Seed Collection and Direct Seeding

Practices for a changing climate

By Kayla Seaforth

A 2021 survey of restoration practitioners indicated that 52% of respondents were interested in learning more about how varying times of seed harvest can promote climate resilient plant stock. 58% wanted to learn more about direct seeding. In this article, we dive into these concepts.

One way that seed collectors and growers promote genetic diversity in nursery grown native plant stock is by collecting seeds throughout a plant population's seed dispersal period. This practice increases the genetic diversity within a harvest and may help plants persist as phenology shifts in response to changing climate patterns. The use of genetically diverse and site appropriate plants becomes more imperative and challenging as we work with ecosystems that will look different in 20, 50 or 100 years due to anthropogenic climate change.

Temperature, light, and genetic variation influence flowering. A Doug fir common garden trial revealed that genotypes from warmer, drier locations flowering earlier than those from colder, wetter locations.

"Given what we don't know about how much phenological elasticity there is in a given species — collecting as much of the current availability in flowering/seed maturation timing as possible is what hopefully gives us a chance for plantings to continue to adapt to the increasing climatic shifts and maintain viable reproduction."

—Georgia Mitchell, Seed Collector

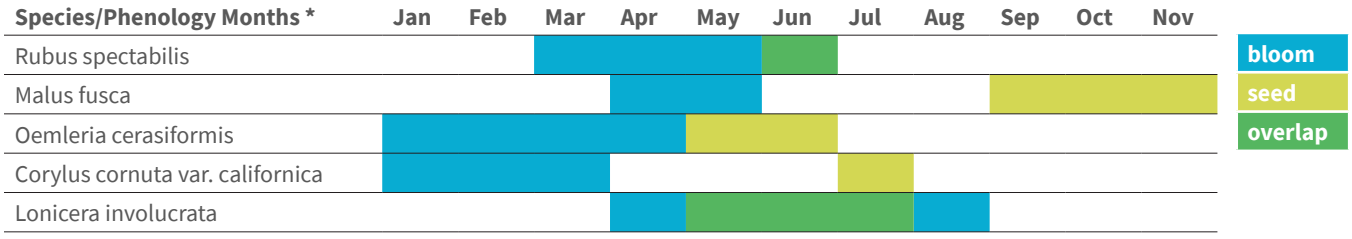
Bloom and seed maturation windows vary widely from plant to plant, and are also affected by climatic and geographic conditions. For example, salmonberry *(Rubus spectabilis)* seeds ripen over a relatively short period in early summer and are quickly desiccated or eaten by wildlife and people, so multiple collections may be impractical and may not capture as much variation in phenology as other species. In contrast, western crabapple *(Malus fusca)* ripens over a period of three months or more in the fall, so collection across a longer timespan of seed maturation for this species may be especially prudent.

Conditions can vary significantly at different elevations, even within a single watershed. While conservation-focused seed collection aims to capture the full range of genetic diversity within a target population, collection for climate resilience may mean intentional collection during time periods thought to more closely reflect future conditions. This may look like collecting seed from five sites within a 10 mile radius, all with different microsite characteristics (slope, aspect, shading, etc.), or may require traveling to higher elevation or more northerly sites within a plant's range as the season progresses. Above all, this practice requires a great deal of knowledge of the habits of individual species, and much observational skill and patience.

In seed production nurseries, practices may include varying harvest timing, or harvesting at early, mid and late

FIGURE 1: *Understanding flowering and seed set periods of native trees and shrub species is essential for collecting through their seed maturation windows. It is also important to have a sense of the historic trends in order to determine if and how climate shifts are affecting phenology.*

source: Burke Herbarium Image Collection (flowering timelines, based on Washington state averages https://biology.burke.washington.edu/herbarium/imagecollection.php), and Fourth Corner Nursery staff observation (seed ripening, focuses on patterns observed in NW Washington).



season peaks in seed maturity. This can be difficult in large scale operations where machinery is used to harvest seed crops, especially if the harvesting method damages plants in a way that prevents subsequent harvesting, but if provisions can be made to capture seeds that ripen at different times, the material sold to practitioners will represent a broader swath of the population's genetic diversity.

While widely accepted as a best practice, the reality of the nursery economy and pressure to grow more plants and species can make the practice of conducting multiple collections per season challenging. This can result in a narrower-than-ideal selection of seed used to grow large numbers of plants, reducing the overall diversity represented in the plants sold. Efforts to vary the timing and spatial range of seed collection has cost and capacity implications for seed collectors and nurseries that funders and purchasers may need to plan and budget for.

Direct Seeding

Another strategy that may bolster plant survival and drought resilience is direct seeding. This strategy requires different, sometimes more intensive site preparation than bare root planting and can limit weed control options later during the establishment period, so a careful weighing of site conditions, goals, benefits and costs is necessary.

Direct seeding differs from natural regeneration in that direct seeding approaches use seed that has been intentionally collected either on or offsite, rather than relying solely on natural seedling recruitment.

Direct seeding can be cost effective, reduce pest and pathogen transfer and can allow natural selection to exert pressure on plant populations at the restoration site.

Wendy and George Kral of Scholls Valley Native Nursery tested this strategy at a mitigation site in Washington County, Oregon where reed canary grass previously dominated. They prepped the site for two years to uncover bare ground and seeded a mix of spirea, swamp rose and chokecherry. Because they invested the time and upfront cost of controlling invasive reed canary grass before putting seed down, many were able to germinate and compete with the nonnative species on site.

What Could This Look Like in Practice?

A goal of many in the restoration economy is a future with numerous, well-trained seed collectors who collect at targeted, documented locations, with attention to sources that are thriving in microclimates or conditions that may mimic likely future conditions in a given location. Restoration practitioners will be able to choose among numerous stock types and approaches including direct seeding. These climate-smart approaches will be valued and supported by customers. communities and the public at large.

Just as diversity improves ecosystem resilience, an array of strategies will be essential in addressing likely future challenges in plant procurement and adapting to climate change. We need solutions at many scales, from small, innovative pilot projects to risk-informed larger scale measures.

FOR FURTHER READING, SEE TREELINE STORY FROM FEB 2021:

Article on the Seedlot Selection Tool by Dr. Dominique Bachelet

Earth Day Executive Action

In April, President Biden signed an **Executive Order** that authorized domestic support for mitigating climate change through enhanced forest stewardship and protection. The goals the White House outlined in the order are to:

1. Safeguard mature and old-growth forests on federal land
2. Strengthen reforestation partnerships across the country
3. Combat global deforestation
4. Enlist nature to address the climate crisis

While just one part of a complex puzzle, this order is a hopeful step toward federal support for some of the strategies needed most to respond to climate change. The order goes on to call out many strategies, including expanded nursery and seed collection capacity to meet the reforestation needs of the West following major forest fires.