watersheds program

treeline

partnering for climate adapted forests

December 2022

Missed the September Treeline Newsletter? Click *here* to learn about how our partners are dealing with strains and stressors related to climate change.

Interested in submitting an article? Reach out to Kayla Seaforth *kseaforth@b-e-f.org*

Photo Credit: Cris Salazar

Treeline aims to: Engage PNW restoration practitioners, nursery partners and researchers who work for or represent tribes, indigenous groups, non-profits, agencies, businesses and more. We gather, disseminate, and discuss information and knowledge across a broad region.

The Resilience Issue

This issue of Treeline focuses on measures that federal, state, local, tribal and NGO agencies are taking to build and plan for resilient communities and ecosystems in the face of the climate crisis.

Photo Credit: USFS Matt Horning

Reflections on Assisted Migration from a Conservation Scientist

An interview with Dr. Mark W. Schwartz

Has your thinking or direction of research regarding assisted migration changed in the last decade, and if so, how?

I have been impressed by a few experiences on assisted migration over the past decade. First and foremost, how people differ in their opinions on the acceptability of assisted migration as a management action given their connection to natural ecosystems. For example, those in the forestry industry appear very comfortable with the notion of shifting planting regimes to new species so that we may have a healthy, harvestable forest in 30-50 years, when those trees mature. In contrast, conservationists considering the same kinds of actions in forests that do not necessarily have harvest plans worry a great deal about the ecosystem. Will planting with a few new tree species create all the envisioned changes to the ecosystem? Or will this be some sort of Frankenstein ecosystem, sewing parts of different ecosystems together, with unknown effects. These differences in opinion drive different management actions, and responses to management. The consequence is that I suspect that there may be instances where there is a public uproar about the possibility of a public agency taking some action on public lands in the midst of the forestry industry taking those actions, without social pushback, on adjacent private lands. Thus, my direction has shifted toward better understanding people's reactions to suggestions of assisted migration and thinking through what parts of these opinions are well supported by some consistent ethos or supported by ecological evidence.

Similarly, people's attitudes appear malleable based on the sense of urgency. I recently spent time talking to conservation groups from Hawaii. Given the imminent extinction threats they face for many of their birds and tree snails, they want to make sure that a decision process is not so onerous that they can get moving on action. Over much of the continent, there seems to be much more circumspection as there is a sense of time to make deliberative decisions. My concern is that we actually use that time wisely and not wait until we, similarly, are in crisis management.

Can you speak to the nature of any collaborative efforts to set guidelines or best practices for assisted migration that you've been involved in or are aware of?

This past summer the Department of the Interior Issue draft guidelines for assisted migration on behalf of the federally listed endangered species. This rule would open the door to assisted migration. One consequence of this kind of thinking is that the Department of the Interior is working

Dr. Mark W. Schwartz

Professor emeritus at University of California, Davis

Dr. Mark W. Schwartz is a conservation scientist. His research focuses primarily on how resource agencies, and people more generally, make decisions about natural resource management under changing climates. Dr. Schwartz is professor emeritus at University of California, Davis, where he is the co-lead for the campus on the seven campus university consortium that is the Southwest Climate Adaptation Science Center, sponsored by the US Geological Survey. Dr. Schwartz has been studying assisted migration since the Torreya Guardians began moving Torreya taxifolia (a coniferous tree endemic to northern Florida) in about 2006.

on defining conditions for taking such actions. The Fish and Wildlife Service (FWS) in the Pacific Islands and Pacific Northwest are actively working on decision guidance for conservation introductions. This follows the National Park Service publishing protocols for assessing risks associated with assisted migration. There are likely to be other on-going efforts. However, this suite of actions by our Federal agencies is indicative of a shift toward a readiness to consider assisted migration as a viable management option.

Do you have any thoughts on the right scale of coordination?

I have been involved in the FWS efforts to develop decision guidance. One of the efforts that we engaged in was a workshop listening session to better understand what interested people from state and local agencies, indigenous groups, NGO's and university researchers would like to see in this guidance. The clear message that emerged from this workshop is that people want to be a meaningful part of the discussion and decision. The federal agencies have been moving in the direction of engaging people in their decision-making more directly. We should expect that the draft decision guidance that the Pacific Northwest Region emerges with in 2023 reflects an interest in collaborative decision-making and collaborative project management.

In this and related publications folks have identified concerns with pest and pathogen transfer, inappropriate applications of things like the seedlot selection tool, ethics, and questions around what guidelines should look like. What else should we be thinking about?

This is, of course, one of the great challenges with non-traditional conservation actions. There are so many things that we not only should, but need to consider. This includes a careful assessment of the risk of adverse outcomes from things such as accidentally transferring pests and pathogens with plant and animal material but also the social risks associated with taking these actions. Public resistance can thwart management efforts very easily. There is understandable resistance to the notion of moving species, and some of this relates to the ethics of our relationships to nature. The challenge that faces managers is that we would like to use due diligence in considering all of the possible pitfalls of assisted migration (and there are many), but we also do not want to fall into something often called analysis paralysis: deferring any decision indefinitely because we don't think we have answered all of our outstanding questions. We need to construct decision processes that make decisions efficiently, yet in a way that includes very serious ecological and sociological concerns.

What other strategies should we be considering when it comes to landscape based climate adaptation?

I often refer to the movie Argo when talking about assisted migration. There is a notable scene where the protagonists are describing their hostage rescue plan to their supervisors, who respond that it is a terrible idea. The protagonists respond with a statement that goes something like: "Yes sir, it is a terrible idea. But it is the best bad idea that we have." This is assisted migration in a nutshell. I think that we all wish we lived in a world where we did not have to consider this as a management option. That would be a simpler world to live in. However, we live in this world. Assisted migration is a terrible idea. It is full of risk. It might, however, be our best bad idea. That isn't to say, however, that there aren't other potentially useful, even necessary, 'bad ideas' out there. Genetic manipulation of species to increase their tolerance to climates; geoengineering to make habitats more suitable to climatically stressed species have also been suggested for particular conservation challenges in particular cases. They have their own challenges and we won't address them here. However, the thought that I would like to share here is this. How many species are there for which we are likely to plan and execute assisted migration? If we do this carefully, then not very many. Certainly, it is not a solution that is on scale with the size of the problem. It may be a solution for species of forestry or fisheries concern. It may be a solution for notable endangered species. But, probably not much beyond that. Thus, we need to maintain our investments in helping ecosystems adapt to the future change that we expect to see.

Ecosystem composition is projected to shift as the climate changes. What role do you think land managers have in deciding when and where to move species as these changes manifest?

Scaling up from species to ecosystems, as I just alluded to, increases the complexity of the problem by orders of magnitude. It also increases the complexity of the proposed actions. How do we move ecosystems? Do we simply bring in truckloads of seed, soils, microbes and hope that the base of the ecosystem sorts itself out and the upper trophic levels can migrate to follow suit? Probably, but that sounds to me like an awful management strategy. I do not envy land managers that are now having to make these decisions. There are a few places where I see this as early warning signs of change where this is happening sooner rather than later. Western wildfires are driving ecosystem change. Managers are faced with the notion of resisting change in ecosystems, accepting changes that come along, or actively directing change. Our public agencies have spent decades in a mode where the primary belief was that a 'light touch' was needed; that nature can manage itself if we simply remove the anthropogenic forces degrading systems. With climate change, and the results of fire suppression, managers aren't really able to exercise this 'light touch' management approach any longer. A secondary challenge is really one of human capacity. A friend from a large National Park once said to me, "well, at the end of the day we are going to have to simply accept most change that nature brings along because we simply do not have the workforce to broadly direct change, even if we wanted to." I think that this is a common challenge: managers will need to carefully pick their battles and engage in managing change where it will have the most benefit. These will be hard decisions.

Managing for Socio-Ecological Resilience First:

How a New Type of Indicator Enhances Wildfire Resilience Monitoring

By Colleen Rossier, University of California, Davis and Bill Tripp, Karuk Tribe

This article was adapted from a blog on fireadaptednetwork.org. Read the full blog post here.

Socio-Ecological Resilience

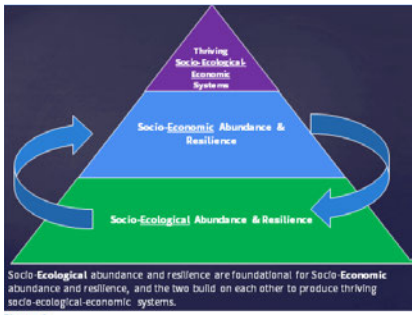
Within the Karuk Tribe, it is a cultural teaching that "you do not harvest anything without first managing habitat for it to survive and reproduce." This is a "socio-ecological first" approach to management.

We say "socio-ecological" rather than purely "ecological" in recognition of the interdependence of human communities and ecosystems. What we do, how we live, and how we manage ecosystems profoundly impacts them — in either positive or negative ways. Likewise, plants, animals and fungi provide us with food, shelter, fibers, fuel, clean air, clean water, climate regulation and much more. Resilience in either context refers to the speed at which the system is able to re-form following disturbance, or a product of disturbance related to human interaction (or lack thereof).

Fire History and Huckleberry Ecology

In the past 150 years, Karuk people have not been able to manage their homeland in traditional ways because they have been **prohibited from conducting traditional burns**, and many species have declined due to this lack of indigenous management (**Norgaard, 2014**).

The Karuk Tribe has called attention to this fact — and to the fact that humans and wildlife can coexist, and thrive, when we **manage for socio-ecological resilience and abundance first** (PDF, 28.25), and let socio-economic resilience and abundance flow from there (Figure 1).



Socio-**Ecological** abundance and resilience are foundational for Socio-**Economic** abundance and resilience, and the two build on each other to produce thriving socio-ecological-economic systems.

Figure 1

For example, the Karuk people manage their landscape such that there are enough berries and acorns to provide an abundance of food for wildlife and local families before using the remaining harvest to produce flour, soups, breads, jams, jellies and pies for ceremony, sale or trade.

One of the plants the Karuk people traditionally tend is evergreen huckleberry. It produces berries that they and many species of wildlife consume — including mice and woodrats: both of which are, in turn, food for the northern spotted owl. In our region, the huckleberry is an answer to the question: What is the food resource that links indigenous human stewardship and use to survival and reproductive rates of declining species?

While huckleberry plants are still prevalent, their berry production has declined due to the lack of indigenous stewardship, including intentional burning. This decline has resulted in overgrown forests full of brush and small diameter trees as well as fewer canopy gaps, leaving less light for understory plants. In the case of huckleberry, this has resulted in denser brush with fewer berries and seeds for the Karuk people as well as mice and woodrats.

Additionally, huckleberries are likely important sources of food for migratory birds because of their high anthocyanin content (**Bolser et al., 2013**; **Schaefer et al., 2008**). And underground, huckleberry bushes form associations with several types of fungi through common mycorrhizal networks (**Largent et al., 1980**). These co-created nutrient super-highways support other plants and trees and are essential for the health of the forest as a whole (**Egerton-Warburgon et al., 2007**; **Kennedy et al., 2003**). Large ungulates like Roosevelt Elk also forage on huckleberry brush when open enough to access. This indicates a food security connection to yet **another focal species** selected by the Karuk. Huckleberries are an excellent example of a species deeply entwined in an ecological food web.

When there are fewer huckleberries, people are directly, negatively impacted as well. Evergreen huckleberries are highly nutritious and medicinal, providing even more antioxidants and anthocyanins than their more commonly known and revered cousin: blueberries.

Huckleberries are also a significant traditional and ceremonial food for the Karuk people, and they are associated with other native species important to the Karuk such as acorns, mushrooms, deer, elk and other medicinal plants.

Huckleberry gathering areas essentially serve as grocery stores, pharmacies and outdoor classrooms for native people.

Thus, the decline in huckleberry quality and abundance is representative of an overall socio-ecological deficit.

Collaboration and Research

The Karuk Tribe is partnering with the U.S. Forest Service and others through the **Western Klamath Restoration Partnership** to revitalize fire and other indigenous stewardship practices throughout their aboriginal landscape. They have chosen the evergreen huckleberry to be an indicator of socio-ecological resilience. As part of their larger landscape restoration effort, they intend to return dense stands of huckleberry brush to the abundantly flowering and fruiting gardens that used to exist. Eventually, the Karuk would like to establish a percentage of the landscape with access to high-quality huckleberries, for both wildlife and humans, as an easily measurable performance metric for their shared stewardship activities. This species was selected for its apparent interconnection regarding the impacts of management actions of an entire living system.

Collecting the Data

In order to evaluate high-quality huckleberry habitat, we interviewed traditional huckleberry stewards of Karuk and Yurok descent to understand what makes high-quality huckleberry patches. This allowed us to define a quantitative metric to assess patch quality on a scale of 0-5 (0 meaning no berries present; 5 meaning a patch with abundant, dense clusters of berries). We then assigned huckleberry patch quality scores to 105 plots within Karuk aboriginal territory.

Overall, we found that although we skewed our site selection toward higher quality habitat, 30 percent of the huckleberry patches had no berries at all (HPQ = 0), and 30 percent had little-to-no good quality berries (HPQ = 1–2). Only 12 percent of our sites had abundant huckleberries (HPQ = 4–5), and the majority of these were known gathering spots that were actively pruned by Karuk and Yurok people. We believe it is likely that with a reintroduction of fire, pruning and targeted canopy thinning (either through fire, manual, or mechanical treatments), many of these huckleberry patches could be rejuvenated and once again produce higher yields of good quality berries.

Huckleberries and Wildfire Resilience

While huckleberry bushes are typically viewed as a fuel by forest managers, the Karuk approach to managing huckleberries suggests that creatively designed fuels reduction treatments (burning and thinning) may actually benefit a forest's overall wildfire resilience, and increase berry production — if done at appropriate intervals and in suitable habitat. We will evaluate our huckleberry plots before and after mechanical, hand and burn treatments in order to better understand that connection.

So far, we have tracked eight huckleberry plots before, during and after prescribed burns. While we do not have enough data to make scientific conclusions, we did make some anecdotal observations. For instance, unless the canopy closure drops below 75 percent, there is little-to-no increase in berry production. However, fire seems to revitalize the bushes by removing old unproductive branches and stimulating vigorous new growth. We have also found that berry production generally takes about two or three years to get going after a fire.

Maintaining healthier huckleberry stands may have another relationship with wildfire mitigation, because as Karuk people gather from them each year, they also prune them — both as a part of harvesting and as a means to keep them lower, more condensed and traversable. This increases their productivity and accessibility while decreasing ladder fuel continuity.

The Big Picture

By using socio-ecological indicators, we can better understand the habitat requirements for plants and animals that have strong ties to our human communities and help our ecosystems function better. Working with indigenous peoples and studying how these indicators respond to wildfire and prescribed fire will help understand how to use fire to foster them. This kind of active management is inclusive of **indigenous stewardship practices**, not only fostering fire-resilient landscapes and communities — but also abundant, prosperous ecosystems and economies.

If you're unsure what socio-ecological indicators are in your area, consider collaborating with local indigenous communities; the potential for collaboration may very well be ripening!

Frank K. Lake, Karuk descendant, and daughter, Ada, gathering evergreen huckleberries. Frank is carrying Ada in a traditional hazel stick baby basket. Photo Credit: Colleen Rossier, University of California, Davis

LaVerne Glaze, Karuk, cleaning evergreen huckleberries in her sifting basket. She picked the berries off of the tips she'd pruned earlier, which are sitting on the ground to her left. Pruning helps keep bushes compact. Photo Credit: Colleen Rossier, University of California, Davis

Colleen Rossier participating in a Prescribed Fire Training Exchange (TREX) in and around evergreen huckleberries on private land. Photo Credit: Frank K. Lake, USDA Forest Service

See another piece from the Fire Adapted Community Network titled **"Cultural Burning and TEK: How Can FAC Practitioners Leverage Indigenous Connections to Fire Without Exploiting Them?"** for advice directed at non-indigenous managers on working collaboratively with tribes to respectfully incorporate their long history with fire as a management tool in modern contexts.

Colleen Rossier is a PhD Candidate in Ecology at UC-Davis. She has been working with the Karuk and Yurok Tribes since 2014, and is currently writing her dissertation about their collaborative research integrating Western and Indigenous sciences with a particular focus on managing for the native understory forest food: evergreen huckleberries (Vaccinium ovatum) within a landscape-scale eco-cultural agroforestry context. She is originally from the East Coast (Virginia), and worked at USDA's Office of the Chief Scientist and National Agroforestry Center before moving out to California for graduate school. She has a deep love of plants, animals, forests, mountains, rivers, the ocean, fire, rock climbing, yoga, gardening, and herbal medicine, and also studies acupuncture and traditional East Asian medicine. She wishes to express love and gratitude to all the Karuk, Yurok, and Hupa people willing to extend their friendship, and to share their time, stories, teachings, and experiences; and to her friends and family near and far for all of their love and support.

Bill Tripp is the deputy director of Eco-Cultural Revitalization for the Karuk Tribe's Department of Natural Resources. Bill is also a co-lead for the Western Klamath Restoration Partnership. This collaborative group is embarking on a new era of shared stewardship. Together, they are changing the discussion regarding forest and fire management in the western Klamath Mountains and beyond.

Novel Approach for Large Woody Debris Placement

A Case Study in Tree Tipping From the Upper Calapooia River

Interview between Cris Salazar, Calapooia Watershed Council and Kayla Seaforth, BEF

KAYLA SEAFORTH: Tell me about the project. How did this idea come about?

CRIS SALAZAR: It was a collaboration between the Calapooia Watershed Council and the Sweet Home Ranger District that started in 2016. My predecessor, Collin McCandless, who's now our executive director, and Lance Gatchell, who is the Sweet Home's, fish biologist and hydrologist originally came up with the idea. There is an Endangered Species Act (ESA) listed population of steelhead in the upper Calapooia, the Upper Willamette population. Like many salmonid populations, it's not doing great. We identified this reach, which is on the Willamette National Forest, as not having all the habitat requirements that you would hope for for steelhead; there wasn't a lot of gravel, there wasn't really any in-stream wood, so we designed a project together with the Forest Service to bring more trees into the stream.

The project was funded in October 2019, and then shortly thereafter the pandemic began. Later in 2020, we had the Holiday Farm Fire. Both of these delayed implementation for a couple of years, and we reassessed things in 2021, to determine if the project was still required — it was. We got it completed in July 2022.

Part of the reason why we used such large trees is because the Calapooia in general, but particularly the Upper Calapooia, is a very powerful stream during the wintertime, and smaller trees don't generally stay put. So we wanted to use large trees with root wads to increase habitat diversity, macro invertebrate abundance and diversity and then provide an opportunity to trap some of the gravel for spawning habitat. These features also provide refuge for juveniles during high flows; they can hide and hunker down behind these large trees, and then also hide under them during the summertime. But, we needed very large trees to deliver these benefits and it took some time to find a contractor that was able to tip them over. We ended up working with BCI Contracting to remove a big floodplain barrier; there was a road that crossed the stream and the bridge was blown out in the 1996 flood. Both sides of the road were left and it was creating a bottleneck in the floodplain, so we also removed that.

We also hired Blue Ridge Timber Cutting, owned by Mark Villars to do all the tree pulling. Mark has been doing this work for a very long time. He worked a lot on the coast with coho populations and is very well versed in this type of tree pulling work where the goal is to retain that root wad as an anchor, because otherwise the bole of the trees will pick up and float during high flow events. The root wad anchors it in place, and provides more diversity too; often you'll

Cris Salazar

Calapooia Watershed Council

A graduate of Oregon State University's Fish and Wildlife Science Program, Cris Salazar has been managing the Calapooia Watershed Council's Habitat Restoration Program since 2018. Prior to his time with the CWC he worked for multiple federal agencies monitoring salmon populations from California to Alaska. With roots in the Umpqua Valley, he has been a longtime advocate for protecting and restoring Oregon's rivers and streams.

get pools forming around the root wad in the channel. There was some uncertainty about whether or not we could pull them over and how many we could tip within the project period. We ended up pulling 13 trees into the stream, which was more than we thought we were going to. To get them down Mark uses a high tech synthetic rope instead of a cable. It's very strong and light, which made moving it through the rigging system and from tree to tree very efficient. There's also a reduced risk of sparking with synthetic rope. Mark has a yarder for logging that was converted to fit on the back of a flatbed truck which has the spool on it, and he basically just spooled out the line.

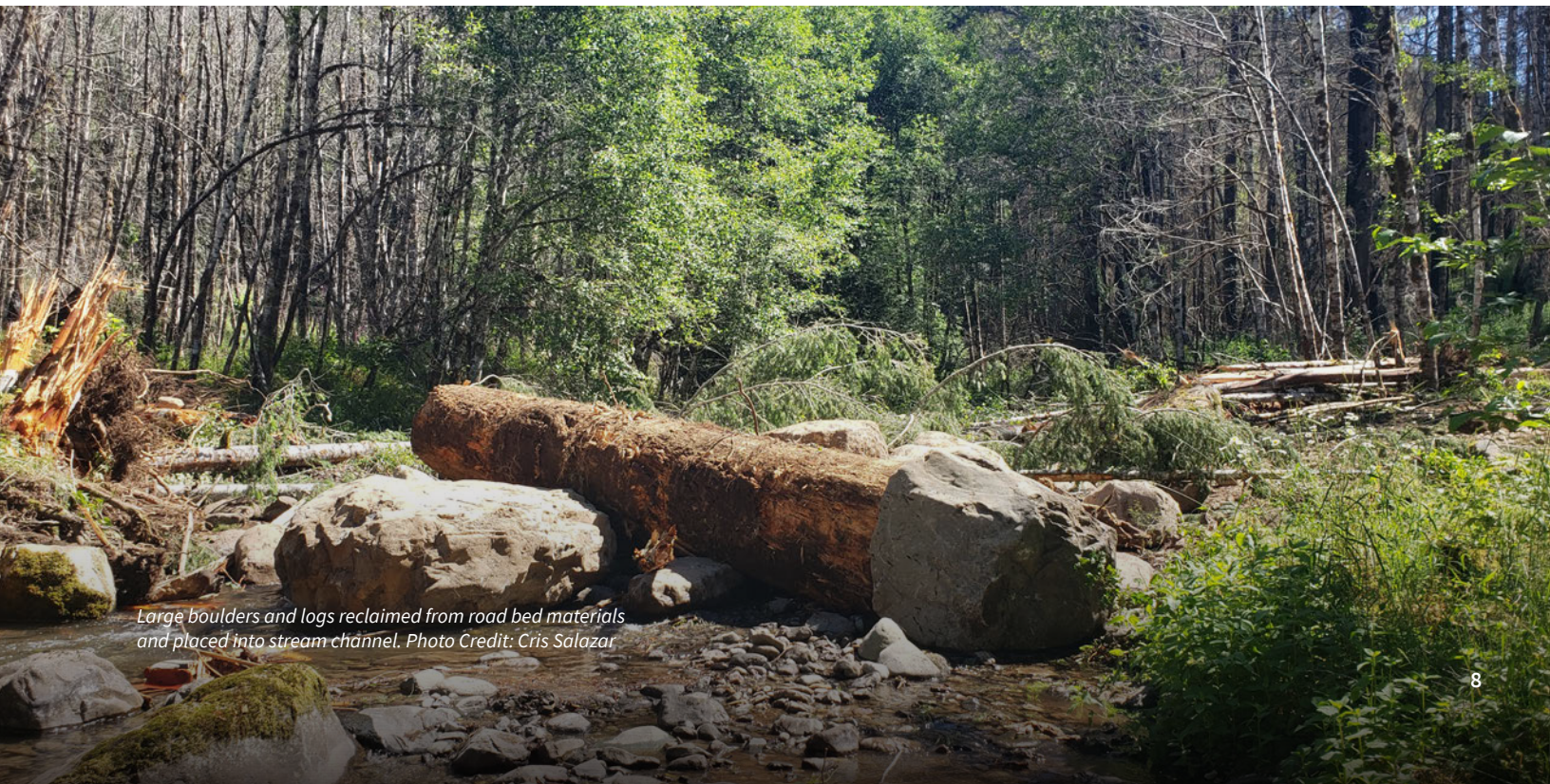
Mark was like a mathematician out there, calculating the angles and the amount of force required to pull these trees over. Part of the pulling process was eliminating some of the smaller trees, mostly alders, in front of the large trees. Dozens of small alders were trapped behind these larger trees, which will act like the backbone of a logjam to recruit smaller wood during floods. Because of the fire, which just barely hit the project area, most of it was upstream, there is going to be a lot of smaller, finer wood moving downstream and getting trapped by these trees which is great for the macro invertebrate populations. All the fine bits like leafs and twigs will decompose providing food for the bugs and then the juvenile steelhead will eat the bugs. We will be doing snorkel surveys for the next couple of years to track trout and steelhead abundance in those areas. When we did steelhead redd surveys before the project we found three redds in the mile stretch that the project encompasses. Hopefully we'll see a lot more in the future.

KS: How does tree tipping differ from other methods of large woody debris installation?

CS: There are lots of different ways to introduce complexity into a stream. What we were going for was the addition of really large trees because it is a powerful system, and anything smaller likely would have just been launched out during the next big flood. Fortunately, we had some large trees streamside. Sometimes people helicopter woody debris in, but that limits the size of log you can bring in. The trees that we put in were 200,000 to a quarter million pounds with the tree and the root wad, so helicopter operations wouldn't have worked on this project. Basically, we couldn't have brought in wood of this size from another location, just because of the logistics of getting them on trucks and the limitations that helicopters have. And really, we were looking to simulate what was once there. A lot of these Cascades streams, historically would have had a lot of large old growth trees in them. And for one reason or another that wood has been pulled out, so we wanted to put things back the way that they once were using the same types of materials. You still see this type of structure in some wilderness areas, which is what this started to remind me of as the project progressed.

KS: What elements need to be in place to make this feasible?

CS: We're lucky on the Upper Calapooia. The project site is fairly remote but there was logging in this area decades ago. However, a lot of the larger trees next to the stream and even up the hillsides were retained. Part of our process was deciding whether or not it was worth it to move these large, sometimes 100 year old trees into the stream. We had an assessment done to determine how many old growth trees were in the area and it ended up that we only needed to take between 1% and 3% of the overall large diameter trees. Initially a few dozen were identified as potentials, then we looked at whether or not any of them had any type of rot that would cause it to snap at the bottom when it was pulled



Large boulders and logs reclaimed from road bed materials and placed into stream channel. Photo Credit: Cris Salazar

over. Those were excluded for safety reasons, and because it would sever the log from the root wad. We didn't include trees that had broken tops, because that made pulling these large trees over more difficult, if a tree has a broken top, you have to pull so much harder, because it doesn't have all that weight at the top that helps guide it to the ground. It ended up being that most of the trees we pulled over were ones that were killed by the fire. We took trees that were already somewhat precarious on the stream bank to begin with; it was likely they were going to fall one way or the other and we just insisted that they fell into the stream.

A standing old growth tree provides a certain swath of wildlife benefits, and then laying down in a stream that tree just provides a different swath of species benefits. With the Calapooia population of steelhead ESA listed as threatened, we thought that it was worth taking down a few of these trees and putting them in the stream for the benefit of our steelhead. The project was ranked number one in the Willamette region, at OWEB's (Oregon Watershed Enhancement Board) open solicitations. That ranking bolstered our confidence, knowing that a large group of experts also agreed with us that it was worthwhile.

On the logistics side, we were lucky to have Mark and Blue Ridge Timber Cutting; they did a lot of the hard work. Once we got it funded, designed, everything was approved, everything was permitted we just stood back and watched them do their thing. It took a lot of time to get the trees rigged up, and all of five minutes to pull them over.

KS: Do you see any drawbacks or challenges to this strategy?

CS: There were some challenges finding a contractor that was able to do the project with the right equipment. If we had used a steel cable, which is the traditional tipping technique, I don't think we would have gotten as many trees down. We might have still been able to accomplish the project, but the amount of productivity that we had, I think, was really enhanced by the fact that we were able to use the lighter rope, which made moving from tree to tree much quicker.

I think that when you're tipping old growth trees, you have to be delicate, realizing that they are gems in most forests. Treading lightly and making sure that we only took what we needed was really important to us. There were a few trees where we had the go ahead to pull them down but we realized it would be redundant, because we already had a few good trees in that location, so we left them standing. It was necessary to keep them in place, and keep this lasting benefit to the forest.

KS: Anything else you'd like to share?

CS: I want to thank the US Forest Service for contributing the trees that were part of the match for the project and their time. Lance Gatchell in particular spent a lot of time working to get things approved and get the permitting completed. There were other forest service staff that came out and helped evaluate things and determined whether or not the project was still appropriate after the fire. Nikki Swanson, the district forest ranger, was a huge help keeping things moving. Thanks also to OWEB for funding the project. The contractors BCI and Blue Ridge, really, they got the work done. This project was really satisfying, even though the implementation went quickly. I'll try to come back and visit this place every so often just to see how things change and we'll continue doing redd and snorkel surveys to see how fish respond over time.

Douglas fir tree with large root wad that will anchor the tree in place. Photo Credit: Cris Salazar

Resilience Hubs: an Overview

By Kayla Seaforth

Communities are experiencing climate related disasters, needs and hardships more frequently, and those with fewer resources are often the ones who are disproportionately impacted. A potential step toward community self-reliance during these times is the creation of resilience hubs: places, networks and services that can support communities in difficult times. This represents a shift from responsive, single need focused, and often temporary services like cooling or warming shelters to permanent, well resourced hubs that can provide real time support before, during and after disasters occur or when needs arise within a community. Resilience hubs are being talked about in a number of ways, and they can be physical locations, or non-physical networks of services that can support people when disasters hit.

This year, Wallowa County in Oregon was awarded funding from the Oregon Department of Energy to develop plans for several resilience hubs in different cities (Kalez, 2022). Federal funding is also being directed toward building community resilience to climate change; funding for FEMA's Building Resilient Infrastructure and Communities (**BRIC**) grant program more than doubled this year (White House Staff, 2022). Other funding programs include Congress' **Community Funding Program** and the Department of Energy's **Energy Efficiency and Conservation Block Grant Program**, both of which are open to state, local, and tribal governments. Regionally, Washington State has established funding for a "solar plus storage for resilient communities program" in the state's supplemental operating budget. The program is currently under development, according to the Department of Commerce **website**. In addition to funding across Oregon provided by the Oregon Department of Energy, the city of Portland is offering funding for nonprofits and volunteer based organizations to support projects like resilience hubs through their **2022 Community Resilience and Capacity Building Grant**. In other states, energy utilities are also stepping up to fund this work. Additionally, the Biden-Harris administration has launched a **website** to guide community resilience planning efforts that connects users with reputable sources for information on climate related hazards, long term exposure projections and federal funding sources. It seems that funders, including the federal government, are responding to the need for community support as we experience the effects of climate change.

The **Urban Sustainability Directors Network** (USDN) conceptualizes resilience hubs operating across five foundational areas: services and programming, communications, buildings and landscapes, power, and operations. They also define different modes as the needs of the community change, which they break down into everyday, disruption and recovery modes. This allows hubs to function year round and become a trusted fixture of a community, and then move into specialized services should a major upheaval like a natural disaster, pandemic or other event occur, and continue to support residents with services through the recovery phase. They also offer a rating system depending on what features a resilience hub has to define baseline, optimal, and ideal operating states. This framework allows hubs to scale according to their needs and resources. USDN emphasizes that hubs operating at a baseline level can provide tremendous community support, and this framework allows continual evolution over time to respond to changing needs (Baja, 2019).

Interested in Learning More?

The Urban Sustainability Directors Network has created the in-depth **Guide to Developing Resilience Hubs**, which outlines why a hub may be needed and detailed guidance for getting started.

Physical Resilience Hub Elements

Services and Programming	Communications	Buildings and Landscapes	Power	Operations
Youth education and enrichment programming	Reliable primary and back-up communications systems	Low impact/sustainable design	Use of renewable energy sources	Staffed to operate in everyday, disruption, and recovery modes
Skills share network	Multi-lingual materials and translation services	Located in an area unlikely to be impacted by natural disasters (i.e. out of floodplain, out of tsunami impact area, away from Wildland Urban Interface)	Power redundancy/back-up systems	External support in place for functions beyond center capacity
Childcare	Consistent and relevant communication with community	Kitchen/food storage	Electric vehicle charging	Tied into larger network for disruption response needs (i.e. local, state and federal emergency managers, voluntary networks, medical facilities, etc.)
Counseling	Disaster preparedness community planning/ communications	Clean water		ADA+ compliance
Financial literacy/ vocational readiness	Radio broadcast	Gardens		
Sheltering facilities		Recreation areas		

Non-Physical or Decentralized Resilience Hub Elements

Services and Programming	Communications	Buildings and Landscapes (pre-existing services)	Power	Operations
Scientific/Environmental assessment, monitoring and modeling	Emergency warning networks	Storm shelters	Network of residential/ commercial solar with storage capacity, connected to grid	Independent organizations staffed according to resources
Emergency medicine	Neighborhood groups/ networks	Temporary housing	Utility providers	Shared disruption response plan with clear roles and responsibilities
Childcare	Local/state emergency operations centers or emergency departments	Food pantries/kitchens/ gardens	Network of backup generators	Orgs lend support to one another to fill gaps in knowledge, resources, etc. (niche model)
Food distribution		Parks and natural areas		
Community skill building				

Credit: Urban Sustainability Directors Network

There are benefits to both physical and decentralized resilience hubs, and in practice it is likely both will be at play during times of community strain. These projects can range from informal support networks to million dollar facilities, depending on the desires and resources of a community. Above all community services should be co-created by those they are meant to serve, regardless of scale. Investing in relationships with community members and building resilience hubs that support their needs should be the driving force for creating resilience hubs (Baja, 2018).

While the frameworks discussed here may offer visions of what community resilience can look like, this is not a new concept. Indigenous communities around the world have long held a community oriented mindset and have designed cultures of community care across generations and through different eras of colonization. Black communities in the United States have organized around community resilience since the period when this country sanctioned slavery. Refugees have gathered together to create supportive networks as they've had to flee violence and oppression in their home countries. The idea of resilience is old, even ancient, and is often invoked in response to systemic violence and oppression. In designing community networks and support services, we should be investigating the source of the violence and organizing to restructure the systems that require certain communities to be continuously resilient whenever possible.

Works Cited:

Baja, Kristin. "Resilience Hubs: Shifting Power to Communities and Increasing Community Capacity." Urban Sustainability Directors Network, 2018, ***http://resilience-hub.org****.*

Baja, Kristin. "Guide to Developing Resilience Hubs." Urban Sustainability Directors Network, 2019, ***http://resilience-hub.org****.*

Kalez, Jennifer. "Oregon Department of Energy Grant Program Supports Renewable Energy Projects from Ashland to Ontario." ODOE Blog, Oregon Department of Energy, 18 Oct. 2022, ***https://energyinfo.oregon.gov/blog/2022/10/18/oregon-department-of-energy-grant-program-supports-renewable-energy-projects-from-ashland-to-ontario****.*

White House Staff. "Fact Sheet: President Biden's Executive Actions on Climate to Address Extreme Heat and Boost Offshore Wind." The White House, The United States Government, 20 July 2022, ***https://www.whitehouse.gov/briefing-room/statements-releases/2022/07/20/fact-sheetpresident-bidens-executive-actions-on-climate-to-address-extreme-heat-and-boost-offshore-wind/****.*

Who Is At the Table Matters

Excerpts from BEF's trauma informed care training modules:

Depending on where resources come from, there may be unequal distribution and access to services, and thanks to structural inequity, those who may need help the most are the most likely to be discriminated against. For example, churches and faith based organizations are often hubs of support following natural disasters, however the position of some religious organizations does not support LGBTQIA+ rights and bars LGBTQIA+ folks from accessing their services. While many religious organization do offer inclusive services, past trauma with religious institutions can make members of the LGBTQIA+ community feel unsafe seeking services from these organizations despite the quality of the support. Federal aid is often available to individuals who have survived disasters, however, despite policies that might say otherwise, undocumented folks tend to be hesitant sharing information with government organizations due to a history of weaponization of this information, and are therefore cut off from the funds that could help them recover financially from disaster.

A Note on Resilience From Trauma Informed Care Teachings

When talking about individual, collective, intergenerational or historical trauma, it is important to remember that healing and reducing the impacts of trauma is possible on both the personal and collective scales. In Trauma Informed Care curriculums, Resilience is frequently talked about in relationship to trauma. Resilience is the ability for an individual or community to return to a state of being healthy and hopeful after emotionally disturbing things happen. Humans are naturally resilient and resilience on its own is not a bad quality or attribute.

But we need to be careful of how and why we focus on resilience. It's important that we're cognizant about which individuals or communities are being asked to be resilient over and over again in the face of systems that target them based on the identities they hold. Resilience is not the solution for systems of oppression. Changing or dismantling the system that target certain groups is. Language around resilience often puts the emphasis and praise on an individual's ability bounce back in the face of adversity or trauma, rather than focusing on changing the systems that force individuals and communities to be resilient over and over again.

A lot of dialogue around resilience can be disempowering and overly burden targeted groups to simply be more resilient. It's important to reflect on what power dynamics are at play when discourse around resilience comes up. We want to emphasize the differences between resilience and resistance and offer resistance as another way to think about overcoming the impacts of trauma.

For example, imagine a forest ecosystem that has been repeatedly burned by wildfires. While wildfires have always been present in that ecosystem, climate change is exacerbating the frequency and intensity of the fires. We may be in awe of how seemingly resilient the forest is, as we see plants and new growth come back to the forest in the years following the fires. But we don't just rely on the resilience of the forest to prevent fires in the future. We commit to work around fuels reduction and thinning, and seek to address the root causes of our changing climate. Rather than merely admire the strength and resilience of the forest, we work to be accomplices to the forest's natural resilience by working to resist the harm being done to the forest at the systems level.

To learn more about trauma informed care and resilience, click **here**.

Forest Service Partnership with Zimbabwe Based Reforestation Group Kicks off with Pacific Northwest Tour

My Trees Trust, a Zimbabwe based organization aims to not only restore native woodlands, but also to address the issues that have led to widespread deforestation in the region. Their primary goal is to restore degraded landscapes to native forests, though in order to do that they also recognize the importance of altering their community's relationship to these places. They are working to bring alternative fuel sources to tobacco drying operations, distribute more efficient cook stoves for domestic use, and provide long term employment to community members. In order to achieve their reforestation goals, the My Trees Trust has started growing a significant number of native plants, and has sought a partnership with the US Forest Service to provide technical advice and a forum to discuss nursery technology. Representatives from My Trees traveled to the Pacific Northwest this September for a tour of several nurseries and an opportunity to engage in discussion with Forest Service staff, nursery managers, restoration and reforestation practitioners and more.

USFS International Programs, Deschutes National Forest, and MyTrees Trust staff at the Deschutes National Forest Headquarters as part of a US reforestation study tour. Photo Credit: USFS Matt Horning

Tour Stops Included

- Oxbow Farms: highlighting small scale nursery, native plants, partnerships and education
- Washington DNR's Webster Tree Nursery: large scale reforestation nursery
- Portland meeting with USFS technical experts, Jean-Paul Zagarola (BEF) and Richard Dickenson (Willamette Riverkeeper), and local restoration contractor Rosario Franco to discuss elements of the reforestation pipeline, Collaborative Grow agreements and large scale revegetation efforts.
- Dorena Forest Genetic Resources: USFS nursery practices, disease resistance screening, seed cleaning and storage
- Work planning and outplanting demonstrations with Deschutes National Forest and Canopyworks staff
- Bend Seed Extractory: seed cleaning and storage
- Derby Canyon Natives Nursery: small nursery operation

The folks from My Trees found the commitment to quality outplanting particularly resonant; Operations Manager Tendayi (TJ) Jeyacheya noted "outstanding from our chat in the park with Jean-Paul, Rosario and Richard was the need to bring all human resources involved in the process of restoration to understand and appreciate the value of their work for the long term. Rosario spoke about why and how his team members care about the work they do and therefore guarantee quality out planting."

My Trees Trust seeks to restore a wide range of forest native to Zimbabwe, where the land has been significantly impacted by mining, industrial tobacco cultivation, heavy grazing and firewood harvest. This tour brought them together with professionals across the Pacific Northwest to discuss strategies for large scale restoration and the fine details of growing healthy plants at scale. BEF's Jean-Paul Zaragola said of the Portland tour stop "everyone that participated that day was fully engaged in the conversation. A general sense of inspiration to continue the important reforestation/revegetation work seemed to emanate from all parties."

The next steps in this partnership are focused on continued joint work planning that will provide a roadmap for future activities, and remote technical support building upon the knowledge sharing of the US Study tour. The USFS International Program is planning a technical mission to work with My Trees Trust in Zimbabwe in early 2023 to further assess their operations, provide technical training, and to assist My Trees Trust with incorporating best management practices into their operations. The long-term goal of the USFS Office of International Programs is to increase and strengthen community-based nurseries to enhance opportunities for watershed restoration and sustainable enterprises, thereby enhancing resilience for people, livelihoods, and nature.

Less May be More in Post-Fire Restoration

Interview between Kathy Pendergrass, Plant Materials Specialist at NRCS and Kayla Seaforth, BEF

In the 2021 treeline survey, 20% of respondents indicated that they were modifying the species mixes they were planting to reduce fire risk, and 52% were interested in learning more. In the following interview we cover what that might look like at various scales, new and developing approaches to post-fire restoration and more.

KAYLA SEAFORTH: How are you thinking about post-fire restoration?

KATHY PENDERGRASS: First, I need to preface our conversation and say that I am not the "expert" on all things fire-related. I have been involved in some prescribed and wild-fire work sporadically over the years of my career.

In the fires that happened [in Oregon] a couple of years ago, with very high winds, we really lost the overstory canopy (trees). But as fast as those fires moved through the landscape, much of the duff layer was left intact. In the aftermath, restoration actions should have largely depended on whether you had a high consumption level of the duff layer. If that layer was consumed during the burn, then it generally burned a lot of root systems and killed shrubs and herbaceous plants — leaving soil without cover and roots to bind it. Instead, we saw an incredible loss of the overstory species, but often, most of our shrubs and herbaceous plants came right back. As usual with fire, we saw a lot of folks quick to reach for seed bags, thinking "we need to fly seed into those burn areas," but often in the past, the seed has not been native, as agencies didn't generally want to spend the money on appropriate seed. There are a number of Forest Service research papers now documenting that we're probably doing more damage than good in a lot of situations. We've seen documented cases where seed stocks were contaminated with seed of yellow star thistle and other noxious weeds, and those seed stocks were aerially spread over burn areas.

In most cases, we don't have enough time to turn around as quickly as we need to get seed on the ground. If the fires are put out early enough and we get some moisture with warm enough temperatures, you could get seed down and actually get some germination and plant establishment. The goal of seeding is to get seed down so you have roots growing in time to slow soil erosion during the first rainy season after the fire. But, you have to mobilize quickly, get the seed down and you have to have

Kathy Pendergrass

Plant Materials Specialist at NRCS

Kathy Pendergrass has been working with plants for over 35 years. She holds a master's degree in Rangeland Ecology from Oregon State University, and has spent the last 17 years working for the Natural Resources Conservation Service (NRCS) as a Plant Materials Specialist. Kathy enjoys sharing her knowledge of the ecosystems she works in with others to promote sound management and ecosystem health.

moisture and the right temperatures for the seeds to germinate. Blue wildrye (a native) is a really fast germinator, but not as fast as [non-native] annual ryegrass. Most native plants establish too slowly to have much effect on the highest levels of soil erosion that will occur within the first two rainy seasons following fire. Studies are showing that by spreading seeds across the forest, we might actually be increasing fine fuel loads in the postfire environment, and that's the stuff that really carries the fire along the ground. If you have a natural forest system where herbaceous plants are pretty widespread you get (fuel) gaps, but where you have fine fuel continuity — plants that are close enough together to carry the fire along the ground — that can lead to rapid fire spread. When you go in after a fire passes through and you seed something that establishes really well, you may actually be increasing the likelihood of postfire reburn.

KS: So have these aerial seeding efforts been primarily focused on erosion stabilization through the application of grass seed?

KP: That's typically what managers are going to reach for because it's been a whole lot easier to get into seed production, especially here in the Willamette Valley, the grass seed Capitol of the world. Native grass seed production is done on a commercial scale, which can affect population diversity due to the timing of seed harvest and other factors. Just by the nature of taking native species into commercial production, you're going to reduce the genetic diversity of the production crop. However, having a slightly less diverse native seed source is better in my mind than spreading a lot of non-native seed all over the landscape, especially in areas where you've got relatively intact plant communities.

Let's take the scenario where you've already got really intact plant communities. On Forest Service land, the highest elevations tend to be the least disturbed, the least weedy. BLM (Bureau of Land Management) is a little lower elevation and they tend to have more weeds, mainly where we've seeded it along the roadsides and in log landings, that sort of thing. If you've got fairly decent, intact plant communities in the understory, when fire passes through, the soil is an extremely good insulator for the roots of those species. So when you're talking about perennial species, it takes one heck of a high severity fire at the ground level to cook the soil and kill the plants. For the most part, our plant species are adapted to fire; while a burn may top-kill most of the shrub species, they tend to resprout. I was up on the Santiam Fire in 2020 three weeks after the fire was out, and I already saw sprouts of salal, big leaf maple, vine maple, Cascade Oregon grape, elderberry — and a long list of herbaceous plants were already growing — everything was already rebounding after the burn.

KS: Of the fires you've seen over the last decade or so, do you think that many of them have been severe enough to warrant these large scale seeding efforts?

KP: To be the most effective, you want to let the fire severity maps guide you. If you're going to do some seeding, I'd find the mapped highest severity areas, and then I'd do some field checking to confirm. Where you lost tree crowns isn't necessarily where you lost all of that mulch and litter covering the soil. So you want to let the fire severity, plus topography, help guide where you're going to seed. But something to remember is that most of the native stuff is slow to germinate. You're almost never going to be able to get it down soon enough after the fires in time to do anything about the erosion load that's going to come. The erosion is going to happen in the first two years, especially during the first winter storms and the first spring; most of the native species will not germinate quickly enough to stabilize the soil. It can be good for improving habitat over the long term (seeding natives), but is likely not going to help much with erosion. Forest Service research is finding that money may actually be better spent mulching for erosion control, and they're doing a bunch of studies on it, looking at different shredded wood material. It's expensive to fly it out, but if you target the areas where you've got high erosion potential, areas with high severity burns and steep slopes, some studies are showing mulching is much more effective than throwing a bunch of seed down.

Especially when you're working on federal lands, they have mandates for using native seed as much as possible, and have to justify when it isn't used. On private lands it's a case by case situation. In the best case scenario, you'd know what the plant composition was pre-burn. If you have a really crappy plant community, even if you seeded with the best stuff under the sun, it's unlikely to get you where you want to be. Most times, you just end up with the plant community you had before fire, minus conifers. Preferably, you'd be doing a whole lot of follow up, spraying out the non-native stuff — if you're looking to try to create a better plant community. It all depends on landowner objectives. Erosion control can be achieved with

Interested in learning more about how genetic diversity factors into commercial seed production? See the **April 2021 Treeline article** "Seed Collection and Direct Seeding" for a more detailed look.

Seeding following wildland or perscribed fire can bolster native species composition, especially when combined with other management actions. Photo Credit: Lomakatsi Restoration Project

Read more: The recent paper "**Passive or active management? Understanding consequences and changes after large, stand-replacing wildfires**" by John Kirkland and Morris Johnson digs even deeper into questions surrounding post-fire management.

various hay and straw products, but those all have potential to introduce non-native seed to the site.

KS: Are there situations where prescribed fire can help reduce fuel loads and promote forest resilience?

KP: Absolutely! Let's take ponderosa pine habitats as an example. These forests would have burned historically, typically at an 8 to 10 year fire return interval — but with low-intensity understory burns. Since we've kept fire (quickly put out all lightning fire) out of the system over the last century, managers have had to do a lot of creative things to reduce ladder fuels and reduce mulch layers. Thinning was used to reduce the overall biomass and reduce the ladder fuels — those shade-tolerant/fire intolerant trees and shrubs that grew tall enough to reach the tree overstory — thus allowing fire easy access to the crowns of trees. These accumulated fuel loads created high intensity and extensive stand-replacing burns. So, the Forest Service started thinning these stands to separate the tree crowns from the understory plants/fuels. When managers started instituting some of the first prescribed burns into these thinned Ponderosa pine forests, they were losing a lot of big old trees, until they determined that they were actually burning the roots of the pine by the fires they were lighting. So they tried a few things like raking the mulch away from big trees and doing spring burns, all to slowly burn the duff layer down. Historically, with the regular fire return interval, pine roots would have grown in mineral soil where they would be much more protected — remember (mineral) soil is an excellent insulator from heat penetration of a fire — because it isn't consumed by fire the way a duff layer is. In a fire-excluded system, the roots had moved up into those layers of duff, because it was a thick nutrient rich layer and full of mycorrhizae. So, Forest Service folks have implemented spring and very low-intensity prescribed burns to reduce those duff layers back to more natural levels.

For my master's thesis (many years ago), we did prescribed burns in native Willamette Valley prairie at two sites that were by Fern Ridge Reservoir. I thought, "oh, boy, I'll be able to burn this area and all the native species are going to be happy, because they've evolved with this frequent fire return interval, and they're going to produce seeds and the non-native stuff will just be impacted and it will go away." Well, that's not what happened.

Fire is just another disturbance, and the non-native plants that we've spread everywhere are very adapted to disturbances, including fires. What I saw after those fires was a very messy response from the plant community — although I definitely saw a fertilizer effect. Fire consumes the dead material aboveground and turns it into usable forms of nutrients — forms of nitrogen, phosphorus and potassium that the plants can actually take up. So you get a flush, what they call the "fertilizer effect", which can lead to these incredible flower blooms following wildfires. The camas in the Fern Ridge prairies really did show a fertilizer effect the first postfire year; I saw a lot more blooms the first year but even more came the second year. Seed production of camas and other species also increased the second year. Unfortunately, a lot of non-native stuff grew quickly and seeded in the first year, things like velvet grass and bent grass. My study was in a research natural area where we had pretty good native plant composition. Few of the native plants bloomed that first year. Most of the species took a second year to respond because they're slower to respond to that nutrient input. Unfortunately, weeds tend to respond quickly to high nutrient flushes.

KS: Some documents mention "fire resistant" plants for firewise and fire resilient plantings. What are your thoughts on this?

KP: Summer drought was historically a really big modifier for local plant communities, so when people talk about fire resistant plants, I think, "that doesn't make any sense." For the most part, once a plant's moisture content is lower than 10%, everything is going to burn, it doesn't matter what they are. When you look at some firewise plants or fire resistant plants, a lot of them are non-native species that won't live unless you give them some summer water, which is what makes them less likely to burn — moisture content. Forbs/wildflowers generally have a higher moisture content

A sawyer removes vegetation surrounding a Garry oak, both reducing fire risk and improving growing conditions for the tree. Photo Credit: Lomakatsi Restoration Project

Garry Oak Savannahs are fire adapted ecosystems and perscribed fires like this may be key to preserving the vast biodiversity they support. Photo Credit: Lomakatsi Restoration Project

Low intenisty understory fires can have a fertilizing effect on local vegetation, native and invasive alike. Photo Credit: Lomakatsi Restoration Project

than grasses, so grasses dry down faster, and they're going to be the continuous fuel that generally carries fire. Unless the whole landscape is dry, forbs are going to be more resistant to fire because they hold moisture longer. That's a general rule, and of course there are exceptions.

KS: And then with trees and shrubs it gets a little more complicated, right?

KP: Right, if you're choosing plants with fire resilience in mind, you wouldn't choose things that are twiggy, or that have high terpene, oils or pitch content, these are plants which tend to have strong scents. Fire flame lengths can get really scary when fire gets into these resinous plants, like Ceanothus or Himalayan blackberry — it's like someone poured gasoline on a fire. In a landscape context, we're more focused on trying to get that separation between the tree crowns and the fine fuels — remove the ladder fuels; and to also space your trees so their crowns are gappy — not continuous. You don't want to get rid of all your shrubs, but promoting a more spotty shrub understory is a strategy that some managers are pursuing.

KS: How do the fires that you've seen recently compare to historic fire regimes?

KP: A recent **Forest Service study** found that the 2020 fires were similar (within the range) to large natural stand-replacing fires that have occurred in the past. That said, we have essentially stopped the more frequent fires that used to occur naturally on the landscape, with a concomitant increase in fuel loads across the landscape (where low intensity fires used to burn). It is generally thought that these shifts are leading to more large-scale stand-replacing fires. Many agencies, including NRCS, are trying to introduce or increase the use of low-intensity prescribed fire, in appropriate places, to reduce fuel loads and the risk of catastrophic fire.

Thinning to reduce ladder fuels and crowding is one element of fire risk reduction. Photo Credit: Lomakatsi Restoration Project

Years ago, I participated in the **Augusta Fire History Study** in the Blue River watershed. For me, it was a one year project with the Forest Service. We counted the growth rings on big stumps, and did some coring in wilderness areas to look for stand ages and fire scars. Ultimately, the general fire history was determined and mapped for this 19,000-acre area — fire areas of each significant fire and fire overlaps to determine fire regimes. This information was used to inform them on how they might manage tree harvest in some better alignment with past fire regimes in the area. In this area of dry Douglas fir dominance, there was evidence of fairly frequent understory fires that were not stand-replacing.

There are a number of fire **studies** that have been done to determine fire regimes for the Cascade and Coastal Mountain forests. Historically, the Cascades and the Coast Range, have had sporadic huge fire events similar to the 2020 fire, where everything lined up climatically and a large number of acres burned — most of the existing older trees on the landscape date to those big fire events. A huge fire event happened some **400-500 years ago** and reset most of the Cascade and Coast Range forests — I mean the entire landscape. Less extensive fires have occurred across these landscapes since then, with each ecoregion having its own fire regime, generally based on its climate and vegetative composition. Lower to moderate intensity fires have occurred by lightning events and set by Native Americans and have shaped much of the Oregon landscape.

KS: We're seeing burn on burn events, and I'm wondering how you're thinking about revegetation, and if managers should be implementing some protective measures for seedlings in areas that are likely to burn before plants have a chance to become established.

KP: I am not the expert on forest protection recommendations, but I'd say the best strategy is probably to remove as much fuel next to roadways as much as possible. Human-caused fires are the most frequent source of fire starts. In the North Santiam area, they were doing a whole lot of chipping next to the road system, presumably to reduce dead tree hazards and reduce fuel loads. The finer fuels left behind (or seeded) are what will carry subsequent fires. The large logs are not that much of a fire risk, so hopefully, many of those should be left for wildlife habitat. Those are the moisture reservoirs for the food pyramid out there, they're like sponges out there. That's where most of the bugs are that are feeding much of the rest of the animal life out there — and where a lot of plants will eventually take root. Efforts to reduce the medium-coarse materials (~ 10-hour fuel range) or put them in close contact with the soil, would help reduce risk of reburns. It should be noted that reburn events were common in the fire record. After those big 400-500 year wildfires, there would have been all this biomass out there, and if conditions are right in a successive year, it's going to burn again. This was also the case with the infamous Tillamook Burn.

KS: Do those types of events tend to have greater impacts to soil communities?

KP: It can, especially when fuel is concentrated. In clear cuts, land managers used to distribute the material and then do a broadcast burn over the whole thing. We've gotten away from that and now they pile and burn in big piles. When you burn that fuel pile the heat does penetrate and cook the soil. If you have high fuel loads sitting on top of the soil, and you get a high severity fire that has a long residence time, that can also really cook soils. Also, fire often creates a hydrophobic soil layer produced by chemical compounds resistant to water infiltration, it becomes almost like plastic over the soil. It takes about one-two years for those chemical compounds to break down.

KS: Anything else you'd like to touch on?

KP: Some areas are seeing completely different fire regimes. Another strategy for fire resistance on the eastside that is gaining popularity is the installation of green strips in areas that used to have long fire return intervals, primarily in sage steppe habitats. They are being used to imitate fire lines or fuel breaks. They've introduced a plant called forage kochia and non-native grasses that stay green late into the season. They're trying to install them around fire prone and developed areas. The area around Boise, Idaho is especially problematic, because of the spread of cheatgrass, which creates that contiguous fuel problem, and sets the plant community up for reburning on an annual basis. Cheatgrass grows from winter into early spring then dies back, leaving this dead dry continuous fuel layer on the ground. Native bunchgrass communities are "gappy", leaving room between plants which create a discontinuous plant/fuel layer. These cheatgrass-infested habitats have burned so many times that the native bunchgrass has been killed — completely changing the plant community and fuel characteristics — creating a more fire-prone landscape. It has created a huge change in fire regime for this region of the sagebrush steppe ecosystem, an area that historically had a long to very long (25-100) fire return interval. Cheatgrass-invaded shrub steppe can now burn every year. The alteration to the ecosystem and fire regime is a huge problem, but I also worry about the introduction of more non-native plants, especially the shrub forage kochia, because I've heard from botanists that it can move and naturalize on its own. I hope that won't become the next reed canarygrass that we have intentionally put out into the landscape. There are always consequences to the actions that we take.

Photo Credit: Lomakatsi Restoration Project

Photo Credit: North Santiam Watershed Council

Field Notes: Drought and Fall Root Growth in Native Plant Nurseries

By George Kral

A hallmark of the Pacific Northwest's climate is a period of summer drought, however this year was exceptional in several ways. Temperatures in the 80's persisted well into October, setting ***records*** *for several cities across the region. Rain also fell at record low levels, which allowed large fires to burn and smoke to linger in the air. In addition to impacts on fire behavior and related air quality issues, this delayed start to fall may also be having impacts on our native plant species. Read on for reflections from Scholls Valley Native Nursery Owner and Forester George Kral about how the late drought may be affecting seedling growth.*

There is surprisingly little basic research on root development and timing to inform nursery practice, even in Douglas-fir and essentially nothing on native hardwoods and shrubs. There is even less on this phenomenon in wild plants or outplanted seedlings. To get another perspective, I called my friend Kathy LeCompte at Brooks Tree Farm. She confirmed my sense of the importance of fall root growth, basically that it is critically important. She too was surprised that there isn't more literature on the subject.

This year, we pulled irrigation from part of our field to allow induction of drought dormancy, which halts shoot development and allows seedlings to "harden off" in advance of fall freezes. This prevents frost from killing tender shoots, which can render plants unsaleable. Typically, we have sufficient dry weather from late August through September to allow fields to dry out enough to induce fall dormancy. Also typically, we begin to see light precipitation and cooler temperatures in late September and October. These fall rains, possibly in combination with lower temperatures and shorter days, trigger a spurt of new root growth. The combined cessation of shoot growth (hardening off) and simultaneous initiation of root growth during this fall transitional period changes the balance of seedlings, increasing the root:shoot ratio, with obvious benefit to seedling viability in the following year.

Unfortunately, neither substantial cooling nor precipitation materialized this year. September was hot and dry, and the first three weeks of October were extraordinarily hot and dry. I had to put an irrigation cannon on parts of our field in October just to keep stuff alive and to get fall root growth started on some species. Clearly, this wasn't an option for outplanted forestry and restoration seedlings, which probably did not start growing roots until late October or early November. If we soon have a series of freezes, winter dormancy will be triggered, which halts root development. As a result, I would guess that fall root growth may be curtailed this year for many wildland plants that have to survive on what nature provides.

What this all means for restoration and reforestation success, and Northwest plant ecology in general, is all conjecture, but I do know that every perennial plant I have ever examined in the fall starts growing roots as soon as the soil is moist. Conifer trees, hardwood trees and shrubs, forbs, grasses, sedges, even bulbs of various lilies which have long since shed their leafy shoots, all of these plants grow roots as soon as fall rains start to wet the ground. Many annual and perennial herbs also germinate with fall rains, so it stands to reason that a delay in fall rains is having all kinds of impacts on all kinds of plants. The development of fungal hyphae and fruiting bodies also depends on fall rains, so the ecological impacts of potential long-term changes in fall rain patterns will likely be very broad.

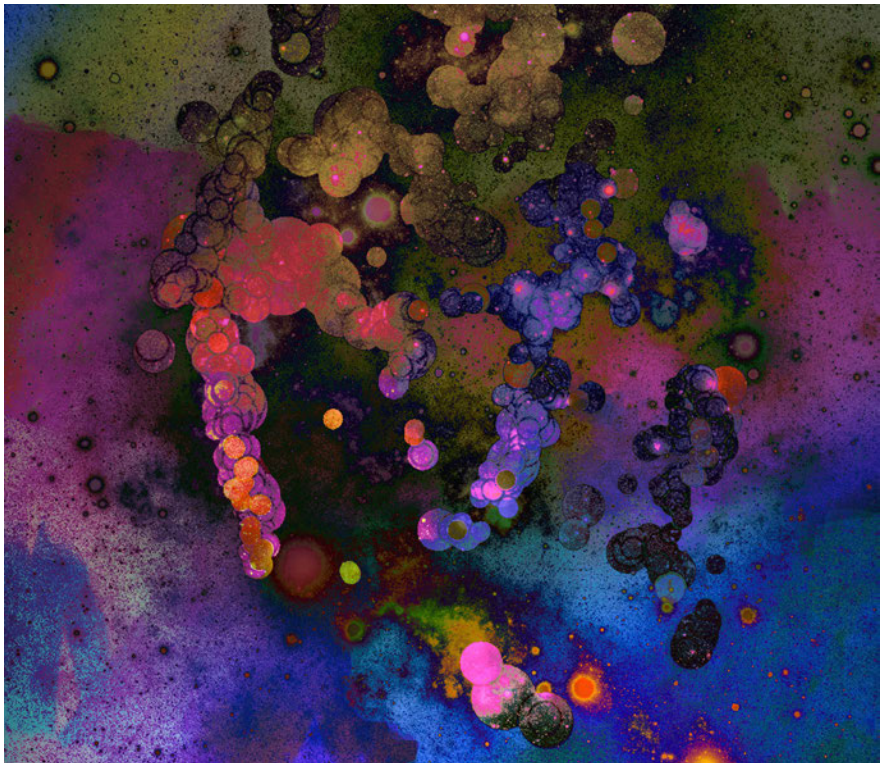
Environmental Graphiti

Science > Art Posting Campaign

Environmental Graphiti® (EG) is a collection of contemporary digital paintings that use art as a vehicle to enhance the public's understanding of the science of climate change. Each of the more than 100 paintings in the series is derived from a graph, chart, map, word or number representing key facts or data about climate change.

The art has been extensively exhibited in the US and other parts of the world, typically printed large and exhibited on the walls of universities or science museums. EG proposes to take the art off the walls of institutions and bring it out into the streets where people can "stumble across" it in their daily lives — placing large prints of art in store fronts, on sides of buildings, bus shelters, etc., throughout a neighborhood, campus or other target area.

- The size and scope of the portfolio — over 100 pieces, each addressing different facts about climate science — allows for the creation of a curated "collection" that reflects not only the global threat, but also impacts specific to the locale. Going from "macro to micro" brings the global story "home", making it more relevant and compelling.
- The exhibit can be integrated into curriculum studies dealing not only with science (e.g., chemistry, biology, physics, earth science, etc.), but also subjects such as statistics, math, engineering, economics, politics, global policy, urban studies, social work, art, religion, data visualization, health, agriculture, communication and even philosophy, ethics and environmental justice.



Snopack. Credit: Alisa Singer

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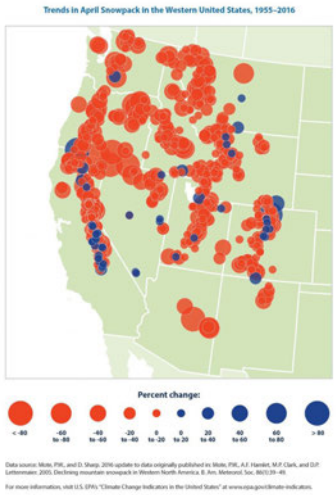
An EG campaign is an ideal team project for a class, campus club, library or other group or organization.

To learn more about Environmental Graphiti or to get involved visit **https://www.environmentalgraphiti.org**



We Want to Hear From You!

Do you have a story of one of those moments that made you think "the work I'm doing matters?" We are working on a much needed issue about hope, and we'd like to feature your stories. If you'd like to share, please reach out to **kseaforth@b-e-f.org**

OPB Article Sheds Light on 2021 Heat Dome

In case you missed it, an **OPB article** featured the work of Karen McKinnon, assistant professor of climate science at UCLA that looked at the probability of an event like the one we saw last June where temperatures reached 116 degrees fahrenheit in some places.

Upcoming Events

WEBINARS:

Tribal Health and Adaptation Peer-Learning Round Table Webinars Series
November 2022–October 2023
Learn more and register **here**

Pacific Northwest DEWS December Drought and Climate Webinar
December 19th, 11:00am - 12:00pm
Learn more and register **here**

VIRTUAL CONFERENCE:

North Sound Riparian Conference
January 26th, 9:30am-3:00pm
Learn more and register **here**

VIRTUAL AND IN-PERSON SYMPOSIUM:

Post-Fire Science and Monitoring Symposium — USFS
February 7 & 8, 2023
Learn more and register **here**

bef watersheds program

Do you have an idea for a future newsletter article or interview, or a suggestion for how we might improve? Please reach out to Kas Guillozet at **kguillozet@b-e-f.org**.

This issue of Treeline is supported by the *Building Nursery and Recovery Infrastructure for Climate and Fire Resilient Oregon Forests Project* which is supported by a subaward from an agreement between the USDA Forest Service and Sustainable Northwest.