

# **Center for Forest Nursery and Seedling Research 2020 Annual Report**

**College of Natural Resources  
University of Idaho**



## About CFNSR

The Center for Forest Nursery and Seedling Research (CFNSR) began in 2002 to address the research, outreach, and educational needs of tree and restoration seedlings in Idaho and the Inland Northwest. The CFNSR manages the Franklin H. Pitkin Forest Nursery, which is the state nursery of Idaho and produces 400,000 seedlings per annum for reforestation and ecosystem and wildlife habitat restoration projects across the region. Proceeds from seedling sales are invested into fulfilling our land-grant mission focused on seedlings. The CFNSR is administered through the College of Natural Resources at the University of Idaho.



*Conifer seedlings at the Franklin H. Pitkin Forest Nursery*

## Executive Summary

The following year was an exciting time for the Center for Forest Nursery and Seedling Research (CFNSR). We continued to provide students with hands-on experience growing an operational seedling crop and expanding our research program even as we navigated the COVID-19 pandemic. We secured \$371,325 in external grant funding bringing the total of active grant funding to \$1,538,383 for research, student training, and extension. This equates to \$4 in external funding for every \$1 in internal funding generated from seedling sales. These funds were used to address seedling questions that align with nursery and reforestation priorities in Idaho and the greater Northwest.

The CFNSR published six papers in peer-reviewed journals ranging in topics from interacting factors influencing tree seedling survival and growth across northern Idaho to long-term effects of site preparation on tree growth.

Prior to the pandemic, the CFNSR was on track to have a record year of engagement with the public. We were able to provide three in-person nursery tours to different stakeholders and school groups and one virtual tour for a forestry class. Even though we were closed to the public, we still provided information to 1,791 stakeholders on seedlings and planting through handouts and phone conversations.

The Franklin H. Pitkin Forest Nursery, the operational nursery that helps us meet our education, research, and outreach mission, sold 351,406 seedlings to 1,295 customers for reforestation and restoration needs across the region. We also sowed 387,918 seedlings for the 2021 spring planting season. To help grow the seedlings, 42 students were hired and trained.

The CFNSR added three new staff members and two new graduate students in 2020. Austin Davis was hired as the Nursery Production Associate and Ehren Moler and Cen Chen were hired as postdoctoral scientists. Emily Behrens, a previous undergraduate employee began her M.S. program and Alex Hoffman started as a Ph.D. student. Two graduate students completed their degrees. Dr. Meghan Foard completed her Ph.D. and Brooke Durnin completed her M.S.

The Pitkin Nursery Advisory Committee met twice in 2020 to elect new members for vacant seats, discuss regional regeneration issues, and engage with leadership of the College of Natural Resources.

We are very much looking forward to the future and fulfilling our mission as the preeminent seedling nursery program in the Northwest.

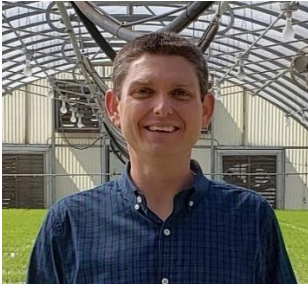
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## CFNSR Personnel

### *Staff*



**Andrew S. Nelson**

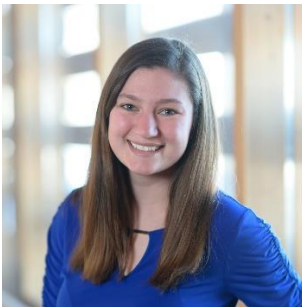
Director

Tom A. Alberg & Judith Beck Endowed Chair of Native  
Plant Regeneration



**Don Regan**

Manager



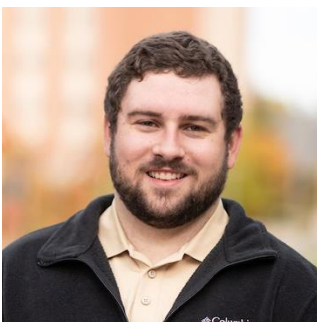
**Lauren King**

Nursery Sales & Outreach Coordinator



**Lori Mackey**

Special Projects Coordinator

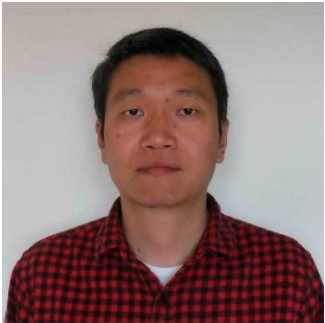


**Austin Davis**

Nursery Production Associate

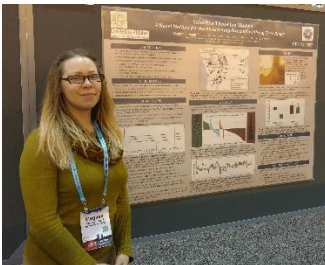


**Ehren Moler**  
Postdoctoral Scientist



**Cen Chen**  
Postdoctoral Scientist

***Graduate Students***



**Meghan Foard**  
Ph.D. completed spring 2020  
Current Employer: Nez Perce Tribe Water Quality Program



**Brooke Durnin**  
M.S. completed spring 2020  
Current Employer: American Forest Management



**Emily Behrens**  
M.S. started fall 2020



**Alexander Hoffman**  
Ph.D. started fall 2020  
Current Employer: Weyerhaeuser Company



**Mary James**  
M.S. student (Ongoing)  
Current Employer: Nez Perce National Historic Park



**Lauren King**  
M.S. student (Ongoing)  
Current Employer: University of Idaho



**Thomas McDonough**  
M.S. student (Ongoing)  
Current Employer: University of Idaho



**Joshua Mullane**  
M.S. student (Ongoing)



## ***Undergraduate Employees***

### *Spring 2020*

Amelia Anderson  
Michael Atkinson  
Connor Augspurgen  
Kennedy Beach  
Emily Behrens  
Devin Bruegeman  
Andrew Davies  
Shawn Forbes  
Nolan Frampton  
Brock Garrity  
Matthan Hale  
Nate Hess  
Mariah Hilliard  
Mary James  
Rylee Jensen  
Tyler Johnson  
Aaron Johnston  
Danielle Larson  
Max Levy  
Keira Terchowicz  
Amanda Puype  
Madison Walker  
Ryan Weaver  
Cody Wiedmeier  
Samantha Wittell

### *Summer 2020*

Amelia Anderson  
Saffron Brooks  
Matthan Hale  
Mariah Hilliard  
Abby Myklebust  
Ilya Panek  
Jeremiah Wheeler

### *Fall 2020*

Cameron Birch  
Justin Bruns  
Libby Campos  
Rylee Carolus  
Jennifer Coats  
Andrew Davies  
Sean Forbes  
Gracie Foutch  
Michael Gilgunn  
Matthan Hale  
Mariah Hilliard  
Brock Keller  
Danielle Larson  
Paige Martin  
Ilya Panek  
Izobel Schmidt  
Jarod Serre  
Ashleigh Vale  
Josephine  
Walterskirchen

## Pitkin Nursery Advisory Committee

Stakeholder Group	Representative person	Representative organization	Email Address
Small Private Forest Seedling Producer	<b>Gabe French (Chair)</b>	Idaho Evergreens, LLC	gabe15@me.com
Idaho Nursery and Landscape Association	Denny Dawes	Wildlife Habitat Nursery	wild@potlatch.com
Kootenai Valley Nursery Exchange	Lon or Kevin Merrifield; Cristina Tuttle	Clifty View Nursery	ftrees@cliftyview.com kevinm@cliftyview.com; cristinat@cliftyview.com
USDA Forest Service Nursery Producer	Aram Eramian	USDA Forest Service Coeur d'Alene Nursery	aeramian@fs.fed.us
Large Private Forest Seedling Producer	Jan Schaefer; Sally Konen	Western Forest Systems	schaeferjk@cablene.net sally.konen@cablone.net
Native Plant Seedling Producer	Kathy Hutton	Plants of the Wild	kathy@plantsofthewild.com
Tribal Representation	Jeremy Pinto	USDA Forest Service	jpinto@fs.fed.us
Private Reforestation Contractors	Matt Engberg	Northwest Management	engberg@consulting-foresters.com
Industrial Forest Landowners	Abbie Acuff	PotlatchDeltic Corp	abbie.acuff@potlatchdeltic.com
Idaho Department of Lands	Julie Donohoe; Tyler Nelson	Idaho Department of Lands	jdonohoe@idl.idaho.gov tnelson@idl.idaho.gov
Family Forest Landowners	Robert Reggear	Reggear Tree Farms	rtf@cpcinternet.com
USDA Forest Service Research	Kas Dumroese	USDA Forest Service	k dumroese@fs.fed.us
Christmas tree producers	John Myhre	Inland Empire Christmas Tree Association	rustygatetreefarm@gmail.com
Cooperative Extension	Randy Brooks	UI College of Natural Resources	rbrooks@uidaho.edu
Government/other entities that provide technical and financial assistance to NIPF landowners	Chris Town	NRCS	christopher.town@usda.gov
Forest Industry Nurseries		<b>OPEN</b>	

## Research Projects

### *Drought Conditioning Effects on Seedling Roots and Physiology*

Ehren Moler, Andrew Nelson, Douglass Jacobs, Andrei Toca, Carlos Gonzalez-Benecke

**Abstract:** Planting seedlings is the first step to reforest recently disturbed sites, yet seedling performance can be poor if seedlings do not quickly acclimate with the planting site. One frontier in forestry is identifying tree seedling phenotypes that maximize seedling survival and early growth. Projects examining root system architecture (RSA) are limited for tree seedlings even though extensive research in agriculture shows its importance for maximizing productivity by optimizing resource capture. RSA can be manipulated in the nursery by modifying growing regimes that may affect the RSA following planting, such as drought conditioning. This project is in collaboration with Purdue University and Oregon State University where we are examining the effects of different intensities of drought conditioning across various seed provenances of western larch, black walnut, and coastal Douglas-fir. Specifically, we are examining the effects of the treatments on RSA, seedling physiology, and stem and root cellular anatomy. Seedlings will be outplanted in each U.S. region to examine performance. Results will improve nursery practices and identify root, physiological, and anatomical traits important for seedling drought resistance. This project is funded through USDA National Institute of Food and Agriculture, Agriculture and Food Research Initiative and National Science Foundation.



**Western larch drought conditioning treatments. Each flag color represents a different seed provenance. Seedlings are ordered extreme, moderate, and no conditioning from front to back of the picture.**

**Project Updates:** The nursery treatments were imposed on the seedlings starting in spring 2020. The western larch and Douglas-fir experiments were conducted at the Pitkin Nursery, while the black walnut experiment was conducted at Purdue University. Western larch and Douglas-fir seedlings were measured every two weeks for height and diameter. Every month, photosynthesis, plant moisture stress, and biomass allocation were measured. Stem and root hydraulics (i.e., water movement through a plant) were measured on seedlings by OSU.



# ***Assessing and Improving Conifer Seedling Preparation for Drought***

**Jessie Godfrey, Jeremiah Pinto, Andrew Nelson**

**Abstract:** Hot dry climates are a menace to seedling establishment for many species in naturally regenerating and restored forests alike. The limited mass of a seedling represents limited reserves of water, energy

(nonstructural carbohydrates, NSC), and nutrients. Smaller leaf surface area and root volume also represent limitations to a seedling's ability to acquire new resources and the only avenue for increasing resource acquisition is to invest reserves in the risky business of growth. With new climate normals promising to mark landscapes across the globe with

hotter dryer hot dry seasons, stand-replacing fires on the upswing in parallel, and mandates from governments across the world to plant (more) trees, it may be valuable to know if production treatments can improve seedling preparation for dry site conditions and so restoration success rates. However, there is still some debate in the literature about how best to quantify a seedling's preparation for drought.

The work on this project consists of a series of experiments using two species common to the intermountain west: Ponderosa pine and western redcedar. These species are phylogenetically distinct, representing both the Pinaceae and Cupressaceae plant families; they are also distinct in their growth habit—Ponderosa pine is determinate, setting a bud at the end of the season whereas western redcedar is indeterminate. They are also, potentially, physiologically distinct, representing divergent drought strategies. Ponderosa pine tends to shut down in response to drought, closing its stomata and stopping growth early on in the progression of soil drying. Species in the Cupressaceae tend to keep their stomata open and maintain growth until later in the progression of soil drying.

**Experiment 1 (Completed summer 2020):** To first address lingering methodological questions about how best to measure a seedling's preparation for drought, we completed a potted drought experiment. The overarching objective of this experiment is to relate the seasonal and diurnal dynamics of seedling hydraulics to seedling NSC concentrations (roots, wood, bark, needles) in response to drought. Seedlings for this project were produced operationally.



**Experiment #1. Potted ponderosa pine and western redcedar seedlings used to measure seedling preparation for drought.**

**Experiments 2 (Completed summer 2020) and 3:** Seedlings were produced with an attempt to modify their hydraulic and chemical (NSC) architecture in the first year of growth from seed for greater drought tolerance in the second year of growth following outplanting. Modifications to production practice include exposing seedlings to various levels of irrigation (well-watered to “dry”) for the duration of their nursery culture. The goal of the “dry” culturing is to direct energy away from growth and towards storage that might be used for early growth the following year and/or to direct anatomical developments towards morphological traits like narrower tracheids that might also generate drought-tolerance in the following season. A second set of treatments will revolve around cold storage. The objective of Experiment 3 is to quantify the loss of stored energy to respiration in cold storage over variable cold storage times and then observe the effects of higher NSC concentrations on establishment. Outplanting field trials are planned for summer 2021.

## ***Black Vine Weevil Root Herbivory on Huckleberry Seedlings***

**Emily Behrens, Andrew Nelson, Stephen Cook, Randall Brooks**

**Abstract:** Root herbivores are major horticultural pests often requiring chemical insecticides to control. Infected plants are disposed as they are deemed unacceptable for sale. In seedling crops, healthy roots are important for survival and growth following planting, although some root damage may be acceptable. We lack reliable tools to determine damage thresholds for field planted seedlings, especially those infected with black vine weevil (BVW) in nurseries. We also need better information on the biological control efficacy for BVW and



**Mountain huckleberry seedlings in the first year of propagation in Jiffy pellets. Seedlings will be transplanted to larger containers in the second year.**

potential residual control of native pests. This integrated research and extension project will improve understanding of plant responses to root herbivory by BVW, while comparing chemical and biological control options, and ensuring results are communicated to nursery growers and other end-users of nursery stock. We focus on huckleberry, a highly valued shrub species that is widely planted across the Northwest that has declined substantially over the last 50+ years. Our specific objectives include: (i) examine how BVW root damage influences seedling root physiology and growth, (ii) single and combined applications of chemical insecticides, azadirachtin, and a nematode on the control of BVW and residual control of rusty tussock moth, and (iii) broadly disseminate the results through multiple extension workshops and publications. Our approach to studying BVW effects on plants and control options will be done through experiments in the greenhouse, laboratory, and the field. End products will include a damage threshold to determine acceptable BVW infestation intensity. Results will improve integrated pest management programs that will benefit the horticultural industry and land managers. This project is funded through USDA National Institute of Food and Agriculture, Agriculture and Food Research Initiative.

**Project Updates:** This project started in June 2020. Huckleberry plants are currently being challenged with BVW in the lab to understand root herbivory behavior. M.S. student Emily Behrens will work on this project studying the effects of BVW root herbivory on seedling physiology and growth.



## ***Root Growth Potential***

**Andrew Nelson, Lori Mackey**

**Abstract:** The CFNSR has offered operation root growth potential testing in our Seedling Quality Lab since 2015. This service tests multiple seedlots of Inland and Coastal Northwest conifers per year for private landowners, state forest management agencies, and research projects. We use an aeroponic mist chamber system that sprays fine water droplet on roots to stimulate new root production. The count of new roots and the length of the longest new root is then measured after either 16 or 20 days, depending



**Conifer seedlings in the root growth potential aeroponic mist chambers in the CFNSR Seedling Quality Lab.**

on the species. In collaboration with some cooperators, we plant many of the Inland seedlots at field sites in northern Idaho and Northeast Oregon to evaluate outplanting performance on an annual basis. These field trials are monitored for three years for growth and survival. The data is then used to examine the correlation between RGP and outplanting performance across an array of site productivity classes in the region.

**Project Updates:** In 2020, we tested RGP for 74 Inland seedlots and 36 Coastal seedlots. The 74 Inland seedlots were only planted at two sites in northern Idaho; the third site in Northeast Oregon was not planted due to travel restrictions during the COVID-19 pandemic. The two sites that were planted were both near Moscow; one site was a low productivity site, and the other site was a high productivity site. Seedlings were measured shortly after planting and at the end of the growing season. We also remeasured the three outplanting sites planted in 2019 for second year growth and mortality, and two of outplanting sites planted in 2018 for third year growth and mortality. The 3<sup>rd</sup> year measurements were not measured for the 2018 planted site in Northeast Oregon because heavy snow in the late fall excluded vehicle access to the site. The outplanting data was compiled in a running database of all RGP lab and outplanting measurements and shared with cooperators.

## ***Cultural Alternatives to Manage Anthracnose Leaf Spot Disease***

**Andrew Nelson**

**Abstract:** Anthracnose leaf spot is a common horticultural problem in Idaho, especially for containerized shrubs grown in greenhouses. The host of fungi species that causes anthracnose are typically controlled using chemical fungicides and usually require repeated application. If not treated promptly, anthracnose can quickly spread across the crop and causes significant damage to plant health and potential for sale. Research in agriculture and ornamental horticulture shows that high moisture and high nitrogen fertilizer



**Antelope bitterbrush seedlings infected with anthracnose leaf spot at the Pitkin Nursery.**

can increase plant susceptibility to anthracnose but modifying common growing regimes in Idaho nurseries has not been well explored. If watering or fertilization regimes could be modified to reduce disease severity, costs to apply fungicides will be reduced and contribute to integrated pest management programs. This project will perform two experiment, one testing different soil moisture regimes and watering methods, and the second testing different fertilizer regimes. The research will be conducted at the Pitkin Nursery and undergraduate interns will be responsible for implementing the treatments and monitoring disease severity under the supervision of nursery staff. The experiments are designed to test modifications to operational growing regimes that can easily be implemented by nurseries in Idaho. Results will be broadly disseminated across Idaho through outreach publications and presentation of results at the Intermountain Container Seedling Growers' Association annual meeting. This project is funded by the Idaho State Department of Agriculture Nursery and Florist Advisory Committee.

**Project Updates:** The project was set to begin in spring 2020, but was delayed due to the COVID-19 pandemic. The project will now begin in spring 2021. Undergraduate interns will be recruited in the spring.

## ***Western Larch and Douglas-fir Seedling Responses to Competition***

**Joshua Mullane, Andrew Nelson, Mark Kimsey, Timothy Prather**

**Abstract:** Competing vegetation often dominates reforestation sites shortly after planting. The competing species are typically forbs and grasses, many of which are non-native and noxious. One option to manage post-planting competition is to apply herbicides that target forbs but produce minimal damage to tree seedlings. This is a common practice in many forested regions across the U.S., but only recently has there been interest in the Inland Northwest. Therefore, we lack information on the potential gains in growth and survival of seedlings from post-planting



**A plot where forbs were chemically controlled after planting (red outline) had substantially less exotic weed species than untreated areas.**

competition release in the region. The first objective of this study is to examine the growth and survival response of western larch and Douglas-fir to competition release across a site productivity gradient in northern Idaho through the second year after treatment. The second objective of the project is to examine the effects of incremental reductions in total competition around western larch and Douglas-fir seedlings on soil moisture, soil temperature, and seedling growth to understand the effects of competition on environmental conditions and moisture availability. This project is funded by PotlatchDeltic Corporation.

**Project Updates:** M.S. student Joshua Mullane is working on this project and using the experiments for his research project. In summer 2020, measurements of second-year post-treatment competition was measured around all seedlings within the plots. Seedling height, diameter, and survival were measured in fall 2020. Early results show that western larch showed a slight gain in growth the first year after treatment, while there were no effects on the growth of Douglas-fir. Survival was also unaffected by the release treatments.



## ***Regional Outplanting Factors Influencing Seedling Establishment***

**Cen Chen, Andrew Nelson**

**Abstract:** Planting for reforestation is increasingly important for the establishment of forests for future timber production and enhanced carbon sequestration. Planting also requires significant investment to ensure successful seedling establishment. The multitude of both biotic and abiotic factors that influence growth and mortality of planted seedlings during the establishment phase is well studied.



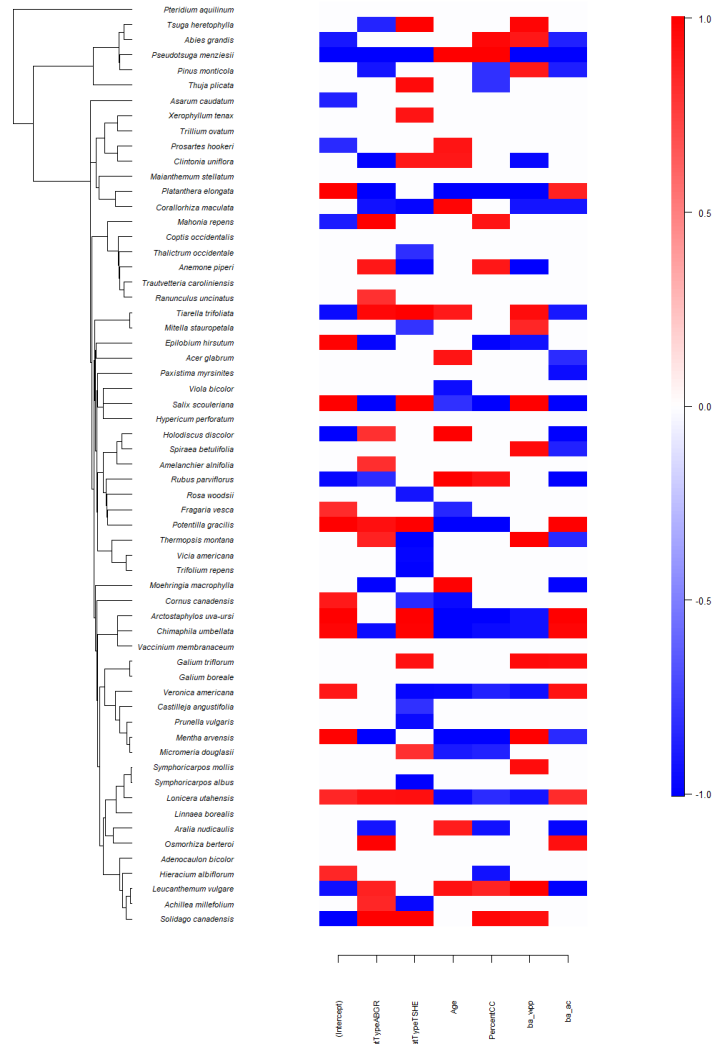
**A common garden of planted seedlings that was one of many plots used in the regional examination of site and seedling quality factors influencing outplanting performance.**

This is likely due to the high variability and complexity of this type of analysis, as well as the general lack of available data. The current study utilized annual measurements of 13,701 seedlings beginning immediately after planting to evaluate growth and mortality of planted interior Douglas-fir and western larch seedlings across multiple contrasting sites in northern Idaho and eastern Oregon for the first two years. Our results indicate that growth and mortality of seedlings were strongly influenced by their initial diameter and height such that slimmer and taller seedlings had higher mortality, while diameter and height growth was positively related to initial diameter and height, respectively. Weather conditions, especially measures of temperature and precipitation, had a similarly important role on seedling growth and mortality. The effects of root growth potential and competing vegetation were generally insignificant as pre-planting chemical preparation was applied to all sites. Improved western larch seedlings from seed orchards had higher growth rates with small increases in mortality compared to wild collected sources, but improved Douglas-fir had minimal gains in growth and much higher mortality. The developed seedling models readily fit into the architecture of current individual tree growth and yield models, which extend these models' ability to forecast seedlings during and after establishment. The identified influential factors and specific differences in seedling growth and mortality during the establishment phase provide critical information and guidance to the increasingly important reforestation practice of planting, and the overall analytical framework presented in this analysis is generally applicable to species beyond Douglas-fir and western larch. This project was part of Dr. Cen Chen's NSF Internship with PotlatchDeltic Corp. through the Center for Advanced Forestry Systems.

# Understory Floristic Diversity in Western White Pine Plantations

Brooke Durnin, Andrew Nelson, Theresa Jain, Eva Strand

**Abstract:** Moist forests of the northern Rocky Mountains cover 2.4 million hectares in the US and Canada and are one of the most diverse conifer forests in the world. These forest that are commonly associated with andic soils were once dominated by western white pine. The introduction of white pine blister rust followed by extensive harvesting during the 20th century decimated western white pine, no mature white pine-dominated forests were left. Since the 1950s, an active breeding program for blister-rust resistant white pine has resulted in resistant seed orchards producing seed and proliferation of white pine plantations across the region. Little information on the understory floristic diversity of stands planted with blister-rust resistant trees exist. Our objective was to examine the understory floristic diversity of planted white pine stands in relation to canopy characteristics and overstory species composition across the Northern Rockies. Understory vegetation was measured to the species level followed by measurements of tree structure and composition, and canopy openness. Results show white pine stands have a high diversity of vascular plant species that thrive under the moderate light conditions compared to unplanted stands with much lower diversity. The species found in these stands were representative of species associated with historic stands as mentioned in previous literature.



Heat map showing the correlation (red=positive, blue=negative) between cover of various understory species and habitat type, overstory canopy cover, and the proportion of western white pine trees in the stand.

## **Publications**

### ***Journal Publications***

- Chen, C. and Nelson, A.S. 2020. Growth and mortality of planted interior Douglas-fir and western larch seedlings during the establishment phase in Idaho, USA. *Forest Ecology and Management* 474: Art. 118386. DOI: 10.1016/j.foreco.2020.118386.
- Cherico, J.R., Nelson, A.S., Jain, T.B., and Graham, R.T. 2020. Multidecadal growth of western white pine and interior Douglas-fir following site preparation. *Forests* 11(5):509. DOI: 10.3390/f11050509.
- Bose, A.K., Nelson, A.S., and Olson, M. 2020. Growth and mortality response of forest regeneration to partial harvesting varies by species' shade tolerance. *Canadian Journal of Forest Research*. 50(10): 1081-1092. DOI: 10.1139/cjfr-2020-0022.
- Haase, D.L., Pike, C., Enebak, S., Mackey, L., Ma, Z., and Silva, C. 2020. Forest nursery seedling production in the United States—Fiscal Year 2019. *Tree Planters' Notes* 63 (2): 26-31.
- Kattge, J., Bönisch, G., Díaz, S. *et al.* 2020. TRY plant trait database – enhanced coverage and open access. *Global Change Biology* 26 (1): 119-188. DOI: 10.1111/gcb.14904.
- Partelli Feltrin, R., Johnson, D.M., Sparks, A.M., Adams, H.D., Kolden, C.A., Nelson, A.S., and Smith, A.M.S. 2020. Drought increases vulnerability of *Pinus ponderosa* saplings to fire-induced mortality. *Fire*. 3: 56. DOI: 10.3390/fire3040056.

### ***Graduate Student Theses***

- Durnin, B.A. 2020. Stand structure and understory diversity of restored western white pine stands. M.S. Thesis. University of Idaho. 88 p.
- Foard, M.B. 2020. Utilizing dendrochronology to investigate multiscale drivers of conifer growth in the Pacific Northwest. Ph.D. Dissertation. University of Idaho. 183 p.



## New Grants

Funding Duration	Funding Source	Title	Amount	Investigators
2020-25	USDA Forest Service, Rocky Mountain Research Station	Mechanisms of seedling drought avoidance	\$25,000	Andrew Nelson (Lead) Jeremy Pinto Kas Dumroese
2020-23	USDA National Institute of Food and Agriculture, Agriculture and Food Research Initiative	Integrating plant physiology. Insect management, and extension strategies to improve survival of nursery stock	\$298,420	Andrew Nelson (Lead) Stephen Cook Randy Brooks
2020-21	Idaho State Department of Agriculture Nursery & Florist Advisory Committee	Cultural alternatives to manage anthracnose leaf spot disease in greenhouses	\$7,403	Andrew Nelson
2020	PotlatchDeltic Corp.	Spring release and garden plots 2020	\$40,502	Andrew Nelson

## Ongoing Grants

Funding Duration	Funding Source	Title	Amount	Investigators
2019-24	National Science Foundation, Industry-University Cooperative Research Centers	Phase III IUCRC University of Idaho: Center for Advanced Forestry Systems	\$500,000	Mark Coleman (Lead) Andrew Nelson
2019-24	USDA National Institute of Food and Agriculture, Agriculture and Food Research Initiative	Acclimating commercial tree seedling root system architecture to drought	\$480,000	Andrew Nelson (Lead) Douglass Jacobs
2018-22	USDA Forest Service, Rocky Mountain Research Station	Supporting drought research towards resilient landscapes	\$96,172	Andrew Nelson (Lead) Jeremy Pinto Kas Dumroese
2017-22	USDA Forest Service, Rocky Mountain Research Station	Silvicultural management strategies for enhancing disturbance resilience in the northern Rocky Mountains	\$49,770	Andrew Nelson (Lead) Terrie Jain

## Outreach

The COVID-19 pandemic severely limited the number of outreach opportunities the CFNSR was able to organize in 2020. Still, a few events were held plus answering phone questions from seedling customers and other stakeholder. In total we engaged with 1,971 people in 2020 sharing information on seedling production, seedling planting, and early reforestation and restoration success. A few notable examples of outreach efforts are highlighted below.

### ***Arbor Day Celebration***

The CFNSR typically has an annual plant sale and provides information on seedlings to the public by hosting a two-day open house the weekend of Arbor Day. The event was delayed in 2020 to June 12 and 13. Luckily, it was a wet spring in northern Idaho that continued through early June so attendance was only slightly below average. A



total of 150 people visited the nursery over those two days. The plant sale was modified so all activities were held outside and to space plants for sale at appropriate distance to facilitate social distancing.

### ***Capitol City Public Market***

Lauren King partnered with Audra Cochran (UI Extension) to table at the Capital City Public Market in Boise, Idaho on July 18, 2020. They interacted with 100 to 125 members of the public of Idaho's largest metropolitan area to discuss the research conducted by the CFNSR.



## ***Nursery Tours & Events***

The CFNSR and Pitkin Forest Nursery was closed to the public for much of 2020 due to the COVID-19 pandemic. Prior to the shut-down we gave a tour to employees of Young Living Essential Oils on February 21, 2020 and hosted the UI Native American Advisory Board Meeting on February 28, 2020. We made a video tour of the Pitkin Nursery that was used in the FOR 102 (Introduction to Forest Management) course in spring 2020.

## ***Trainings & Field Tours***

Andrew Nelson co-taught the USDA Forest Service Rocky Mountain Regional Silviculture Course. The course had 30 participants from across the entire Rocky Mountain Region from Montana to New Mexico. The course was completely online for two weeks in May and July of 2020.

## ***Meetings***

The Intermountain Container Seedling Growers' Association meeting was cancelled in 2020 due to COVID-19. Instead, we teamed the ICSGA with organizers of other regional nursery conferences to host an 8-week virtual webinar series in August and September. Over 1,000 people attended the webinars across the 8 weeks.

## ***Togo Project***

The resiliency of the nursery and restoration efforts in Togo were put to the test in 2020 since we were unable to travel overseas due to the COVID-19 pandemic. The emphasis of species grown in the nursery has shifted almost exclusively to tree species native to Togo, many of them listed as threatened on the IUCN Red List. We have constructed a more durable nursery structure and expanded the capacity by laying a concrete pad and installing metal posts to hold the shade cloth. This improvement has made it easier to



**Group meeting to discuss outplanting plans for seedlings in the new Togo Nursery. June 2020.**



upgrade the structure. The nursery has produced over 30,000 seedlings through the end of 2020. Most of the seedlings have been donated to local villages throughout central Togo for community restoration projects. Seedlings were planted as part of agroforestry projects between rows of agricultural crops to maximize the use of the land and increase the proportion of native trees across the region. Partners in Togo continue to monitor our outplanting experiment. In 2019 we installed an experiment testing the effects of different proportions of coco coir mixed with local compost as a soil medium for the propagation of the native *Melicia excelsa* (African teak). This and other experiments form a foundation for future undergraduate and graduate research projects. We hope to return to Togo in 2022 to continue our educational programming and furthering seedling production and restoration.



**Student planting a seedling grown in the Togo nursery in June 2020. Seedlings were planted for agroforestry in between rows of corn.**

## ***Presentations***

<b>Date</b>	<b>Venue</b>	<b>Presenters</b>	<b>Location</b>	<b>Title</b>
January 15	Forest Vegetation Management Conference	Joshua Mullane and Andrew Nelson	Anderson, CA	Douglas-fir and western larch response to spring release herbicide treatment in north Idaho
January 24	UI Extension Family Forests Workshop	Andrew Nelson	Coeur d'Alene, ID	Choosing reforestation stocktypes for family forests – Results from the Inland Northwest stocktype study
February 5	U of I Forest, Rangeland, and Fire Sciences Seminar	Andrew Nelson	Moscow, ID	Nursery practices and outplanting performance of tropical hardwoods in Togo, West Africa
February 19	USDA Forest Service Annual Reforestation Workshop	Theresa Jain, Andrew Nelson, Marcus Warwell	Missoula, MT	Climate, disturbance, and mitigating factors that affect seedling growth environments
March 3	Inland Empire Reforestation Council	Andrew Nelson	Coeur d'Alene, ID	Reconsidering stocktype sizes: Long-term results from a stocktype comparison study in northern Idaho
March 24	Intermountain Forestry Cooperative Technical Meeting	Cen Chen, Andrew Nelson	Virtual	Identification and modeling of key variables to reforestation success
June 4	Center for Advance Forestry System Summer IAB Meeting	Andrew Nelson, Douglass Jacobs, Carlos Gonzalez-Benecke	Virtual	Intraspecific hydraulic responses of commercial tree seedlings to nursery drought conditioning

<b>Date</b>	<b>Venue</b>	<b>Presenters</b>	<b>Location</b>	<b>Title</b>
December 7	Center for Advance Forestry System Winter IAB Meeting	Andrew Nelson, Douglass Jacobs, Carlos Gonzalez-Benecke	Virtual	Project Update: Intraspecific hydraulic responses of commercial tree seedlings to nursery drought conditioning
December 11	UI Extension Current Topics in Forest Health	Andrew Nelson	Virtual	Competition threshold studies in the Inland Northwest

## Franklin H. Pitkin Forest Nursery

The Pitkin Forest Nursery produced 364,885 seedlings and sold 351,406 seedlings in 2020 that were distributed to customers in fall of 2020 and spring of 2021. Of the total, we grew 51,061 Styro-20 (Superstock) conifer seedlings and 275,370 Styro-5 to Styro-10 conifer seedlings. We also grew 36,294 Styro-20 hardwoods and shrubs and 2,160 Styro-10 showy milkweed seedlings. There were 1,295 customers from across the western United States that purchased seedling in 2020.

<b>Conifers</b>				
	<b>Styro-20</b>	<b>Styro-10</b>	<b>Styro-8</b>	<b>Styro-5</b>
Cedar, Incense	765			
Redcedar, Western	3,100	16,510	1,570	
Fir, Canaan	165			
Fir, Concolor	1,645			
Fir, Corkbark	400			
Fir, Douglas	3,055	8,290	7,650	22,660
Fir, Fraser	730			
Fir, Grand	2,210			
Fir, Subalpine	1,205			
Hemlock, Western	460			
Juniper, RM	6,840	10,150		
Larch, Western	5,095	9,140		47,830
Pine, Austrian	2,206			
Pine, Bristlecone	660			
Pine, Limber	500			
Pine, Lodgepole	1,185		18,000	2,800
Pine, Pinyon	1,520			
Pine, Ponderosa	9,000			75,255
Pine, Scotch	655			
Pine, West White	1,865		500	16,935
Redwood, Dawn	215			
Spruce, Blue	5,715			31,540
Spruce, Engelmann	980	6,540		
Spruce, Norway	890			
<b>TOTAL</b>	<b>51,061</b>	<b>50,630</b>	<b>27,720</b>	<b>197,020</b>



<b>Hardwoods/Shrubs/Forbs</b>				
	<b>Styro-20</b>	<b>Styro-10</b>	<b>Styro-8</b>	<b>Styro-5</b>
Alder, Sitka	243			
Alder, Thinleaf	15			
Apple, Common Wild	965			
Ash, Native Mountain	220			
Aspen, Quaking	2,465			
Bayberry, Northern	355			
Birch, Water	665			
Birch, Western Paper	630			
Bitterbrush, Antelope	2,115			
Boxwood, Mountain	35			
Ceanothus, Redstem	777			
Ceanothus, Shiny-Leaf	70			
Cherry, Black	40			
Cherry, Choke	2,235			
Chestnut, American	50			
Cinquefoil, Shrubby	1,070			
Cottonwood, Black	595			
Currant, Golden	1,960			
Dogwood, Redosier	1,721			
Elderberry, Blue	1,575			
Hawthorn, Black	540			
Huckleberry, Mountain	5			
Juniper, Horizontal	100			
Kinnikinnick	695			
Lilac, Purple	1,548			
Maple, Bigtooth	138			
Maple, Rocky Mountain	345			
Maple, Sugar	655			
Ninebark, Common	870			
Oak, Bur	990			
Oak, Bur-Gambel	820			
Penstemon, Taperleaf	230			
Poplar, Idaho Hybrid	1,125			
Rose, Nootka	385			
Rose, Rugosa	380			
Rose, Woods	1,407			
Sage, Purple	270			
Serviceberry	2,955			
Snowberry	135			

Sumac, Oakleaf	560			
Sumac, Smooth	30			
Syringa, Lewis	2,105			
Walnut, Black	90			
Willow, Arctic Blue	715			
Willow, Coyote	340			
Willow, Drummond	530			
Willow, Mackenzie	530			
Milkweed, Showy		2,610		
<b>TOTAL</b>	<b>36,294</b>	<b>2,160</b>		

## **NAC Spring Meeting Minutes (18 February 2020)**

Attendees: Gabe French (NAC Chair; Idaho Evergreens, LLC), Abbie Acuff (PotlatchDeltic Corp.), Dennis Becker (University of Idaho, CNR Dean), Denny Dawes (Wildlife Habitat Nursery), Kas Dumroese (USDA Forest Service, Rocky Mountain Research Station), Julie Donohoe (Idaho Department of Lands), Kathy Hutton (Plants of the Wild), Sally Konen (Western Forest Systems), Kevin Merrifield (Clifty View Nursery), John Myhre (Inland Empire Christmas Tree Association), Tyler Nelson (Idaho Department of Lands), Jeremy Pinto (USDA Forest Service, Rocky Mountain Research Station), Bob Reggear (Family Forest Land Owners), and Andrew Nelson (University of Idaho, Director of the Pitkin Nursery)

Andrew opened the meeting at 10:03 am by welcoming everyone followed by a short introduction from all attendees. Andrew mentioned that Ryan Merrifield, the representative of the Kootenai Valley Nursery Exchange on the NAC, passed away in January 2020.

With some minor changes to the September 2019 NAC meeting minutes, Kas Dumroese moved to approve the minutes, Sally Konen seconded, none abstained, and the minutes were passed.

Dennis Becker, the College of Natural Resources Dean provided updates on the college and university. The college took a 27% budget cut in the last year, but enrollment is growing and the college is working to sell our programs to further increase enrollment. Dean Becker provided some background on the new UI president, Scott Green, including his business background, which should be a good skill set to help navigate the university through the budget crisis. Dean Becker mentioned that he recently interviewed for the CNR Dean position and he was the only candidate, so he should be officially appointed as the CNR Dean soon. Denny Dawes mentioned that during the budget crisis, care should be taken to not put additional pressure on the nursery to help with financial shortfalls. Dennis agreed and said the college is looking for ways to put more resources into the nursery rather than take away from it. The NAC had a brief conversation about the status of building a new greenhouse in the place of aging greenhouses. A new greenhouse will be used to train students on the best available nursery technology to better prepare them for the workforce and also further the applied research efforts of the Pitkin Nursery. The NAC thanked Dennis for attending and Dennis thanked the committee for the conversation and their continued engagement in furthering the mission of the nursery.

Andrew shifted the conversation to provide an update on nursery activities since the September 2019 meeting. Lauren has been active in her outreach efforts and engaging with local communities within the region. She has started working with Audra Cochran, the new forestry extension educator and Yvonne Barkley's replacement, to develop



extension programs focused on seedlings. Andrew mentioned that Thomas McDonough, the Pitkin Grower, accepted a position as the manager of the 6<sup>th</sup> street greenhouses in the College of Agriculture and Life Sciences, and Pitkin is in the process of interviewing candidates for his replacement. Andrew provided updates on other conferences and meeting he and others presented at and also provided a list of upcoming engagements. Andrew asked the committee for their thoughts on future training programs. Many good ideas were proposed including combinations of classroom and hands-on activities for nursery personnel as well as employees working the field. Andrew requested the committee their ideas for training programs and he will work with Pitkin staff and CNR affiliates to begin developing some workshops.

Andrew talked about some of the students working at the nursery this year. The nursery employed 29 students during the school year that have helped grow the seedling crop. Andrew mentioned plans for continuing the summer Pitkin Native Plant Propagation internship program again in 2020 based on the success of the previous year. He plans to target students in horticulture programs in Idaho, but also across the United States. The conversation shifted to graduate students associated with the Center for Forest Nursery and Seedling Research. Two students (one MS and 1 PhD) are scheduled to finish their degrees in spring 2020, while two new graduate students will join the lab in the fall focused on seedling propagation (1 MS and 1 PhD). The MS student will be a UI graduate and has worked at Pitkin for the last 3 years.

Andrew mentioned that the Pitkin Nursery is part of collaborative efforts that secured \$540,502 in funding since September. Additional grants are pending approval including a grant from the USDA to study black vine weevil damage on nursery crops, and a grant from the Idaho State Department of Agriculture to study cultural alternative to anthracnose leaf spot disease in nurseries.

Discussion shifted to the 2019 pack-out and 2020 projected crop numbers, broken down by species and stocktype. Some species sold well shortly after sale opened, including Christmas tree stock. Therefore, the nursery will grow more of these species for the next crop. Other species, such as ponderosa pine and western white pine, have not sold well this year. The total crop amount for 2020 is expected to be 410,000 seedlings, which Andrew mentioned is a good number for the nursery to cover salaries, fix infrastructure and equipment, and invest in minor upgrades.

It was agreed the next meeting would be September 9, 2020 at the Pitkin Nursery. Andrew suggested the next spring meeting should be February 23, 2021. The committee expressed interest in continuing with two meetings per year and evaluating on an annual basis if they prefer to go back to one meeting per year in the fall.

Andrew shifted discussion to a plan to design the BS Forestry major to have different emphasis tracts. One tract will focus on forest nursery management, which will be the only program in the US focused on forest nursery management within a forestry major.

The courses will be a blend of forestry, horticulture, and business management. The committee was excited to see a draft curriculum plan for the tract. Andrew mentioned that the earliest the tract could start would be fall 2021 due to university policies. Abbie suggests the NAC collectively prepare a statement in support of the forest nursery tract to present to Dr. Charles Goebel, the chair of the Forest, Rangeland, and Fire Sciences Department. Denny Dawes made a motion that the NAC was in favor of the new degree tract Sally Konen seconded, all were in favor.

Graduate students then gave short presentations on their research projects.

The next Intermountain Container Seedling Growers' meeting is scheduled October 15 and 16 in Moscow. The indoor session will be held either at the Reveley Building or the Best Western depending on the number of registrants. Gabe French has agreed to host the nursery tour at Idaho Evergreens in Deary. Andrew asked the group for potential topics for the meeting. Kas Dumroese suggested a round-table discussion to get different perspectives from growers on a set topic. Ideas included greenhouse space, seed availability, fertilization, irrigation scheduling.

Following some additional updates on nursery activities in Togo, Kas Dumroese motioned to end the meeting, Gabe French seconded, all were in favor. The meeting adjourned at 1:26 pm.

## **NAC Fall Meeting Minutes (9 September 2020)**

In-person Attendees: Abbie Acuff (PotlatchDeltic Corp.), Denny Dawes (Wildlife Habitat Nursery), Kathy Hutton (Plants of the Wild), Andrew Nelson (Pitkin Forest Nursery), Tyler Nelson (Idaho Department of Lands), Robert Reggear (Family Forest Land Owners), and Chris Town (USDA Natural Resources Conservation Service Idaho)

Virtual Attendees: Dean Dennis Becker (College of Natural Resources), Julie Donohoe (Idaho Department of Lands), Kas Dumroese (USDA Forest Service, Rocky Mountain Research Station), Matt Engberg (Northwest Management), and John Myhre (Inland Empire Christmas Tree Association)

Andrew opened the meeting at 9:03 am by welcoming everyone.

Dennis Becker, the Dean of the College of Natural Resources, provided updates from the college and university. Following the spring NAC meeting, Dennis assumed the role of permanent Dean of CNR. Even during these unprecedented times with the COVID-19 pandemic, research and teaching within the college have continued with minimal interruptions. Many universities feared massive drops in enrollment for the fall semester, but the University of Idaho's enrollment is only down 5%, while enrollment in CNR enrollment has increased. This was partly attributed to the university making the decision to hold in-person classes this year. Dean Becker discussed his philosophy that this is not the time to stand still but instead remain aggressive and continue to push forward with new initiatives.

Andrew mentioned that part of being aggressive and moving forward, there has been considerable discussion in the department and college about making classes and programs more flexible for online education. The department has proposed modifying the forestry major to provide specialized degree tracks including forest operations, forest hydrology, forest biology, and forest wildlife management. There is still interest in a forest nursery track but discussion is ongoing regarding where it best fits within the college degree options.

Andrew shifted the conversation to the replacement Pitkin Nursery greenhouse. He distributed materials to the committee on the desired structure, Cravo brand A-frame. Funding options were discussed including partial support from the state of Idaho, seedling sales, and fundraising. The new greenhouse will further student training to enhance their career success and enhance research capacity. Bob Reggear asked about the potential cost of the new greenhouse. Andrew provided a cost estimate of \$450-475 thousand, which includes the structure, labor, and equipment and supplies to outfit the operation.

Chris Town with the NRCS joined the meeting at 9:47 am. This was his first meeting, so he introduced himself followed by the committee members introducing themselves. Andrew provided a brief overview of the 34-year history and charge of the NAC.

Abbie moved to approve the minutes from the February 2020 meeting, Tyler seconded. The motion passed unanimously.

Andrew discussed the Forest Utilization Research report for fiscal year 2020, including the metrics on the number of seedling customers, the number of stakeholders engaged by the nursery, and the number of new and ongoing nursery projects.

Andrew discussed COVID-related adjustments at the Pitkin Nursery. The nursery remains closed to the public. All staff are required to wear face masks and are spaced to maintain social distancing. All surfaces are sanitized frequently throughout the day.

Andrew provided updates on CFNSR activities. He co-taught the biannual two-week Rocky Mountain Regional Silviculture short course for US Forest Service employees in the National Advanced Silviculture Program. Most other outreach was cancelled due to COVID-19. The nursery was able to hold a delayed Arbor Day Celebration in early June and the attendance was better than expected. Andrew is also co-hosting an eight-week Nursery Technology webinar series this fall due to the cancellation of all regional nursery meetings. Andrew discussed graduate students who completed their degrees, provided updates on students in progress, and introduced new students starting in the fall, one MS and one PhD. Dr. Ehren Moler, a postdoctoral fellow, has joined the team from Northern Arizona University to work on the western larch drought conditioning study. The Pitkin Nursery hired a new grower, Austin Davis, who joined the team in April 2020. Andrew secured \$330,000 in external research funding since the spring meeting.

Bob Reggear mentioned the fires in the Clearwater Canyon and the future need for seedlings for post-fire reforestation. He asked if the Pitkin Nursery could fill that gap in seedling demand in the short term. Denny Dawes made a motion that Andrew investigate sourcing a seed appropriate for lands burned in the Clearwater Canyon and grow up to 50,000 seedlings if possible. The 50,000 seedlings would be grown within the guidelines of total seedling production of the Pitkin Nursery. The motion passed unanimously.

The conversation shifted to the loss of nursery capacity in the region with Western Forest Systems closing at the end of the year. Kathy Hutton and Andrew Nelson both said they had to compost approximately 50,000 ponderosa pine seedlings grown on speculation due to poor demand, possibly COVID related.

The committee discussed the future of Western Forest Systems seat on the NAC and whether Sally Konen could remain on the committee even if she no longer works for WFS. Bob Reggear stated Sally should remain on committee even though her job is



going away as she is a private nursery owner and has extensive nursery experience and contacts. The entire committee agreed, and Andrew will follow-up with Sally to discuss the decision.

Andrew solicited feedback on new research projects for the nursery. A few were provided and Andrew will investigate their feasibility.

The spring NAC meeting was scheduled for February 23<sup>rd</sup>, 2021.

Meeting Adjourned at: 12:24 pm

