Seed & Seedlings

A healthy forest means finding the right seed and seedlings for the project.

In this document:

Image credit: Mast Reforestation

Find suitable seed

Successful reforestation starts with finding the right seed. This includes seed that is from native species, and is locally sourced from the same or similar environmental conditions of the project. This will give the trees the best chance for survival.

Finding the right seed for your site is critical to ensure a successful reforestation project. This is done through matching seed that is sourced from a similar ecological region and adapted to the specific environment and climate of the project site (see the topic on “seed zones”)

For non-industrial landowners, consulting foresters will typically find seed for the project. Seed is usually sourced through orchards or collected from the wild. Unfortunately, native tree seed is in short supply, especially for non-industrial landowners, and acquiring the right seed may delay the project. However, there are several viable options available for acquiring native tree seed. The forester will either purchase the seed directly (likely from a nursery), or work with a partnering organization to collect the seed on behalf of the project/landowner.

Find suitable seed (continued from page 1)

This can be a time-intensive and expensive part of the project. However, sourcing the appropriate genetic material is critical for success. While seed from orchards can play a role in reforestation, finding wild-collected seed can benefit the project with material genetically adapted for that specific environment. Read more about this in the “seed zones” topic

Image credit: Mast Reforestation

Cone Scouting Guide

Silvaseed Co. by Mast Reforestation developed a Cone Scouting Guide with instructions and visuals for identifying common crop species.

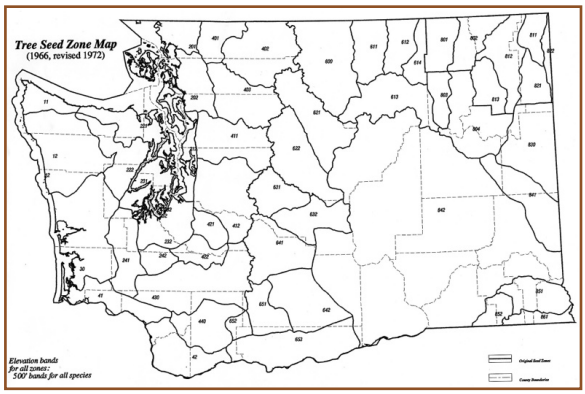
Download the Guide here.

SILVASEED BY MAST

Seed Zones

Tracking where seed is sourced from helps the right seed get to the right place, which is critical for a tree’s survival. Seed zones were developed by foresters to spatially categorize seed sources and lower the risk when replanting. It may be possible to transfer or migrate seed across zones, but this should be done with care.

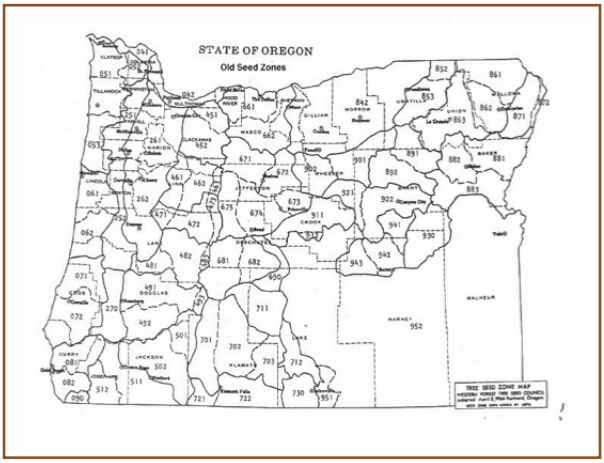
Ideally, seed in reforestation goes back to the same zone it came from. The differences among trees – even among the same species – are established by genetic variability and environmental factors. These distinctions are important to consider when selecting seed. Foresters in the 1920’s-1940’s realized the importance of tracking seed source from large-scale planting projects following wildfires. In the late 1960’s and 70’s seed zone maps in Oregon were developed by foresters knowledgeable in topography, weather, climate, and tree growth. These seed zones are still used on the US west coast to decrease the risk and give seedlings greater chance of survival.



Washington State Seed Zones

Unfortunately, tree seed supplies are limited, especially for non-industrial landowners. Therefore, projects may rely on seed from adjacent zones if available, or seed migration (sometimes referred to seed transfer).

Seed Zones (continued from page 2)



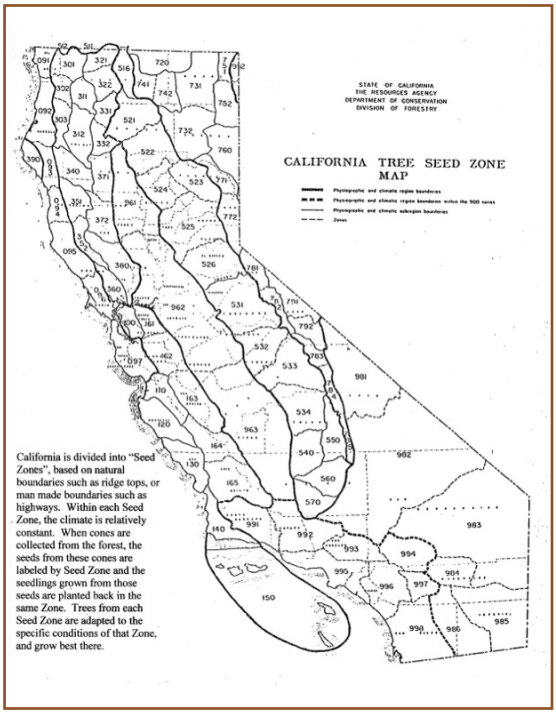
Oregon State Seed Zones

More about seed migration

Transfering seed between zones should be done with great consideration, and a decision made in agreement by expert forester and landowners. The associated risk should be assessed based on "environmental distance" rather than strictly geographic distance. In other words, looking at things like temperature, precipitation, and elevation. Guidelines have been developed based on field tests for a variety of species and environmental conditions, and accounting for climatic variables, mainly temperature and precipitation.

If guidelines for a specific species are unavailable, some general guidelines are:

- Local populations are generally well-adapted and the safest to use
- Seed transfer to higher elevations usually has higher risks. Transfer to lower elevations could decrease productivity. If this is a concern, transfer should probably not be over 500 ft.
- Latitude has less influence on seed transfer than longitude.
- Transfer poses the same risk regardless if to a harsher or milder site
- A higher planting density combined with early thinning may be prudent to account for potentially higher mortality when transferring seed
- Risk increases if transferring across multiple conditions (ex: transferring west to east and lower to higher elevation)
- Seed zone boundaries can be flexible, depending on the site location and conditions



California State Seed Zones

The above guidelines are based on recommendations from the Oregon Department of Forestry for Western Oregon.

In the US, there are tools to assist with the migration decision.

Due to the complexity of these tools, it is recommended that they be used by a professional:

- Seedlot Selection Tool: https://seedlotselectiontool.org/sst/
- Climate-Adapted Seed Tool (CA, OR, WA, ID, NV): https://reforestationtools.org/climate-adapted-seed-tool/

Suitable Seedlings

Seedlings in a nursery should be grown with full considerations of objectives and site conditions. You will want to consider the soil, amount of precipitation, slope and aspect.

For landscapes with torched soils specifically, looking for seedlings with a greater root versus shoot mass have the possibility to exhibit greater survival.

The Target Plant Concept provides a framework for producing and handling seedlings, and helps with planning reforestation projects, coordinating with nurseries, and choosing the right materials and techniques for landowner objectives.

Image credit: Mast Reforestation

For more information about the different types of seedlings that can be grown in a nursery, read the “stocktypes” section on the following page.

Ordering Seedlings

Once the species and quantity are determined, and seed is procured, the seedlings will need to be ordered and grown in a nursery. Typically, a consulting forester will work directly with the nursery to ensure this work is completed. They will also manage the contract, including shipping logistics.

It can take one year or more for the seedlings to grow in a nursery before they are ready for planting (and this is if the seed is available).

If you do not have seed, the nursery may be able to work with you to source or collect. However, this can delay the project further.

Image credit: Trever Santora, Mast Reforestation

Once seedlings are inspected and deemed ready, they are available for delivery. This is a critical stage which can affect seedling quality. Proper planning of seedling transportation will decrease costs and improve chances for survival.

Stocktypes

Put simply, stocktype refers to seedlings (stock) produced based on the container (type) it was grown in. The stocktype will convey a seedling's age and the method it was produced (container, bareroot, transplant, etc).

Naming Convention

You will likely see stocktypes expressed in a two-part code (ex: 1+0, P+1) or dash (ex: 1-0, P-1).

If the first part is a digit:
- It was grown in an outdoor seedbed
- The digit represents the years (growing seasons) it grew in the bed

If the first part is a letter:
- It started as a containter (P=Plug)

The second digit represents years in a transplant bed

Common Stocktypes

Styroblock	2A	Starter plug size for transplant seedlings
	4A	Good for remote locations with poor access
	5	Stony, shallow soils or high spring water table
	6	Shallow soils in areas at risk of drought with high level of duff / debris
	8	Mixed soil types with risk of drought or snowpack
	10	Saturated soils with competing vegetation
	15	Deep soils with high risk of environmental damage (snowpack, browsing, vegetation)
Bareroot	P+1 2A	Sites with high risk of environmental damage (snowpack, browsing, vegetation)
	P+1 4A	Sites with high risk of environmental damage where larger seedling is needed
	P+1 XL	Largest seedling available, best for sites with high risk of browsing damage or vegetation

See the following page for examle images of stocktypes

Stocktypes (continued from page 5)

Styro 2A
Western Red Cedar
40mL, 4-5 inches

Styro 4A
Douglas Fir
60mL, 4-5 inches

Styro 5
Western Larch
95mL, 5-6 inches

Styro 6
Lodgepole Pine
105mL, 6 inches

Styro 8
Incense Cedar
130mL, 8 inches

Styro 10
Ponderosa Pine
170mL, 10 inches

Styro 15 Plug
Noble Fir
250mL, 12 inches

Image credits: Trever Santora, Mast Reforestation

Additional Resources

Oregon Department of Forestry - Forest Tree Seed Zones for Western Oregon - includes individual species-specific recommendations for seed transfer

CA Seed Zones (CAL FIRE) - Includes map of the seed zones and description for the numbering system

Reforestation Is Great! But We're Running Out of Seeds - Wired article discussing the nationwide seed shortage

National Forest Foundation: Is there such a thing as too many trees? - Short summary with pictures and graphics of healthy versus overstocked forests.

"Preparing for climate change: forestry and assisted migration". Williams and Dumroese (2013) - Dive deeper on the topic of seed transfer

"The scientific basis of the Target Plant Concept: An overview" (Davis and Pinto) - Read more about the Target Plant Concept, summarizing current knowledge from existing literature

"Review of reforestation value chain planning and management: A conceptual framework" (Mousavijad et al, 2022) - A thorough literature review to identify existing reforestation value chain frameworks.