redwood forests in these extraordinary places. —



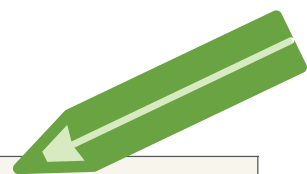


ELK RIVER, HEADWATERS FOREST RESERVE

CLIMATE



WHAT THE 2018 MIDTERM ELECTION RESULTS MEAN FOR REDWOODS



The 2018 midterm elections yielded a number of positive outcomes for conservation priorities, including measures that support redwood forests and the work of Save the Redwoods League.

The League endorsed or took a position on four measures on the California ballot. Three of the outcomes will help us protect and restore our redwood forests, and connect people to California’s magnificent redwood parks.

SAN FRANCISCO BAY AREA MEASURES

In the San Francisco Bay Area, voters overwhelmingly supported Measure FF in Alameda and Contra Costa counties, and Measure M in Sonoma County, both endorsed by the League. Funding from Measure FF will support the League’s education and interpretation programs, as well as forest restoration projects on East Bay Regional Park District redwood lands in partnership with the League. These projects will keep our East Bay redwoods resilient and on an accelerated path to old-growth forest form and function. Funds from Measure M will support work to protect and restore redwood forests in Sonoma County, and build trails and park infrastructure for the public. Also, with Measure M approved, up to \$42 million from the Clean Water and Safe Parks Act of 2018 will be made accessible for park projects in Sonoma County, including those to protect mighty redwoods.

CALIFORNIA STATEWIDE PROPOSITIONS

Californians rejected the League-endorsed Proposition 3, the California Water Bond, an \$8.9 billion citizens’ initiative. The bond would have invested in projects to ensure safe drinking water, repair infrastructure, and protect watersheds, including redwood forest restoration and protection projects. However, voters’ rejection of Proposition 6, the Gas Tax Repeal, was a win for the League. The League opposed Prop 6 because it would have repealed the gas tax that partially supports California State Parks and thousands of projects underway across the state, including many designed to reduce greenhouse gas emissions. A significant portion of gas tax revenue is directed to creating jobs that support the League’s work to expand and enhance California State Parks across the redwood range.

While the election results were mixed for conservation and climate change priorities, the League is taking cues from the redwoods we protect and steward. We remain resilient and stand tall for our mission to protect and restore the redwood forests and connect people to their peace and beauty. ←←

—Articles by Shelana deSilva, Director of Government Affairs & Public Funding, Save the Redwoods League

MIDTERM 2018 BALLOT			
MEASURE	OUTCOME FOR REDWOODS	PASSED	REJECTED
Measure FF in Alameda and Contra Costa counties (San Francisco Bay Area)	In East Bay Regional Park District, supports: <ul style="list-style-type: none"> · League education and interpretation programs · Sustainable forest management in partnership with the League 	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Measure M in Sonoma County (San Francisco Bay Area)	Supports work to protect and restore redwood forests, and build trails and park infrastructure	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Proposition 3 the California Water Bond (statewide)	Would have supported projects to ensure safe drinking water, repair infrastructure, and protect watersheds, including redwood forest restoration and protection	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Proposition 6 the Gas Tax Repeal (statewide)	Would have cut partial funding for California State Parks and projects, including many to reduce greenhouse gas emissions	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Results of elections on three measures in California will help us protect and restore our redwood forests, and connect current and future generations to magnificent redwood parks.

PREVIOUS SPREAD Permanent reauthorization of the federal Land and Water Conservation Fund will support the League’s work to expand the pictured Headwaters Forest Reserve.

CLIMATE



Photo by Wayne Hsieh, Flickr Creative Commons, © 2019.

The largest giant sequoia in Calaveras Big Trees State Park is doing its share to defend itself, other redwoods, and even the homo sapiens who caused global warming, from the gathering crisis. If we humans do our part, we can build a future in which humans and redwoods alike continue to flourish.

Community Voices

Can Redwoods Survive a Hotter Planet?

‘Climate Change Ranks As the Top Threat’

Community Voices is a series in which guest writers share their perspectives on redwood forests.

“When we try to pick out anything by itself, we find it hitched to everything else in the Universe,” John Muir wrote in *My First Summer in the Sierra*. I was reading a lot of Muir during my first summer in the Sierra, the summer I fell in love with giant sequoia trees.

I had spent most of the past 10 years traveling around the world to research a book about humanity’s environmental future. When I returned to the United States to write what became *Earth Odyssey*, I lived in a log cabin deep in the forest of the Sierra Nevada. A mile past the end of the paved road that led back to civilization, the cabin had electricity and running water, but no telephone, much less Internet access. But a 40-minute hike over the ridge lay the North Grove of Calaveras Big Trees State Park, home to some of the biggest and oldest trees—indeed, some of the biggest and oldest living things—on Earth.

“Climb the mountains and get their good tidings,” Muir urged, and I eagerly complied. I visited the North Grove countless times, in all four seasons. Even at the height of springtime’s exuberance, when Douglas squirrels squawked a counterpoint to the insistent tapping of white-headed woodpeckers, and dogwood blossoms splashed color among the awakening undergrowth, the grove was pervaded by a deep calm. The giant sequoia towered skyward, massive yet graceful, dominating their environment without overwhelming it. From the forest floor arose the rich aroma of pine needles and duff warmed in the morning sun, while the creek gurgled with the new life imparted by the melting snows of the High Sierra. The giant sequoia seemed at once inseparable from—yet indifferent to—the swirl of nature’s elements; they had held this ground forever. As moment followed moment, time dissolved into the eternal Now and the splendor of life on this Earth was revealed as a never-ending miracle.

Muir’s observation that every single thing on Earth is “hitched” to everything else is now recognized as a fundamental ecological truth. Having spent much of my life reporting and writing about ecological matters, I can think of no more urgent example of this insight than global warming. Burning coal, driving gas-guzzlers, leveling forests—even when these actions happen thousands of miles away, they imperil redwoods as surely as loggers’ saws and axes did in Muir’s time. As global temperatures keep rising, the redwoods that Muir revered and did so much to protect need fresh champions—and fresh thinking and policies, including the Green New Deal idea that is gaining traction in Washington, D.C., and around the world.

Humanity must act at unprecedented speed and scale to avoid catastrophic heat waves, storms, droughts, and sea level rise that could kill hundreds of millions of people, warned the United Nations

Humanity must act at unprecedented speed and scale to prevent a global temperature increase above 1.5°C, thereby avoiding catastrophic heat waves, storms, droughts, and sea level rise.

Intergovernmental Panel on Climate Change (IPCC) in its October 2018 report. The report’s title, *Global Warming of 1.5°C*, alludes to a milestone scientific finding: While a temperature increase of 2°C above pre-industrial levels used to be regarded as the threshold of dangerous impacts, the latest science—coupled with observations of the record hurricanes, wildfires, and Arctic ice melt already happening after “only” 1°C of warming—says that 1.5°C is the new limit for avoiding unparalleled climate breakdown.

The good news, the IPCC adds, is that 1.5°C is achievable—there are no barriers in science or technology; rather, it's a matter of political will and economic transformation. Humanity must stop burning fossil fuels (unless we capture their carbon emissions); we must stop cutting down so many trees; and we must stop raising so many cattle, among a host of other necessities. We must transition to solar and other forms of zero carbon energy, shift to regenerative agriculture and forestry, eat less meat, and embrace other climate-friendly alternatives to the status quo. And we must do all this very quickly. Humanity must achieve “carbon neutrality”—meaning, our societies must emit no more carbon dioxide than they extract from the atmosphere—by 2050.

The good news is that 1.5°C is achievable. California, the world's fifth largest economy and home to the vast majority of Earth's redwoods, is on track to make the transformations needed.

If that sounds impossible, here's another piece of good climate news, one with direct relevance to redwoods: California, the world's fifth largest economy and home to the vast majority of Earth's redwoods, is on track to make the transformations needed to hit the 1.5°C target. Bipartisan leadership from former Republican Governor Arnold Schwarzenegger and then Democrat Jerry Brown helped the state cut its greenhouse gas emissions to 1990 levels by 2018. In 2018, Brown signed into law Senate Bill 100, which requires 100 percent non-carbon electricity in California by 2045. Brown also signed an executive order requiring the entire state economy (not just the electricity sector) to be carbon-neutral by 2045. Disproving claims that protecting the climate puts people out of work and companies out of business, California has done all this even as its economy grew and created jobs faster than the United States as a whole did. “When you put [the world's fifth largest economy] on this path, it sends a huge message to the rest of the United States and the world that this is possible,” said Kevin de León, the former state senate president pro-tempore and the author of Senate Bill 100.

Happily, growing trees turns out to be a kind of miracle weapon against climate destabilization. Through photosynthesis, trees “inhale” carbon dioxide and store it in their leaves, branches, and roots, rather than letting it remain in the atmosphere, trapping heat. This is why scientists call forests a carbon “sink,” whereas trees that are cut down or burned are a carbon “source.” Growing trees thus offsets some of the warming that humans' emissions would otherwise cause.

Nevertheless, rising temperatures will test all human societies and natural ecosystems, including redwoods, in the years ahead. In the entire history of civilization, global temperatures have never risen as fast as they are rising today. And the physical inertia of the climate system—the fact that carbon dioxide remains in the atmosphere for many decades after being emitted—guarantees that temperatures will keep rising for some time. Hence, climate action must now embrace a twin imperative known as “avoiding the unmanageable and managing the unavoidable.” Humanity must avoid an unmanageable amount of temperature rise—by limiting global warming to 1.5°C, the IPCC says—even as we manage the temperature rise that's already locked in due to past emissions.

“Our research underscores that climate change ranks as the top threat to redwoods,” said Anthony Ambrose, a plant ecologist at the University of California, Berkeley. Ambrose was a core collaborator on the Redwoods and Climate Change Initiative (RCCI), which Save

the Redwoods League launched in 2009 to increase scientific understanding of how giant sequoia and coast redwoods will be affected by climate change. “It's not only higher temperatures that concern scientists,” Ambrose told me; it's also the knock-on effects of higher temperatures. “The main worries are water availability, fire patterns, and increased potential stress from bugs, fungi, or other pathogens,” he added.

The outlook for coast redwoods is better than it is for giant sequoia, and water is the main reason. Weather generally moves west to east in California, from the Pacific across the Central Valley to the Sierra. The coast is frequently engulfed in fog as moist ocean air meets land. This pattern is projected to continue as temperatures rise; the coast could even become foggier if higher inland temperatures pull still more ocean air eastward (though climate models are uncertain on this point). Fog provides coast redwoods with much of the moisture they need, augmented by the rains that fall from the lowest of the clouds. (Even during the record drought California endured from 2011 to 2017, the northern coast received significant rainfall.)

This more favorable water situation may help explain why the temperature increases registered to date do not seem to have bothered old-growth coast redwoods. As temperatures continue rising in the decades ahead, the most important projected effect for coast redwoods is that their range will shift northward as redwoods in the Big Sur area face greater stresses.

Giant sequoia face a tougher outlook, Ambrose said, because their water supply is “highly dependent on the Sierra Nevada snowpack, and that snowpack is changing rapidly” as global warming intensifies. The snowpack's plight was already evident in 2009, when I interviewed Greg Stock, a geologist for the National Park Service. “The way things are going, Yosemite's glaciers will be entirely gone within a few decades,” Stock told me. “The melting is already having an effect on the visuals available to park visitors. We don't see as many snow-covered peaks as before. As the melting continues, there will be much more troubling impacts, because glacial melt is the source of some of the streams and rivers the flora and fauna of Yosemite rely on.”

Growing redwoods is particularly potent in offsetting some of the warming caused by humans' emissions.

And melting snow isn't the only way global warming threatens giant sequoia. Higher temperatures cause more precipitation to fall as rain rather than snow. Such rain ends up in rivers that carry it to the valleys below. By contrast, snowmelt sinks slowly into the soil and replenishes the groundwater below.

This lack of replenished soil moisture poses an exceptional threat to giant sequoia, said Ambrose. “One giant sequoia tree can consume up to 4,000 liters of water a day in the summer because sequoia have so much leaf area that transpires moisture, [passes moisture through the leaves' pores],” he explained. “When there's not enough snowmelt to provide that water, the trees compensate by pulling more water out of the soil. That leads to a drier immediate ecosystem, which increases the threats from wildfires as well as from pests and pathogens.”

Giant sequoia are famously impervious to most forest fires. But Ambrose warned that even giant sequoia could die in exceptionally hot and lasting wildfires fueled by other trees that have perished in severe, long-lasting droughts. The record drought from 2011



Photo by Stephen Sillitt, Institute for Redwood Ecology, Humboldt State University.

to 2017 also spurred a proliferation of bark beetles that “are now attacking some giant sequoia in Sequoia and Kings Canyon National Parks,” Ambrose added. “This is the first time we’ve seen that, which is pretty concerning.”

“Redwood trees are incredibly resilient, but when do they reach a tipping point?” Ambrose asked. “I don’t think the species will disappear; there are redwoods in various parts of the planet now. But the existing redwood groves here in California? Those might disappear. That’s my concern.”

Redwoods are far from shrinking violets: Given a fair chance, they might well survive the climate turbulence that lies ahead, just as they have survived countless natural threats for millennia. Giving redwoods a fair chance means, first and foremost, limiting global warming to the absolute minimum—science is clear on that. Traditional threats to redwoods, notably the leveling of trees and the construction in their place of roads, houses, and shopping malls, remain a danger as well. But every such battle could be won, and yet the larger cause may be lost if global warming is not contained, and soon.

Hence, an irony: Saving redwoods alone can no longer protect the redwoods. If humans do not contain global warming, redwoods will likely wither and perish, at least in California. Thus a recalibration of strategies and tactics seems necessary. For example, such long-standing practices as purchasing private land containing redwoods and putting it into public trust must now take into account that global warming will increasingly shift the geographical ranges where redwoods can thrive.

As part of its vision for the next 100 years, Save the Redwoods League is making restoration of coast redwood forests a strategic priority.

The outlook for coast redwoods is better than it is for giant sequoia, and water is the main reason. Fog provides coast redwoods with much of the moisture they need, augmented by the rains that fall from the lowest of the clouds.

But how much global warming, with its attendant droughts and wildfires, can redwoods endure? Can redwoods survive a future in which global temperatures increase 2°C? Or do they, like human societies, need global warming to halt at 1.5°C? How would redwoods fare if, god forbid, global temperatures increase by 3.5°C, our civilization's current trajectory?

No one can say. I would urge Save the Redwoods League to address this key question in their next phase of RCCI research. A given forest restoration plan may make perfect sense in the face of today's 1°C increase, but fail utterly if temperatures instead rise by 1.5°C or more.

The twin imperative of avoiding the unmanageable while managing the unavoidable requires that the best available science be translated into far-reaching public policy. "We've got to build resilience into our ecosystems, especially our forests, if we're going to deal with what climate change will throw at us," said Robert Wilkinson, a professor of environmental studies at the University of California, Santa Barbara. "Clear-cutting leaves exposed soils, which dry out more quickly than those with forest cover, and erode more readily during precipitation events."

"We need our forests, especially up in the mountains, to be like sponges," Wilkinson added, "so when there are big storms or other high-precipitation events, the trees and soil can soak up that water like a sponge. In the short term, that means less flooding downstream. In the long term, it means that water is stored underground and available to use later. Then, if the climate system swerves in the other direction, and suddenly there

League restoration work aims to raise redwoods' capacity to recover quickly from increased wildfires resulting from global warming.

isn't enough water coming off the mountains, we can rely on that naturally stored water, both to supply our own needs and to keep the forests less vulnerable to wildfires."

As for limiting temperature rise, bear in mind the good news mentioned above: We already have in hand most of the technologies and practices we need. A scientifically rigorous yet nontechnical compilation of our options is found in the book *Drawdown*, edited by Paul Hawken. Because most of these reforms are both job creators and moneymakers, the happy fact is that stabilizing the climate could become the biggest economic enterprise of our time, a huge source of employment, profits, and poverty alleviation.

This happy fact—saving the climate can also save our economy—is the foundation of the Green New Deal that has gotten so much attention recently. Rep. Alexandria Ocasio-Cortez, the rock star new congresswoman from New York, and her supporters in the Sunrise Movement began pushing the incoming Democratic majority in the US House of Representatives to back a Green New Deal. The idea fast went on to gain endorsements by 2020 presidential prospects Bernie Sanders, Kamala Harris, and Elizabeth Warren. The new prime minister of Spain, Pedro Sanchez, has also backed the idea, telling elites at the World Economic Forum in Davos they should not fear it because it will create, not destroy, jobs.

As I explained 20 years ago in *Earth Odyssey* when proposing a Global Green Deal—essentially, a global version of a Green New Deal—this program would rely on government leadership

to subsidize activities that are valuable to society but not yet supported by market forces, while also halting subsidies to such climate-destroying activities as exploring for more oil. Governments would establish rules of the road so that market prices reflect the social costs of overheating the atmosphere and clear-cutting forests. Thus, a key component of a Global Green Deal would be to set a rising price on carbon that would drive companies and

We need governments to subsidize activities that are valuable to society but not yet supported by market forces, while halting subsidies to climate-destroying activities.

consumers to choose, say, a solar electric car rather than a gas-guzzling SUV.

There's one last essential in the toolbox of change. "People need to get close to nature," Ambrose urged. "If you get out and experience redwoods, you'll want to do something about global warming to protect them."

Not long ago, I visited the South Grove of Calaveras Big Trees State Park, which contains one of the RCCI research plots. To get there, one crosses the north fork of the Stanislaus River. Over the preceding five years, as California endured the worst drought in its recorded history, the Sierra snowpack had dwindled. Luckily, the latest winter had brought lots of precipitation, and I could see the results when crossing the Stanislaus. A river that had been a shrunken, pitiful thing the previous summer was now a frothy, roaring torrent. Trees and foliage were vibrant as well.

With Muir's advice to "climb the mountains and get their good tidings" flashing in my brain, I followed the trail past one giant sequoia after another until I reached the end. There, beside Big Trees Creek, resided the largest tree in the park. Estimated to be 2,000 years old, the tree is by no means the loveliest of giant sequoia, nor is it the tallest. Its extraordinary 25-foot diameter, however, recalls the encouraging fact that old trees store more carbon than young ones do, and that redwoods are three times more effective at carbon storage than the average tree species.

Muir had it right: Everything is connected to everything else. This massive tree was doing its share to defend itself, other redwoods, and even the *homo sapiens* who caused global warming, from the gathering crisis. If we humans do our part, we can build a future in which humans and redwoods alike continue to flourish, reveling in the mystery and wonder of life on the only planet we have.

—Mark Hertsgaard

CONTACT US

What redwood forest topics do you care about?
Write to us at Redwoods@SaveTheRedwoods.org.



Photo by FIG & Olive Photography.

Community Voices

Redwoods Helped Connect My Latino Family to the Outdoors

Amanda Machado (center) visits Redwood Regional Park in Oakland with friends Janet Henkai (left) and Rocío Bravo.

Five months after moving to Oakland, when my family visited for Thanksgiving, they agreed to hike with me in Redwood Regional Park. I didn't take moments like this for granted. As I had written about before their visit, growing up, I had believed hiking was a "white people thing" and had difficulty relating "outdoorsy culture" to my Latino family's experience.

On that hike, I remember the moment we found ourselves in an open area surrounded by giant redwoods, the gold afternoon light glowing through their leaves. My whole family stopped and looked up. For a minute, we stood there, necks stretched, saying nothing. I couldn't

finally coming together, the space where the outdoors also began to feel culturally like home.

As someone without a car, I also couldn't believe a place so beautiful was so easily accessible using Oakland public transportation, or a mere 15-minute taxi ride from my house.

But unfortunately, most people of color and people from low-income communities do not have that same opportunity. According to a 2016 study by the Center for American Progress in 11 western states, more than 80 percent of these communities lived in areas with fewer natural spaces than the state average.

In the environmental movement, advocates often say, "Our public lands belong to everyone." But when marginalized people cannot access natural spaces, those statements ring hollow. People shouldn't have to search outside their community to find magic outside. They should be able to find that magic within their own communities, so it becomes clear that natural spaces belong to them too.

I hope the environmental movement can focus on giving more people of color and people from low-income communities the opportunity to fall in love with nature, to live near a natural space that feels sacred to them in a way that moves them to defend it, and to experience magic outside in a place that feels like home.

—Amanda Machado

More people of color and people from low-income communities should have the opportunity to feel nature's magic near their homes.

remember the last time my family stood in awe that way, so taken by nature that it drove us to silence.

Moments like these made a difference. By sharing Redwood Regional Park with family members and later, other friends of color, it became the space where my Latino identity and my outdoorsiness started

LEARN MORE

Enjoy Oakland's redwoods. Read "Redwoods in the City" on page 14 of this magazine.

Save The Redwoods

L E A G U E

SAVE

2019

**JAMES CAMPBELL &
JESSICA MONTAGUE**

Gala Co-Chairs

the

GALA

DATE

SATURDAY

OCTOBER 12, 2019

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SAVETHEREDWOODS.ORG/GALA

415 820 5833

BOOKS

SONG OF SIX RIVERS

Zev Levinson

Song of Six Rivers is a long, reflective poem in which author Zev Levinson recounts the bittersweet history of Northern California as he faces his grief over the loss of his mentor and fellow teacher Guy Kuttner, as well as that of his own father decades before.

Accompanied by haunting historic images, Levinson's words weave through decades in California's most serene and striking landscapes. He acknowledges what the Native American Yurok, Karuk, Hupa, Sinkiyone, and Wiyot tribes have mourned, and reminisces about days with his family of writers, including Kuttner, at their Lost Coast Writers Retreat. "We sip the wisdom of John Muir / As generations of authors write / These trees limned by his fractious voice, / These trees with crowns beyond our sight. / Sequoia sempervirens tower / Along our rocky, shifting coast."

Naming all three species of redwoods, the poem paints the nostalgia of the magnificent forest, the serpentine rivers, the craggy coastline overlooking the vast Pacific, and the people who not only live among the splendor, but also make the watersheds and the sleepy towns as special as they are. In these places, enveloped in joy, sadness, and humble reverence, Levinson is able to let go of his trauma and find peace with the path that he's on.

This piece is a heartbreakingly beautiful tribute to two important men, but deep in the heart of it, it's also a sorrowful love letter to redwoods country and the people who call it home.



Song of Six Rivers
Zev Levinson

Humboldt State
University Press

Powell's Books
powells.com

2018, 89 pages.
\$22 hardcover,
\$12 paperback

STRETCH TO THE SUN: FROM A TINY SPROUT TO THE TALLEST TREE ON EARTH

Carrie A. Pearson with illustrations by Susan Swan

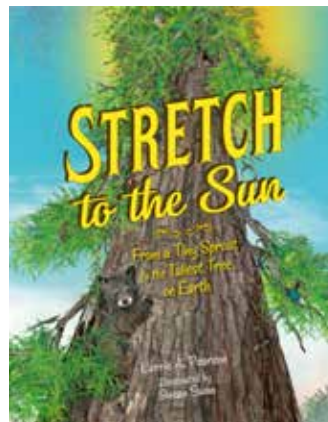
Stretch to the Sun: From a Tiny Sprout to the Tallest Tree on Earth by Carrie A. Pearson is an essential read for young naturalists. It illuminates the coast redwood forest through the seasons, and tells the story of a real redwood that has grown to be the tallest tree on Earth, at 380 feet.

Pearson's words and Susan Swan's stylistic illustrations show the richness of the forest canopy and understory, painting a rugged and vibrant world of black bears and northern flying squirrels, spotted owls and marbled murrelets, and huckleberry bushes and ferns. The book covers a wide range of topics, from the coast redwood's fire-resistant bark, to the logging era, to the protection of the last remaining redwood forests.

The end of the book features coast redwood facts, which expand on the narrative in the first half. This makes the book enjoyable for various ages. Most children can grasp the brief story. Older, more inquisitive youths can have many of their inevitable questions answered about the science and history of redwood forests. Even grown-ups without previous knowledge of the trees will learn the basics.

The founding of Save the Redwoods League in 1918 is included as an important moment for *Sequoia sempervirens*. *Stretch to the Sun* will hopefully inspire a new generation of scientists, conservationists, and adventurers to see the redwoods and protect them for all time.

—Book reviews by Dana Poblete



***Stretch to the Sun:
From a Tiny Sprout
to the Tallest Tree
on Earth***

Carrie A. Pearson
with illustrations
by Susan Swan

Charlesbridge
charlesbridge.com

2018, 32 pages.
\$16.99, ages 5-8

Dedicated Members Exceed Legacy Gift Challenge

‘The Centennial 100’ Support Future Forest Conservation

For many of us, taking in the majesty of one enormous redwood tree stirs the imagination. But standing in a forest of many ancient giants is an experience like no other, filled with the raw power and beauty of an entire ecosystem. It is with the power of many in mind that Save the Redwoods League set a bold goal in our Centennial year of 2018.

We asked 100 supporters to designate legacy gifts to the League. Their pledges, made through gifts in their

After exceeding our goal of 100 new legacy gifts in 2018, League Board member Peggy Light thoughtfully increased her gift to \$105,000 to match each commitment with a \$1,000 contribution.

wills, trusts, and retirement plans, are commitments to protect the forests beyond their lifetimes. They are promises to protect the formative redwoods experience for the next generation of visitors.

As added inspiration for their commitment, League Board member Peggy Light offered to pay forward \$100,000 of her legacy gift to match each new pledge with an outright gift of \$1,000. The League is pleased to announce our success in exceeding our goal. By the end of 2018, 105 dedicated supporters made their commitments, securing their spots in our Redwood Legacy Circle, and creating a foundation for the next 100 years of redwood forest conservation. These supporters will forever be known as The Centennial 100.

“This achievement strikes a personal chord with me, as my own connection to the organization goes back to its beginnings,” Light said. “My grandfather, A. E. Connick, was one of the founding members and a President of the League. His passion for preserving these magnificent giants had inspired my own dedication to Save the Redwoods. I am elated to know that we are now poised to continue this work for another century to come.”

We are exceedingly grateful for Light’s generous gift, which inspired so many to create a legacy gift of their own. Thank you.

Write Your Will in Minutes, for Free

A New Service for Our Supporters

Everybody needs a legal will, but too many people put it off year after year. Many of our supporters are making 2019 the year they get their plans in order. Making a will gives you peace of mind and lets you show your love for the people and causes close to you. Including a gift to Save the Redwoods League in your will helps to ensure protection of our redwood forests for generations far in the future. It’s the biggest gift most people will ever give, and it costs you nothing now.

Before you get started, here are some of the common mistakes to avoid when thinking about wills.

MISTAKE 1: But I don’t have “an estate.”

You don’t have to own a castle in Europe to need an estate plan. It’s important to plan for things such as who might care for your pets.

MISTAKE 2: But I plan on living 100 years.

Good! We hope you do. Making a will now is an incredible expression of values for the people and causes you love, and you don’t want to be stuck without one.

MISTAKE 3: Will this even help the causes I love?

Yes! It’s valuable for us to plan for these gifts, even for the distant future. And it gives nonprofits a chance to celebrate and thank you today.

Get Started

Join your fellow supporters in making a transformative difference and checking a big item off your list in just 20 minutes. Visit [FreeWill.com/savetheredwoods](https://www.savetheredwoods.com/free-will).



ABOVE Marcia and Jim Allegretti want to protect redwood forests after their lifetimes, so they named Save the Redwoods League in their wills.

RIGHT League Board member Peggy Light stands with Sam Hodder, League President and CEO. In 2018, Light generously matched each of 105 new legacy gift pledges with a gift of \$1,000.



Top photo by Julie Martin; right photo by Paolo Vesecia.



STAND FOR THE FUTURE

YOUR LEGACY IS THE KEY

You can safeguard the immersive experience of our redwood forests for the next generation of wanderers: It's as simple as including a gift to Save the Redwoods League in your will or trust. With your support, you ensure that future generations can witness firsthand the awesome power of nature.

Please return the attached postcard for a free estate planning guide to help you protect these ancient giants well into the future.

**PROTECT
CALIFORNIA'S
GIANTS
FOR THE NEXT
GENERATION**

PLEASE CONTACT:

Sharon Rabichow

Director of Gift Planning

415-820-5828

legacy@SaveTheRedwoods.org

MyRedwoodsLegacy.org

SaveTheRedwoods.org



Photo by Suzanne Moss.

the new climate heroes

League's High School Program Inspires Future Scientists

Today's youths are destined to be tomorrow's climate champions. That's why it's so critical to empower them to learn about climate change from all angles — including from inside a redwood forest. Through the League's Redwoods and Climate Change High School Program, students gain crucial environmental literacy.

The program takes San Francisco Bay Area high school students on field trips to study the area's redwood forests. As citizen scientists, they collect data on trees and ferns, biodiversity, and the effects of drought. Classroom lessons support the field trip through hands-on activities in which students calculate biomass and carbon storage, analyze climate change data from the League's Redwoods and Climate Change Initiative, and learn basic redwood forest ecology.

Some students are even inspired to become scientists. Aria Everingham, a senior at Oakland Technical High School, said the program has influenced her since her freshman year.

"I remember learning about the redwoods, how they grow, and how important their conservation is," she said. Now Everingham plans to major in environmental science in college.

Whether or not individual students decide to pursue careers in science, understanding trees' ecological value results in a well-rounded view of climate change.

"I learned that redwoods hold a lot of carbon in them," said Laura Taylor, another senior at Oakland Technical High School and an alumna of the program. "They are a really important way to get carbon out of the atmosphere."

The program also offers the sheer pleasure of being in the forest.

"I think that the redwood forest is such an important place for people to see," Everingham said. "The field trip should be expanded to as many schools as possible because the forest is kind of a magical space."

Climate change is an urgent issue that also calls for long-term vision. We look to the youths to lead us as a new generation of environmental stewards and scientists. 🌿

—Dana Poblete

CLIMATE



WHAT

The League's Redwoods and Climate Change High School Program teaches San Francisco Bay Area students about the impact of climate change on redwood forests.

LEARN MORE

See a video about the Redwoods and Climate Change High School Program: [SaveTheRedwoods.org/rcchs](https://www.savetheredwoods.org/rcchs)

Read about the League's Redwoods and Climate Change Initiative on page 34.

Students in the League's Redwoods and Climate Change High School Program study a Western swordfern as an indicator of how drought impacts the forest.

Photo by Deborah Zierfen.



Photo by Paolo Vescia

Thank You

for Joining the Crowd

Members Centennial Grove 2018 Provides Forest Stewardship Support for Years to Come

More than 1,400 members contributed to the League's first crowdfunded grove, which honors the organization's 2018 Centennial. The grove is in Peters Creek Old-Growth Forest, a League-owned property west of San Jose.



In the Santa Cruz Mountains lies a lush, secret gem where time stands still and surprises delight the senses around every corner. Only a 45-minute drive from San Jose near Portola Redwoods State Park, ancient coast redwoods rise from carpets of sorrel along rippling Peters Creek. This hidden wonder is the 145-acre Peters Creek Old-Growth Forest, protected from subdivision and development by Save the Redwoods League and our supporters in 2014.

We marked another great milestone for this League-owned forest last year: More than 1,400 League members contributed to reaching our \$100,000 goal in our first crowdfunding effort to dedicate the Members Centennial Grove 2018. The grove commemorates the League's Centennial and 100 years of collaboration with our members to protect and restore redwoods and connect people to their peace and beauty.

With the generous contributions to the Members Centennial Grove 2018 to support our stewardship of Peters Creek Old-Growth Forest, this unique home of towering giants will stand healthy and strong for future generations to experience.

Thank you so much for helping us dedicate the Members Centennial Grove 2018. We look forward to inviting contributors on a hike to this special grove this year. 🌿

—Kate Berry, Senior Manager of Annual Giving, Save the Redwoods League

JOHN WOOLLAM: ACTING QUICKLY WITH A BIG HEART



John and Cyndi Woollam (SECOND FROM LEFT AND CENTER), with their grandson Adam Rustermier (LEFT), daughter Cathy Rustermier, and granddaughter Ahna Rustermier (FOURTH AND FIFTH FROM LEFT) at the League's Centennial Celebration Gala last year.

Dr. John A. Woollam has been a generous and steadfast supporter of Save the Redwoods League for over three decades. His gifts in recent years have helped to protect Peters Creek Old-Growth Forest in the Santa Cruz Mountains and Mailliard Ranch with its Cathedral Grove of old-growth redwoods in Mendocino County. Most recently, he supported Harold Richardson Redwoods Reserve (formerly McApin Ranch) in Sonoma County. This reserve is the largest privately owned old-growth redwood forest and home to the oldest coast redwood south of Mendocino.

John was the lead donor for the League's purchase of the reserve, which was acquired in 2018. In describing his inspiration to support the acquisition, John explained, "When I heard about the situation with these redwoods I had to act—and act quickly with a big heart—to save them. Just think what is at stake: We who live only about a century can save hundreds of trees that have lived thousands of years! For dozens of generations into the future, these awesome trees will continue to grow, and be loved by others."

Not only has John led the charge to save these old-growth properties, he has inspired others to follow his example by pledging to match their contributions dollar for dollar. At times anonymously and at other times more publicly, his matching gifts have helped the League raise millions of dollars over the years. Recently, he made a pledge to the League's Redwood Land Fund contingent on League donors stepping up to join him with matching gifts. So far, his commitment has leveraged \$3 for every \$1 he has given!

A research physicist by training, John has made his mark as both an educator and entrepreneur. He is the George Holmes Distinguished Professor at the University of Nebraska, and the founder of J.A. Woollam Co., a high-

technology leader in the development of ellipsometry instruments (devices used to analyze material surfaces). His company recently celebrated its 30th anniversary. John is the recipient of the American Physical Society's Industrial Applications of Physics Prize, and a National Research Council Fellow.

In addition to his work with the League, John and the J.A. Woollam Foundation have been involved with numerous preservation and restoration projects in the Caribbean and in Michigan, where he and his family created the Woollam Family Nature Preserve on the shores of Lake Michigan.

John's passion for California's iconic redwoods was sparked by a visit to the West Coast in the 1970s. As he recalled, "I decided to drive the coast from Southern California all the way up to Northern Washington, and when I got to the Avenue of the Giants [in Humboldt Redwoods State Park], I was stunned. I still remember standing under one of those giant redwoods, just marveling at its size, and the sense of tranquility, the silence all around me. It was solitude without loneliness, and it was wonderful, heartwarming. I travel back to California as often as I can, in large part just to repeat that experience, just to walk through the redwoods."

In an era when we face the loss of biodiversity and natural habitat at an unprecedented rate worldwide, the irrepressible resilience of the redwoods gives us hope. Save the Redwoods League is grateful to John and the J.A. Woollam Foundation for his partnership, which has resulted in the protection of over 2,000 acres of old-growth forest throughout the redwood range. Together, we are saving this treasured resource for the benefit and enjoyment of future generations. —

—Tim Whalen, Chief Development Officer,
Save the Redwoods League

JOIN US

Canopy Club and
Redwood Leadership
Circle members
are protecting our
redwood forests for
future generations
through their
generosity today

Save The Redwoods
LEAGUE

Photo by Max Foster



Become a member of the Canopy Club with an annual gift of \$10,000 or more, or the Redwood Leadership Circle with an annual gift of \$1,000 or more, and join us for special redwoods tours and experiences throughout the year.

For more information, please contact Georgia Young, Director of Major Gifts: gyoung@SaveTheRedwoods.org or 415-820-5849.



YOUR REDWOODS STORY

Our 2018 edition of *Redwoods* celebrated the Centennial of Save the Redwoods League, our legacy of leadership, and the launch of our conservation vision for the future. To mark these milestones, we invited you to tell us why you stand for the redwoods.

HOW TO SEND US YOUR STORY

We invite you to share your thoughts about your favorite redwood park. Your contributions could appear in upcoming issues of this magazine.

POST your thoughts and images on Instagram, Facebook, and/or Twitter with the tag **#Stand4Redwoods**.

EMAIL notes and photos to **Redwoods@SaveTheRedwoods.org**.

MAIL your story to our address that you can find on the back cover. We cannot return items, so please send a copy we can keep.

Here's what our members and fans have to say.

WHY I STAND FOR THE REDWOODS

I #Stand4Redwoods because getting to tromp through my favorite place in the world (wherever my giant sempervirens friends are) is unbelievable. Just breathing in the still, moist, verdant air is a gift.

—Carly Hume

I went to Redwood Regional Park the other day with friends. To me, our redwoods help us connect with our roots as Californians. These trees give me a feeling of respect for the land and those who were here before us. I #Stand4Redwoods because they are a disappearing cultural resource we can all enjoy and learn from.

—Jonathan Howell





WHY DO YOU STAND FOR THE REDWOODS?

Let us know your answer at #Stand4Redwoods

MONTGOMERY WOODS STATE NATURAL RESERVE

I stand for the redwoods because in all their grandeur they remind us how small we are, and in their long years on this planet they remind us that life endures.

—Amanda Dauphinee

I stand for the redwoods because they are so much more than trees. The redwoods are an experience—pure magic and soul-changing.

—April Kennedy

I earned some money at a garage sale that I would like to donate. The redwoods are important to me because they're so resilient and unique. When I grow up, I would like to be a dendrologist and help save the redwoods.

—Naiya Brown, age 12

KIDS' GROVE

Redwood Forest Matching Game

Learn about species of the redwood forest ecosystem. Draw a line from the description to the picture.



The Roosevelt elk is the largest species of elk in North America. Each spring, males shed their antlers. About a week later they begin to grow new ones.



Every fall, coho salmon lay their eggs in the cool streams that flow through the coast redwood forest.



Pileated woodpeckers peck holes in the trunks of trees in which other birds and bats can nest.



The mountain lion is a solitary predator that needs large areas to hunt. It can run up to 50 miles per hour.



The trillium gets its name from its three leaves and petals. Ants are attracted to its seeds.



The northern spotted owl lives in forests with really old trees, and has lost much of its habitat to logging.



The banana slug is the largest slug in North America and the second largest slug worldwide. It grows up to 8 inches long and can live for 7 years.

BONUS: What is the name of the species drawn on this page? What is the name of the species on the opposite page?
HINT: They are all in the matching game too!

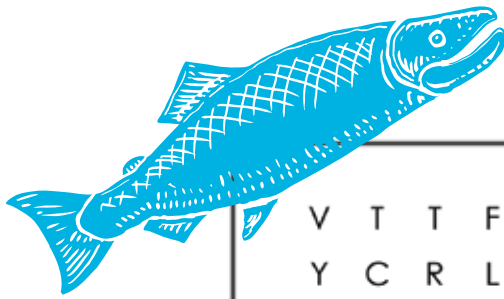


KIDS' GROVE

Word Search

Redwoods and Climate Change

CLIMATE



Word search grid:

V T T F R P L I T V Q F T G X N C N
 Y C R L D Z H Y E Q L O Z I T M O F
 D A F E E Z S A M C I S B A E K A B
 K R I V E O E N P L E S I N Y U S W
 F B X I S C Q K E I R I O T B G T E
 L O M A S E U O R M M L M S M U R A
 G N R Q K A E U A A X F A E G N E T
 T C J E Z N S X T T F U S Q C Z D H
 K E I X S S T K U E F E S U X Z W E
 K L A I J T E L R B G L K O I G O R
 E B B Q Y C R A E T S S N I N E O B
 I W Z Z H U E N E R G Y Z A Q R D Q

Find the following words in the puzzle.

Words are hidden → ↓ and ↘ .

BIOMASS
 CARBON
 CLIMATE
 COAST REDWOOD
 ENERGY

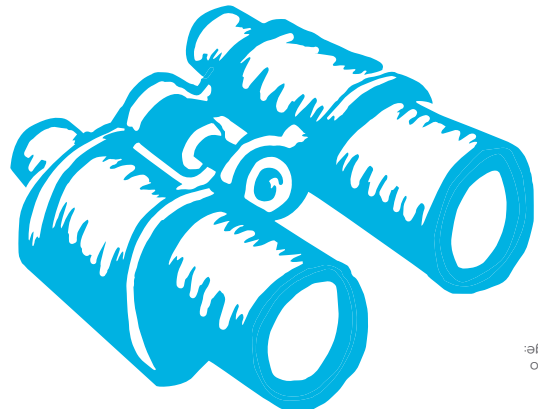
FOREST
 FOSSIL FUELS
 GIANT SEQUOIA
 OCEAN
 SEQUESTER

TEMPERATURE
 TREE
 WEATHER

Answers grid:

T . F . G
 C . R . . . S . M . C . S . B . A . E . K . A . B .
 A . R . . . E . O . E . N . P . L . E . S . I . N . Y . U . S . W .
 F . B . X . I . S . C . Q . K . E . I . R . I . O . T . B . G . T . E .
 L . O . M . A . S . E . U . O . R . M . M . L . M . S . M . U . R . A .
 G . N . R . Q . K . A . E . U . A . A . X . F . A . E . G . N . E . T .
 T . C . J . E . Z . N . S . X . T . T . F . U . S . Q . C . Z . D . H .
 K . E . I . X . S . S . T . K . U . E . F . E . S . U . X . Z . W . E .
 K . L . A . I . J . T . E . L . R . B . G . L . K . O . I . G . O . R .
 E . B . B . Q . Y . C . R . A . E . T . S . S . N . I . N . E . O . B .
 I . W . Z . Z . H . U . E . N . E . R . G . Y . Z . A . Q . R . D . Q .

Answers:



Answers:
 A. Pileated woodpecker
 B. Trillium
 C. Mountain lion
 D. Banana slug
 E. Northern spotted owl
 F. Roosevelt elk
 G. Coho salmon
 Bonus: This page: coho salmon. Opposite page: banana slug.

Save the Redwoods League

111 Sutter Street 11th Floor
San Francisco CA 94104

SaveTheRedwoods.org

STORIES OF

HOPE

Welcome to the Climate Change Edition of *Redwoods*.

Read how our new scientific research shows that our redwood forests are a tremendous resource in mitigating climate change. Learn how, with your support, we are protecting, restoring, and connecting people to the world's superlative forests that will sustain and inspire future generations.



CLIMATE CHANGE EDITION