watersheds program

treeline

partnering for climate adapted forests

June 2021

Missed the April Treeline Newsletter? *Click here* to learn about what our partners are working on with fire recovery.

Interested in submitting an article? The August issue will focus on native plant nurseries. *Contact Kira*.

Restoration planting in Clark Co., WA

Floodplains Issue

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 in support of climate adaptation.

Drought Status Update for the Pacific Northwest

71.52%
of the Pacific Northwest is in drought

10.91%
of the region is experiencing Extreme to Exceptional Drought (D3-D4)

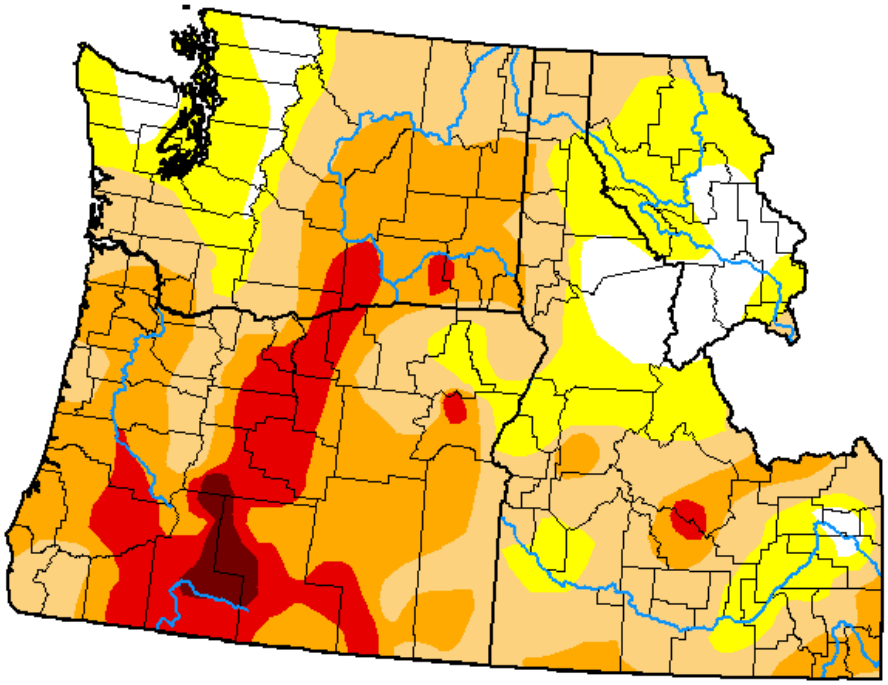
1895
was the last time it was this dry in Idaho during March and April

Drought continues to worsen in the PNW

- The official June-July-August forecast from the NOAA Climate Prediction Center shows higher chances of above-normal temperatures and below-normal precipitation for most of the region, which indicates that drought conditions are likely to get worse in the coming months.
- The Significant Wildland Fire Potential Outlook shows higher chances of wildfire potential east of the Cascade crest throughout Oregon and into southwest Washington by June and July.
- Impacts are being felt across the region with poor pasture and rangeland conditions, reduced irrigation, more spring season fires than previous years, poor crop conditions, and the need to haul water or move livestock out of drought-impacted areas.

Information and graphics provided by Drought.gov

Published on May 13, 2021



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	7.79	92.21	71.52	37.87	10.91	1.27
Last Week *05-25-2021*	8.43	91.57	69.22	35.49	10.91	1.27
3 Months Ago *03-02-2021*	45.85	54.15	34.04	18.98	4.71	0.00
Start of Calendar Year *12-29-2020*	38.14	61.86	40.77	27.90	10.74	0.00
Start of Water Year *09-29-2020*	21.70	78.30	51.11	28.83	13.73	0.00
One Year Ago *06-02-2020*	38.07	61.93	42.41	18.15	1.73	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

U.S. Drought Monitor Conditions: Pacific Northwest — May 11, 2021

Current U.S. Drought Monitor map for the Pacific Northwest, as of May 11, 2021. The U.S. Drought Monitor (USDM) is updated each Thursday to show the location and intensity of drought across the country. Drought categories show experts' assessments of conditions related to dryness and drought including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year.

Stay up to date with the U.S. Drought Monitor: https://www.drought.gov/drought-status-updates/drought-status-update-pacific-northwest

Treeline Network Partners Answer Questions Relating to Adaptation to Climate Change, Including Drought

The Treeline survey closed on May 15th with a total of **50 responses** from partners in over **14 different ecoregions** in the Pacific Northwest. Here is a snapshot of the energy and work being dedicated to on the ground adaptation actions in response to drought conditions.

Actions Partners Are Taking

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

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

Irrigating or truck/hand watering plantings

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

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

Enhancing and widening riparian and shoreline buffers

Thinning trees to reduce woody plant water use

Facilitating beaver or installing Beaver Dam Analogs

Modifying species mix to reduce fire risk

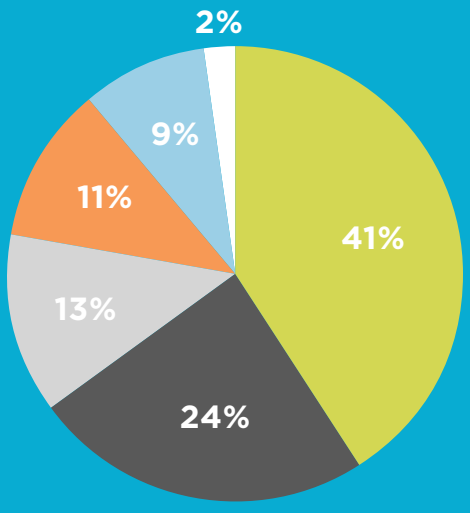
Extent to Which Practitioners Have Information About Plant Material Seed Zones

Reflections by Scott Kolpak, SW Oregon Area Geneticist, USDA Forest Service

A core principle to ensure plant materials used for restoration projects will thrive is to match the seed zone to the planting site. Seed zone utilizes biogeographic, climatic, and genetic information to define the scale of local adaption so that the range of genotypes and families included into a seedlot growing in a nursery is matched to deployment locations. Woody plant seed zones were defined for the PNW conifers in the 1960s, and are widely used by federal, state, industrial, tribal, and non-profits.

The Treeline's March/April 2021 survey on a broad range of restoration topics (e.g., climate adaptation, assisted-migration, and nursery) resulted in some interesting results in the areas seed zones, genetic diversity, and assisted migration. Among a diverse array of restoration practitioners from tribal, non-profit, business, and government; most respondents (65%) suggested seed zones were being utilized for planning and implementation of woody plant restoration projects (Figure 1). Of the remaining 35%, knowledge and adherence to woody plant seed zones was less. The diminished awareness may be due to knowledge gaps between personnel involved in project planning, nursery operations, or implementation. Thus, utilization of seed zones may be even higher.

Plant Material Seed Zone Utilization



USUALLY · ALWAYS · UNKNOWN · NOT APPLICABLE · SOMETIMES · NO

The Skagit River System Adapting Restoration Plantings to Climate Change

Brenda Clifton, Senior Restoration Botanist at Skagit River System Cooperative

We are expecting an average temperature increase of four-degrees Fahrenheit by the 2040s and seven-degrees Fahrenheit by the 2080s in the Pacific Northwest. Rainfall will increase overall but decrease by ten percent during the summer by the 2040s. Reduced snowpack that melts earlier will reduce summer stream flows and increase the frequency and severity of floods and droughts. The soil moisture available on July 1 will decline throughout the North Cascades by up to 35 percent.

As a result, drought stress will reduce forest species' growth and survivorship while wildfires and pathogens alter forest structure and composition. The severity of climate change, the ability of individual plants to acclimate, the ability of plant populations to evolve to new conditions, and the ability of plants to migrate to better conditions will determine how these stressors affect restoration plantings.

The Skagit River System Cooperative was created by tribal resolution to provide natural resource management services for the Swinomish Indian Tribal Community and Sauk-Suiattle Indian Tribe. We plant between 30,000 and 50,000 trees every year in the floodplain of the Skagit River and along its tributaries as part of our mission to recover habitat for salmon. We want to make sure that we are planting forests that will be as resilient as possible to climate change.

Genetic and Species Diversity

Forest health and resilience will rely upon biodiversity to tolerate change and rebound from disturbances. Genetic diversity allows forests to adapt to environmental change through plasticity in traits such as cold hardiness, bud set and break, cone seed release, and pest resistance. Long-lived, woody species have the highest genetic diversity among all plant species. The best predictor of diversity levels within this group is the extent of a species geographic range. Outcrossing breeding systems and wind or animal-ingested seed dispersal also results in greater genetic diversity than other traits. For example, Douglas fir and black cottonwood have high levels of

Plantings along Nookachamps Creek. The Skagit River System Cooperative has installed over 40,000 plants along Nookachamps Creek with funding from the Washington Department of Ecology and the Washington Recreation and Conservation Office. Nookachamps Creek is one of the few tributaries to the Skagit River large enough to support Chinook salmon.

genetic variation. While woody species have more variation within species and within populations than other plant forms, they have less variation among different populations. For example, Sitka spruce has a lot of variation from one tree to another within an area like the Skagit Basin, but there is little difference between the entire populations found in Oregon and Alaska.

That is why we pay attention to the ranges, reproductive traits, and seed distribution methods of the trees used in our restoration plantings. We want to ensure that future forests possess the tools to survive changing environmental conditions. We try to use a high variety of genetic material within each species we plant. We prefer nurseries that harvest small numbers of propagules (i.e., live stakes and seeds) from many plants over large areas and varying microclimates and pay special attention to isolated, disjunct, or marginal populations, which contain rare gene pools. Growers should also harvest throughout the season to capture varying phenology. Variety in bud set, flowering, and fruiting timing may be important to cope with changing seasons. We have discussed this process with vendors and stressed the value of genetic diversity. To increase genetic diversity, we purchase plants from several vendors and collect seed to grow in our own nursery.

We also consider species diversity in our plantings. Different species will be affected by climate change at different levels. Some species will suffer across the landscape. For example, western red cedar has low genetic diversity from a population bottleneck that occurred 6,000 to 10,000 years ago and it may not adapt well to climate change. Other species may suffer on a site-by-site basis due to insect or pathogen outbreaks. Our planting plans incorporate as much structural and species diversity as possible.

Our plantings also incorporate as many flood and drought tolerant species possible. Flood tolerant species include red alder, Oregon ash, western red cedar, black cottonwood, red-osier dogwood, hardhack, Sitka spruce, and willows. Drought tolerant species include cascara, bitter cherry, red flowering currant, pacific dogwood, grand fir, western hemlock, Pacific madrone, big-leaved maple, Garry oak, tall Oregon grape, shore pine, clustered wild rose, and thimbleberry.

Assisted Migration

Plants have adapted genetic variations in response to climate, which shape phenology, morphology, and growth. Plants can migrate in response to changing climate, but models suggest that many species will not be able to migrate fast enough to keep up with future climate change. Because temperature, precipitation, and light control the timing of life history traits, plants will suffer phenological imbalances with altered growing seasons, impacting forest growth and composition.

The Conservation Biology Institute has developed the Seedlot Selection Tool to match seed sources with planting sites based on climate change scenarios. The Department of Forest Ecosystems and Society at Oregon State University and the U.S. Forest Service Pacific Northwest Research Station partnered to develop this tool and used available climate-interpolation models to define seed zones. The Seedlot Selection Tool suggested Hoquiam, Washington as a good seed source for the climate in the Skagit Basin in 2070. We plant up to ten percent of our trees from Hoquiam stock; the remaining 90 percent of our trees come from the Skagit Basin (we are unsure how well the migrant trees will do in today's climate).

Extended Monitoring and Stewardship Timelines

Climate change will increase pest outbreaks. Insects and pathogen populations will increase in the warmer conditions and many insects and some fungi are attracted to pheromones released by stressed plants. As part of our site monitoring, we are monitoring for insect and pathogen outbreaks and treating detrimental outbreaks with pesticides, pheromones, and other techniques. We are also thinning older plantings to increase the ability of the plants to withstand summer moisture stress. We plan to replant if species experience die-offs due to climate change.

James Quintasket, a Swinomish tribal member, working in the Skagit River System Cooperative Nursery. Every year we grow over 15,000 plants to install along salmon streams.

Is There a Future for Oregon Ash? Forest Genetics to the Rescue?

Genetic & Emerald Ash Borer Resistance Projects

Richard Sniezko, USDA Forest Service,
Dorena Genetic Resource Center, Cottage Grove, OR

Oregon ash *(Fraxinus latifolia)* is an important species on the West Coast of North America, particularly in riparian areas. But, the threat of the invasive emerald ash borer (EAB, **USDA APHIS | Emerald Ash Borer**), which has nearly wiped out green ash in parts of the country, suggests that the future of Oregon ash may be dim, and the species could go functionally extinct – something no one wants. Already, some municipalities such as Corvallis, Oregon have stopped using it in restoration projects and are now considering non-native tree species as replacements.

EAB has already made it as far west as Colorado, when will it arrive on the West Coast? Can we do anything to save Oregon ash? That is unknown, but the forest genetics/tree improvement and public gardens communities recognize the value of genetics and tree improvement (Showalter et al. 2018; Sniezko and Koch 2017). We have an early alert and have the chance to respond, but the time to start is now. What can we do? We can mobilize as a community, be proactive, and see what we can do for these communities around us that value *F. latifolia*.

Most species have at least some level of genetic resistance to diseases or pests. If this is the case for Oregon ash, then it may be possible to develop populations of ash for future restoration efforts. The USDA Forest Service's Dorena Genetic Resource Center is a world leader in the development of populations of trees with resistance to non-native pathogens such as white pine blister rust, Port-Orford-cedar root disease, and koa wilt (Sniezko and Koch 2017). A similar effort could potentially be launched with Oregon ash and EAB resistance.

Just as a journey of a thousand miles starts with a first step, the same is true for looking into the chances Oregon ash has of being maintained/restored when emerald ash borer reaches the Pacific Northwest. There are interested individuals and groups – if we work together, we can examine the genetic variation within Oregon ash and its potential for the future. The initial work would be to gather seed from a large array of ash parent trees, both for gene conservation, and a working collection to learn more about genetic variation in this species and information on possible genetic resistance to EAB.

Pictured to the right: (from top to bottom) Photos 1 and 2: Oregon ash trees in riparian areas, close up of Oregon ash leaves, Oregon ash seed clusters, Photo credit: Richard Sniezko

Note from the Author

Prevention is still our main goal – hopefully we can be vigilant and have early detection and eradication of EAB on the West Coast (I know the Oregon Invasive Species Council is being proactive in that regard; and California has just instituted a quarantine), but we also need the backup plan of knowledge of the degree of susceptibility and resistance within our native ash. The EAB threat could be a 'forever' threat (could happen soon; or could happen later, even with proactive measures), so knowing something about the genetics of Fraxinus latifolia will allow communities to know the long-term future of this species.

Objective

Begin proactive measures to address community concerns on the West Coast about the future fate of the important riparian species *Fraxinus latifolia* (Oregon Ash) by (1) initiating the first well documented resistance testing of this species to EAB, (2) establishing two genetic conservation plantings that will also serve to examine adaptive genetic variation and be a sentinel planting for the species, We believe that this will be the first investigation of genetic variation in this wide-ranging species, which occurs in CA, OR, WA & BC, and (3) preserve the genetic diversity of *F. latifolia* by depositing seed collections and storing them for long-term use and preservation prior to the very high mortality expected from EAB – these collections will also be a source for future genetic studies.

Progress to Date

The first gene conservation seed collections of Oregon ash occurred in fall 2019 – both Oregon Department of Forestry and the U.S. Forest Service were involved. Most of the collection were of parent trees in Oregon. In general seed viability (from xrays) appeared to be relatively low, but a large amount of seed was collected for many trees, ensuring sufficient seed for genetic trials. A few additional collections were made in WA in 2020. Collections were made by both agency staff and citizen scientists. Additional collections in OR are planned by ODF in fall 2021.

Using a subset of the seedlots collected, seed from individual parent trees were sown in spring 2020 to be used for (1) EAB resistance testing, and (2) common garden field trials in OR & WA.

A common garden field trial of 27 seedling families was planted at Dorena GRC in fall 2020, and additional seedlings of the same families were transported to WSU's Puyallup Research & Extension Center for planting in fall 2021 (Dr. Gary Chastagner is the contact there).

Seedlings of 17 ash families were sent to Dr. Jennifer Koch, USFS Northern Research Station, in early March 2021, for future EAB resistance testing (likely in 2022 when seedlings are larger).

Gene Conservation of all western ash species is now planned: worked with Tim Thibault and Brian Dorsey, at The Huntington (**Gardens | The Huntington**) to write proposals for funding to collect ash seed from all the western species in 2021 and 2023. The USFS FHP-WO funded the proposals and collections will be made in fall 2021 and 2022, including collections of *F. latifolia* in WA and CA. Tim & Brian will organize collections. Once this collection is completed there will be a more substantial range-wide collection of *F. latifolia* available to use for future genetic studies. Several groups in WA have been contacted to provide Tim with locations of ash stands for potential collection in fall 2021. Seed for *F. latifolia* will be stored at Dorena GRC, and also at the ARS facility in Ft. Collins, and at The Huntington.

Pictured to the right: Oregon ash (Fraxinus latifolia) common garden trial at Dorena Genetic Resource Center. Seedlings were planted in fall 2020, and have just recently (late April) began their 2021 growing season.

Want more information or are you interested in helping or staying abreast of developments?

Contact Dr. Richard Sniezko:
richard.sniezko@usda.gov

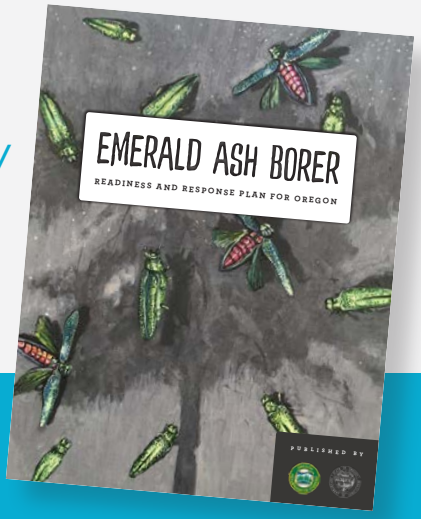
Acknowledgments

Thank you to the many professionals and citizen scientists who have assisted with seed collections, and advice on ash. The USFS Forest Health Protection (WO) and Tualatin Soil and Water Conservation District have provided funding for the common garden field trials and future EAB resistance trial in 2021/2022; and the FHP (WO) for the new seed collections scheduled for fall 2021. Thanks also to USFS NRS (Jennifer Koch) and WSU (Gary Chastagner) for hosting ash trials, ODF (Wyatt Williams) for many ash seed collections in OR, and The Huntington for their seed collections slated for WA and CA in 2021. The technicians and staff at Dorena GRC are thanked for all their assistance.

This is just a start on gathering information on genetic variation in ash. It is a project that will require inputs from many people, and an opportunity to enlist citizen scientist inputs and assistance.

See Oregon's 'Readiness and Response Plan' for other measures that are being contemplated.

https://static1.squarespace.com/static/58740d57579fb3b4fa5ce66f/t/5b1ad1896d2a73a4cffcdad1/1528484258046/EAB+Plan+2018.pdf



Background information on ash, genetic resistance in forest trees and related information:

Emerald Ash Borer – Readiness and Response Plan for Oregon

https://static1.squarespace.com/static/58740d57579fb3b4fa5ce66f/t/5b1ad1896d2a73a4cffcdad1/1528484258046/EAB+Plan+2018.pdf

National Academies of Sciences, Engineering, and Medicine. 2019. Forest Health and Biotechnology: Possibilities and Considerations. Washington, DC: The National Academies Press.

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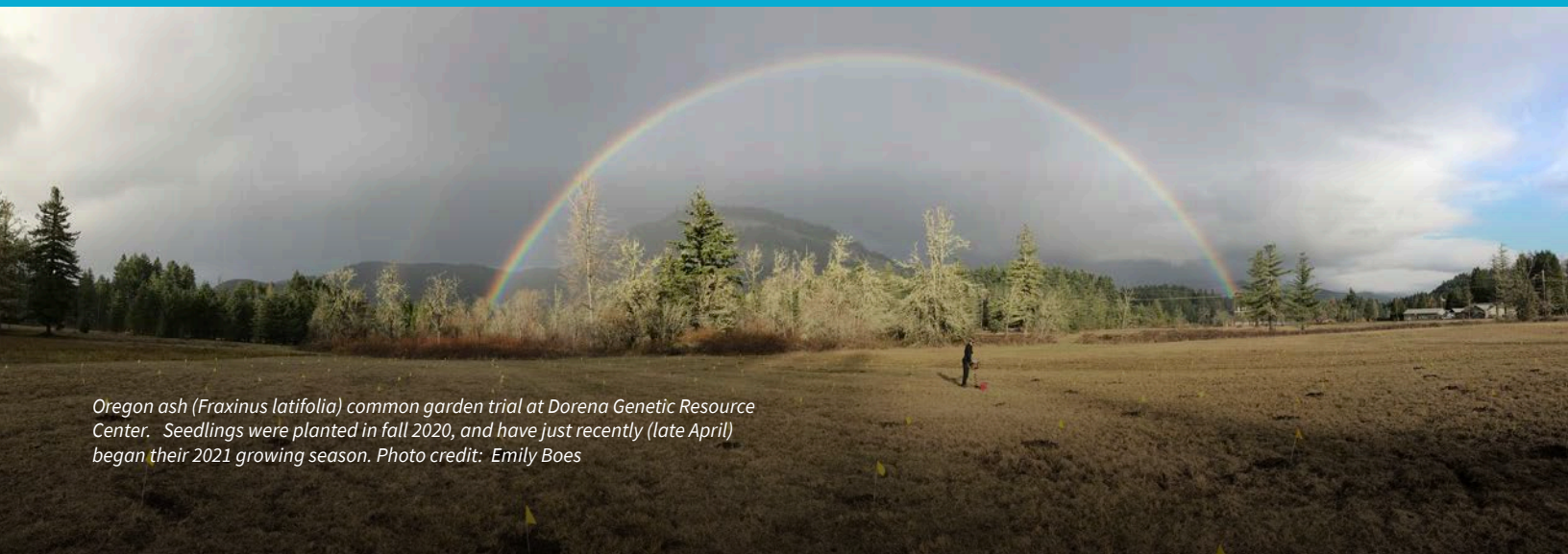
Showalter DN, Raffa KF, Sniezko RA, Herms DA, Liebhold AM, Smith JA and Bonello P (2018) Strategic Development of Tree Resistance Against Forest Pathogen and Insect Invasions in Defense-Free Space. Front. Ecol. Evol. 6:124. doi: 10.3389/fevo.2018.00124

Sniezko, R.A.; Koch, J. 2017. Breeding trees resistant to insects and diseases: putting theory into application. Biol Invasions 19(11):3377-3400. doi:10.1007/s10530-017-1482-5



Oregon ash (Fraxinus latifolia) common garden trial at Dorena Genetic Resource Center. Seedlings were planted in fall 2020, and have just recently (late April) began their 2021 growing season. Photo credit: Emily Boes

Reflections from Landowners Grappling with the Threat of EAB

Leland (Lee) Peterman and
Shirley Joliff, Bogwood

An 80-acre former woodlot near Scio, OR has transformed into a model for sustainable tree farming and is preparing for possible functional ash extinction as Emerald Ash Borer migrate.

Recently, we attended a mini-symposium titled: Emerald Ash Borer in our natural areas: Preparing for the functional extinction of Fraxinus Latifolia: Science, options and actions on the imminent arrival of the dreaded Emerald Ash Borer (EAB) - it was a sobering eye-opener, (note the term 'functional extinction'.) Only 98% of the news was bad. The rest was hopeful. The think-tank symposium was a follow-up to one held last year in Portland and of the six guest speakers this time, three noted that our Oregon Ash was most susceptible of all North American species at a nearly 96% mortality rate in test stands. They suggested that Watershed Councils and foresters should not continue planting thousands of Fraxinus latifolia, as those stands will become both a source of food as well as a highway for the infestation to travel and spread even more quickly. The clear and oft-repeated theme from nearly all the speakers was: greater diversity in riparian areas and forested land -- mono-cultures like Ash forests and even-aged Doug-fir plantations will be doomed either through infestation or the warming climate. Trees such as native Black cottonwood (Populus trichocarpa), willows (Salix) and Red Alder (Alnus rubra) as well as Oregon White oak (Quercus garryana) even the Ponderosa Pine (Pinus ponderosa) can fill in the gaps, but not wholly replace the Ash in boggy or riparian areas when the catastrophic EAB infestation arrives.

Another theme expressed by all the guest speakers, experts in their fields, was that there is unambiguous evidence that climate change is causing both floral as well as faunal species to relocate in a northerly drift; species of trees from northern California and southern Oregon are poised to fill niches soon to be vacated by Willamette valley natives as they die-off or head north towards

Lee Peterman and dog, Trina, work in the meadow at Bogwood.

Washington and BC. One specific tree already well known in the Medford, OR. area is the Hinds Walnut (Juglans hindsii) which has adapted to and can be found in similar habitat as the Oregon Ash. In essence, Urban Foresters, Watershed council project managers as well as private landowners should seek such adapted and adaptable species to use in future reforestation areas.

Which leads us to today's
Word of the Moment:

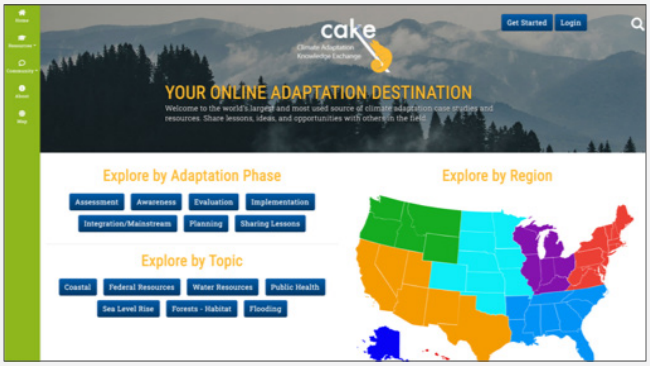
Adaptability
a·dapt·a·bil·i·ty
NOUN
Definition: the quality of being able to adjust to new conditions.

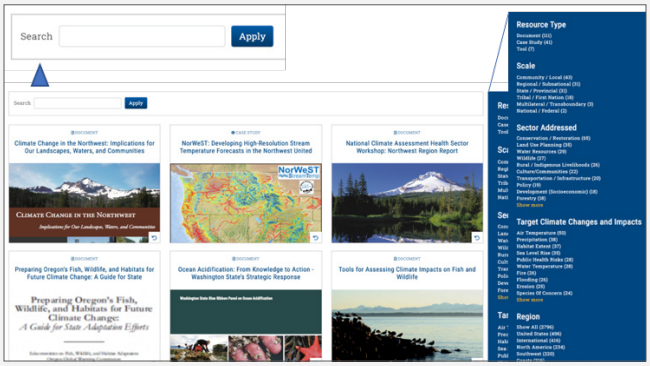
Now, more than ever, we as small woodland owners and managers need to be adaptable to the speed with which new data and the evidence of observable climatic changes are coming at us. Diversity of species is to be sought out and embraced, species which are both adapted to and are unperturbed by those climatic changes. The take-away I got from the EAB symposium and hope to leave you with is that some change is inevitable; the Emerald Ash Borer is on its way, nothing short of running out of Ash trees, literally, will stop it. The climate is changing, the empirical evidence is overwhelming. The challenge we face collectively is how we as private landowners and managers can be adaptable to these threats and make the necessary changes for us, our land and those who follow. Perhaps we can learn from the W. Valley Ponderosa pine; it can live in the foothills, as well as the valley floor -- it can withstand drought periods, as well as, having its roots underwater. I think this tree can teach us a bit about adaptability.

For additional info on the W. valley sub-species of P. pine and the Willamette Valley Ponderosa Pine Conservation Association, visit https://westernforestry.org/wvppca/

A parting thought:

"Perhaps the time has come to cease calling it the 'environmentalist' view, as though it were a lobbying effort outside the mainstream of human activity, and to start calling it the real-world view." — Edward O. Wilson





Online Resource: How to use Climate Adaptation Knowledge Exchange (CAKE)

Jessica Hitt, EcoAdapt

The Climate Adaptation Knowledge Exchange (CAKE) was launched in July 2010 and is managed by EcoAdapt. CAKE is a knowledge sharing platform featuring high-quality climate change adaptation case studies, tools, and resources spanning all phases of the adaptation process (assessment, planning, implementation, evaluation and monitoring).

CAKE is a platform where managers, planners, and the broader community can take more informed action through resources collected and submitted by their peers and reviewed and approved by experts.

Search for resources by filtering content using our keywords. You can filter by impact of concern, phase of adaptation, type of resource here or see image below.

Through on-the-ground case studies and other resources created by and for the adaptation community, CAKE users have the opportunity to share their own experiences as well as learn from others in the field. **Sign up**, help grow the field, and submit your own resources to the CAKE database!

If you need any additional technical support you can watch our **tutorial videos** or be in touch with us directly at **info@cakex.org**.

Working with People and Beaver to Restore Mid-Willamette Watersheds and Improve Climate Resiliency

An interview with Kathleen Westly, Education and Restoration Project Manager at the Marys River Watershed Council and Jean-Paul Zagarola, Senior Project Manager at the BEF Watersheds Program

What is the mission and purpose of the Mid-Willamette Beaver Partnership?

The Mid-Willamette Beaver Partnership (MWBP) is made up of seven core member entities and engages with a diversity of stakeholders. We want to tap into the huge potential of beaver based restoration to generate a cascade of ecosystem benefits (see more below). The MWBP was recently funded to conduct fine-scale habitat analysis across five Willamette subwatersheds to identify the best places to target beaver based restoration and/or conservation activities and to conduct in-depth stakeholder engagement to better understand concerns and address social barriers to promoting beavers across the landscape. The MWBP is promoting the implementation of beaver dam analogs, revegetation with plant species highly desired by beaver; non-lethal options for mitigating impacts of beaver; and beaver translocation as a final course of action when the conditions are perfect.

Our work is rooted in subwatersheds of the middle Willamette, however, we are working with others such as the Oregon Beaver Coalition to mainstream beaver based restoration and conservation across Oregon, the Beaver State. Beavers tend to move and the same behaviors that benefit ecosystems and society can negatively impact infrastructure, crop and timber production. Therefore, we aim to be strategic and deliberate in discovering where the opportunities lay to implement this work.

What are the major ecosystem benefits to beaver based restoration practices?

1. Improve fish and wildlife habitat for a variety of sensitive species especially salmon and steelhead by creating a rearing habitats in beaver dam ponds
   - Beaver habitats also greatly enhance bird and wildlife diversity (diversity hotspots), by providing habitat and abundant food resources
2. Increased water retention improves the quality and quantity of water resources:
   - Flooding recharges groundwater through hyporheic exchange
   - Raising the water table and increased stream complexity enhances plant diversity
   - Water quality improves because of cold sub-surface releases during warm summer months (benefit to aquatic organisms) and retention of fine sediment
3. Reduce downstream flooding and improve the water quality for communities downstream by attenuating high velocity flows that essentially slow moving water while recharging floodplains.
   - Stream channels remain connected to their floodplains rather than the streams incising
   - Improved sinuosity and habitat complexity of stream systems
   - Bedrock stays covered by bedload that is retained in the system rather than washed out; this provides spawning gravel retention and keeps the bedrock from becoming a solar sink when exposed
4. Improved climate adaptation and resilience of watershed ecosystems and human communities as a result of water retention and improved summer base flows

Core members of the MWBP:

MARYS RIVER WATERSHED COUNCIL

Luckiamute WATERSHED COUNCIL

Confederated Tribes of Grand Ronde

NORTH SANTIAM WATERSHED COUNCIL

South Santiam Watershed Council

CALAPOOIA WATERSHED COUNCIL

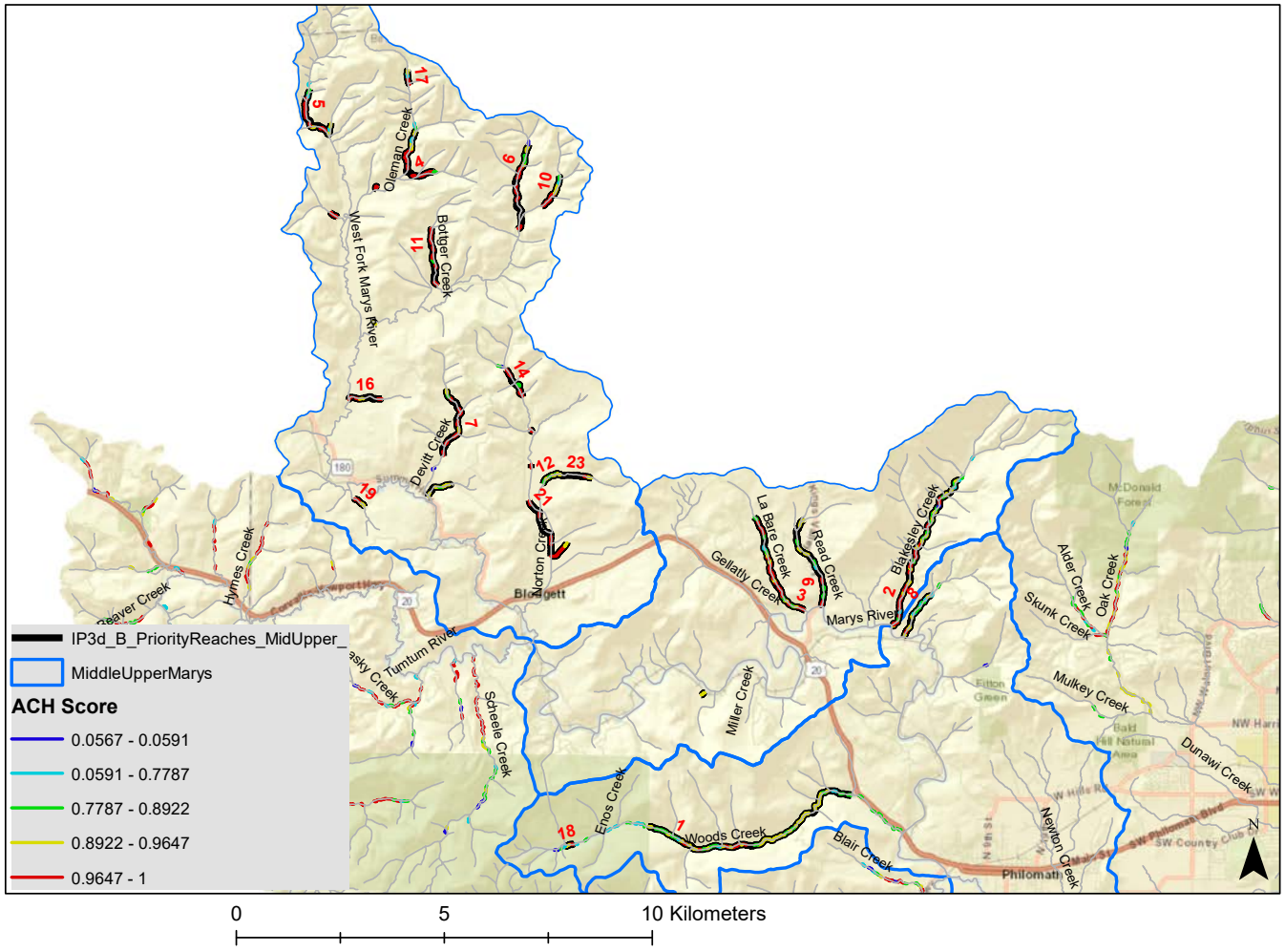
Education ★ Habitat Restoration ★ Community

bef

How were the locations that the BDA's will be implemented selected? Please describe this process and all of the contributing factors (landowners, wildlife habitat, river/creek morphology, etc.).

MRWC had worked extensively in other headwater tributaries within the Meyer Memorial Trust-funded "Model Watershed Program". All of those tributaries had been assessed using the Rapid Bio-Assessment methodology which involved walking the extent of the stream, snorkel surveys of salmonids and full limiting factors analysis. We had originally scoped our assessment of the Upper and Middle Marys sub-watersheds to follow a similar protocol, but elected to use TerrainWorks LiDAR-based NetMap model instead. Working with J.P. Zagarola of BEF, the partnership refined the model using a combination of cutthroat trout and beaver intrinsic potential attributes. Modeling identified and ranked key tributaries in which to focus our ground verification efforts. MRWC then contacted the landowners to obtain access permission to survey these streams; Kathleen Westly and consulting fish biologist Steve Trask surveyed the 11 top-ranked streams. **Of these 11 streams, MRWC selected four with the highest potential for beaver-centric restoration, based on the historical legacy of beaver dams, forage and construction material available or possible to establish, anchor habitat criteria for cutthroat trout and of course - and critically important, willing landowners.** Westly and Trask worked to develop project designs, recruit landowners and secure funding. One of those streams, Devitt Creek, will be the site of 2021 BDA installations. All landowners in a .9 mile reach from the confluence with the Marys River are participating in the project, with fish passage barrier mitigations and/or BDA installations. All are supportive of encouraging beaver and beaver dam building activities, and exhibit a historical legacy of beaver dam presence. Project activities will:

- Place vertical posts across the floodplain (2' on-center) by an excavator (3 sites). Hand install using a backpack post pounder to keep equipment out of a functional interactive floodplain (1 site).
- Posts provide a platform for beaver to build upon and will be woven with Douglas fir boughs or willow to provide floodplain linkage even if not colonized by beaver.



Map of the Mid Upper Marys River demonstrating the anchor habitat research and modeling to select the sites for BDA installation.

Are there any human or institutional barriers that stand in the way of installing more BDA's?

While some landowners believe that beaver dams negatively impact water quality and act as a barrier for migrating fish, overwhelming research shows that the opposite is usually true. Beaver typically improve water quality and are a boon for migratory fish. Concerns about conflicts such as flooding or vegetation browse are often raised by landowners and infrastructure managers. Thus stakeholder engagement is essential to gaining a more complete understanding of what the social barriers are to promoting beaver so that we can address those barriers and identify opportunities for beaver based restoration.

Education is key to helping people to understand the critical role that beavers have played in the health and function of stream systems and the loss that their reduced numbers and reduced dam building has meant for salmonid populations and other aquatic organisms. It is also important to concurrently educate on the importance of persistent large woody debris in the stream as a foundation upon which beavers can build dams. Because of historical logging conducted in stream corridors by settlers, large conifer contributions to stream systems have been limited in the past 100 years. This, combined with pressure from development, nearby infrastructure and agriculture practices has caused streams to become disconnected from their floodplains, simplified,straightened and incised, sometimes cutting down to bedrock. These conditions make winter stable beaver dam persistence much more difficult to achieve.

We are fortunate in Benton County to have a novel approach in the Agriculture and Wildlife Protection Program, which provides funding support to landowners to implement non-lethal means of coexisting with beavers. It helps to cover the costs of installing things like "beaver deceivers" (flow device that prevents blockage of culverts), pond levelers that allow flooding only to a specified extent, and tree protection that prevents beavers from eating prized trees or crops.

Constructed BDA with vegetation weave

Permitting is required for the installation of BDAs, through the Oregon Department of Fish and Wildlife. This permitting process is designed to avoid creating fish passage barriers. While relatively new in ODFW's fish passage permitting, best management practices and protocols for permitting are now in place.

Are there any ecological/ natural barriers that stand in the way of the implementation of BDA's?

As indicated above, lack of large wood in the streams is a critical factor in beavers' ability to build dams, and especially for them to persist through high winter flows. Equally critical is available forage and construction material. Many legacy beaver flats have been colonized by reed canary grass, choking out native vegetation. In some cases, the first approach is to establish these species in the floodplain terraces and riparian corridors prior to the installation of BDAs or PALS (post-assisted log structures). If the geomorphological conditions are right vegetation management may be the only activity needed to encourage beavers to build dams. In some cases, streams have been abandoned by beavers because of these factors; the best scenario is to make the conditions such that beavers return to these systems. Relocation of beaver is currently seen as a less preferable means of colonizing habitat.

Pre-commercial thinned logs for BDA construction

Inundation behind recently constructed BDA

How do BDA's help address the issues that climate change has posed to floodplain environments?

BDAs provide important floodplain linkage. Even if not colonized by beavers, the posts and vegetative weave (usually willow or fir boughs) retain water on the floodplain during winter flow regimes. This inundation of the floodplain provides low velocity rearing habitat for salmonids, enhances the proliferation of "Stage 0" channel forms (multiple channels and a high frequency of lateral connectivity) and recharges groundwater for slow hyporheic release during the warm summer months (providing a source of cold water to the system longer, improving water quality).

In the Marys River watershed, retention of water higher in the system for longer in the year addresses the top salmonid limiting factor: elevated summer stream temperatures. Increased riparian water table keeps vegetation alive and green during the dry months, helping to mitigate drought conditions and wildfire impacts along stream corridors. Increased floodplain linkage and retention of water higher in the system during high winter flow regimes reduces flood impacts downstream. In forests impacted by high intensity wildfire, beaver complexes can provide refuge for plants and animals during and after the fire, provide a seed source to regenerate the plant community in the surrounding scorched forest and where there are very large beaver ponds, even act as a firebreak aiding in reducing the severity of the fire.

How does the implementation of BDA's in floodplain environments work in tandem or complement the work of the assisted migration of woody plants and shrubs in the Pacific Northwest?

As indicated above, elevating the water table by retaining water in the riparian corridor for longer enables plants to establish and thrive more easily, mitigating drought conditions. It's another form of climate adaptation and a way of creating climate resilience. By increasing the "wettedness" of forests, beaver habitats or mimicked beaver habitats (created via beaver based restoration) allow some species to exist and for plants to take refuge in these areas. If we have networks of these beaver ponds across the landscape, we can help prevent the extinction of vulnerable species while providing a lot of the ecosystem services we hope to retain through assisted migration.

Floodplain Restoration Efforts for the Grand Ronde in the North Santiam and Beyond

Lindsay McClary, Restoration Ecologist/ Fish & Wildlife Policy Analyst at The Confederated Tribes of Grand Ronde

Since time immemorial, the bands and tribes that comprise the Confederated Tribes of Grand Ronde (Tribe) have been the historical caretakers of the Willamette Valley. The native plants and animals are intrinsic resources to the Tribe as they form the foundation to traditions and values. The North Santiam River (River) located along the east side of the Valley holds significant historical and cultural importance, once being the home of the Santiam band of the Kalapuya. Most noted for their indigenous burning of the Valley landscapes, the Kalapuya have deep connections to place along the North Santiam River and its salmon resources. Historically, these riparian habitats were complex and diverse. Broad floodplain forests were vital, hosting an overstory dominated by native hardwoods and an understory dominated by native shrubs. These floodplain forests provided high-quality and highly-valued habitat for several species. Large and small deciduous trees provided nesting, cover, and feeding opportunities for wildlife. Large tracts of forests provided for natural water storage capacity, increasing water availability during the summer along with areas of cold water refuges and cold water sources that benefited native fish. The open, low gradients fostered multi-channeled, densely braided, and dynamic side-channel, back-channel and off-channel habitats often inundated by natural River flows.

Arrival of European settlers to the Willamette Valley began in the 1840s and led to profound impacts on the North Santiam River and its tributaries. The settler population by the 1850s had only established 10 households and 3 mills, but there was a growing demand for agricultural land. A General Land Office (GLO) map from 1854 documents that agricultural development was quickly underway. This demand contributed to rapid deforestation and significant changes to the River and its floodplains. Conversion of floodplain forest to agricultural landscapes substantially reduced existing habitat, but the combination of this action with the development of in-River construction projects led to devastating impacts on natural River processes. Two major hydrosystem projects, Detroit Dam and Big Cliff Dam (Dams), were constructed in 1953 at river mile 47 for generating hydropower. The Dams are used for flood control and have significant influence on downstream flows, effectively eliminating the natural, dynamic hydrological processes of the River and associated floodplain forests. Further, revetment structures were built to protect towns, farms, industrial, and residential development within the floodplain from natural River flows and flooding. These actions had unintended consequences. By taming and channelizing the River with these structures and converting floodplain forests to agricultural landscapes, natural River capacity for sustaining the complex habitats necessary to support juvenile salmon, steelhead, Pacific lamprey, and Oregon chub was reduced.

Along the North Santiam River, the Tribe re-acquired the Chahalpam Wildlife Area in phases during 2013 – 2019 through the Willamette Wildlife Mitigation Program (WWMP). This program is funded by Bonneville Power Administration (BPA) and administered by Oregon Department of Fish and Wildlife (ODFW) to acquire property for

Plant establishment efforts on Chahalpam conducted by J Franco Reforestation (photo by Miguel Franco February 25, 2021)

conservation in an effort to mitigate hydrosystem impacts. Chahalpam, located below the Dams near Stayton, Oregon totals 462 acres; portions of floodplain forests cross both banks of the River and the property encompasses more than a mile of river frontage. Chahalpam is permanently protected by three conservation easements and is located within the boundaries of two designated Conservation Opportunity Areas (COA): the Willamette Sub-basin Plan's Conservation Priority Area titled the Willamette Synthesis COA and ODFW's Oregon Conservation Strategy titled the Santiam Confluences COA. The Strategy identifies the COA as a focal area for extensive habitat conservation and restoration for off-channel, flowing water, floodplain, and riparian areas. Oregon chub is highlighted as one of the key strategy species and off-channel habitat is highlighted as a specialized local environment. Recommended actions include enhancing wetlands and ponds to support western pond turtle; enhancing in-channel function and connection to improve flow and hydrology; and restoring riparian ecological function to ensure sufficient habitat complexity.

As documented by the GLO, Chahalpam once hosted closed-canopy riparian floodplain forest and wetland habitats. Frequent River inundations created several back-channel and off-channel habitats critical to native species including cold water fish, rearing salmonids, and lamprey. An aerial photo from 1936 indicates approximately 90% of Chahalpam was still in floodplain forest or intact native habitat. But in 1944, a private landowner acquired Chahalpam and primarily used it for farming and residential development. By 1955, the floodplain forest was reduced to 67% and by 1968 a majority of the property had been converted to agricultural production. Agricultural expansion continued until 2013 and production on the property still occurs today. In the past 50 years, agricultural development on Chahalpam has reduced the capacity of the native floodplain forest, limiting the quantity and quality of available habitat. Private lands adjacent to Chahalpam are also managed for agricultural production, compounding this issue within the lower North Santiam River.

Upon re-acquisition, 195 acres of Chahalpam were still in agricultural production and actively managed through a contracted agreement. The Tribe desires to restore native habitats to the extent possible and developed a management plan to help guide and support these efforts. Primary goals include restoring floodplain connectivity by reconnecting River flows to historic channels, restoring floodplain function by increasing native plant species while reducing invasive species, and increasing riparian habitat through conversion of agricultural lands back to floodplain forests. To-date, the Tribe has converted 44 acres back to floodplain forest utilizing the Rapid Riparian Revegetation (R3) methodology. This approach promotes rapid cover of woody plants to accelerate the development of a diverse, multi-layered healthy forest. The Tribe planted trees and shrubs at a high density using a 3:1 shrub to tree ratio with an average of 2,200 stems per acre in a uniformed row design. Species included Oregon ash, red alder, black cottonwood, big leaf maple, western red cedar, snowberry, vine maple, hazel, mock orange, ninebark, red osier dogwood, Indian plum, and thimbleberry. The Tribe has an agricultural phase out plan and will continue efforts until all acres have been converted back to native habitat. Grants and partnerships with entities such as Bonneville Environmental Foundation contribute to habitat restoration at a landscape level, support project costs, leverage funds, and stretch dollars to be the most effective with limited resources.

(Top) Plant establishment efforts conducted on Chahalpam by J Franco Reforestation to return agricultural land back to riparian hardwood forest (photo by Miguel Franco February 25, 2021)

(Bottom) Indian plum planted at Chahalpam in February 2021 to convert agricultural land back to floodplain forest (photo by Lindsay McClary March 23, 2021)

Mass Timber and Innovative Wood Products

An interview with Lauren Redmore, Project Manager at Sierra Institute for Community and Environment

Mass timber is a technology and a building material. The phrase “mass timber” is originally derived from the German word “Massivholz.” The technology of mass timber is inspired by the widely used practice of heavy timber, or the process of making a log fit the specific shapes and needs of a building under construction. This practice popularized because it utilizes wide, thick and structurally sound materials to customize to the needs of a building. Heavy timber relies on the logging of large trees, but mass timber on the other hand was Europe’s response to the decreasing availability of large trees and the need to be more efficient with resources.

The first versions of mass timber utilized nail laminated techniques, and many buildings with nail laminated timber are still in use over a hundred years later. Mass timber can use lower grade lumber conjoined with other lower grade lumber to create thick, strong and structurally solid wooden building materials. Because of this possibility, mass timber offers us the opportunity to replace demand for high quality lumber with a market for lower value material, representing an important contribution towards a restoration economy.

Following the Great Chicago Fire in 1871, there was a pushback against the use of wood in taller buildings in the U.S., because of concerns for fire safety. Now that we have adapted a plethora of technologies to deal with fire threats (i.e. sprinkler systems) the question re-emerges: **why can’t we start using wood again?** Starting in the 1970s, mass timber technologies were developed and widely adopted in Europe. In more recent years, the technology has gained momentum in the U.S. There is adequate and unparalleled evidence that using wood is more sustainable, that it is a renewable source of material, and that it is more aesthetically pleasing within buildings.

We now have the ability to create mass timber panels that are 20 feet tall and beyond. It can be used in 18-story buildings per the new International Building Codes, and it is seismically sound and fire resistant. Mass timber is more fire-resistant than traditional wood framing, because the panels are a single piece, therefore they will char on the outside, but not catch fire as quickly as smaller pieces of wood. They are easy to manufacture to strict seismic codes and earthquake prone areas because wood is flexible and can remediate tensional stress more effectively. Additionally, a major benefit of reverting to mass timber technology is increased happiness. When inside of a building with visible wood, there are positive psychological impacts to the human brain, such as increased

Lauren Redmore

Project Manager at Sierra Institute for Community and Environment

Lauren Redmore, Ph.D., is a project manager at the Sierra Institute for Community and Environment where her work focuses on supporting rural economic development through forest management. Lauren is interested in human-environment interactions, and spent 11 years working in Africa on issues of rural development, natural resource management, and community-based conservation. Before becoming a Peace Corps volunteer in Cameroon, Lauren completed her masters at Oregon State University where she studied the Women Owning Woodlands Network, an extension program by and for women forest landowners and managers. Lauren advocates for the centering of natural resource management around the rights of local and indigenous communities.

productivity in work environments, a sense of biophilia, and a more sensational connection to nature.

The dedicated interest in wood products is rampant across the US, but especially on the West Coast. Many builders in California, Oregon and Washington have adopted the mindset that not all wood products are created the same, and that in order to move towards sustainability, the use of mass timber must increase. Currently, California imports almost 70% of all wood products. When thinning occurs throughout the state, acres of wood are burned and regarded as biowaste. Instead, it is time for places to take charge of their own wood use. Those piles of burned low-grade trees could actually be implemented into really high valuable building materials using the techniques of mass timber. Mass timber represents a unique opportunity to add a lot of value to forest restoration material. We are starting to see the early stages of this critical work in action.

Colorado based company, **Timber Age**, is taking advantage of the opportunity that mass timber represents. Timber Age is using fuels reduction harvested timber from wildfire mitigation projects around the wildland urban interface in southwestern Colorado to produce Cross-Laminated Timber (CLT). CLT is made by gluing boards together in alternating layers at right angles to one another to create strong and sturdy building materials. Mass timber adds value to a material that would have struggled to find its place in the market, while simultaneously addressing some of climate change's biggest threats.

Wildfires, insect damage, and overgrowth allow forests to become a source of carbon emissions, rather than a sequestration of carbon as trees are fundamentally meant to do. Mass timber is an invitation to rethink the way carbon is accounted for in the forest industry. By deploying mass timber technology and materials, there is a full story of how building materials arrive on to a construction site, while also a sustainable and renewable approach to utilizing trees that would normally be blazed in a fire. Timber also doesn't release carbon when it's harvested, instead sequestering the gas inside lumber. The work that forest agencies, local governments, landowners, and stewards do to thin forests in preparation for fires have potential for reimagination with a mass timber approach - simply put - let's use the wood instead of waste it.

Nestled into a mountain valley of the North Cascades, the town of Darrington in Snohomish County, Washington has put this reimagination to the test. Darrington Mayor, Dan Rankin, is in the process of converting a 94-acre wooded lot into a timber innovation center. The center would focus on mass timber technology and production, creating over 100 jobs and promoting the educational and conservation efforts of mass timber. Rankin hopes to revitalize the timber economy in his rural town while creating awareness for this vital step towards a sustainable future. By sending the mass timber to urban cities around Washington for buildings, Rankin has identified a new niche, a "farm to table timber approach" to help shorten the divide between urban development and rural products. Mass timber is just another strong opportunity to bring the forest to the city. To learn more about the Darrington Timber innovation center, **read this article in the Daily Herald by Julia-Grace Sanders**.

In order to effectively create an industry for mass timber that will bring the forest to the city, there needs to be better alignment between economy, policy and action. Reinvestment is a critical step. There are 5 ways that reinvestment of resources could promote mass timber.

Wildfires spread easily through dense, unhealthy forests

1. Reinvest in educational models. In higher education, the field of "Wood Products Science" is not attracting young, innovative minds. There should be a greater shift to climate change language and a reimagination of this field. What about "Sustainable Natural Resources"?
2. Create high value and intentional forest sector jobs. Timber jobs are usually seen as low paid, desolate, and physically demanding. Mass timber requires distinct models for training people to do the work that is highly skilled and tactful while also maintaining a higher quality of life and fair pay.
3. Move from reactive to proactive forest management. Fighting wildfires is now a common necessity. Mass timber provides an opportunity for thinning the forests and science informed forest management to happen preemptively to wildfires and potentially decrease the devastating outcomes.
4. Reinvest in local collaborative efforts. There needs to be more incentives from state and federal agencies to allow companies, communities and individuals to experiment with moving ideas to products. Folks need to be empowered to innovate, and one important way to do that is create monetary incentives for this experimentation (i.e. US Forest Service Wood Innovation Grants, California XPrize).
5. Allow people the opportunity to experience what it feels like to walk into a mass timber building. When the government commits to building with mass timber, the general public will be able to experience biophilia for themselves. The simplest way to get people on board with mass timber is to give them the opportunity to touch and see a mass timber building.

Just as governments play critical roles to support the development of the mass timber industry, the forest sector itself can be an important part of the climate solution. With policy change, research, education, awareness, and investment this is possible. In addition to big agencies, local tribes, watershed councils, environmental NGOs, etc. also have a duty to help this sustainable, renewable and promising industry. If these groups have room for innovation, even on smaller budgets, there is a cost-effective tool to reimagine the use of wood products in buildings however small. **It is time that we all engage in this fundamental shift in how we think about the role of forest products as sustainable solutions. Mass timber gives us the opportunity to adapt to a changing climate by pushing the boundaries of forest management, science, and building and construction methods.**

For additional information and resources on mass timber, please visit WoodWorks.org

To locate the nearest mass timber building near you, visit https://www.woodworksinnovationnetwork.org/projects/

A modern sawmill can process much smaller trees more efficiently than ever before

CLT wall and roof panel being hoisted into place at California's first all CLT building in Quincy, CA

Treeline Webinar Series Presents

Unpacking Assisted Migration — Definitions and Ethics

When: Thursday, July 1, 2020 from 12:30-2:30 PT

What: A two hour online event featuring presentations from experts in the field of assisted migration, followed by a roundtable discussion on the ethics of its application.

Hour one will feature four 10-minute presentations:

1. Seed migration: seed sources are moved climatically or geographically within their current ranges. (Example: collecting seed from droughty or flood-prone sites for propagation and out-planting at different site, but within the same seed zone)
   - Brenda Clifton, Skagit River System Cooperative
2. Range Expansion: seed sources or plant materials are moved to suitable areas just outside of ranges. (Example: planting California black oak north of Lane County, and still within Oregon's Willamette Valley)
   - Dan Hintz, Mountains to Sound Greenway
3. Assisted species migration: species are moved far outside current ranges to prevent extinction, or to serve as a surrogate for another species in decline due to climate change (Example: planting incense cedar from central Oregon)
   - Scott Kolpak, Forest Service SW Oregon Geneticist
4. Climate change genetics: implicit assumptions in moving seed to mitigate for climate effects
   - Dr. Deborah Rogers, Center for Natural Lands Management

Working definitions adapted from Williams & Dumroese (2014)

Hour two brings together an eclectic panel to discuss the ethics and potential skepticism of applying assisted migration methods in restoration. Featuring:

- Marc Gauthier - Upper Columbia United Tribes
- Dr. Deborah Rogers, Center for Natural Lands Management
- Dave Shaw, Professor; Forest Health Specialist, Forestry and Natural Resources OSU
- Dr. Clare Palmer - Professor of philosophy at Texas A&M University

Register for event for free on eventbrite:
https://www.eventbrite.com/e/unpacking-assisted-migration-definitions-and-ethics-tickets-157661300193

Missed the first two Treeline webinars?

Tune into the recordings and check out the resources below.

Assisted migration brings risks of introduced Phytophthoras in native ecosystems

Small-scale restoration nurseries are potential pathways for the introduction of Phytophthora species into native ecosystems. These pathogens can cause root disease and foliar blight on many host plants and are able to spread in water. Due to difficulties of disease detection, nursery stock planted in restoration sites may be unknowingly infected with Phytophthoras. Current best management and cultural practices are available to help prevent and detect infestations in nurseries. This talk provides information on Phytophthora and provides an overview on what small-scale restoration nurseries can do to minimize risk of spreading potential harmful pathogens into wildlands.

https://www.youtube.com/watch?v=p_0zR5FgrYQ

A follow up from the researchers:

It's really important for small-scale nursery and restoration practitioners to follow the best management practices (BMPs) to keep pathogens, like Phytophthoras, from spreading in nursery and restoration sites. Some highlights from the upcoming extension publication include:

Preventing pathogens from entering the nursery or being inadvertently spread in a nursery.

Implementing a monitoring program and being alert for symptoms like wilting, foliar blight, shoot dieback, stem lesions, absence of fine roots, decayed root or root collar (for comparison, know what a healthy plant looks like).

Restoration practitioners should purchase plants from nurseries that implement best management practices and then avoid contaminating clean nursery stock during transportation or at intermediate storage sites.

At the restoration site, implement sanitization measures for tools and footwear. This includes cleaning any dirt or debris off footwear using a brush and spraying footwear with Lysol and cleaning tools with isopropyl alcohol.

Reflections on Climate Change and Floodplain Priorities of the Stillaguamish Tribe

Jason Griffith, Fisheries Biologist, Stillaguamish Tribe

1. From what we are already seeing, climate change is affecting the Stillaguamish in two main ways: warmer temperatures and more variable weather (higher high flows, lower low flows). The literature is pretty clear that when natural floodplain processes (channel migration, beaver, log jams, riparian forests, etc.) are allowed to function like they did historically, the habitats used by fish are more resilient in the face of a changing climate. And so we are aiming to acquire a corridor of lands from the spawning grounds to tidewater where we can remove infrastructure (roads, houses, levees, bank armoring, etc.) while protecting and restoring the ingredients that make for resilient habitat. To date we've acquired about 1000 acres in the floodplain, but the aim is to acquire at least 6000 more. These lands are deed restricted (no development allowed), meaning that the habitats we are restoring will be allowed to mature for the hundreds of years it takes a tree to reach old growth status. To put things in perspective, this will take more time than America has existed as a nation!
2. The Stillaguamish has had a trend of increasing peak flows and warming water for decades, so we have long known that the climate is changing here. We have always had that perspective in our minds when we have been scoping and implementing floodplain projects. I would say that we haven't changed things radically in the 20 years I have worked here. But the pace of implementation is accelerating as we are more successful with securing grant funds.
3. I am most encouraged/excited to see the Tribe linking properties in the floodplain and watching the corridor of protected lands take shape. The Tribe embarked on this effort only about a decade ago (2009), but have already protected over 1000 acres. The pace is picking up and there are some exciting opportunities to more than double the acreage in the next 5-10 years. Because these lands are deed restricted, I look forward to seeing the trees grow on these parcels for as many days as I have left to live. Especially the trees I've planted with my own hands!

Western Redcedar: Cultural and Ecological Reflections, Dieback Concerns and Community Science

This webinar was hosted live on zoom on April 20, 2021 12:30 PM PT

Western redcedar (Thuja plicata) is an iconic PNW tree species with tremendous importance. Observations of widespread dieback in recent years has elevated community concern over this cultural keystone species. This talk provides information about cultural and ecological dimensions and how community science is being leveraged to better document and understand dieback.

https://www.youtube.com/watch?v=FrGBTo7HBnk

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This bimonthly newsletter compiles stories from people working to sustain watersheds in the PNW. 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 work is supported by a Coordination and Collaboration grant from the Climate Resilience Fund