California Society for Ecological Restoration *Quarterly Newsletter*

Lessons from the California Sycamore

by Will Spangler[1]

Thank you for reading SERCAL's *Ecesis* journal and for being a member of California's ecological restoration community. We just wrapped up our second virtual conference and even across disparate screens it was a powerful reminder of the depth, breadth, the vitality of our field of practice. I hope you enjoy these timely articles about applying native seed post-fire, field-based learning in a beautiful North Coast watershed, and the challenges facing an iconic California riparian tree, the California sycamore, and an encouraging set of recommendations to propagate them vegetatively. A colleague once encouraged me to view California sycamores as living on a longer time scale than we're typically used to; there are often many more years between the ideal conditions for their regeneration and establishment than for the willows and other riparian species we often work with. And in this way, they're a window into another time, one that spans the drastic interannual variability of California's climate, which itself is changing to bring even more dramatic interannual variability. As we face that new climate, may California sycamores show us a way to be resilient!

SER
CAL

[1] Senior Conservation Biologist, Santa Clara Valley Habitat Agency.

Photo: Sycamore tree, Upper Coyote Creek. Courtesy H. T. Harvey & Associates.

Fall 2021 Volume 31, Issue 3

Guest Editor: Will Spangler,
Santa Clara Valley Habitat Agency
will.spangler@scv-habitatagency.org

Managing Editor: Julie St John
Contributing Editor: James Mizoguchi

Ecesis is published quarterly by the California Society for Ecological Restoration, a nonprofit corporation, as a service to its members. Newsletter contributions of all types are welcome. See sercal.org/newsletter for a link to our Guidelines.

Meet the Guest Editor: **Will Spangler**

Editor's Note: Will is one of my favorite people. His enthusiasm and curiosity are contagious and his ability to connect disparate dots (people, expertise, habitats, you name it!) is transformative. Thanks, Will, for this great issue of Ecesis!

What is your Occupation and where do you work? I am a senior conservation biologist with the Santa Clara Valley Habitat Agency, where I help implement a regional Habitat Conservation Plan/Natural Communities Conservation Plan to protect endangered species and natural resources. I conduct restoration projects and help to manage over 7,000 acres of protected reserve lands.

County of residence or work: I work in Santa Clara county and consider wildlife linkages with adjacent counties.

How long have you been a member of SERCAL? I joined on the recommendation of a colleague (Karen Verpeet) in 2013 and have continually increased my involvement.

What is the biggest benefit of your SERCAL membership? SERCAL has helped me encounter the wide range of disciplines that inform habitat restoration, and meet specialists with valuable input on my own work.

What do you like best about the SERCAL conferences? The SERCAL conferences are fun and informative, and invaluable for learning the latest tricks, soaking up tried and true tips, and connecting with fellow restoration practitioners to share the joys of working in this field. I've collaborated with others to describe how the annual conferences advance new thinking in the field and provide value from scientific discourse: https://onlinelibrary.wiley.com/doi/abs/10.1111/rec.12994.

What is your specific discipline (or underlying education)? I work with restoration ecology and plant biology. I studied interdisciplinary coursework in environmental studies at the University of California Santa Cruz and contributed to research on invasive plant species control and revegetation.

What services do you provide for restoration in California, or what is your restoration passion? My restoration passion is bringing together diverse teams of experts to apply multiple lenses to habitat restoration projects that bring multiple benefits to the landscape.

How did you get into the field of ecological restoration? My childhood was spent playing outdoors, and I was fortunate to take an ecology class in high school and volunteer in the Golden Gate National Recreation Area where I was inspired by passionate restoration technicians. I incorporated environmental service projects while working in outdoor recreation and leadership during college, spent summers during college working as a seasonal park ranger, and followed an internship with the University of California's natural reserve system into positions as a land steward, consulting restoration ecologist, and currently as a conservation biologist..

What is your favorite California native species? The native grass and wildflower species that make up California grassland communities fill a diverse range of functional niches and collectively represent the resilience of the California landscape and its variability from year to year.

Any advice for others in the field of restoration? Pay attention to the many ways that different people can know a place. Listen, read, and research to develop your rationale for restoration and land management decisions, explain that rationale clearly and in simple language, and document what you do (and don't do!) so that you and others can learn more over time.

Restoration ecologist walking through sycamore alluvial woodland habitat.

California Sycamore Hybridization with a Common Landscaping Tree and Implications for Restoration of Riparian Habitat

by Ryan Hegstad[1] and Charles McClain[1] *Photos courtesy H. T. Harvey & Associates*

California sycamore (*Platanus racemosa*) is a native riparian tree species found in California and northern Baja California. Historically, it was the dominant tree along many intermittent, depositional streams throughout much of its range (Griffin and Critchfield 1972, Holland 1986). California sycamore is also the dominant species within Sycamore Alluvial Woodland (SAW), a rare habitat type dominated by well-spaced California sycamores, creating an open to moderately-closed canopy — a winter-deciduous, broad-leafed, riparian woodland (Holland 1986). California sycamores generally occupy intermittent, groundwater-supported streams and floodplains that are subject to floods that deposit coarse alluvial sediment, disperse and deposit seed, and recharge groundwater basins that slowly draw down during the dry season (Keeler-Wolf *et al.* 1996). Dams, agriculture, gravel mining, and development have altered the natural hydrologic and geomorphic processes that support California sycamore populations and this has resulted in a lack of natural recruitment of California sycamore from seed (Keeler-Wolf *et al.* 1996, Kamman Hydrology 2009, SFEI and H. T. Harvey & Associates 2017, SFEI 2018).

Local agencies within the San Francisco Bay Area (e.g. Valley Water, Loma Prieta Resource Conservation District, Santa Clara Valley Transportation Authority, and Santa Clara Valley Habitat Agency) have explored techniques to restore California sycamores within

continued next page

[1] H. T. Harvey & Associates. rhegstad@harveyecology.com cmcclain@harveyecology.com

California Sycamore Hybridization *continued*

riparian habitats including SAW. Initially, much of this work was done by propagating California sycamore from wild-collected seed. However, it was later found that the wind-pollinated California sycamore can hybridize with a common nonnative landscaping tree, London plane (*Platanus* x *hispanica*), which may result in genetic erosion, outbreeding depression, and loss of wildlife habitat values provided by California sycamore (Whitlock 2003, Johnson *et al.* 2016). California sycamore x London plane hybrids have been identified throughout the Sacramento Valley, including trees with trunk diameters up to 50 inches (Johnson *et al.* 2016). Like London plane, these hybrids may be resistant to sycamore anthracnose, a fungal disease that causes the formation of deadwood and cavities in California sycamores that are important to cavity-dwelling species including wood ducks (*Aix sponsa*) and ringtails (*Bassariscus astutus*) (Whitlock 2003). Additionally, hybridization between native and nonnative species is a common evolutionary pathway that can lead to invasiveness (Schierenbeck and Ellstrand 2009). It was thought that hybrids could be identified based upon leaf morphology. However, the use of leaf morphology for California sycamore versus hybrid identification was later questioned regarding its ubiquity; we found that leaf morphology was highly variable and did not indicate that trees were California sycamores or hybrids based on our early genetic testing. For these reasons, the practice of planting California sycamores propagated from seed has largely ceased to avoid outplanting hybrids, and many native plant nurseries have transitioned to propagating California sycamores vegetatively from cuttings, rather than from seed. To avoid propagating hybrids, cuttings are generally collected from large California sycamores that presumably established before London plane was widely introduced or from trees that have been genetically identified as California sycamores. However, vegetative propagation has had limited success (10–30% cutting survival) and may produce less genetically diverse trees than ones produced from seeds.

To address these issues, H. T. Harvey & Associates, San Francisco Estuary Institute (SFEI), local agencies, and genetic laboratories have been working together to assess the extent of California sycamore x London plane hybridization in Santa Clara County, and determine if tree size or pollination barriers (i.e., distance between California sycamores and London planes) may be used to identify trees and seeds that are extremely unlikely to be hybrids and could be used as propagule sources for restoration projects. We hypothesized that hybrid trees would be young and have small trunk diameters, and that hybrid trees and seeds would be more common near urban centers, where London plane trees are common, compared to rural areas. Below, we summarize the methods, results, and implications for restoration of riparian habitat using California sycamores.

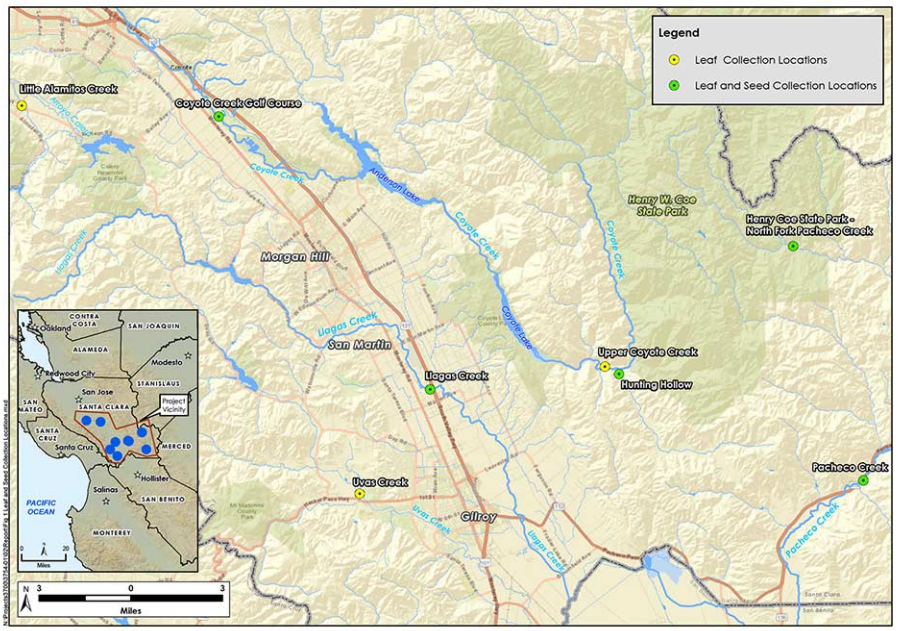


Figure 1. Leaf and Seed Collection Locations
California Sycamore Hybridization and Implications for Restoration
September 2021

Methods

Tree Study

In 2016 and 2019, H. T. Harvey & Associates restoration ecologists collected leaf samples for genetic analysis from 344 putative California sycamore trees at eight study sites in southern Santa Clara County (Figure 1). All putative California sycamores that were collected from were located in natural riparian areas where the planting of London plane trees was unlikely and all trees had morphological traits consistent with California sycamores. The study sites ranged from 0 to 13 miles from developed areas where London planes are common. At each site, individual trees were identified and their size (diameter at breast height, DBH)—ranging from less than 1 inch to 73 inches—and location were measured and recorded. Leaves from each tree were placed in Ziploc bags upon harvest, labeled with a unique identification code, and kept cool in an ice chest containing dry ice.

Seed Study

In 2018, seeds were collected from one tree at five of the study sites in collaboration with the Grassroots Ecology nursery (Figure 1). The seeds were placed in paper bags and labeled with a unique identification code upon harvest. The seeds were propagated at the Grassroots Ecology nursery located in Palo Alto, California. Leaves from 39 propagated seedlings were collected for genetic analyses, representing 3–12 seedlings from each of the five sampled trees. Each tree from which seed was collected was confirmed to be a California sycamore by genetic analysis of leaves prior to testing the seedlings propagated from their seeds.

Genetic Analysis

Leaves collected in 2016 were delivered to Dr. Michael Miller's genetics lab at U.C. Davis (Miller Lab) for identification (O'Rourke and Miller 2017). The Miller Lab used Restriction-site Associated

continued next page

California Sycamore Hybridization *continued*

DNA (RAD) sequencing during their identification. Analyses of the RAD sequencing data were conducted using both principal component analyses and admixture analysis. Leaves collected in 2018 and 2019 were delivered to Genomeadvisors located in La Mirada, California, who used microsatellite markers and Sanger sequencing to identify California sycamores, London plane, and hybrid trees. After sequencing, the computational program STRUCTURE version 2.3.4 (Pritchard *et al.* 2000) was used to assign the samples to reference California sycamore or London plane genetic samples, or were categorized as hybrids.

Results

Tree Study

Of the 344 putative California sycamore leaf samples collected, 309 were California sycamores, 11 were hybrids, and 24 samples did not have sufficient DNA to be genetically identified. Hybrid trees were generally small (<10 inch DBH); one hybrid tree had a 20-inch DBH. Hybrid trees were located both near and far (up to 13 miles) from the nearest urban centers including the most remote sycamore population in our study.

Seed Study

Of the 39 seedlings that were propagated from seeds collected from California sycamores (verified by genetic testing of leaves), 29 were California sycamores, 7 were hybrids, and 3 could not be identified due to low-quality genetic material. Hybrid seeds were collected from trees located near and far (up to 13 miles) from the nearest urban centers including the most remote sycamore population in our study. Additionally, three trees produced both California sycamore and hybrid seed, demonstrating that fertilization can vary within the same tree.

Discussion

The results of our study indicate that California sycamore x London plane hybrids in southern Santa Clara County were generally young and have small trunk diameters (<10 inches), and that hybrid trees and seed occur near urban centers and in rural areas. Approximately 3% of the putative California sycamores in our study were identified to be hybrids, which suggests that the extent of hybridization is low in southern Santa Clara County. Of those 11 trees, five were likely planted as part of a riparian habitat mitigation project located along Pacheco Creek. Based on the low percentage of hybrids observed and their small size, hybridization between California sycamore and London plane in southern Santa Clara County may be less extensive than in the Sacramento Valley (Whitlock 2003, Johnson *et al.* 2016). However, because we only tested a small sample of the putative California sycamore trees within Santa Clara County, we cannot confirm that more or larger hybrid trees do not exist.

Sycamore leaf collection for genetic testing

…results suggest that pollen from London plane trees may travel and fertilize California sycamores over great distances to produce viable hybrid seed. Previous studies suggest that pollen from both species can travel up to 10 miles.

Approximately 19% of the seedlings propagated from seed collected from California sycamore trees (verified natives via genetic testing of leaves) were hybrids, and hybrid seeds were collected from trees located both near and far from urban centers. These results suggest that pollen from London plane trees may travel and fertilize California sycamores over great distances to produce viable hybrid seed. Previous studies suggest that pollen from both species can travel up to 10 miles (Schierenbeck pers. comm. 2016). Our study indicates London plane pollen may travel up to 13 miles. However, London plane trees on private property, particularly in rural areas, may have been pollen sources that could have fertilized the hybrid seed found within our most rural study sites.

Our findings bring into question the use of wild-collected seed for California sycamore propagation in riparian restoration projects, even when seeds are sourced from remote stands of genetically-tested California sycamores. However, propagated seedlings could be tested to confirm their identity. Additionally, our study suggests that California sycamore populations throughout southern Santa Clara County (and potentially the entire California sycamore range) may be susceptible to hybridization with London plane trees due to the distance that viable London plane tree pollen can travel via wind and the commonness of London plane trees.

Restoration Implications

To reduce the likelihood of outplanting California sycamore x London plane hybrids at habitat restoration sites, the following propagule types should be used:

- Genetically tested nursery-grown seedlings propagated from seed collected from genetically tested California sycamores;
- Seedlings grown from vegetative cuttings sourced from genetically tested California sycamores;

continued next page

- Seedlings grown from vegetative cuttings sourced from putative California sycamores that are extremely unlikely to be hybrid based on their location, age, and size.

We identified hundreds of native California sycamore trees, verified via genetic testing, in southern Santa Clara County from which cuttings could be sourced. These native trees could also provide a source of native seed with the caveat that genetic testing of seedlings would be required, since 19% of this seed was found to be hybrid. The locations of these genetically verified native California sycamore trees are available from H. T. Harvey & Associates upon request. Additionally, while genetic identification of sycamore trees has been troublesome and expensive in the past, the process developed by Genomeadvisors using of microsatellite markers to identify California sycamores, London plane, and hybrid trees is relatively less expensive and can be used as a routine tool for future sampling efforts to quickly and accurately test nursery stock prior to installation. We recommend that similar studies be conducted to identify and map California sycamores and hybrids, further our understanding of the extent of hybridization in California and Baja California, and assist in restoration efforts using California sycamores.

SER CAL

References

Griffin, J., and W. Critchfield. 1972. The distribution of forest trees in California. U.S. Department of Agriculture Forest Service Research Paper PSW-82, Pacific Southwest Forest and Range Experiment Station, Berkeley, California.

Holland, R. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Department of Fish and Game, Natural Heritage Division. Sacramento, California.

Johnson, M.G., K. Lang, P. Manos, G.H. Golet, and K.A. Schierenbeck. 2016. Evidence for genetic erosion of a California native tree, *Platanus racemosa*, via recent, ongoing introgressive hybridization with an introduced ornamental species. *Conservation Genetics* 17:593–602.

Kamman Hydrology. 2009. Phase 2 technical report Sycamore Grove Recovery Program. Sycamore Grove Park, Livermore, California. San Rafael, California. Prepared for Livermore Area Recreation and Park District, Livermore, California, and Zone 7 Water Agency, Livermore, California.

Keeler-Wolf, T., K. Lewis, and C. Roye. 1996. The definition and location of central California sycamore alluvial woodland. Prepared by Natural Heritage Division, Bay-Delta and Special Water Projects Division, California Department of Fish and Game. May. 111pp. + appendices.

O'Rourke, S.M., and M.R. Miller. 2017. RAD sequencing identifies trees that area product of hybridization between California sycamore (*Platanus racemosa*) and London planetree (*Platanus* x *acerifolia*). May 30. Department of Animal Science, University of California, Davis.

continued next page

Meet the Contributing Member: **Ryan Hegstad**

Occupation: I am a restoration ecologist working for H. T. Harvey & Associates.

County of residence or work: The majority of my work is in the San Francisco Bay Area.

How long have you been a member of SERCAL? About three years.

What is the biggest benefit of your membership? Meeting other restoration ecologists and sharing knowledge/techniques.

What do you like best about the SERCAL conferences? I enjoy the breadth covered in the conferences, from new restoration techniques to discussions on racial equity in the field of ecology.

What is your specific discipline (or underlying education)? I studied plant sciences and ecology at UC Santa Cruz for my undergraduate degree and studied plant-herbivore interactions and why their effects on plant populations vary in space for my Master's degree at the University of Montana. My work currently focuses on designing, monitoring, and providing maintenance recommendations, primarily for riparian restoration sites.

What services do you provide for restoration in California, or what is your restoration passion? I have enjoyed working on the California sycamore genetics and restoration projects. California sycamores are a rare and valuable tree species that is included in many of our restoration projects. Helping to understand threats and how to mitigate those threats has been rewarding.

How did you get into the field of ecological restoration? I took a restoration ecology class during my undergraduate studies at UC Santa Cruz with Karen Holl. Additionally, my senior thesis monitored and analyzed data from a restoration project focused on reestablishing a critically endangered plant species. While my masters work was not directly related to restoration, I knew that I would come back to it.

What is your favorite California native species? Incredibly hard to choose, but I'll go with California tiger lily (*Lilium pardalinum*) today.

Any advice for others in the field of restoration? Be outside often and think about the "big picture" when working on restoration projects.

California Sycamore Hybridization *continued*

Pritchard, J.K., M. Stephens, and P. Donnelly. 2000. Inference of population structure using multilocus genotype data. *Genetics* 155:945–959.

[SFEI] San Francisco Estuary Institute–Aquatic Science Center. 2018. Observational study of sycamore regeneration at two sites in Santa Clara County after the 2016–2017 water year [memorandum, SFEI-ASC's Resilient Landscapes Program, Publication # 874]. June. Richmond, California. Prepared for the Santa Clara Valley Water District, San José, California.

[SFEI] San Francisco Estuary Institute–Aquatic Science Center and H. T. Harvey & Associates. 2017. Sycamore alluvial woodland: Habitat mapping and regeneration study. February. SFEI Contribution No. 816. Richmond, California, and Los Gatos, California.

Schierenbeck, K.A., and N.C. Ellstrand. 2009. Hybridization and the evolution of invasiveness in plants and other organisms. *Biological Invasions* 11:1093–1105.

Schierenbeck, K. Professor of Biological Sciences, California State University, Chico. April 25, 2016—email correspondence with Charles McClain of H. T. Harvey & Associates regarding California Sycamore Genetic Study.

Whitlock D.L. 2003. The hybridization of California sycamore (*Platanus racemosa*) and the London plane tree (*Platanus* x *acerifolia*) in California's riparian woodland. Thesis. California State University, Chico.

Native Sycamore Propagation: A Collaborative Research Study

Prepared by Deanna Giuliano[1] in partnership with Diana Benner[2] Photos courtesy Deanna Giuliano.

The regeneration of native California sycamores (*Platanus racemosa*) is of great concern, as genetically pure seed in nature is threatened by hybridization with the commonly planted non-native London plane tree (*Platanus* x *hispanica*). Hybridization dilutes native genetics, leads to outbreeding depression, and may threaten the existence of California sycamores as a species (H. T. Harvey & Associates, 2019).

Sycamores are commonly used in restoration and mitigation projects, and having pure genetic stock of California sycamores is essential to maintaining the integrity of the species. Traditionally, land managers have sourced nursery stock plants from wild-collected seed, which is a cause for concern due to hybridization. Furthermore, vegetative propagation of California sycamores has been difficult, with success rates of about 10%. Collection of wild seeds is preferred for this reason.

[1]Nursery Director / Botanical Consultant, Grassroots Ecology. nursery@grassrootsecology.org [2]Principal, The Watershed Nursery. diana@thewatershednursery.com

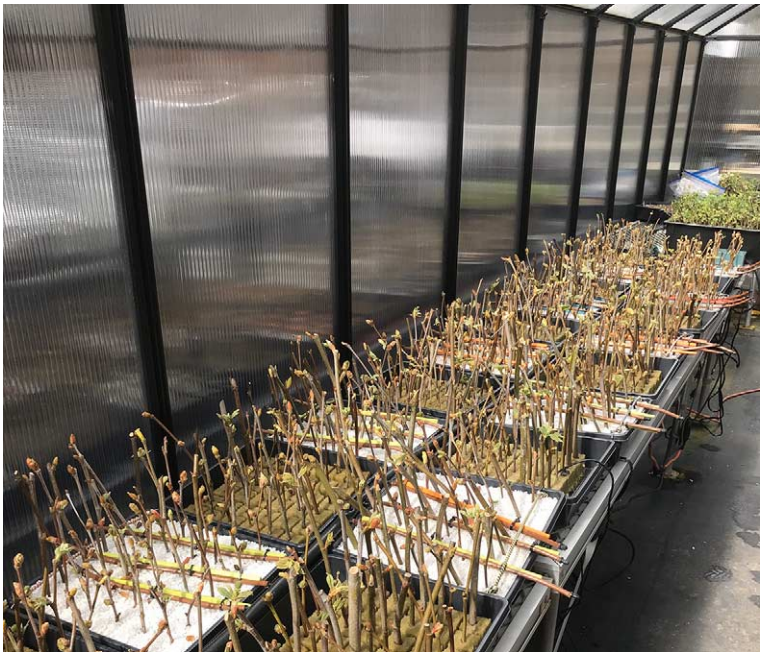
In order to address these concerns, a collaborative team was assembled with experts from:

- H. T. Harvey & Associates, an ecological consulting firm based in Los Gatos.
- Grassroots Ecology, an environmental restoration and education nonprofit with a Native Plant Nursery serving Santa Clara, San Mateo, and Santa Cruz Counties.
- The Watershed Nursery, a business that has been providing quality native plant material and services to local Northern California restoration projects since 2001.

Their purpose was to conceive of a study plan for the genetic purity of California sycamores that would enhance future vegetative propagation success. Because identifying genetically pure California sycamores cannot be done in the field and can only be done by genetic testing, H.T. Harvey GPSed, tagged, and collected leaf

continued next page

Cutting roots.



Cutting flats.

Native Sycamore Propagation: A Collaborative Research Study *continued*

samples from individual trees which then were sent to a lab for genetic testing. Test results were used to identify "Mother" trees as sources for cuttings in the Sycamore Propagation Study for the Upper Llagas Creek Flood Protection Project (H. T. Harvey & Associates, 2019). The vegetative propagation section of the study plan was a collaborative effort between The Watershed Nursery and Grassroots Ecology.

The main objectives of the vegetative propagation study include:

- Advance the science of vegetative propagation of California sycamores
- Improve cost-effectiveness of vegetative propagation of California sycamores
- Determine additional studies needed that could build on research findings to further advance the science and efficiency of vegetative propagation of California sycamore.

In our literature research of the different propagation techniques to increase the survival, vigor, and growth of California sycamores, we found only a few studies addressing vegetative propagation. Reference was made to collecting cuttings during different seasons, crown vs. basal cuttings, and using variable rooting hormone concentrations. Standardized as well as non-standardized techniques were incorporated into the final study design. Some examples include the use of Rock Wool as a rooting medium to lessen root disturbance, and presoaking in willow tea for its perceived beneficial properties.

The study investigated how the treatments would affect the survival, health, and growth rates of California sycamores, and which combination of treatments could be scaled up for use in restoration and mitigation projects (H. T. Harvey & Associates, 2019). The treatments were investigated *in situ* in both native plant nurseries to replicate the conditions likely to be used in other native plant nurseries.

Both The Watershed Nursery and Grassroots Ecology Nursery use best management practices (BMPs) to reduce the risk of cultivating and spreading *Phytophthora* spp. and other plant pathogens. Before processing the cuttings in the nurseries, the study team consulted with the plant pathology consulting firm Phytosphere Research on the best protocol treatment for the California sycamore to reduce the chance of transferring pathogens, particularly anthracnose. A heat treatment using a hot water bath of 120 degrees for 30 minutes was determined to be the best protocol for BMPs. Vintners have traditionally used this technique on grape canes to reduce plant pathogens. In order to survive this heat treatment, we discovered the best time of year to collect the cuttings is in the winter when the California sycamores are completely dormant. To achieve a higher survival success from the heat treatment, field cuttings were processed minimally.

All cuttings processed were approximately 0.25″–0.50″ in diameter and 6″–8″ in length. Both nurseries recorded response values to include survival, initial vigor, and growth rate. Each cutting was assessed twice with measurements taken during each transplant event. H.T. Harvey analyzed the resultant data.

Over the two years of the study we learned important lessons for field collection and treatments. When assessing California sycamores in the field for future genetic testing, we recommend choosing trees that

continued next page

Close-up of cutting flats.

Upsized cuttings.

Native Sycamore Propagation: A Collaborative Research Study *continued*

have the following characteristics that will aid nurseries in acquiring excellent vegetative propagation material:

- Trees that have reachable material within 10'
- Trees that are healthy with little to no anthracnose disease
- Trees that have younger material sprouting from the mother tree

Our recommendations to optimize vegetative propagation of California sycamores are as follows:

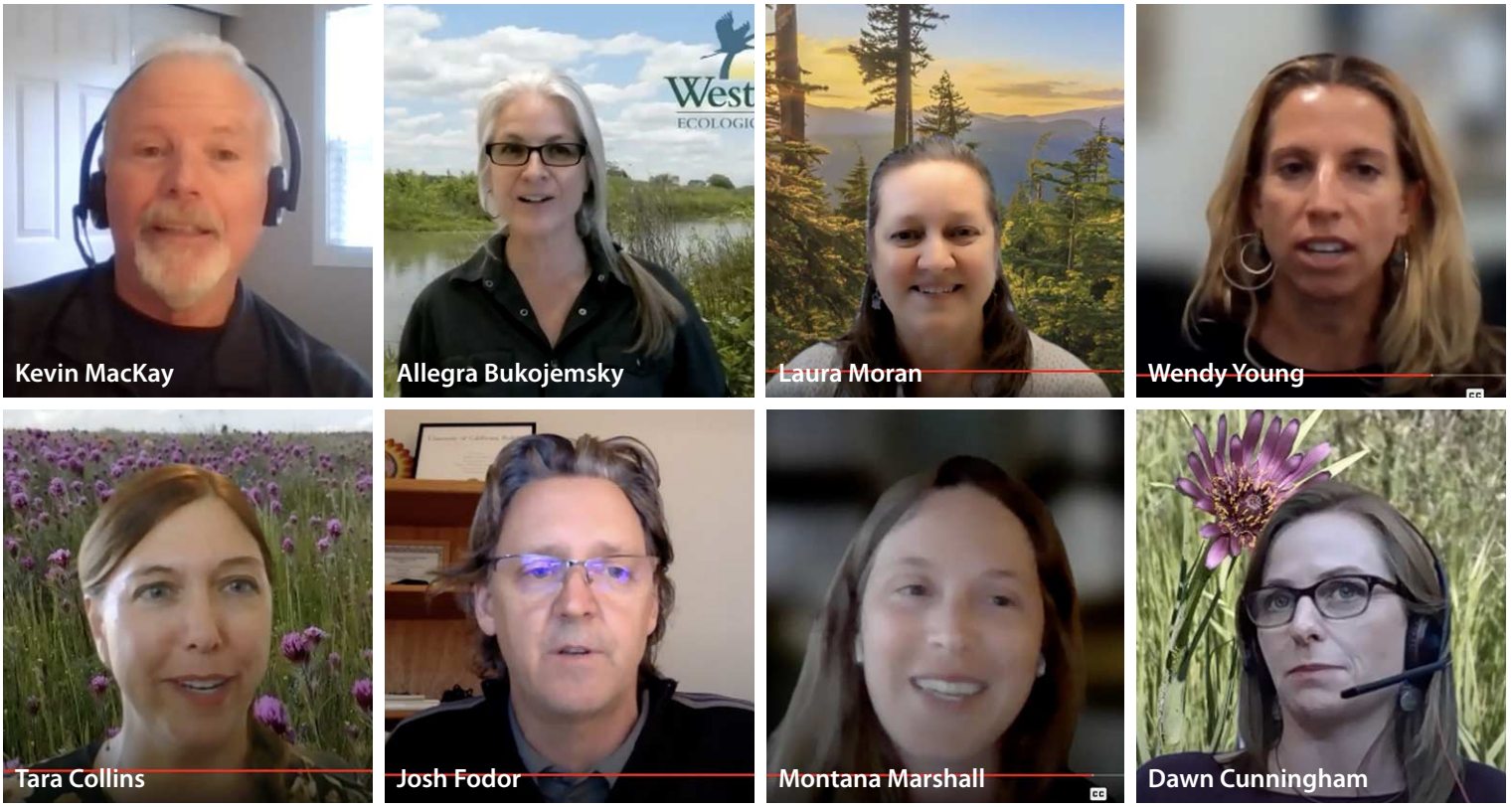
- Collect California sycamores in mid-winter when trees are completely dormant, usually about January.
- Use basal cuttings for the best vigor.
- Apply heat treatments the same day the cuttings are collected.
- Soak un-processed cuttings in willow tea.
- Trim, treat, and then transplant cuttings into perlite mixed with a 1% peat moss
- Irrigate as needed, preferably using drip irrigation

As the Nursery Director of Grassroots Ecology, participating in this study was demanding yet worthwhile because of the results that it yielded and the collaborative partnerships it forged. I look forward to future studies that can help restore our native ecosystems while keeping their natural biodiversity intact.

SER CAL

Reference

H. T. Harvey & Associates, The Watershed Nursery, Grassroots Ecology Nursery, and UC Davis. 2019. California sycamore genetics and propagation study. Project 3161-03 and 3754-02. Prepared for the Santa Clara Valley Water District and the Loma Prieta Resource Conservation District. February. Available online at https://www.harveyecology.com/sites/default/files/CA%20Sycamore%20Genetics%20and%20Propagation%20Study%20H.%20T.%20Harvey.pdf.



SERCAL 2021 Jobs & Networking Panel Recap

by Will Spangler, Panel Moderator at SERCAL 2021 and SERCAL Board Member

The 2021 SERCAL conference brought California habitat restoration professionals and students together virtually around the theme of Restoration in Our Backyard. The final day of the conference featured a jobs & networking panel with representatives from SERCAL's sponsoring organizations who shared what helped them get to their current position and highlighted current job opportunities. The panelists represented a range of disciplines and divulged invaluable wisdom, including:

Kevin MacKay of ICF encouraged respectful yet persistent outreach by job seekers,

Allegra Bukojemsky of Westervelt (and SERCAL Board President) referenced learning from and joining professional organizations, adding unique experiences to your resume, and proactively asking for informational interviews even if a job is not posted,

Laura Moran of SWCA recommended being open to whatever opportunities may arise,

Wendy Young of Harris & Associates spoke of the value of finding collaborators with similar passions and interests to expand on ideas and further learning,

Tara Collins of Westervelt encouraged doing internships and finding mentors and taking time to learn about plants as the foundation to understand what is happening in a place,

Josh Fodor of Ecological Concerns shared the value of adding business management skills and spoke of how not being afraid of bureaucracy and paying close attention to details can open doors to work on impactful projects,

Montana Marshall of Balance Hydrologics recommended to keep searching for the right fit and to not shy away from passions and outside work that may yield professional connections, and

Dawn Cunningham of RES relayed the value of positive relationships and not being deterred by age or previous occupations in a different field.

All panelists spoke of the value of getting comfortable asking questions.

Many panelists enjoyed that their work allows for a mix of field and office work, allows for frequent learning from others with a range of expertise, and how the tangible nature of the work provides for a long-term view of how projects and landscapes can change over time.

The best news of all is that many of these organizations are hiring!

The video recording is available to everyone at **https://youtu.be/ZcWZ-A5Egwo**. Be sure to bookmark the SERCAL jobs board to find, share, and post about jobs in our field: **http://www.sercal.org/job-openings**.

Good luck to all out there!

Humboldt State University aquatic ecologist Dr. Alison O'Dowd discusses ecological roles of macroinvertebrates in coastal streams after sampling in the Mattole River at A.W. Way County Park.

Mattole Field Institute: *Fertile Ground for Field-Based Learning*

by Flora Brain[1] *Photos courtesy the author.*

Imagine…

A Humboldt State University grad student who studies the intricacies of the pathogen that causes Sudden Oak Death (SOD) comes to the Mattole and exchanges knowledge with the Mattole Restoration Council employee who monitors SOD in the watershed…

A Mattole Valley forestland owner shares his approach to creating a sustainable small wood products business while also restoring health to his forest, who receives input from Humboldt State and College of the Redwoods forestry professors, while students take notes…

A tribal forestry student whose home river was dammed in 1937 comes to the Mattole to connect with and learn about salmon and how to restore watersheds…

A university professor who studies aquatic ecology leads a short macroinvertebrate sampling session in the lower Mattole, and is ecstatic over the diversity of creatures present in our river in this drought year…

A hike in the old growth Douglas-fir forest with local conservationists explaining how the community saved the Mill Creek Forest…

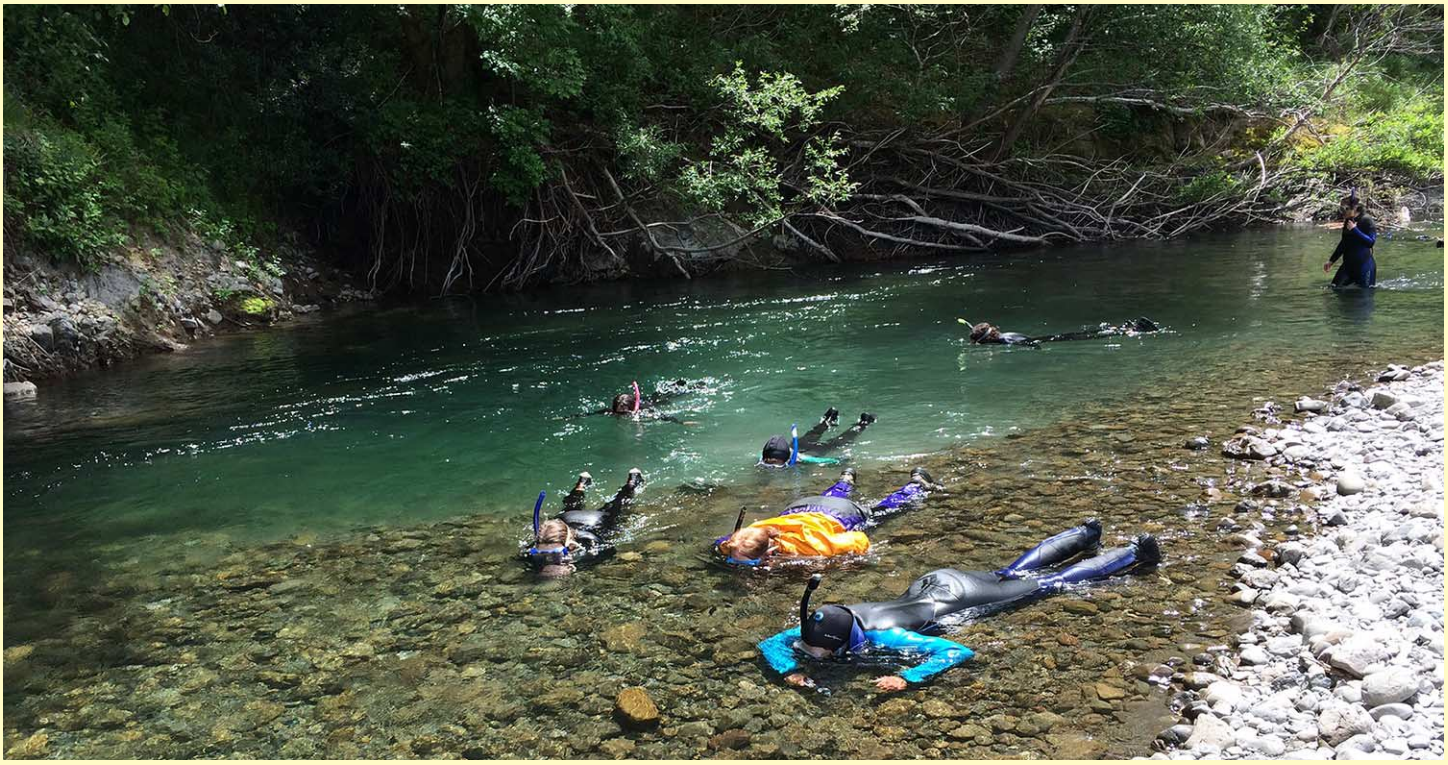
Eager students ask deeply insightful questions during each session…

All this — and so much more — happened in just five days in May as part of the Mattole Field Institute's annual watershed restoration field course.

The original idea was that these field-based courses would primarily educate the Humboldt State University students who attend them, immersing themselves in a week of hands-on

continued next page

[1]Mattole Field Institute and King Range Alliance Coordinator, Mattole Restoration Council. flora@mattole.org



Mattole Salmon Group Fisheries biologist Nathan Queener leads Mattole Field Institute students on an investigation of the different feeding strategies of juvenile steelhead versus Chinook salmon in the Mattole River, May 2021.

Mattole Field Institute *continued*

exposure to restoration. However, after ten years, something much more profound has taken hold: the cross-directional education of all involved.

I have once again been blessed by the presence of a group of gifted teachers in the form of students.

One moment, perhaps, illustrates the beauty of these field courses. Imagine an evening campfire circle, a group of twenty HSU students and Mattole Valley locals who've just feasted on king salmon cooked on redwood stakes around the fire. Local archaeologist Jamie Roscoe and a colleague of his appear, and while talking about their work ("we do what the tribes want: we work for them") he's asked a question by one of the HSU students. He pauses, then invites the student to share their own experience. The mantle of teacher swiftly shifts, and we get to hear and learn from a brilliant young tribal forester named Chris Villaruel. And as with every Mattole Field Institute group, we all — every one of us being both student and teacher — have become better humans through our time spent together in the field.

My goal, as director of the Mattole Field Institute, is to bring these rich, field-based learning experiences to more people. My vision includes university faculty coming to the Mattole and King Range National Conservation Area to conduct their research to build understanding and appreciation of this precious place. It includes grad students focusing their studies here, deepening understandings of local ecology, sociology, climate, resilience, and other topics. It includes significantly more opportunities for Indigenous participation and ideally, if they so desire, local Indigenous leadership in shaping the Institute's future. It includes people being inspired by weeklong immersion courses in the Mattole River watershed and King Range, going on to conservation careers and/or more sustainable lifestyles. It includes Mattole Valley community members sharing their skills, expertise, and experience, and visitors sharing theirs. It includes restoration professionals inspiring young adults towards environmental careers through hands-on experiences that truly teach. It includes connecting Lost Coast tourists with our local communities and restoration programs, so that their visits support our unique rural landscape and those who live here — environmentally, economically, and socially. At some future point, I would also like to create opportunities for our rural local high school youth to participate in extended MFI courses alongside university students.

Right now, MFI is planning for the eventual creation of a Resilience, Education, and Research Center from which to base all of our programs. We will create a vibrant gathering space for all people to come together to share skills and explore ideas that contribute to deeper understandings of nature, including humans' place within it.

Please join me in this joyous and fulfilling work.

continued next page

Mattole Restoration Council (MRC) Native Plant Nursery Manager Veronica Yates explains how to insert a *Phytophthera ramorum* test strip into a macerated plant sample at the MRC Native Plant Nursery.

Mattole Field Institute *continued*

The Mattole Field Institute has steadily grown since 2012, partnering with Humboldt State University faculty and local community and conservation connections to provide hands-on, field-based education.

We are now poised to expand. We seek in the coming years to create an actual Mattole Field Institute Resilience, Research, and Education Center: a space from which to offer expanded curriculum year-round.

The vision of the Mattole Field Institute is to deepen field-based study of the unique Mattole watershed and surrounding bioregion's ecosystems and communities.

The Mattole Field Institute will accomplish this by:

- Cultivating a diverse and inclusive community of instructors and students and creating equitable learning environments in which all participants are learners.
- Inspiring the next generation of learners, and the learner in every one of us, through a cross-curricular, place-based education program with a focus on environmental conservation and fieldwork.
- Utilizing the terrestrial, freshwater and marine habitats of the Mattole River watershed, King Range National Conservation Area, and Lost Coast as our classroom.
- Deepening our collaborative teaching and research partnerships with universities, local tribes, and community organizations including those providing social services, restoration, fire safety, and k-12 education. In this we are serving to deeply ground academic research concerning Humboldt's environments and communities.
- Promoting and engaging local conservation and stewardship initiatives across the globe by showcasing the Mattole as a demonstration watershed, embracing honest reflection on our successes, challenges, and failures to better inform the future.
- Centering connections among and between diverse human communities and the rest of natural world to build ecological and sociocultural resilience.
- Hosting a vibrant educational center to serve as magnet and interpretive center for individuals and groups to learn, explore, connect, and access resources.
- We are presently securing planning funds to conduct community and collaborative partner outreach, assess properties for acquisition and site development, and create a long-term financing plan.

If you are interested in supporting this work, please contact Flora Brain: Flora@mattole.org, or (707) 629-3514.

Making a Difference: **David Gilpin, Pacific Coast Seeds**

How does your organization fit in its "ecosystem"? Our MIssion is to provide California Native Seed from an increasing set of species and from expanded ecological settings. We thrive to further the capacity of restoration efforts in California through collaborative efforts of our partners and customers.

Who does your organization closely work with? Environmental planners, government agencies, private parties and restoration and seeding practitioners.

Please share a project/program/initiative: We offer customers a custom seed collection of California native seed species from select locations. We also offer amplification of these and other select species for specific project use. This services helps provide more location genetic material to current projects and under specific conditions to other future native seeding projects.

How does the work you do relate to SERCAL's mission? We have supported the science of the SERCAL's mission by supporting efforts similar to those presented in the adjacent article. We support the art and practice of SERCAL's mission by offering design suggestions and advice on seed availability. To practitioners, we provide competitive pricing and prompt delivery of seed to projects.

What is your favorite part of the work you do? Scouting for seed source, Starting a new seed collection project, Walking previously seeded and or planted sites.

Any final thoughts you'd like to share? I am closing in on completing my career in the seed business. I am pleased to see so many people who have chosen to be involved in the environmental restoration field. I hope and trust that they will be able to effect real change in the way we managed our resources that that change leads to sustainable and bright future for them, their families and the earth.

How can our readers learn more about your work? Visit www,pcseed.com or www.hedgerowfarms.com, and contact info@pcseed.com or info@hedgerowfarms.com.

Ready to harvest.

Downingia.

Post-Fire Seeding & Mitigation on the Butte Fire

by David Gilpin[1], Chris Swann[2], and William Agnew[3]

Introduction and Overview

Since 2002, the use of seed in post-fire mitigation projects in California has been confined almost exclusively to state highway and county roads, Federal Emergency Management Agency (FEMA), and other private reseeding efforts. These agencies have found specific situations where seeding and mulching offers appreciable value for the protection of property and reduction of on-site erosion. The reasons stated for not utilizing seed for large-scale fire rehabilitation in the State of California are those usually sited in the 1995 position paper from the California Native Plant Society (CNPS). In the "Seeding After Wildfires" statement of policy, CNPS concludes that: 1) Seeding is not a reliable method of reducing post-fire erosion. 2) Natural vegetative recovery can be compromised by artificial seeding. They enumerate several additional concerns, including:

- Non-local native types may contaminate local gene pools
- Lack of available, adequate, and appropriate seed supply to meet scalable incidents
- Seeding may disrupt small-scale ecological patterns, and
- Artificial seeding with any species is not likely to produce significantly better results than allowing natural vegetative recovery

The use of native seeding following catastrophic fire has been lightly studied. A considerable portion of post-fire rehabilitation literature does not address seeding in general, or as a means to effectively control erosion following fire. Of 1,164 USDA Forest Service Burn Area Reports available in 2011, only 380 contained any information on seeding treatments (Peppin *et al.* 2011). Peppin *et al.* 2011, states that quantitative data and information on overall seeding trends are lacking.

While long-term detailed analysis of plant community regeneration is not yet available for the Butte Fire area, this study provides some preliminary evidence on the effects of native seeding on species diversity and plant community recovery. This study examines the quantitative differences between immediate and delayed seeding and mulching in terms of vegetative cover, plant productivity (residual dry matter =RDM), and soil loss over a two-year period. This information in combination with the developments in the California and national native seed programs invites agencies and practitioners to revisit the questions and concerns of reseeding after fires.

Butte Fire in Perspective

On the afternoon of September 9, 2015, a rapidly moving wildfire began in Amador County, California. Known as the Butte Fire, it spread into and across 14,500 acres in Calaveras County during the first 12 hours. By Day 2, the fire had more than doubled in size as it rapidly spread southward. When the fire was finally extinguished on October 1, 2015, 70,868 acres had burned. At its peak, nearly 5,000 firefighters battled the blaze. Resources included 519 fire engines, 18 helicopters, 8 air tankers, 92 hand crews, 115 bulldozers, and 60 water tenders, according to Cal Fire (Branan 2016). In the aftermath, 475 residences and 343 outbuildings were destroyed, 45 structures were damaged, and 2 people lost their lives.

Recognizing the potential — during the rainy season that would follow the fire — for extensive post-fire erosion and catastrophic sediment-loading to waterways and reservoirs downstream of the fire, East Bay Municipal Utility District (EBMUD) staff moved to address potential erosion and consequent water quality issues in severely burned areas of the Mokelumne River Watershed. EBMUD is a large municipal water utility, offering potable water service to 1.3 million customers in the greater Oakland, California, area. EBMUD elected to fund and facilitate a $330,000 emergency remediation project to install various sediment and erosion control measures that would reduce soil erosion and related impacts from severely burned areas. Treatments included hand-applied native seed, mechanically and hand-applied weed-free rice straw, and late season (winter) aerially applied wood chip mulch.

Selection of Erosion and Sediment Control Measures

Control measures that were selected were based on product availability, effectiveness, cost, and the ability to implement application strategies with available resources. The following materials and methods were adopted:

Native Seed Mixes

Native seed mixtures were developed from local regional seed collections from within Calaveras County and surrounding counties. All species selected/used were of California origin and native to the region. Individual species, composition, and the rate of application changed slightly between erosion control treatments in Table 1.

Rice Straw

Rice straw was noxious-weed-free and hand-applied to the burned area shortly after the fire was extinguished (Fall 2015) by EBMUD staff with support from the California Conservation Corp (CCC) and state crews The estimated mulching rate was 3,250–3,620 pounds/acre. Approximately 36 acres were treated using rice straw. Once seeded, the rice straw treatment was identified as SS = Seeded Straw treatments.

Wood Chips

Initially, 28 acres were seeded and then wood chips were applied aerially directly to the charred soil surface at an estimated rate of 4,000

continued next page

[1]General Manager, Pacific Coast Seed. [2]Ranger Supervisor for East Bay Municipal Utility District. [3]Agnew Environmental Consulting
bill@agnewconsulting.us

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

pounds/acre. Wood chip treatments were applied several months following the fire (winter) and coordinated with the BLM. A total of 900 acres were treated within the Upper Mokelumne watershed using wood chips. Once seeded, the wood chip treatment was identified as SW = Seeded Wood treatments.

Following seeding and erosion control materials installation (rice straw and wood chips), an independent study was initiated to evaluate the performance of erosion control measures in relation to the timing of material installation. Vegetation measurements included canopy cover and herbaceous production. Vegetation cover focused on plant establishment from seeded species and from natural regeneration onsite. To further value the performance of treatment strategies, soil erosion rates were calculated using the Revised Universal Soil Loss Equation (RUSLE2) to estimate soil loss in tons/acre/year for each treatment. Sites were visited periodically to review conditions and vegetation establishment over the following two years.

In the Butte Fire study, it appears timely precipitation following seeding is beneficial to initiate seed germination and plant establishment. The straw treated areas were seeded on October 25, 2015, just before a series of moderate rain events totaling 12.83 inches through January 25, 2016. The seeding associated with the wood chip treatments was initiated on January 27, 2016, and planted on rain-compacted and somewhat eroded surface soils. The January seeding and wood chip treatment was followed promptly by 1.16 inch of precipitation and additional rain events totaling 9.45 inches through April 22, 2016. As reported below,

continued next page

Table 1. Seed Mixtures

Species	% Species Composition Fall Mix[1]	Winter Mix[2]
California brome (*Bromus carinatus*)	46.3	53.3
Blue wildrye (*Elymus glaucus*)	18.5	20.0
Pacific fescue (*Festuca microstachys*)	11.1	13.3
Tomcat clover (*Trifolium willdenovii*)	7.4	8.9
Purple needlegrass (*Stipa pulchra*)	8.3	4.5
Sky lupine (*Lupinus nanus*)	4.2	0
Western yarrow (*Achillea millifolium* var. *occidentalis*)	4.2	0
Total	100.0	100.0

[1]Seed applied at a rate of 13.0–15.0 lbs/acre on October 25, 2015 under the rice straw mulch treatment

[2]Seed applied at a rate of 20.0–22.0 lbs/acre on January 26, 2016 under wood chip mulch treatment

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

vegetation response and effective erosion control were directly correlated to timely seeding in relation to reliable precipitation. The amount of precipitation received during the 2015–2016 study period (September 9, 2015, to September 9, 2016) was 24.77 inches. Weather data in 2017 indicate above-average winter and spring precipitation resulting in accelerated plant growth on all treatments. From September 10, 2016, to September 9, 2017, weather records show 37.08 inches of precipitation (Mokelumne Hill, CA) compared to a historic yearly average of 30.94 inches.

Vegetation and Erosion Control Overview

Rapid vegetation establishment over large areas has been regarded as one of the most cost-effective methods to mitigate the risks of increased runoff and soil erosion (Beyers 2004). A number of researchers including Pinaya *et al.* (2000) reported vegetation cover value to be significantly higher when compared to untreated controls, significantly reducing the erosion rate on their sites six months post seeding. Pinaya's results were supported further by the work of Robichaud *et al.* (2000) who reported similar findings over several growing seasons on their study sites. Vegetation establishment using native species was noted as having a positive outcome to mitigate erosion on the Taylor Bridge Fire in Washington State in 2013 (Goldberg 2017). Although the use of native species in post-fire seeding has increased (Beyers 2004, Wolfson and Sieg 2011), inadequate availability often limits the inclusion of native species. The demand for certified native seed has also increased (Loftin 2004) with native collection and local germplasm the future direction of the native seeding program in California (Lund, personal communication).

Sediment yield from high severity burn plots were 10–26 times greater than unburned plots as observed in a Colorado study (Benavides-Soloria 2001). Bautista *et al.* (1996) reported runoff and sediment yields to be significantly greater from control plots with soil loss approximately 7.2 times higher than the loss from mulched plots.

Methods

Percent Herbaceous Canopy Cover

Herbaceous canopy cover and composition sampling consists of two staged point-intercept layouts at each of the treatment areas. Random starts on transects were used, while intercept interval was developed by calculating intercepts based on estimated 85% confidence interval. Multiple hits per intercept were recorded and the corresponding height class identified to a species level classification.

Herbaceous Productivity as Residual Dry Matter (RDM)

Herbaceous production samples were collected at estimated peak production based on phenology of the species. RDM samples were collected at the end of summer prior to new germination onset by autumn rains. Sample locations were taken at random, alternating the baseline transect within each treated area. Herbaceous forbs were

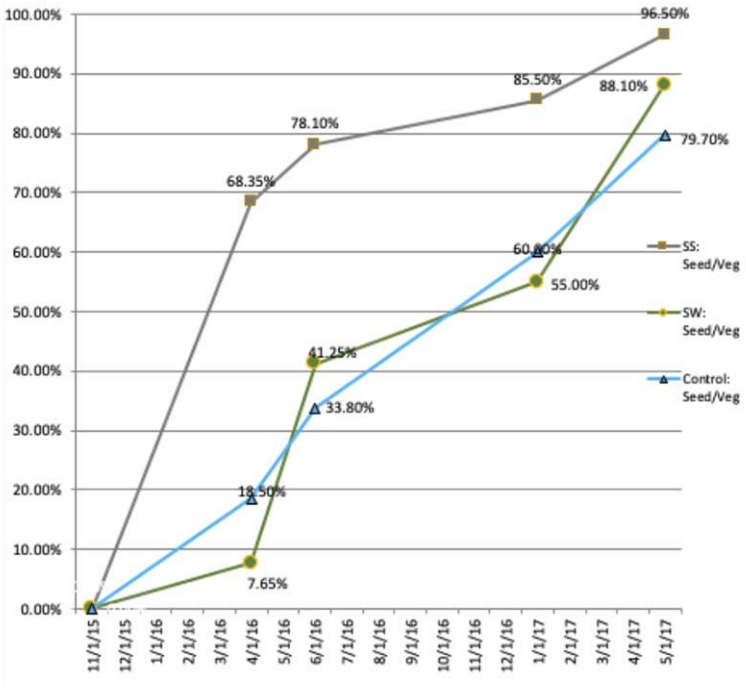


Figure 1. Herbaceous canopy cover over time on all treatments.

removed from the samples and grey residual matter from previous year's growth. Productivity samples were air-dried for an estimated ten days, then dried further in an oven at 100° F for 10 minutes and weighed. RDM was determined to be the best measure of herbaceous production. Aboveground herbaceous biomass was collected in early October prior to the new growing season.

Photomonitoring

Benchmarks used for the baseline transects were also used as photomonitoring locations. Photos were taken with the direction of the baseline referencing the opposite benchmark location for each treatment area.

Sediment Loss

The Revised Universal Soil Loss Equation 2 (RUSLE2) was used to compute sediment loss from erosion. RUSLE2 software predicts sediment loss on a single hillslope profile based on project site characteristics. RUSLE2 "pulls" location-specific data for climate (R), soil (K), slope steepness (S), slope length (L), compaction/tillage practices (P), and vegetative or mulch cover (C) from an established database. This data is used in conjunction with user-input data which describe the hillslope profile: topography, yield (production level), rock cover, and type (e.g. mulch, rice-straw) and amount of applied materials.

Findings

Vegetation Cover, 2015–2017

Our data clearly indicates that SS treatment (immediately after the fire has been extinguished and prior to the onset of reliable precipitation)

continued next page

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

provided the greatest benefits, increasing vegetation establishment and reducing the amount of erosion. As a result of early and timely seeding in October 2015, the vegetation canopy cover associated with the SS treatment was initially higher when compared to other treatments. For the SS treatment, total canopy cover, including seeded and volunteer species, was 68.35% in April 2016 and 78.10% in June 2016. The untreated control treatment had 18.50% canopy cover by April 2016 and 41.25% canopy cover by June 2016. SW treatment had 7.65%

continued next page

Figure 2. (left column, from top) Ocular canopy cover of the seeded rice straw treatment — Early Spring (April 16) 2016, Late Spring (June 5) 2016, and Spring (May 8) 2017.

Figure 3. (right column from top) Ocular canopy cover of seeded wood chip treatment — Early Spring (April 15) 2016, Late Spring (June 6) 2016, and Spring (May 9) 2017.

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

canopy cover in April 2016 and 33.80% canopy cover in June 2016. Figure 1 shows herbaceous canopy cover, over time, from the initial sampling period (April 2016) through the May 2017 sampling date, for all treatments. The data indicated that the SS treatment consistently outperformed the other two treatments. In the latter part of the second growing season (May 2017), the SW treatment and untreated control treatment began to approach the cover performance of the SS treatments. Figures 2–4 shows estimated vegetation cover percentage establishment on each treatment over time.

Figure 4. (from top) Ocular canopy cover of the control — Early Spring (April 18) 2016, Late Spring (June 7) 2016, and Spring (May 10) 2017.

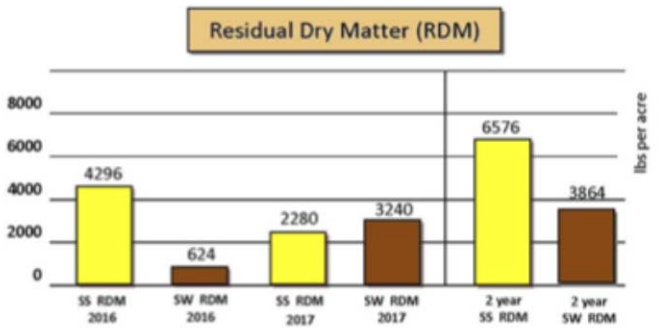


Figure 5. RDM for seeded rice straw (SS) and wood chip (SW) treatments by year and between years

Herbaceous Production

Herbaceous vegetation production (aboveground herbaceous biomass) was more abundant on early seeded areas. The SS Treatments produced 4,296 lbs RDM/acre in 2016 (Figure 5). The wood chip treatments produced 624 lbs RDM/acre. To reiterate, the SS treatment was completed in late October (24–27) 2015 and the SW treatment was completed later, in January (25–29) 2016. The data suggests that early seeding and timely precipitation are directly related to the amount of plant biomass produced in this study area. Other collateral benefits include enhanced habitat cover and increased forage value at the site.

In 2017, RDM production in the SS treatments decreased to 2,280 lbs/acre. In the SW treatment, RDM production was more than five times the 2016 production levels, outperforming the SS with a calculated 3,240 lbs RDM/acre. Total RDM over the two-year period on the seeded straw was 6,576 lbs RDM/acre and 3,864 lbs RDM/acre on the seeded wood chip plots (Figure 5). The data indicate that perennial grasses, mostly California brome and Blue wildrye, returned strongly from their crowns and provided significant cover in the second year. The authors suspect that the total RDM of the wood chip site may continue to trail the seeded straw treatment for years due to nutrient loss associated an estimated loss of 78 tons/acre over the initial two recovery years.

Sediment Loss

In the first year after seeding, SS plots, SW plots, and the control plots yielded 6.4, 50.0, and 64.0 tons per acre year, respectively (Table 2). By the end of the second year, the calculated erosion rate from the early seeded plot was 3.9 ton/acre/year. Estimates are that erosion will continue to decline to a baseline level of 2.4 ton/acre/year in calendar years 2018 and 2019. The SW plots show a steady decline in the rate of erosion when compared to soil loss estimates on SS plots. The soil loss from the control plots over the next four years decreased significantly over time. Over the five-year estimate, the SS treatment yielded 18 tons per acre of sediment, the SW treatment yielded 104 tons per acre of sediment, and the control yielded a staggering 137 tons per acre of sediment. While vegetative cover appears to show nearly equal recovery

continued next page

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

Table 2. RUSLE 2 calculated sediment delivery rates (tons/acre/year) over 5-year period all treatments

Treatment	Immediate Seeding Plus Rice Straw Mulch		Delayed Seeding Plus Wood Chip Mulch		Untreated Control	
Description	Grass/Forb Vegetation Seeded 10/25/2015 plus 3,000 lbs Rice Straw Mulch		Grass/Forb Vegetation Seeded 01/25/2016 plus 4,000 lbs Wood Chip Mulch		No Seed or Mulch; Only Volunteer Vegetation Modeled	
Average Annual Soil Loss (tons/acre/year)	3.6		21.0		27.6	
Sediment Delivery (tons/acre/year)	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative
Year 1 (2015–2016)	6.4		50.0		64.0	
Year 2 (2016–2017)	3.9	10.3	28.0	78.0	43.0	107.0
Year 3 (2017–2018)	2.9	13.2	15.0	93.0	17.0	124.0
Year 4 (2018–2019)	2.4	15.6	7.4	100.4	8.5	132.5
Year 5 (2019–2020)	2.4	18.0	4.0	104.4	4.9	137.4

Note: Yearly sediment delivery is from September 15 to September 14 of next year

of vegetation after two full growing seasons, the difference in soil loss per year continues to be relatively high in the SW and untreated control plots, resulting in substantial soil loss over the first five years after the fire.

The modeled rate of erosion in the control treatment was 10 times that of the SS plots during the initial modeling period (September 15, 2015 to September 14, 2016) (Table 2). The erosion rate modeled for the SW treatment was over seven times that of the SS treatment. The ability of wood chips to reduce the erosion rate relative to the control was also evident but to a lesser degree. Regardless of treatment, sediment loss was consistently greater in untreated control plots compared to treated areas.

Conclusions

The data collected on this Butte Fire Study strongly indicate that early seeding of native grasses and forbs in conjunction with straw mulching produced the most beneficial outcome in the form of increased vegetation canopy cover, reduced surface erosion, and accelerated vegetation production. Late seeding with wood chip mulching applications resulted in lower vegetative cover and productivity the first season and higher soil erosion rate when compared to the early seeding treatment. Note that every treatment demonstrated more effective outcomes, for every category, when compared to the control. The control plots showed the lowest rates of vegetative cover and the highest rates of soil erosion. Thus, the data supports early seeding and mulching to minimize erosion from the severely burned areas.

Although there are still challenges associated with seeding natives after fires, this study indicates that early seeding and mulching can be a highly effective post-fire treatment. Even mid-season seeding and mulching demonstrated a positive response. While more information and a follow-up study of this site will improve our understanding of treatment efficacy, the natural vegetative recovery did not appear to be compromised by the artificial seeding. The questions from the 1995 CNPS position paper regarding the use of non-local native seed types, lack of seed supply, disruption of small-scape ecological patterns, and success of natural vegetation recovery are all valid and should continue to be examined.

When addressing lack of seed stocks of a local source for large projects, the California seed industry understands the varied and dynamic nature of supplying seed to end users and has made

continued next page

Post-Fire Seeding & Mitigation on the Butte Fire *continued*

great strides to fill the gaps and provide significant quantities of local native species for projects. Unfortunately, conducting local collections is still an expensive proposition for a seed company. Seeds have a fixed lifespan and it is impossible to know when and where fires will break out. Clearly a more centralized and comprehensive system for sources of emergency seed supplies is needed and would allow for prompt and effective treatments, particularly when dealing with local ecotypes. As the National Seed Strategy for Rehabilitation and Restoration becomes the established norm, it should allow the seed industry, agencies, and practitioners to identify the seed supply needs to make timely and informed decisions for current and future ecological restoration projects regardless of scale.

Acknowledgments

Special thanks to David Lightle for his skilled input, direction, and instruction of RUSLE2, and to Vanessa Stevens, Botanist/Resource Analyst, for her outstanding effort in botanical data collection.

References

Bartolome, J.W., W.E. Frost, and N. McDougald. 2002. Guidelines for residual dry matter on coastal and foothill rangelands in California. University of California Division of Agriculture and Natural Resources. Rangeland Monitoring Series Publication 8092.

Beyers, J.L. 2004. Post-fire seeding for erosion control: Effectiveness and impacts on native plant communities. *Conservation Biology* 18(4):947–956.

Bautista, S., J. Bellot, and V.R. Vallejo. 1996. Mulching treatment for postfire soil conservation in a semiarid ecosystem. *Arid Soil Research and Rehabilitation* 10(3):235–242.

Benavides-Solorio, J., and L.H. MacDonald. 2001. Post-fire runoff and erosion simulated rainfall on small plots, Colorado Front Range. *Hydrological Processes* 15:2931–2952.

Branan, B. 2016. Cal Fire blames PG&E for Butte Fire, will seek $90 Million. *The Sacramento Bee*. April 28, 2016.

Goldberg, S. 2017. Growing it back: Revegetating after wildfire. **https://www.stormh2o.com/erosion-control/vegetation-management/article/13030715/revegetating-after-a-wildfire**.

Loftin, S.R. 2004 Post-fire seeding for hydrologic recovery. *Southwest Hydrology* 3:26–27.

Lund, C. (2017). Post-fire seeding and mitigation on the Butte Fire. Personal communications.

Peppin, D.L., P.Z. Fule, C.H. Sieg, J.L. Beyers, M.E. Hunter, and P. Robichaud. 2011. Recent trends in post-wildfire seeding in the western US forests: Costs and seed mixes. *International Journal of Wildland Fire* 20(5):702–708.

Pinaya, I., B. Soto, M. Arias, and F. Diaz-Fierros. 2000. Revegetation of burnt areas; Relative effectiveness of native and commercial seed mixtures. *Land Degradation and Development* 11:93–98.

Robichaud, P.R., J.L. Beyers, and D.G. Neary. 2000. Evaluating the effectiveness of postfire rehabilitation treatments. General Technical Report RMRS-GTR-63. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Wolfson, B.A.S., and C.H. Sieg (2011). 40-year post-fire seeding trends in Arizona and New Mexico. USDA Forest Service, Rocky Mountain Research Station, General Technical Report.

Mentoring the Next Generation: **Ben Nelson**

Guest Editor's Note: You can learn more about the Merritt College Natural History and Sustainability Program at www.merritt.edu/nhs/

What is your Occupation and where do you work? Adjunct Professor and Program Director of the Natural History and Sustainability Program at Merritt College.

What is your specific discipline (or underlying education)? I'm an educator at a community college. I'm eligible to teach Biology courses because of my Master's. Other than that, it's all about experience and effort. I've had multiple trainings and education on how to teach effectively and equitably.

What services do you provide for restoration in California, or what is your restoration passion? Our program's goal is to provide our students the education that will make them great candidates for environmental jobs. We offer 3 certificates of achievement that attempt to prepare our students for the wide variety of skills that environmental jobs require. We don't offer any restoration courses, but lots of training around the concepts that restoration is based on. My restoration passion is to help people get trained to try to make the world a better place, that includes helping restore the health to our environment. Especially in urban spaces.

How did you get into the field of ecological restoration? After graduating with my B.S. I began doing coastal bluff restoration in Santa Cruz. Frankly, I found too many barriers to getting another job and shifted my career focus to education..

What is your favorite California native species? I can't choose one, I'm a generalist. *Calochortus* is a genus that I can never get enough of. Even when I expect to find them it's still a treasured moment and a reminder of how the natural world can steal my breath from me.

Any advice for others in the field of restoration? Take advantage of opportunities. Make sure you focus on the skills that you want to build, seek them out, and eventually you will apparate your dream job.

We paired 24 Mentees with Mentor at SERCAL 2021

SERCAL is embarking on a new outreach adventure for early-career restoration professionals, college students, and underrepresented communities. As an education-based organization, we would like to offer those who are just starting their careers, or looking to broaden their career, a way to connect with mentors within our membership during our annual conference. With a wealth of knowledge and experience to impart, and resources to share, SERCAL mentors can bridge the gap for their mentees and set them up for success in our field.

SERCAL sercal.org *Inspire and Be Inspired*

This is just the first step… Watch for updates and year-round opportunities! And please reach out to julie.sercal@gmail.com if you would like to volunteer as we develop our mentoring program.

Thank you 2021 Mentors! Chad Aakre, Westervelt ❊ Gregory Andrew, retired ❊ Alys Arenas, Newport Bay Conservancy ❊ Shannon Bane, Harris & Associates ❊ Brian Bartell, WRA ❊ Barbra Calantas, ESA ❊ Courtney Casey, ICF ❊ Laura Cunningham, Western Watersheds Project ❊ Nick Deyo, ICF ❊ Nick Garrity, ESA ❊ Andria Greene, H. T. Harvey ❊ Brad Hoge, The Nueva School ❊ Nina House, California Botanic Garden ❊ Kristin Lantz, ICF ❊ Jean-Philippe Marié, UC Davis ❊ Julia Michaels, Reed College ❊ Leticia Morris, GEI Consultants ❊ Gwen Santos, RES ❊ Geoff Smick, WRA ❊ Will Spangler, Santa Clara Valley Habitat Agency ❊ Jill Sunahara, ESA ❊ Lindsay Teunis, SWCA ❊ Megan Wolff, Palos Verdes Peninsula Land Conservancy ❊ Wendy Young, Harris & Associates ❊ Matt Yurko, Project Grow

The Last Word: *Rest*

"Growth happens in periods of rest." — Shelana deSilva, Plenary Speaker at Cal-IPC 30-Year Anniversary Symposium, Special Session on Expanding the Community in Conservation (27 October 2021)

Are you getting enough rest?

If you're like many of the people I've been in contact with since summer's boom in restoration work, I would feel safe in guessing that you haven't had the time to even ask this of yourself.

I realized recently that for me the word "weekend" has become synonymous with taking care of everything in my personal life that there's no room for during the work week. So I have rephrased it to "taking two days off" and have created a practice of living in "when I have time to do this" clutter and learning to co-exist with the generations of dust bunnies under my sofa.

But back to rest: How do we put the *Rest* back into *Restoration*? How do we make time to restore ourselves, let alone our relationships with others, in this post-pandemic chaos?

I doubt there's a one-size-fits-all answer to this; and I KNOW no one will give it to us. This is something we're going to have to individually carve out for ourselves — whether two days off every week or one unplugged hour each day.

And what better time to start than *now* as the hours of daylight wane? For the rest of the natural world, the days approaching the Winter Solstice are all about slowing *way the heck* down. It's a cycle of life that we've forgotten in the last hundred years or so, but we *are* natural beings, just the same as bears and deciduous trees.

What I'm saying is that there's no way our species has evolved as quickly as technology has… so please, take a rest. You've earned it!

Take yourself for a wander in the woods this weekend. Revisit some of those new skills you learned during Shelter in Place… or try something new! Contact an organization you've always admired and volunteer — it will get you out of your learned routine and into new places or among new faces. You can even time travel by listening to music you loved as a teen. Better yet, do nothing at all wherever you love to do it — beach, mountain overlook, swimming hole.

Really, all you need to do is find your inner puppy and play — I guarantee your body and soul will take it from there — *Julie*

SERCAL Leadership Team 2021

Board Officers

President Allegra Bukojemsky

Secretary Cindy Thompson

Treasurer Geoff Smick

Regional Directors

North Coast & High Desert (Alameda, Contra Costa, Del Norte, Humboldt, Lassen, Marin, Mendocino, Modoc, Napa, San Mateo, Santa Clara, Shasta, Siskiyou, Solano, Sonoma, and Trinity)

Geoff Smick *WRA, Inc.* smick@wra-ca.com

Ross Taylor *Ross Taylor & Associates* rossntaylor@sbcglobal.net

Isaiah Thalmeyer *Point Blue* ithalmayer@pointblue.org

Central Coast & Valley (Alpine, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Madera, Mariposa, Merced, Monterey, Nevada, Placer, Plumas, Yolo, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Sierra, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, and Yuba)

Thor Anderson *Burleson Consulting, Inc.* ta@burlesonconsulting.com

Allegra Bukojemsky *Westervelt Ecological Services* abukojemsky@westervelt.com

Will Spangler *Santa Clara Valley Habitat Agency* will.spangler@scv-habitatagency.org

South Coast & Eastern Desert Lands (Imperial, Inyo, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Diego, and Ventura)

Mauricio Gomez *South Coast Habitat Restoration* mgomez@schabitatrestoration.org

Jeannine Ross *KMEA* jross@kmea.net

Cindy Thompson *Habitat Restoration Sciences* cthompson@hrs.dudek.com

At Large Directors

Kari Dupler *RestorCap* karidupler@gmail.com

Jamie Silva *CA Department of Water Resources* Jamie.Silva@water.ca.gov

Lindsay Teunis *SWCA* Lindsay.Teunis@swca.com

Affiliates

Liz Agraz *WRA, Inc.* agraz@wra-ca.com

Greg Andrew *Retired* AndrewEnv@aol.com

James Mizoguchi (Contributing Editor) *Triangle Properties* jmizoguchi@teichert.com

Cassie Pinnell *Vollmar Natural Lands Consulting* cpinnell@vollmarconsulting.com

Administrative Director

Julie St John julie.sercal@gmail.com

Calandrinia breweri

You are crucial to the resilience of California's native habitats

Just like our floral first responders, SERCAL members make California's ecological systems healthy and whole again. In the three decades since SERCAL was founded (let alone, last year) so much — almost everything — has changed. Yet one thing remains constant: *The exceptional power we have when we work together.* We are grateful for all our members and want to recognize these individuals and businesses for their generous support in 2021:

Sustaining Businesses:

Edith Read **E Read and Associates** *Orange* ❊ Jeff Quiter **Hedgerow Farms** *Winters* ❊ Robert Freese **Irvine Ranch Conservancy** *Irvine* ❊ Travis Gramberg **Koheid** *Costa Mesa* ❊ Prairie Moore **Natural Resources Management Corporation** *Eureka* ❊ Alisa Flint **OC Parks Natural Resources Team** *Irvine* ❊ Cindy Tambini **Wildlands** *Rockland*

Sustaining Individuals:

Philip Brownsey Environmental Science Associates *Sacramento* ❊ **Gina Darin** California Dept of Water Resources *Sacramento* ❊ **Jason Drew** Nichols Consulting Engineers *South Lake Tahoe* ❊ **Deborah Goldeen** *Palo Alto* ❊ **Catherine Homsey** *San Francisco* ❊ **Robert Mazalewski** Consulting Horticulturist *La Mesa* ❊ **Ross N. Taylor** Ross Taylor & Associates *McKinleyville* ❊ **Peter Warner** Peter Warner Botanical & Ecological Consulting *Sebastopol* ❊ **Emily Zefferman** Resource Conservation District of Monterey County *Marina*

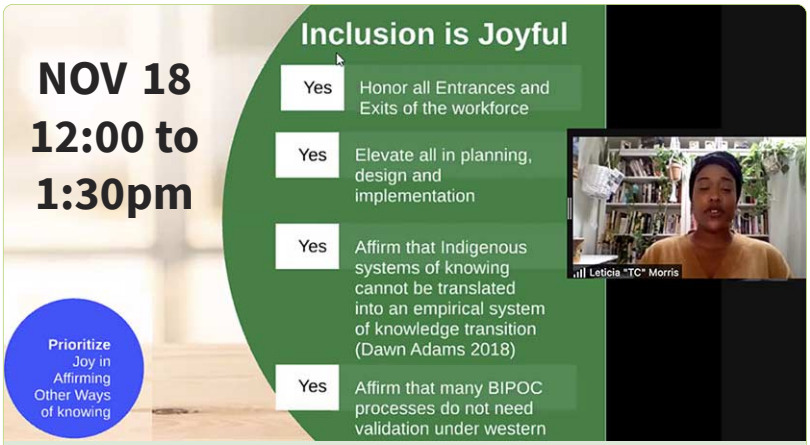
California Society for Ecological Restoration SERCAL

515 N Desert Stravenue, Tucson AZ 85711

ADDRESS SERVICE REQUESTED

FIRST CLASS
US POSTAGE
PAID
TUCSON, AZ
PERMIT 3341

Watch MailChimp for a link to renew for 2022!



"Any conversation of race and place in our industry comes with it a responsibility not only to see things as they are, but also to see and envision things as they can be." — Leticia "TC" Morris, *Ecesis*, Summer 2021

At SERCAL 2021, we began a critical conversation on Diversity, Equity, and Inclusion in California's Restoration Community… **Please join us for a lunchtime webinar Thursday 18 November as we continue the journey and plan for future gatherings!**