

# Genetic Resource Management in the USFS, PNW Region: Past, Present, and Future

BY VICKY ERICKSON

**T**he Pacific Northwest Region (Region 6) of the US Forest Service encompasses 26.2 million acres in Oregon and Washington. The 16 national forests and grasslands support some of the most diverse ecosystems and flora in the US, with habitats ranging from the high deserts east of the Cascade Mountains in central Oregon to the rain forests of the Olympic Peninsula in western Washington.



The region's genetics program was launched over 50 years ago with the establishment of the Dorena Tree Improvement Center (now Dorena Genetic Resource Center [DGRC], Cottage Grove, Ore.) as headquarters for the white pine blister rust disease resistance program for western white pine and sugar pine. With an expanding focus on improved growth and productivity in coastal Douglas-fir and other commercial conifer species, the region also became an early member of the PNW Progressive Tree Improvement Program, which was established in 1966. The region's genetics program was further expanded throughout the 1980s with large investments in seed orchards and progeny test sites for priority species in eastern Oregon and Washington, including ponderosa pine, Douglas-fir, western larch, and lodgepole pine.

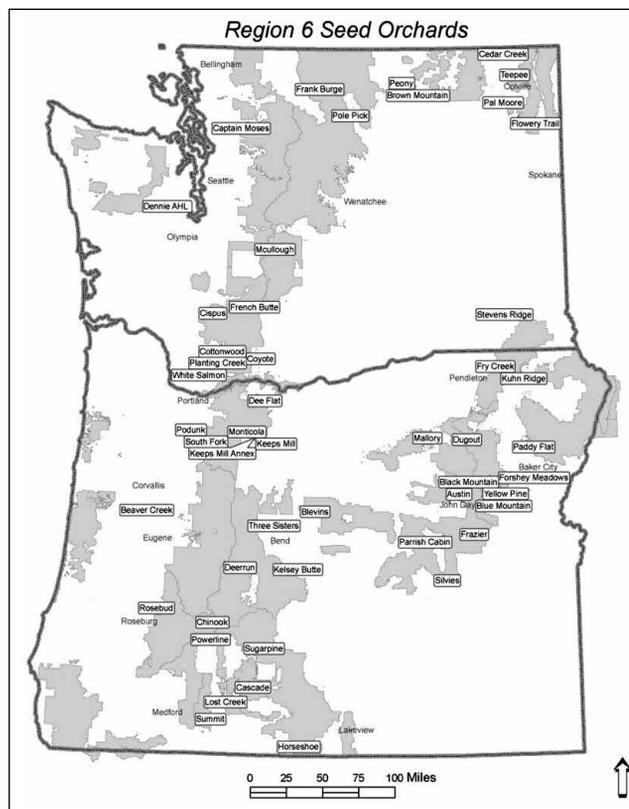
Fast forward to 2017, a changed landscape where reforestation needs in the region are no longer driven primarily by timber production objectives or regeneration harvest activities, but rather by responses to disturbances such as wildfires, insect and disease outbreaks, and wind storms. Regional genetics programs have responded to these changing conditions by evolving from a focus on tree improvement for enhanced growth and yield to today's broader emphasis on genetic resource management, genetic conservation, and ecosys-

tem resiliency and health. This work is spread across numerous species, expanding in recent years to include non-commercial native conifer and hardwood tree species as well as native shrubs, grasses, and forbs that are important for restoration and land management priorities such as creation of fire resistant understories and enhancement of forage and habitat for wildlife, including pollinator species.

## Staff and facilities

**Geneticists:** In addition to a regional geneticist, there are four area geneticists in the region. Each area geneticist serves multiple forests, but also provides specialized expertise, consultation, and training across the entire region on specific topics such as seed biology, cone collection, analysis of genecology studies and progeny test data, interpretation of molecular data, design and implementation of genetic conservation strategies, and more. Additional resources include the DGRC geneticist, as well as the five-needle pine and Port-Orford-cedar program managers. The regional geneticist provides oversight and support to the area geneticists, DGRC, and the regional Bend Seed Extractory (Bend, Ore.), and also serves as the regional native plant program manager.

**Dorena Genetic Resource Center:** This unique, multi-faceted facility houses a world-leading applied disease resistance testing program for non-native pathogens including white pine blister rust and Port-Orford-cedar root disease. Containerized Port-Orford-cedar seed orchards are maintained in DGRC greenhouses for operational production of disease resistance seed for reforesta-



SOURCE: VICKY ERICKSON

**USFS seed orchards are positioned in 50 locations and cover approximately 1,900 acres.**

tion in southwest Oregon and northern California coastal forests. Newly upgraded freezer storage facilities house genetic conservation seed collections for at-risk tree species, as well as a unique collection of seed from the over 40,000 parent trees represented in Region 6 progeny test sites and seed orchards. DGRC also produces small quantities of containerized seedlings for national forests and partner clients. Over 120 new species propagation protocols have been developed through this work. DGRC assists in regional trainings and is home to the USFS national Tree Climbing Program, a certification program to ensure safe and effective tree climbing for Forest Service and other agency work, including cone collection, red cockaded woodpecker nest placements, snag creation, smoke jumper training, and monitoring for Asian long-horned beetle. In 2016, DGRC celebrated its 50 years of accomplishments and shared with partners their current work and bright vision for the future.

## Regional priorities and challenges

Described below are some highlights of Regional Genetic Resource Management program priorities and accomplishments, as well as several initiatives underway in response to new challenges such as expanding exotic pests and forest health issues, climate degradation, and the conservation of at-risk tree species.

**1. Protect and maintain seed orchards, breeding orchards, and genetic test sites:** These installations are invaluable and irreplaceable repositories for genetic conservation and use in future breeding efforts, and for monitoring the impacts of new insects, pathogens, or a changing climate. They also provide the most efficient and economical source of high-quality and genetically diverse seed for reforestation. At present, there are 50 seed orchard installations totaling over 1,900 acres on Oregon and Washington national forests. Significant investments are made annually across the region in priority maintenance activities such as orchard fence repairs and replacement, mowing, and fire protection.

**2. Replenish reforestation seedbanks and re-initiate seed training programs:** The region's reforestation seedbanks are aging and rapidly diminishing, particularly for those species and national forests frequently affected by wildfires. In addition, the region has lost many seasoned reforestation specialists experienced in seed use planning, seed biology, and cone collection procedures due to retirements. Consequently, the region has re-vamped online and in-person cone and seed training programs and established a new regional contract for cone collection. In 2016, Region 6 national forests made the largest cone collection in over two decades, with nearly 1,500 bushels of cones (425 pounds of cleaned seed) collected from six different species. Washington State Department of Natural Resources (WADNR) and several private companies also took advantage of the 2016 bumper crop through permits to collect cones in national forest wild stands and seed orchards.

**3. Combat invasive pathogens and insects through development of genetically resistant planting stock for an expanded array of priority species and**

**populations:** DGRC's disease resistance testing program has grown in recent years to now include 8 five-needle pine species and geographic sources from the US, Canada, and Mexico. One of the more prominent new focal species is whitebark pine, which has been proposed for federal listing under the Endangered Species Act. Port-Orford-cedar, another focal species, involves a vastly smaller geographic zone but is important to USFS, Oregon Department of Forestry, tribes, private landowners (industrial and non-industrial), NGOs, and the general public. The region has strong working partnerships with these groups and interest in resistant seed is growing. DGRC's geneticist also provides technical assistance in developing programs elsewhere, such as the koa wilt resistance program in Hawaii.

**4. Accelerate and expand genetic conservation and restoration efforts for highly vulnerable species and populations:** Many ecologically important PNW conifer species are in decline due to insect and disease outbreaks, wildfires, climate change, and other disturbances and stressors. A recent regional assessment indicated that high-elevation species and populations in isolated areas or at the edge of a species distribution were at the highest risk of loss. The assessment identified priority species and geographic areas of special concern and set goals for seed collection and other conservation and restoration work. International collaborations with the U.K. Forestry Commission and the Millennium Seed Bank have been leveraged to help collect seed for genetic conservation, with seed from over 1,200 individuals from seven different species collected to date. The collection is stored locally at DGRC and at the USDA National Center for Genetic Resources Preservation (Ft. Collins, CO).

**5. Develop climate-based solutions for seed deployment:** Under any climate scenario, the selection of appropriate seed sources provides the foundation for successful reforestation. With predicted changes in future climates, the movement of seed sources during reforestation will become an increasingly important strategy for maintaining forest productivity and re-aligning species and genetic resources to cope with new stressors and site conditions.

In preparing for the future, geneticists are working with silviculturists and reforestation specialists to evaluate existing seed inventories and test new models such as the Seedlot Selection Tool (see Harrington and St. Clair article) to identify areas where seed may be well suited to future climates, or to choose the best seed source for a particular planting site under predicted climate scenarios. These and other related climate change adaptation activities are guided by a national USFS strategy document: "Genetic Resource Management and Climate Change: Genetic Options for Adapting National Forests to Climate Change."

## Looking ahead

Maintaining productive and resilient national forests into the future will require new tools, practices, and re-focused investments in all areas of land stewardship, including genetic resource management. Retaining expertise and a supporting plant production infrastructure (i.e., nurseries, seed extractories, disease resistance screening centers, and seed and breeding orchards), coupled with strong support from research, management, and our external partners are all vital elements for sustaining a strong and forward-thinking PNW Genetic Resource Program. Although there are many constraints and undoubtedly bumps ahead, the region is well-positioned to respond to the needs and challenges of the next 50 years and beyond. ♦

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