watersheds program

treeline survey summary report

April 2022

North Fork John Day River, Oregon.
Photo credit: North Fork John Day Watershed Council

spring 2021:

the Treeline project released a survey to gauge restoration practitioners' attitudes and current and planned actions on assisted migration.

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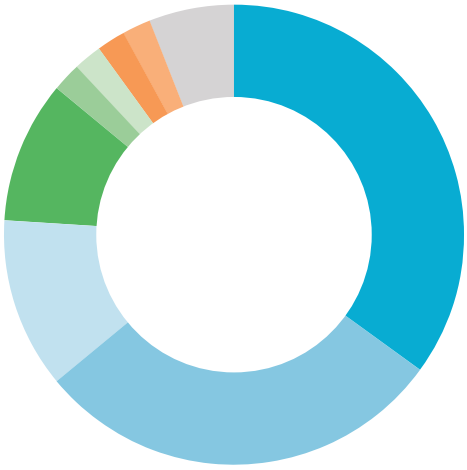
51 individuals responded. These responses have helped plan newsletter articles and webinar content, and allowed us to pursue collaborations and share research relevant to the Pacific Northwest restoration community. This work was made possible with contributions from numerous partners and funding from the Climate Resilience Fund.

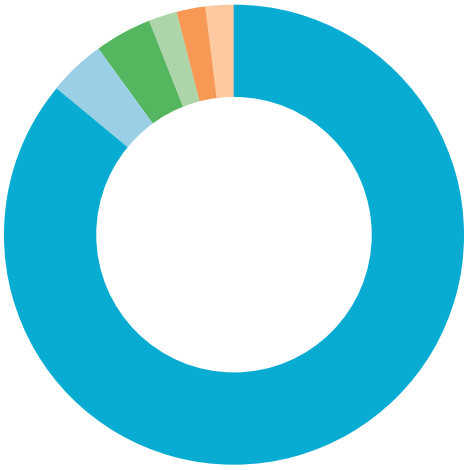
1 Respondent Demographics

I represent or work for a:



- Non-profit (35%)
- U.S. federal, state or local agency or municipality (29%)
- Tribal Nation (12%)
- Business (10%)
- Tribal member (2%)
- Indigenous led or serving organization (2%)
- Water Resource Utility (2%)
- Academic institution (2%)
- Other (6%)

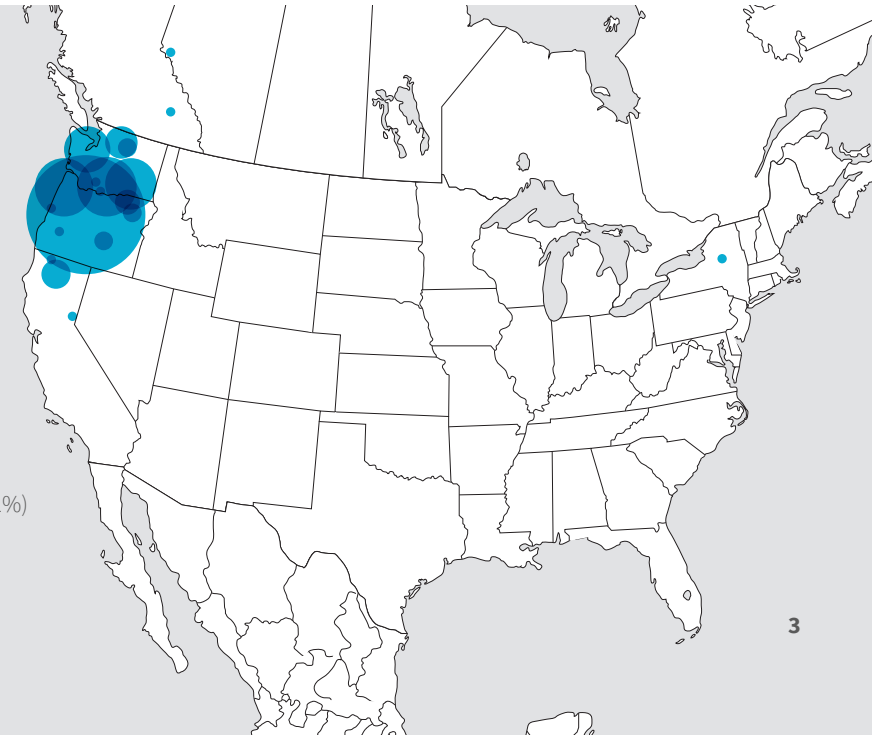
My primary work focus or roles:



- Habitat restoration - project design, planning and/or implementation (86%)
- Public lands management (4%)
- Private lands management (4%)
- Community outreach and education (2%)
- Genetic variation and disease/pest resistance in native tree species (2%)
- Nursery management (2%)

Ecoregions where I work:

- Willamette Valley (25%)
- West Cascades (14%)
- Northwest Coast (12%)
- East Cascades (10%)
- Puget Trough (9%)
- North Cascades (6%)
- Klamath Mountains (5%)
- Columbia Plateau (4%)
- Okanogan (3%)
- Blue Mountains (3%)
- Northern Basin and Range (2%)
- Canadian Rockies (1%)
- Coast Range (1%)
- Columbia Gorge (1%)
- Selkirk Mountains (1%)
- Sierra Nevada (1%)
- South Cascades (1%)
- Umpqua Basin (1%)
- Siskiyou Mountains (1%)
- Northeastern US - New York (1%)



2 Trees, Shrubs and Climate Adaptation

	Please list trees and/or shrubs that you consider native to your ecoregion and that you are concerned may be suffering from increased mortality, morbidity, diminished growth or poor regeneration as a result of climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and that you deem a priority in terms of supporting their ability to adapt to climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally sourced seed or plant materials from an area outside your customary seed zone for the purpose of climate adaptation	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally collected seed or plant materials from a microhabitat within your customary seed zone that you believe has characteristics that are suited to future climate conditions:	Please list trees and/or shrubs that you DO NOT consider native to your ecoregion but that you are or have planted or propagated in anticipation of continued climate change:
Alaska Yellow Cedar			●		
Ash	●				
Balsam Fir	●				
Beaked hazelnut	●●	●●			
Bigleaf Maple	●●●●●●●●●●	●●●●	●●	●	
Bitter Cherry				●	
Bitterbrush		●		●	
Black Cottonwood	●●●●●●●●●	●●●●●●●●	●●	●●	
Black Hawthorn			●		
Black Oak	●	●●			●●●●●
Blue Elderberry		●	●	●	
Buckbrush			●	●	●
California Black Oak		●	●		
California Walnut					●
Cascara		●●●			
Ceanothus					●
Chokecherry		●			
Coast Redwood					●●●●●
Coyote Bush			●		●●●
Creeping Oregon Grape					●●
Douglas Fir	●●●●●●●●●●●●	●●●●●●●●●●●●	●●●●●●	●●	
Douglas Hawthorn	●●●●●	●●●●			
Douglas Spirea			●		
Eastern Hemlock	●	●			
Foam Berry		●			
Giant Sequoia					●●●
Garry Oak			●●		
Grand Fir	●●●●●	●●	●	●●	
Gray Pine	●	●			
Hairy Manzanita					●●●
Hines Walnut	●	●			

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Trees, Shrubs and Climate Adaptation (Continued)

	Please list trees and/or shrubs that you consider native to your ecoregion and that you are concerned may be suffering from increased mortality, morbidity, diminished growth or poor regeneration as a result of climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and that you deem a priority in terms of supporting their ability to adapt to climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally sourced seed or plant materials from an area outside your customary seed zone for the purpose of climate adaptation	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally collected seed or plant materials from a microhabitat within your customary seed zone that you believe has characteristics that are suited to future climate conditions:	Please list trees and/or shrubs that you DO NOT consider native to your ecoregion but that you are or have planted or propagated in anticipation of continued climate change:
Huckleberry Species	●	● ● ● ●			
Incense Cedar	● ●	● ●			● ● ● ● ● ● ● ● ● ●
Jeffrey Pine		●			
Juniper					●
Madrone	● ● ● ● ●	● ● ● ● ● ●	● ●	●	
Mock Orange			●	●	
Nootka Cypress		●			
Oregon Ash	● ● ● ● ● ●	● ● ● ● ● ●	●	● ●	●
Oregon Grape			●		
Oregon White Oak	● ● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ● ● ● ● ●		● ● ● ● ●	●
Osoberry	●	●	●		
Pacific Ninebark			●		
Pacific Willow		● ●		● ●	
Pacific Yew	● ● ● ●				
Ponderosa Pine	● ●	● ● ●		● ●	
Port Orford Cedar					●
Quaking Aspen	●	● ● ●			●
Red Alder	● ● ● ● ● ● ● ● ● ●	● ● ● ● ● ●		●	
Red Elderberry		●	●	●	
Red Flowering Currant	●	●	●	●	
Red Osier Dogwood		●	●		
Redstem Ceanothus			●	●	
Rose Species			●		
Salal	●	●			
Salmonberry	●	●	●		
Serviceberry		●			
Shore Pine			● ●		
Sitka Spruce	● ●	●	●		
Sitka Willow				●	
Snowberry				●	
Snowbrush Ceanothus				●	

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Trees, Shrubs and Climate Adaptation (Continued)

	Please list trees and/or shrubs that you consider native to your ecoregion and that you are concerned may be suffering from increased mortality, morbidity, diminished growth or poor regeneration as a result of climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and that you deem a priority in terms of supporting their ability to adapt to climate change:	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally sourced seed or plant materials from an area outside your customary seed zone for the purpose of climate adaptation	Please list trees and/or shrubs that you consider native to your ecoregion and for which you have intentionally collected seed or plant materials from a microhabitat within your customary seed zone that you believe has characteristics that are suited to future climate conditions:	Please list trees and/or shrubs that you DO NOT consider native to your ecoregion but that you are or have planted or propagated in anticipation of continued climate change:
Spirea	●	●			
Stinging Nettle				●	
Subalpine Fir		●			
Sugar Maple	●	●			
Sugar Pine	●	●●			
Sweetgale		●			
Sword Fern	●●	●			
Tall Oregon-Grape		●		●	
Thimbleberry	●	●	●		
Western Crabapple		●●	●●		
Western Hemlock	●●●●●●	●●●●	●●		
Western Larch	●	●●			
Western Redcedar	●●●●●●●●●● ●●●●●●●●●● ●●●●●●●	●●●●●●●●●● ●●●●●●●●●● ●●●●	●●●●●	●●	
Western Serviceberry			●	●	
Western Wahoo		●			
Western White Pine		●●●		●●	
White Alder			●●●		●●
Whitebark Pine	●●	●●●●			
Wild Roses				●	
Willow Species	●		●		

3 Plant Materials Propagation and Procurement

The seed or plant materials we propagate OR the plant materials we purchase is:

- Always collected and labeled according to known, established seed zones or collection areas
- Usually collected and labeled according to known, established seed zones or collection areas
- Sometimes collected and labeled according to known, established seed zones or collection areas
- Nursery managers let us know seed/material collection location but the plants are not labeled
- I don't know
- Not applicable to me or my work

Of species that may be planted as cuttings (willow, cottonwood, dogwood, spiraea, etc.), are you:

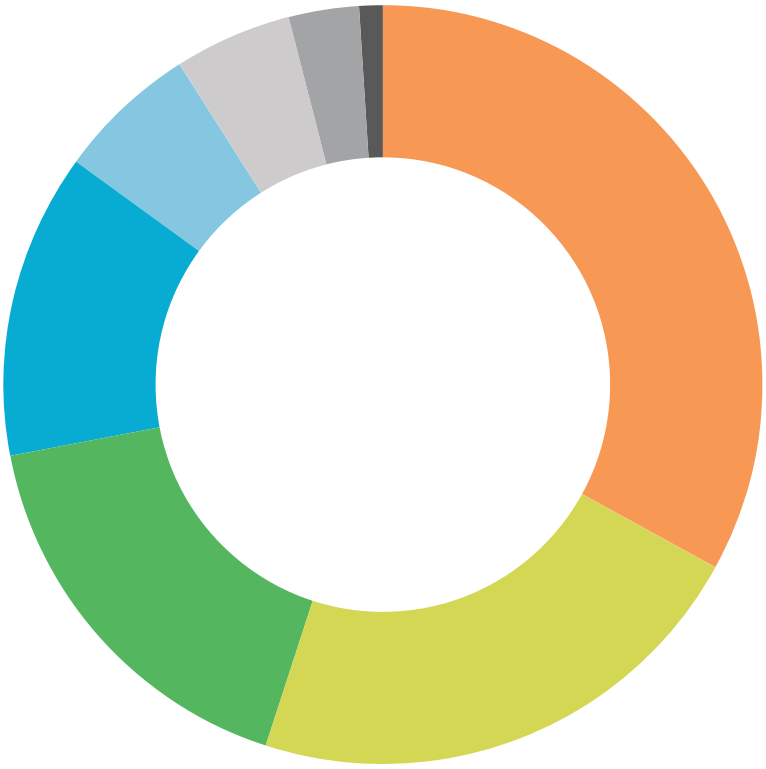
- Stable in production or purchase of cuttings
- Increasingly inclined to produce or purchase cuttings
- Less likely to produce or purchase cuttings
- N/A

Do you or your program have challenges in finding the plant material you want?

- Often
- Sometimes
- Never
- I don't know
- N/A

Pacific ninebark starts. Photo Credit: Jeremy Ojua

Plant Materials Propagation and Procurement (Continued)



The seed used for propagation of plant materials we produce or purchase is collected by:

- Nursery vendor (32)
- Ourselves (21)
- A partner organization (16)
- An outside professional seed collector (13)
- Volunteers (6)
- Not applicable (5)
- I don't know (3)
- Contractor (1)

Willow cutting beds at Gut Hnch'mchinmsh, the Coeur d'Alene Tribe's (CDAT) Native Willow Nursery. Photo credit: Thomas Biladeau

How many total woody plants do you typically produce or plant each year?

James Quintasket, a Swinomish tribal member, working in the Skagit River System Cooperative Nursery. Photo Credit: Brenda Clifton

4 Adaptation Actions

● CURRENTLY DOING ● INTERESTED IN LEARNING MORE ● NOT INTERESTED ● PREVIOUSLY ATTEMPTED AND ABANDONED ● N/A

Collecting seed or cuttings from sources within your seed zone or collection area that appear to be thriving in microhabitats similar to predicted future conditions

Retaining or purchasing plants with higher root:shoot ratios than typical specifications

Intentionally increasing genetic diversity by collecting seed from multiple locations within your seed zones or collection areas

Varying timing of seed harvest

Retaining or purchasing plants that may be smaller or larger than typical specifications

Adjusting planting season according to changing weather patterns (i.e. modify planting timelines)

Irrigating or truck/hand watering plantings

Sevenoaks Nursery. Photo Credit: Scott Anderson

Adaptation Actions (Continued)

CURRENTLY DOING · INTERESTED IN LEARNING MORE · NOT INTERESTED · PREVIOUSLY ATTEMPTED AND ABANDONED · N/A

Using fire to remove extra fuels or invasive plants

Pre-conditioning seedlings to improve drought tolerance with inoculation of mycorrhiza and beneficial bacteria

Using deep planting practices, either with augurs, trenches or hand planting

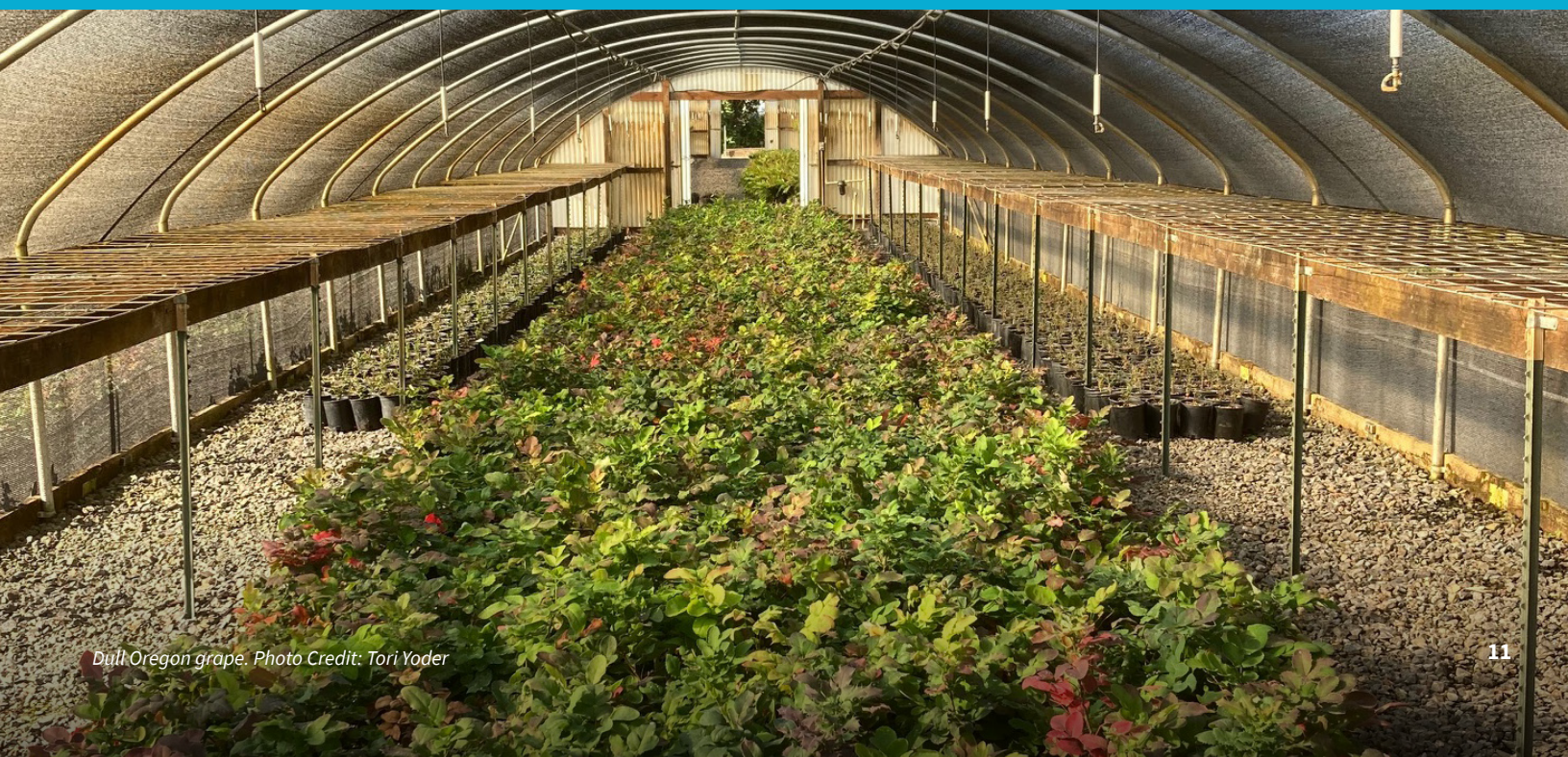
Enhancing and widening riparian and shoreline buffers

Lengthening plant establishment period

Using species that you consider hardier or more adaptable to continue to provide key structure/function

Creating seedbanks or cutting blocks of stock you believe to be well-adapted

Thinning trees to reduce woody plant water use



Dull Oregon grape. Photo Credit: Tori Yoder

Adaptation Actions (Continued)

CURRENTLY DOING · INTERESTED IN LEARNING MORE · NOT INTERESTED · PREVIOUSLY ATTEMPTED AND ABANDONED · N/A

Restoring and managing multiple sites to provide redundancy

Directly seeding woody plants at revegetation/reforestation sites

Removing competing vegetation around plants through manual or herbicide application

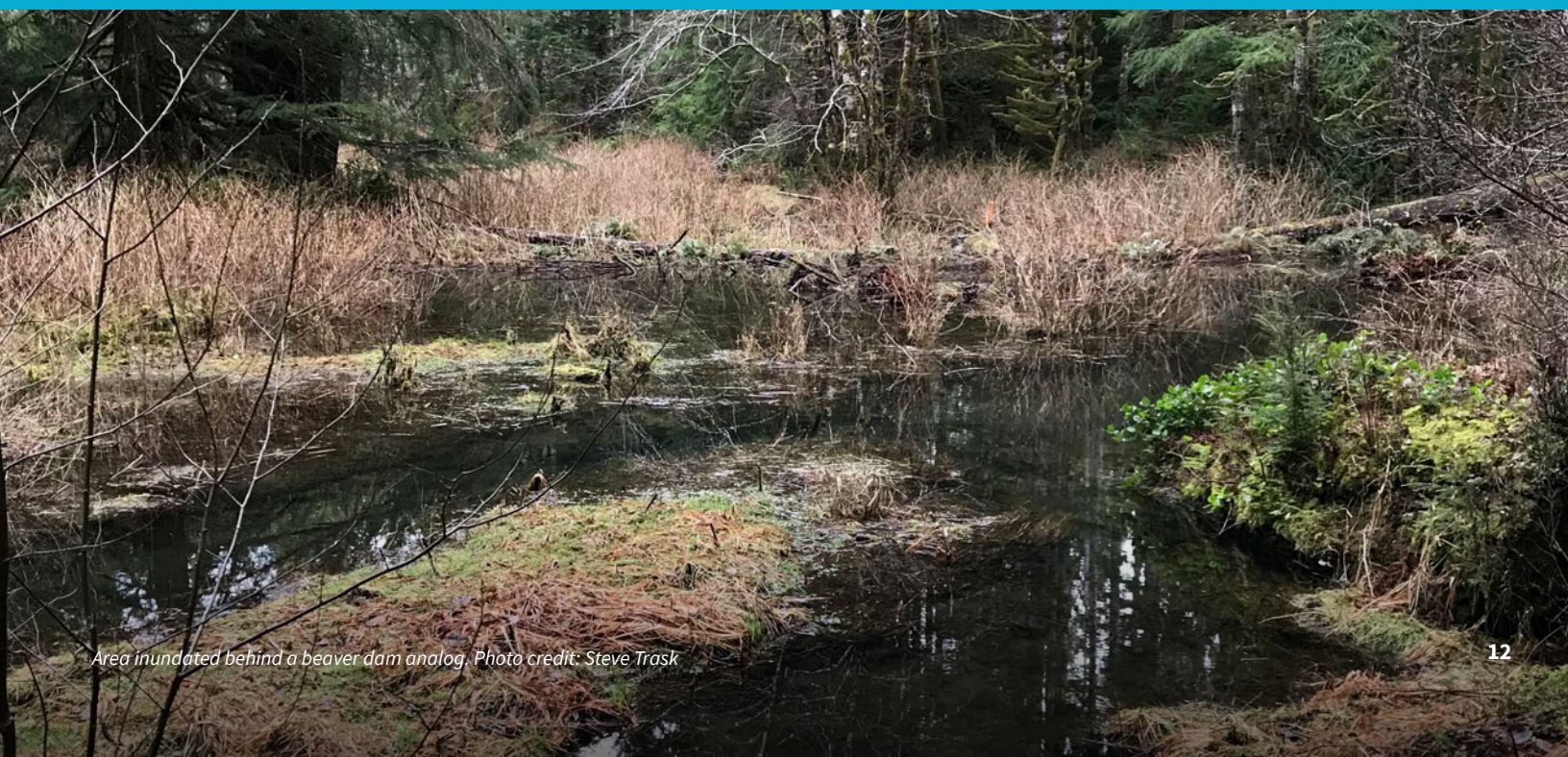
Facilitating beaver or installing Beaver Dam Analogs

Minimizing fragmentation through property acquisition to encourage natural migration

Modifying species mix to reduce fire risk

Conserving leading-edge or sensitive populations

Retaining or augmenting dead wood on ground



Area inundated behind a beaver dam analog. Photo credit: Steve Trask

Adaptation Actions (Continued)

CURRENTLY DOING · INTERESTED IN LEARNING MORE · NOT INTERESTED · PREVIOUSLY ATTEMPTED AND ABANDONED · N/A

Thinning to remove ladder fuels

Adding mulch or plastic sheeting

Monitoring woody plant pests and diseases

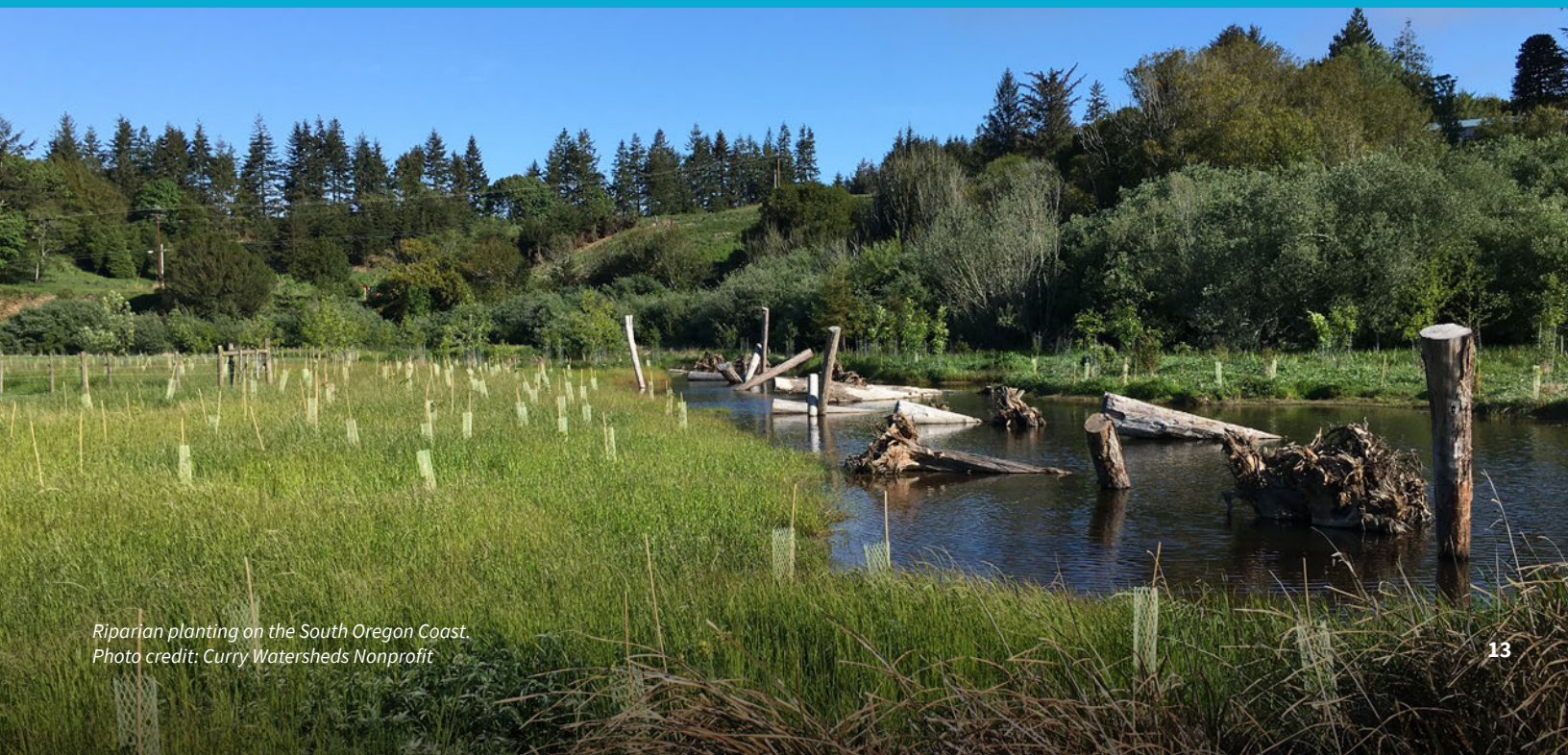
Running common garden trials or experiments

Keeping detailed records of mortality and morbidity of established plants

Selectively removing trees & creating gaps to favor certain species

Monitoring animal damage to plants

Using climate/vegetation models like the Seedlot Selection Tool to inform decisions



Riparian planting on the South Oregon Coast.
Photo credit: Curry Watersheds Nonprofit

Adaptation Actions (Continued)

CURRENTLY DOING · INTERESTED IN LEARNING MORE · NOT INTERESTED · PREVIOUSLY ATTEMPTED AND ABANDONED · N/A

Using climate/vegetation models like the Seedlot Selection Tool to spur discussion

Joining networks and communities of practice to learn and share information

Using education and outreach with multiple neighboring landowners to encourage land management practices that enable natural migration

Engaging volunteers in community science

Talking to elders and long term residents to learn from them

Documenting observations about plant health in a tool like iNaturalist

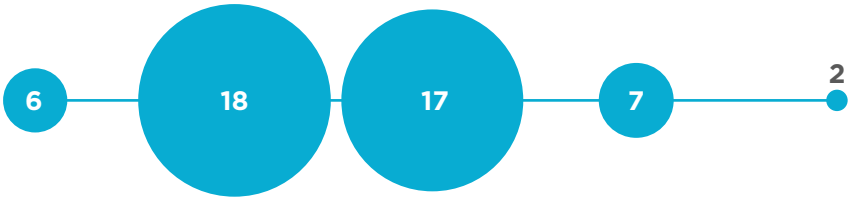
Documenting phenological observations (bud break, flowering timing)

Contacting experts to ask specific questions

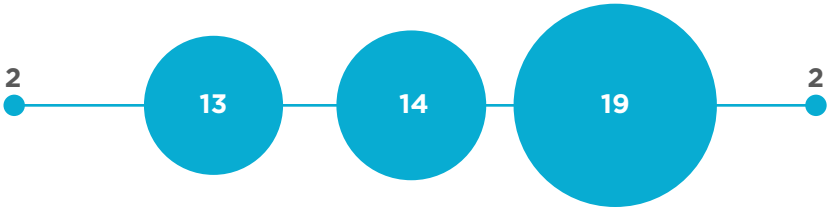
BEF's Collaborative Grow Project Manager Jean Paul Zagarola inspects bare root plants. Photo Credit: Hannah Buehler

5 Agreement Scales

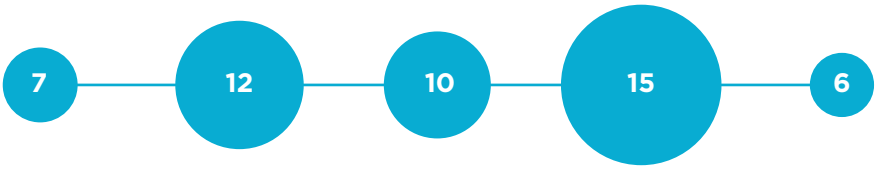
I have adequate means to record and share scientific monitoring data on site conditions, how woody plants are faring and conditions may be changing to inform strategies for climate adaptation.



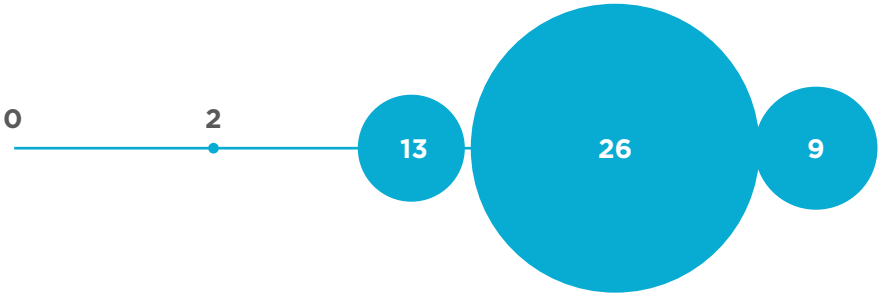
I have access to adequate knowledge, information and research to guide my work in relation to woody plants and climate adaptation



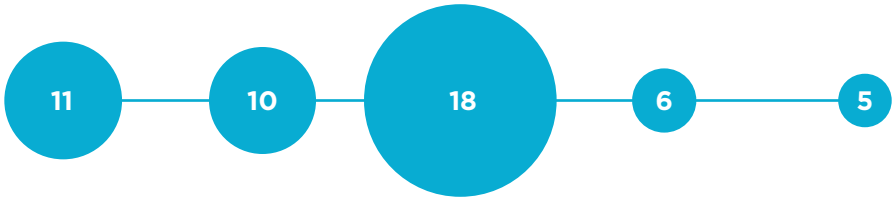
I am/my organization is in regular contact with elders or long term residents in my place and I have the opportunity to learn from them about plant communities and changing conditions



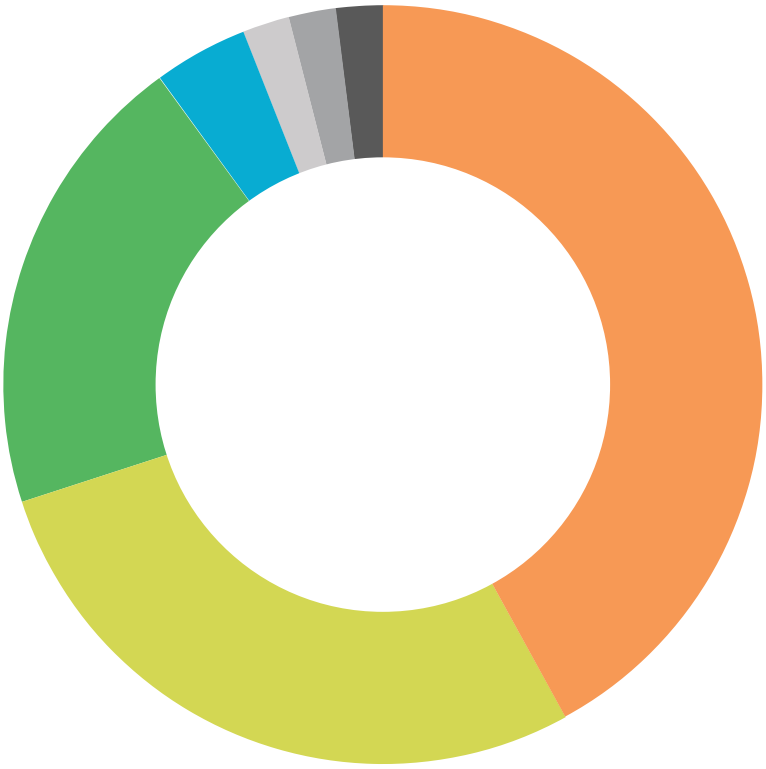
I have close relationships with peers and we frequently discuss observations, issues and questions relating to woody plants and climate adaptation



I have access to the funding and capacity resources I need to advance the actions that I think will help woody plant/forest communities in my place adapt to climate change

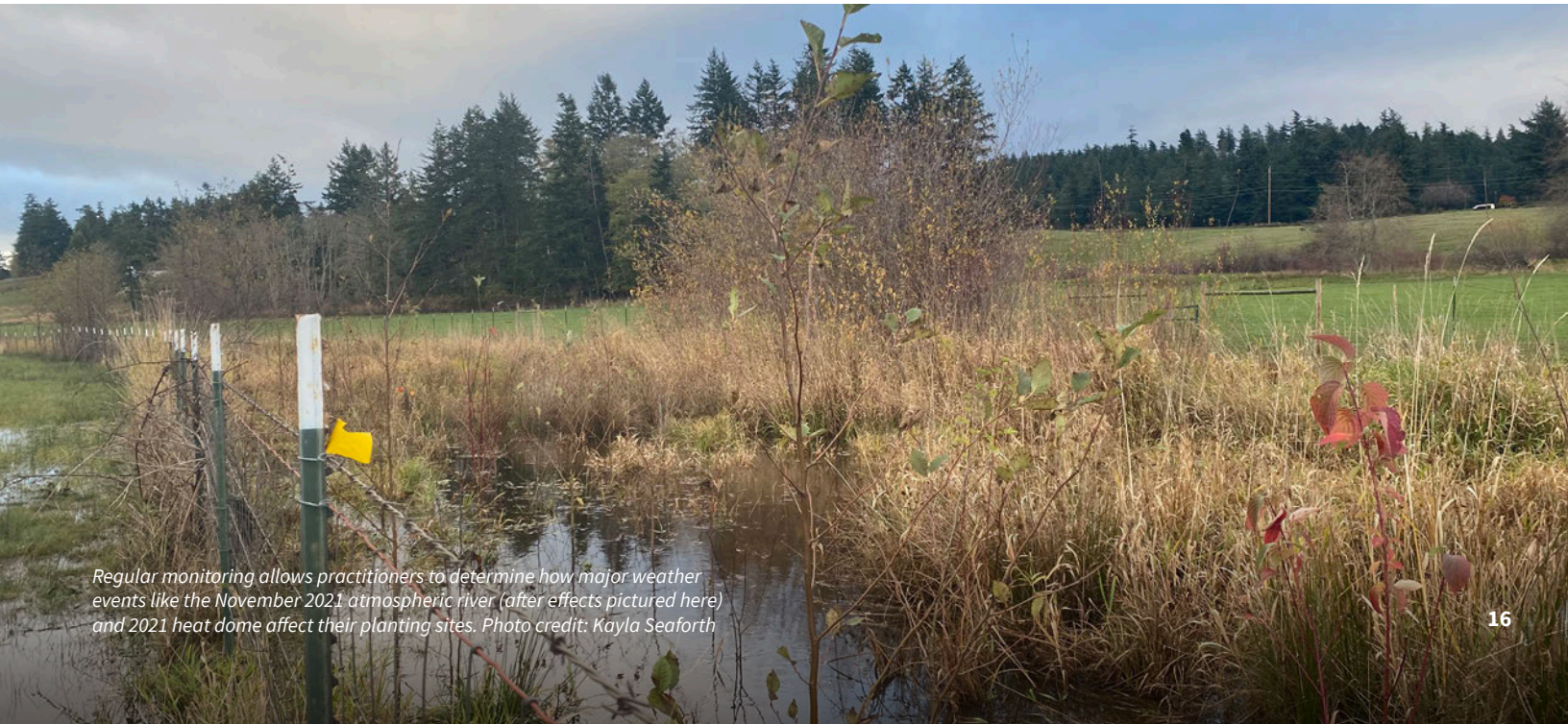


Needs



The single biggest constraint right now that keeps me or my organization from advancing a solid climate adaptation strategy is:

- Time to learn and plan (21)
- Funding (14)
- Reliable and sufficient information (10)
- We are already advancing a strategy I feel great about (2)
- Decision-making authority (1)
- In-house expertise (1)
- Not relevant to me (1)



Regular monitoring allows practitioners to determine how major weather events like the November 2021 atmospheric river (after effects pictured here) and 2021 heat dome affect their planting sites. Photo credit: Kayla Seaforth

Appendix 1: Long form answers

What are the challenges you face in acquiring plant material?

Sufficient sources for cuttings; if we want plants outside the BEF contract (something arises after the order is final) we can sometimes have challenges getting the number and species we want.

Having enough availability so that all partners can meet their desired amount; typically there are shortages and the available amount gets divvied among request.

Finding the climate adapted stock

I want to get more plant material with seed sources farther south (Northern CA) and its not really available.

With high demand for plants there are often shortages of particular species from nurseries I have an order with. By the time we are aware of the shortages, it's often too late to find another source for those plants.

Timing of projects and seeds

Without proper lead times (due to grant timelines) nurseries may not have the desired plant material on hand for propagation. Receiving the material we want requires planning 1.5 years in advance or more, which is not always possible due to funding or project shifts.

Acquiring locally sourced material on tight timelines.

Changes in nursery forecasted numbers often due to surprise late/early frosts.

When we cannot anticipate our needs, sometimes certain species are just not available on short notice due to demand - almost never a big deal.

Forb species are often unavailable. Annual shortages in tree/shrub bare root orders.

Finding the needed quantity and species.

Repeated fires have used up available seed stores.

Sedges and rushes are more difficult for us to find, and some of our partners (that give us plant material) simply produce fewer sedges/rushes than shrubs.

General availability of certain species at certain times; can be because of crop failure or low numbers of certain species in the supply chain (e.g. more demand for X species than anticipated).

Nursery shortages.

Nursery availability, purchasing in desired quantities, trusting seed sources

Vendors who are in our grow contract will have failures of some species from time to time, but our plant procurement team works hard to make up for short falls from other vendors.

We can generally find the common tree and shrub species for our area.

Sometimes species are not available in the quantities we need so we select other species to take their place. It can be hard to find quality large cottonwood cuttings which we started using more often.

Scarcity from wildfires is increasingly an issue for species that are planted in the western cascades

Finding the desired seedling age, knowing the precise provenance of genetic stock.

More people are planting gardens therefore some seeds are sold out.

Time for seed collection; no private nurseries with appropriate stock for the Umpqua.

Immediate availability - we pay landowners after they plant - little pre-planning.

Having appropriate starter material for seed increase.

Limited purveyors/quantity.

Many local growers provide cultivars rather than straight species of native plants.

We have more difficulty procuring conifer seed that is collected to our preferred standards, as that is the one group of species we mostly do not collect in-house.

Availability, stock quality.

Not enough locally sourced seed and plants in the species we need.

Limits in Volume, species, timing.

Oregon White Oak with burned leaves following the 2021 heat dome. Photo Credit: Kayla Seaforth

Do you have other thoughts to share about on-the-ground adaptation actions?

We have started a trial of uncommon species that might be more able to persist with climate change but results are mixed. We need more regional coordination on this.

The topics above pretty well cover it. Many of these I've tried or am trying but I'm interested in learning more.

We are considering processes related to climate change-induced changes in reproduction, ie, black cottonwood seed release timing (triggered by warming) that may decouple from river flow regimes, in particular dammed rivers with flows managed for consumption.

Crew training and documentation of treatments in order to study trends in successful practices is key.

Common garden experiments are needed to determine species fitness or adaptation to local conditions. Once we complete survey and comparison of sites with analogue climates and some of the common soil or hydrologic conditions, we will begin these with propagules of species gathered in those zones.

Based on previous results in the field, I often plant high densities of shrubs, especially thicket-forming shrubs, and use smaller stock to take advantage of lower costs and relative ease of handling/planting.

Some of these actions are more possible in some areas of our sites. Some of these actions would not be possible on the scale we are working and with the limitations of the site.

The Organic Seed Saving Initiative has long been breeding vegetable seed landraces that do particularly well in specific geographic areas and conditions, and I believe that the woody nursery industry could learn a good amount from these practices.

Carbon retention is better in young stands than mature stands.

Because my work is in the Urban environment, some of the actions (such as leaving large woody debris in place) is not applicable. We also have unique planting environments relative to other restoration practices, with many projects installed in parking areas or other hot/dry environs. So, we already are aiming toward more heat and drought tolerant species and would be very interested in other techniques to provide successful planting in challenging conditions.

Control on non-native grasses (reed-canary grass) and forbs prior to planting.

Establishing shade trees such as conifers which serve to protect the desirable and more sensitive riparian plants from solar radiation and drought conditions.

Protecting newly planted trees from wildlife damage until they are able to get established.

To clarify the issue of mixing in seed from outside our seed zone to increase genetic diversity: we grow seed from provenances outside the Puget Lowland, but we do not mix it with local seed; our seed zones always match their stated origin.

Many of these questions could have had multiple answers but had to choose one. Some things we are doing we still could learn more about. I would be interested in knowing if we have regional guidance accessible and based in the Best Available Science on these practices. Where are there guidance gaps?

Mulch is good, seeding woody plants sounds good. Fire and thinning needs vary greatly.between zones. Maintaining and restoring canopy will help retain moisture through microclimate in west side forest areas. Variable width buffers are important to match restoration with reality of sites.

Plant establishment efforts on Chahalpam conducted by J Franco Reforestation. Photo by Miguel Franco

Do you have other thoughts to share about observing, communicating and collaborating?

Extension is already doing community science around plant phenology and precipitation. Please don't reinvent the wheel on those items.

When framed in the right way, collaboration with neighboring properties is extremely popular, however much funding is often not available or easily obtainable across properties.

Our projects are partner centered and most of these actions are reliant on them or contractors. We are always wanting to increase our knowledge about these elements of projects.

Need more organizational capacity to do all that we would like to do related to the above.

While we are engaged in the CAPM project, we would like to keep our cadre of folks relatively exclusive in order to be efficient and strategic to our basin. We are open to wider regional collaboration at a later stage in our work. We are happy to share results as well. But it is important to understand local conditions/analogues and work efficiently for now.

We are open to learning more and increasing collaboration as capacity allows.

Collaborating takes time which is rather short these days, but could amplify our collective efforts in the long run.

Secretary of Pinchot Partners and actively involved in making suggestions to USFS of land management.

Landowners in the North Santiam Basin pick up over 30,000 tree and shrub seedlings to support post fire recovery 1.5 years after the Beachie Creek and Lionshead fires. Photo Credit: Amanda Bintliff, North Santiam Watershed Council

What are your research priorities relating to woody plant/forest adaptation and climate change?

Information to help practitioners implement the reveg projects with maximum long-term resiliency to predicted impacts of climate change. Effective ways to communicate to landowners, partners and communities about climate change and adjusting plantings to predicted conditions (for example we've heard resistance to incense cedar used in place of western red cedar, which is an intentional substitution due to climate change).

How will climate change affect plant species and availability for Tribal cultural practices; how will cultural practices adapt to decreased availability; will cultural practices adapt to alternative plant species as climates shift?

Finding an appropriate palette for steep slopes, in particular.

Moving species, moving genes and how to get best seed material.

Beaver as a climate adaptation and mitigation tool.

Water availability.

No research priorities—my implementation priorities are to increase extent and resilience of vegetated floodplain and riparian zones.

Cottonwood forest survival on regulated low-land arid zone rivers.

Migration of species as the environment continues to warm.

Forest thinning with high amount of down wood retention. Photo credit: Kayla Seaforth

What webinar or convening topics are of interest to you? Do you have speaker recommendations to share?

George Kral - see example talk, his research gives a lot of hints of species to focus on using : **https://www.luckiamutelwc.org/sips-and-science-plant-nurseries.html**

Many of the suggested topics were great ones. Dr. Emily Fairfax recently gave a great talk on the benefits beaver provide with regard to climate change adaptation.

Traditional Ecological Knowledge experts.

Increasing climate change resilience in riparian zones and floodplains, as related to planting; speakers related to black cottonwood seed release timing and climate change: Kevin Fetherston, PhD at Natural Systems Design.

Conversations about assisted migration, expanded genetics, planting strategies.

TEK, tribal perspectives on climate change.

Adaptive management for assisted migration.

Climate change differences in restoration projects in the last 20 years. Project failures and success' with planting and sustainability of restoration projects.

Regional species most at risk. Presentations about active efforts already under way.

North Fork Stillaguamish River from the site of the Oso landslide. Photo Credit: Jason Griffith

Is there anything else you would like to share?

I expressed interest in learning more about a lot of topics. Obviously, I can't work on all of that - 1 or 2 items at most at a time due to time constraints.

We have resources but need access to elders, knowledge holders and experts in climate change and ways to share experiences with peers, land managers.

I greatly favor current plant adaptation and use of micro sites. This should be the main focus and needs more funding and research. I think purposely moving plants from other regions needs more research before this is a supported strategy.

Want to learn more and assist more with the effort.

I appreciate this effort to understand and document what is currently happening in this arena and to support greater learning and knowledge sharing among plant producers and land managers.

Standardized monitoring techniques or protocols would be helpful to share land managers and with more practitioners we can begin to gather data that can contribute to showing a larger regional trend. Many grants do not pay for monitoring so simple monitoring techniques will be more likely to be implemented. Thanks!

On Bogwood, we are already implementing many forward-thinking ideas. All electric/battery power tools, rehabilitating former woodlot to wet prairie and White oak habitat. More things to share, too numerous to list.

Just a volunteer but very interested.

Thanks for helping practitioners coalesce around this issue!

I am just really thankful that you are taking this issue on. We collectively need a lot of education, guidance and traditional knowledge to ensure our efforts mimic and respect the natural processes that have allowed our planet to adapt over the ages. We have created a fragmented and fragile landscape that will require assistance but if we are thoughtful we can do it in a manner that nature would have done on her own, if not for the extreme circumstances and the expedited timeline we are facing. What is critical is that we assist, but that we commit to do so while ensuring we do not cause irreversible ecological damage in the process.

Thank you for this important work.

Volunteers of all ages have a role in revegetation and monitoring efforts. Photo Credit: Lower Columbia Estuary Partnership

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