The Case for Including Shrubs in Lowland Restoration Projects

By BEF Staff

Restoration practitioners pursue revegetation efforts for many reasons including, but not limited to improving water quality and salmonid habitat, enhancing terrestrial habitat for birds, pollinators, amphibians and mammals, restoring culturally important landscapes, and promoting resilience to climate change. The strategies to achieve these goals can vary significantly. If a restoration practitioner or group seeks to improve habitat for salmonids they may focus on restoring long lived conifers to the landscape to shade the waterway and provide durable sources of large woody debris. A project focused on improving pollinator forage likely relies more heavily on planting a wide array of forbs, and some flowering shrubs and trees. Specific objectives may vary from project to project, but all take place in the context of larger ecosystems that are made up of complex interactions between many plants, animals, fungi, microbes, and physical and climatic features. Trying to determine how to facilitate a complex ecosystem within the confines of available funding, relatively narrow timelines, and occasionally competing interests in land use is exceedingly challenging, but necessary for the health of our waterways and all they support.

To further complicate things, the climate crisis is creating urgency around restoring landscapes to conditions that will be resilient to rapid change and able to store carbon over the long term. Numerous initiatives to fund large scale tree planting have emerged and have opened up new funding options for practitioners. These programs often focus exclusively on tree species, and can leave restoration sites heavily simplified if not combined with other funding sources that support shrub planting. To contribute to these conversations, we highlight some of the existing knowledge and research that describes the ecological niches that shrubs fill and that describes their potential roles in climate change adaptation.

> In this current era of drought and wildfire, there are also concerns about shrubs serving as ladder fuels. We do not go into depth on this complex topic here, but invite experts to reach out to us for a future article.

Biodiversity and Habitat

HIGHLIGHTS

1. Shrubs are a large component of the productive ecosystems of the Pacific Northwest, and many species rely on them for food and habitat.
2. Without shrubs, both native pollinators and imported honey bees would not have enough food to survive, which would have cascading impacts on our ecosystems, agriculture and wildlife.

The native forests of the Pacific Northwest have historically been structurally and floristically diverse ecosystems. A large number of shrub species call this ecosystem home, and their presence is essential to support the wildlife that live and forage in forests. For example, one of the most ubiquitous shrub species in riparian areas within the

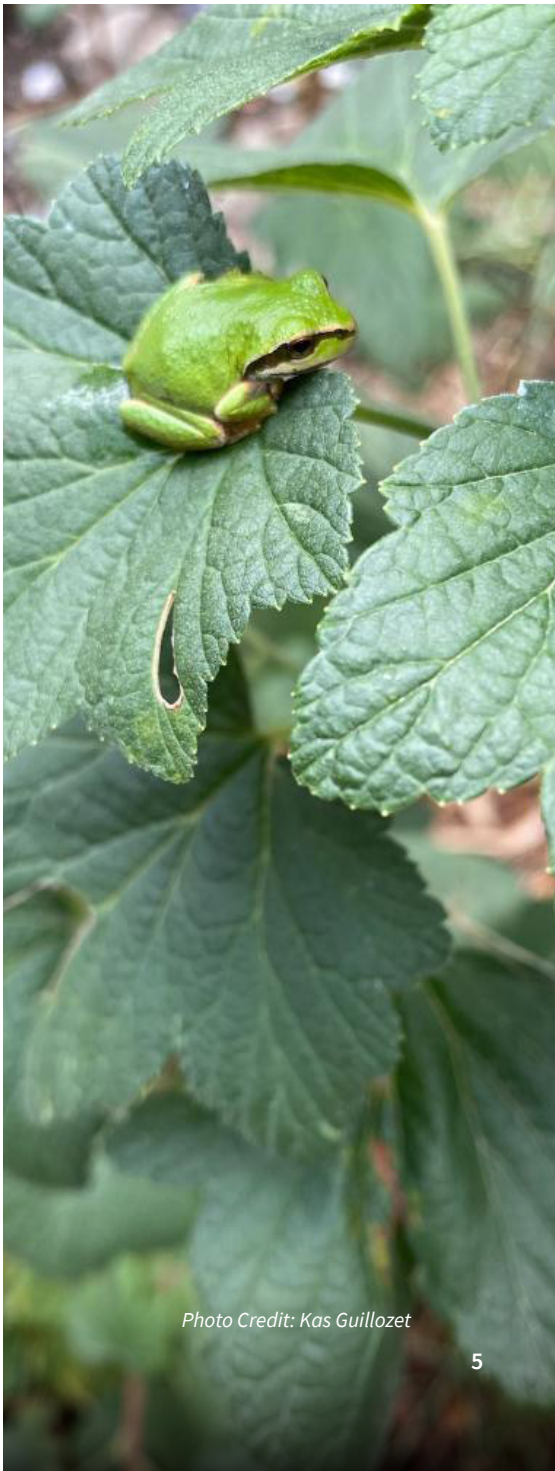

Photo Credit: Kas Guillozet

Puget Lowlands, salmonberry, occupies the understory, and often forms thickets that provide nesting habitat for songbirds. The flowers provide food for pollinators, and the berries are consumed by many animals.

From the forest floor to the top of the canopy, each layer of the structurally diverse forest of the Pacific Northwest supports unique nesting habitat for a wide array of bird species. Some birds nest on the ground under thick shrub cover. Others nest in the branches of mid-story, thicket forming shrubs like salmonberry and thimbleberry. Some, like the willow-flycatcher rely on dense patches of streamside willows to hold their nests. The endangered marbled murrelet needs solid platforms, most often found on branches of old growth conifers to establish a simple mat of moss on which it lays its eggs. In most cases, it benefits birds to promote clumps and gaps within shrub plantings, which also increase structural diversity and habitat value.

Insects and pollinators also rely on healthy ecosystems with a robust shrub component. A study was conducted in the Blue Mountains of Oregon, along 11km of Meadow Creek in USFS Starkey Experimental Forest and Range to look at pollinator diversity among shrubs and forbs installed in a large-scale riparian restoration project. During restoration, over 50,000 native trees and shrubs were planted in the riparian area, including flowering-shrubs such as willows, currants *(Ribes* spp.), and black hawthorn *(Crataegus douglasii),* which occur naturally in similar habitats throughout the western United States (Hoag & Landis **2002**).

The study found that season-long, bee community composition on shrubs differed from that of forbs.

In riparian areas, shrubs play a key role during periods with less floral abundance for pollinators, since they often bloom early in the spring. This provides valuable forage for bees during the critical period of native bee emergence (Dumroese & Luna 2016; Bentrup et al. 2019).

In some communities, willows are one of few plant species blooming when bees first begin to emerge (Moquet et al. **2015**). Many willows have sufficiently nutritious pollen and nectar to attract and feed bees (Roulston et al. **2000**; Weiner et al. **2010**; Saunders **2018**), despite some being anemophilous.

Other life history traits, beyond phenology, may make shrubs valuable to riparian bees. The pollen of some shrub species has relatively high protein content. For example, Roulston et al. (**2000**) reported average protein in willow pollen as 41.4%, which is high, given a range of 2.4–61.0% protein observed in pollen from >300 plant species.

Willows and other streamside shrubs provide habitat for numerous insects that in turn support rearing salmonids in riverine and off channel habitats.

Shrubs are a natural and vital part of various pacific northwest ecosystem types, and if they are under-represented in restoration projects we may be shortchanging wildlife that rely on them.

Culturally Important Plants

HIGHLIGHTS

1. In an Indigenous worldview, all plants have inherent value. They are not seen as commodities, and all plants that occur in a natural system belong. This reduces the bias toward merchantable timber that a capitalist system has prioritized.

2. Many shrub species have cultural and spiritual significance to Tribes, and have been a part of the traditional diet and art for centuries.

The Indigenous Peoples of the Pacific Northwest's lifeways are closely intertwined with all manner of native plants that occupy the region. They have also stewarded the environment to facilitate the growth of these plants since time immemorial. Modern land use practices have drastically reduced the abundance of native plants across the landscape, and opportunities for harvest are limited, which affects community health and wellbeing.

This concept is well illustrated through a framework of social-ecological resilience, in which the health of an

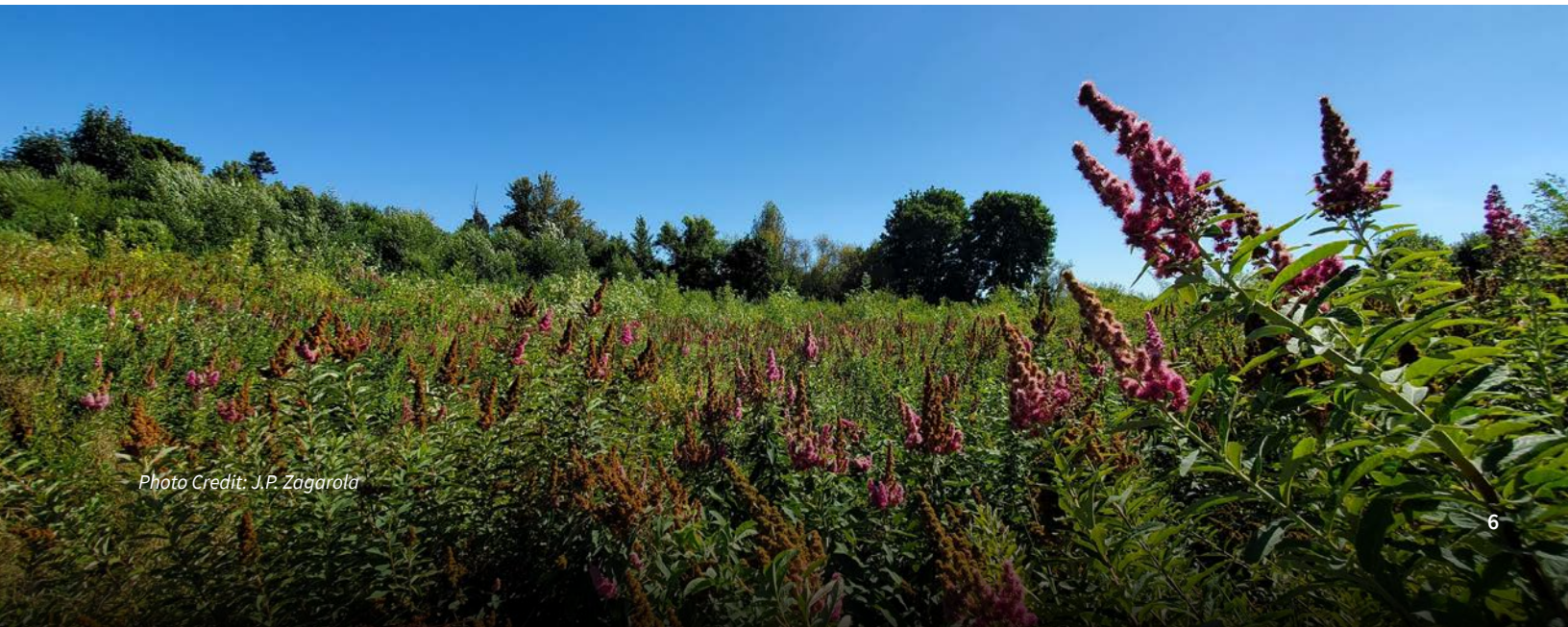

Photo Credit: J.P. Zagarola

ecosystem reflects and influences the health of proximal human communities through a number of factors. This framework has recently applied to **public health**, **planning and infrastructure**, and other fields, however this way of thinking has been common in Indigenous communities long before the present moment. Both historically and in the present, many Indigenous Peoples have relied on native ecosystems for food, shelter, and spiritual wellbeing, and have stewarded various landscapes to serve their needs. Embedded in this way of thinking is the knowledge that an ecosystem that supports cultural needs also supports wildlife habitat, ecological processes, and is resilient to disturbance and change.

> For more on social-ecological resilience and huckleberry stewardship, see the piece in the **December 2022 issue** of Treeline, which was adapted from a blog post by Colleen Rossier and Bill Tripp.

The practice of stewardship that enhances socio-ecological resilience is well illustrated in the management of huckleberry patches up and down the North American west coast. Various huckleberry species occur across this range, and almost all were managed by Indigenous stewards pre-contact. Stewardship practices included burning, pruning and ensuring that patches remained accessible. These patches are now less abundant and accessible due to wildfire suppression and a lack of acceptance of cultural burning, forest management practices, and efforts to diminish Indigenous sovereignty. However, in recent years many Indigenous communities have revived efforts to restore huckleberry patches, often in partnership with non-Indigenous managers. One such **partnership between the Tulalip Tribe and the US Forest Service** has led to active management of huckleberry patches, preservation of access, and a venue for youth to learn about and carry out traditional practices.

Huckleberries are a widely applicable example, but most native shrubs have significance to Indigenous Peoples. Plants like Nootka rose, devil's club, thimbleberries, salmonberries, oceanspray, salal, Oregon grape, elderberries, and many others have long been harvested by local Indigenous communities and tribes for food, medicinal and spiritual purposes. Willow, hazelnut and other shrubs are used in basketry and the fabrication of tools such as fish traps. Their inclusion in restoration projects not only opens up the possibility for greater co-stewardship, but also supports the vast and complex web of life that are vital to social-ecological resilience.

Mutualism

HIGHLIGHTS

1. While not heavily researched, native shrubs likely play a role in facilitating the mycelial networks that support life in the forest.
2. A transition from a competitive to a facilitative view of forest dynamics is underway, in which the various physical, chemical and structural components of individual plants and organisms support the system they exist within.
3. Many shrub species are adapted to a wide range of conditions and can persist or recover quickly amid stressors like prolonged drought and flooding, which may intensify with climate change, adding resilience to the landscape as a whole.

While humans often interact with the forest through the above ground world; picking ripe berries from bushes; watching birds duck in and out of cover; picking a mushroom after a fall rain; some of the most important work that forest plants do happens underground. Shrubs in particular, play a large role in nutrient cycling — converting atmospheric gasses to mineral forms that can be used by other plants in the forest to aid in growth. Many shrubs are deciduous, and their annual cycle of dropping leaves in the fall contributes to the forest litter that breaks down to become rich and productive forest soil over time.

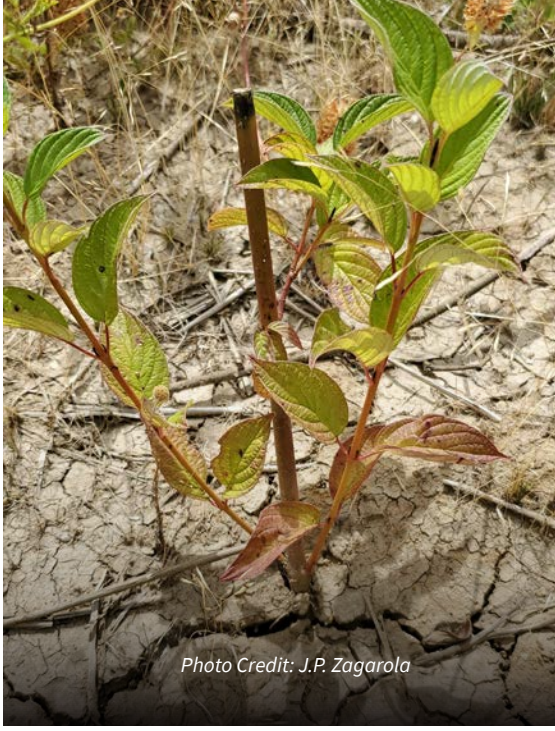

Photo Credit: J.P. Zagarola

In arid landscapes, nurse planting schemes are sometimes used to facilitate plant survival. The nurse plant theory goes like this: certain species, often shrubs, facilitate the survival of the plants around them through a variety of mechanisms. These mechanisms include things like protection from UV radiation, moisture recruitment, protection from herbivory, seed trapping, and increasing the presence and diversity of mycorrhizal fungi. Where resources are more readily available (i.e. in much of the Pacific Northwest) nurse plant effects may be less noticeable, however as temperature extremes continue to increase in frequency, practitioners may choose to borrow strategies like nurse planting to mediate the effects of climate change.

Some morphological traits of shrubs may lead to greater adaptive capacity in a changing climate. Some evidence suggests that shrubs dedicate less energy to supporting branch and stem tissue than trees, and thus can allocate more resources to root growth. A more robust root system, especially when paired with the ability or tendency to resprout, may lead to greater regrowth following disturbance like fire, browsing and drought. Due to the multi stemmed growth habit of shrubs, they have more bark area than trees, which may lead to a greater ability to sprout and grow new organs, especially after disturbance (Göttmark, et. al.).

The role of shrubs as supporters of forest life is understudied, with much

more research focused on income generating plants like trees. While the scientific community may not know the exact biochemical mechanisms by which shrubs support and facilitate functional forest ecosystems, it seems unwise to assume they are unimportant accessories, only valuable for the food and cover they supply.

Reducing Maintenance and Chemical Weed Controls

HIGHLIGHTS

1. Most trees (especially conifers) cannot be planted at a density needed to reclaim old fields or other sparsely vegetated areas and are often slow growing.
2. Shrubs can grow aggressively to compete with weeds which may reduce duration of required maintenance.
3. Dense shrub planting may be a strategy where herbicide use is not feasible or desired.

Planting is often just the first stage of implementation of a restoration project. Once plants are in the ground, surrounding vegetation often needs to be managed to reduce competition and habitat for plant eating critters like voles and rabbits. Invasive species may outgrow planted natives in their first few years, and significant resources are typically allocated to managing them. Planting shrubs does not replace follow up maintenance, but it may reduce the amount time spent annually, and potentially the number of years maintenance is required. Fast growing shrubs may establish and spread rapidly in the right conditions, and shade some of the grass and weed species that compete with plantings. This theory has not been well researched, however could prove important as we look to reduce reliance on chemicals in sensitive areas, or where long term invasive control work is not feasible.

In ecosystems or locations where herbivory is a barrier to plant establishment, creative shrub planting schemes may provide plastic and metal free protection from browse. Plants that have sharp spines or form thickets could be employed as living plant protectors or fences. Western redcedar are sometimes planted together with Sitka spruce, since the spiny needles of the spruce deter deer and elk from nibbling the highly palatable cedar tips, or rubbing its bark as the trees grow. What about a nootka rose fence, or a Douglas hawthorn and Western crabapple thicket to act as natural barriers? These theories are under-tested, and may not work in every situation, but it may be wise to start thinking about how living plants can serve some of the needs that are currently met by non-renewable materials.

Photo Credit: J.P. Zagarola

Concerns and Questions

- What is the role of shrubs in arid lands, especially where fuels reduction projects are implemented? Is there risk of simplifying the landscape in the name of fire safety if shrubs that act as ladder fuels are removed?
- What role do shrubs play in the transfer of pests and pathogens? Will there be an increased focus on this as new niches open up in an altered climate?
- Many shrubs fill in gaps readily following disturbance — especially when invasives are removed. Is it cost effective to plant shrubs when locally abundant and suitable species volunteer?
- Riparian buffers are often defined by tree height indices. Is there validity to prescriptions for shrub cover to promote healthy and diverse buffers?

Works Cited

Filazzola, A. and Lortie, C.J. (2014), A systematic review of nurse-plant mechanisms. Global Ecology and Biogeography, 23: 1335-1345. https://doi.org/10.1111/geb.12202

Gómez-Aparicio, L., Zamora, R., Gómez, J. M., Hódar, J. A., Castro, J., & Baraza, E. (2004). Applying plant facilitation to Forest Restoration: A meta-analysis of the use of shrubs as nurse plants. *Ecological Applications,* 14(4), 1128–1138. https://doi.org/10.1890/03-5084

Götmark, F., Götmark, E., & Jensen, A. M. (2016). Why be a shrub? A basic model and hypotheses for the adaptive values of a common growth form. Frontiers in Plant Science, 7. https://doi.org/10.3389/fpls.2016.01095

Matías, L., Quero, J. L., Zamora, R., & Castro, J. (2012). Evidence for plant traits driving specific drought resistance. A community field experiment. *Environmental and Experimental Botany,* 81, 55–61. https://doi.org/10.1016/j.envexpbot.2012.03.002

Mitchell, SR, DeBano, SJ, Rowland, MM, Burrows, S. 2021. *Feed the bees and shade the streams: riparian shrubs planted for restoration provide forage for native bees. Restoration Ecology,* Vol 30, Issue 3. https://onlinelibrary.wiley.com/doi/abs/10.1111/rec.13525

Thompson, I., Mackey, B., McNulty, S., Mosseler, A. (2009). Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. Secretariat of the Convention on Biological Diversity, Montreal. Technical Series no. 43, 67 pages.