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