Application of the Seedlot Selection Tool

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Outline

Climate change impacts on trees

- Relationship between trees and climate

Seedlot Selection Tool

- Seed inventory gap analysis

Climate Change Impacts on Trees

Abiotic Stressors:

- Summer heat and drought
- Warm winters

Biotic Stressors:

- Insect and disease outbreaks

Forest Impacts:

- Losses in productivity
- Changes in species distributions
- Ecosystem loss

Drought related tree mortality. Sequoia National Park.

Nate Stephenson, US Geological Survey

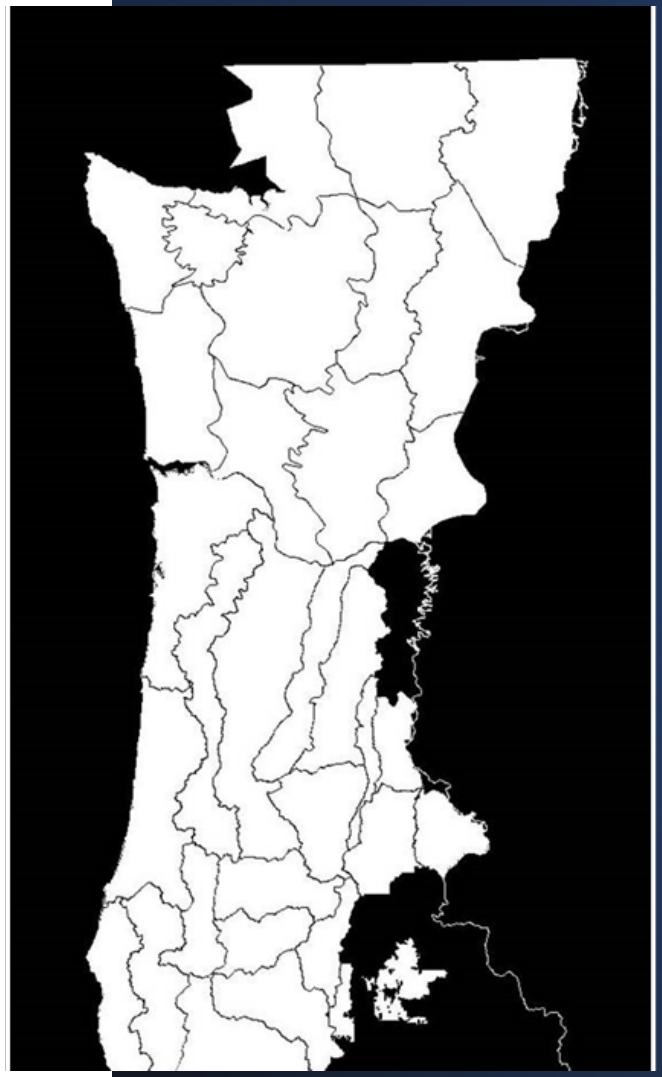
Mountain pine beetle tree mortality.

William M. Ciesla, Forest Health Management International, Bugwood.org

The relationship between trees and climate

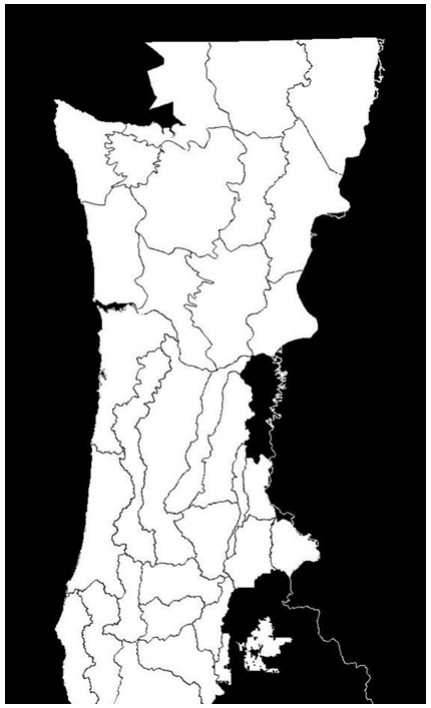
Provenance Trials (seed source variation)

- 200+ years of data: trees are adapted to local climate
- Productivity declines outside of certain thresholds, or transfer distances
- These studies were the basis for creating seed zones
- Provenance tests can be used to infer the effects of climate change

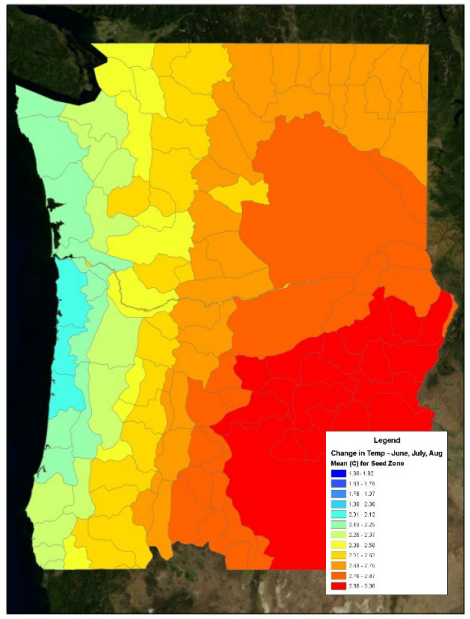


Randall (1996) OR Dept. of Forestry

What if we do nothing?



Static Zones



Projected mid-century summer temperature increases in PNW seed zones

Species Migration:

- Historical rates: < 100 m/yr.
- Needed to keep pace with climate change: > 1000 m/yr.

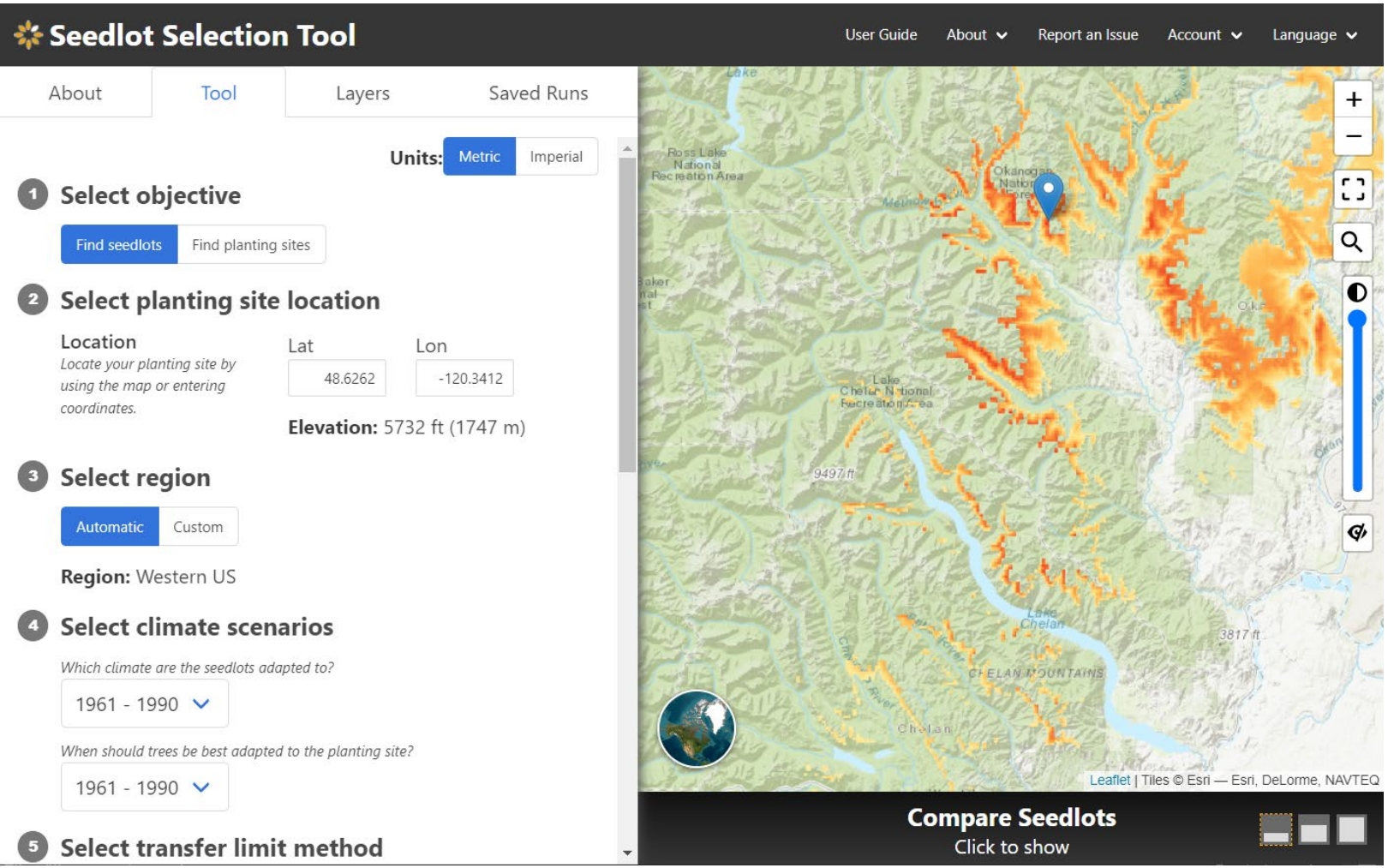
Species Adaption:

- Too slow

Pearson RG (2006) Climate change and the migration capacity of species. Trends Ecol Evol 21:111–113

Seedlot Selection Tool

seedlotselectiontool.org

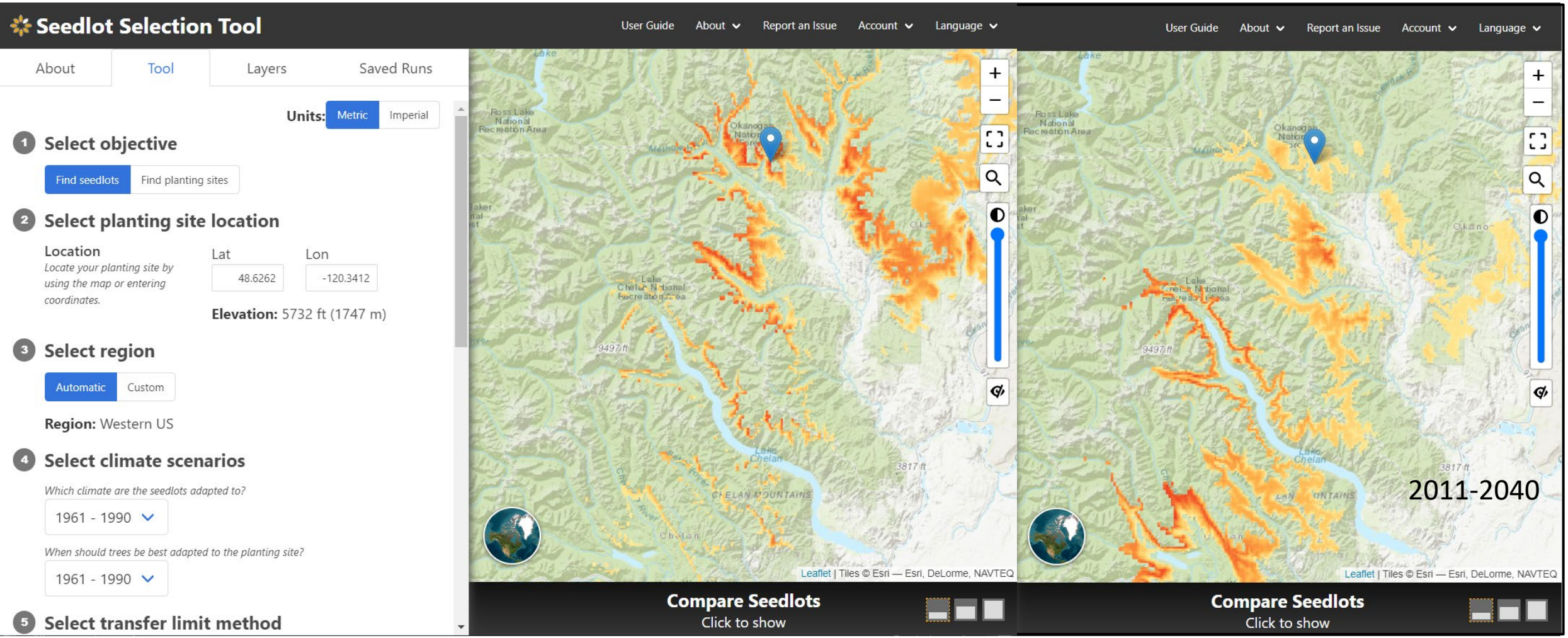


- Developed by OSU and the PNW Research Station
- Helps managers match seedlots with planting sites based on climatic information.
- The climates of the planting sites can be chosen to represent current climates, or future climates based on selected climate scenarios.

USDA United States Department of Agriculture
Northwest Climate Hub

Seedlot Selection Tool

seedlotselectiontool.org



Environmental Factors that drive the seed transfer……

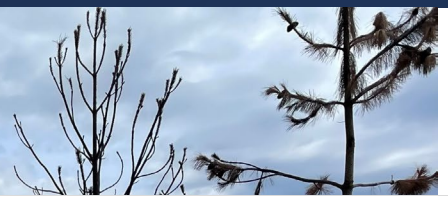
MCMT: Mean coldest month temperature
Value at point: **-5.5**
Transfer limit (+/-): **2.00 °C**
Avg.transfer limit for zone set: **-- °C**

SHM: Summer heat-moisture index
Value at point: **90.9**
Transfer limit (+/-): **45.5**
Avg.transfer limit for zone set: **--**

How Much and How Soon?

- Prior to 2023 the Okanogan Wenatchee NF has relied on the Historic Seed Transfer.
- Out-planting scheduled for 2024 utilizes the SST to select 60 % of the seed
  - 40% of the seed > **Historic** Transfer Guidelines
  - 30% of the seed > SST **“Current Climate”**
  - 30% of the seed > SST estimated **“Near Century”**

Trailing Edge…Predictor of future forested landscapes



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Drought, wildfire and forest transformation: characterizing trailing edge forests in the eastern Cascade Range, Washington, USA

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Climate change and the compounding effects of drought and wildfire are catalyzing rapid ecosystem changes throughout the world. Relatively dry, trailing edge (TE) forests are especially vulnerable to ecological transformation when tree regeneration is moisture-limited following high-severity fire. Here, we illustrate the potential landscape-scale impacts of changing disturbance regimes by focusing on TE forests in the eastern Cascades of Washington, USA. Our specific objectives were to: (1) map TE forests based on climatic water deficit and forest cover; (2) characterize the composition, structure, and ownership of TE and non-TE forests; (3) quantify recent fire activity in TE and non-TE forests; (4) identify locations of potential forest loss where recent fires have burned severely in TE forests. Across the study area, TE forests encompassed 387 000 ha, representing a substantial portion (21 per cent) of the total forested landscape. TE forests generally were characterized by dry, mixed-conifer forest types with more open structure and less biomass than non-TE forests. The structural and compositional conditions within TE forests make them ideal locations for management strategies designed to enhance landscape resilience and sustain fire-resistant trees. TE forestland ownership is diverse (35 per cent federal, 19 per cent Tribal, 16 per cent Washington State, 14 per cent private non-industrial and 13 per cent private industrial), indicating that successful land management will require collaboration among numerous partners. Recent wildfires (1984–2020) cumulatively covered 84 300 ha (22 per cent) of TE forests and 363 500 ha (25 per cent) of non-TE forests. TE forests experienced less high-severity fire than non-TE forests (39 per cent vs. 46 per cent, respectively). Recent high-severity fire effects in TE forests occurred primarily in the northern portion of the study region, reflecting the distribution of individual large fires. By quantifying the variability of TE forests and their recent fire activity, this study supports adaptive management strategies for landscape restoration, post-disturbance reforestation and climate adaptation.

Introduction

Forests are dynamic, and their characteristics and benefits to society vary across space and time with climate, disturbance and land use. Anthropogenic climate warming and land use have altered natural disturbance regimes throughout the world, and recent increases of tree mortality are projected to accelerate, particularly in seasonally dry ecosystems (van Mantgem *et al.*, 2009; Millar and Stephenson, 2015; Ramsfield *et al.*, 2016; Stephens *et al.*, 2018; Hagmann *et al.*, 2021; McNellis *et al.*, 2021; Williams *et al.*, 2022). The compounding effects of high-severity, stand-replacing wildfire and drought stress may result in widespread tree regeneration limitation and associated conversion of forests to novel forest conditions or non-forest cover types (McKenney *et al.*, 2007; Donato *et al.*, 2016; Kemp *et al.*, 2019; Coop *et al.*, 2020). Such tipping points, where wildfires punctuate ongoing directional changes, are especially likely in trailing edge forests (hereafter 'TE forests') near current ecotones (Davis *et al.*, 2019; Parks *et al.*, 2019; Davis *et al.*, 2020; Urza *et al.*, 2020). Here, we define TE forests as locations between the current limits and projected future limits where trees are unlikely to persist due to moisture stress. Widespread changes within this critical interface could accelerate losses of ecosystem services and co-benefits, including carbon storage, water quantity and quality,

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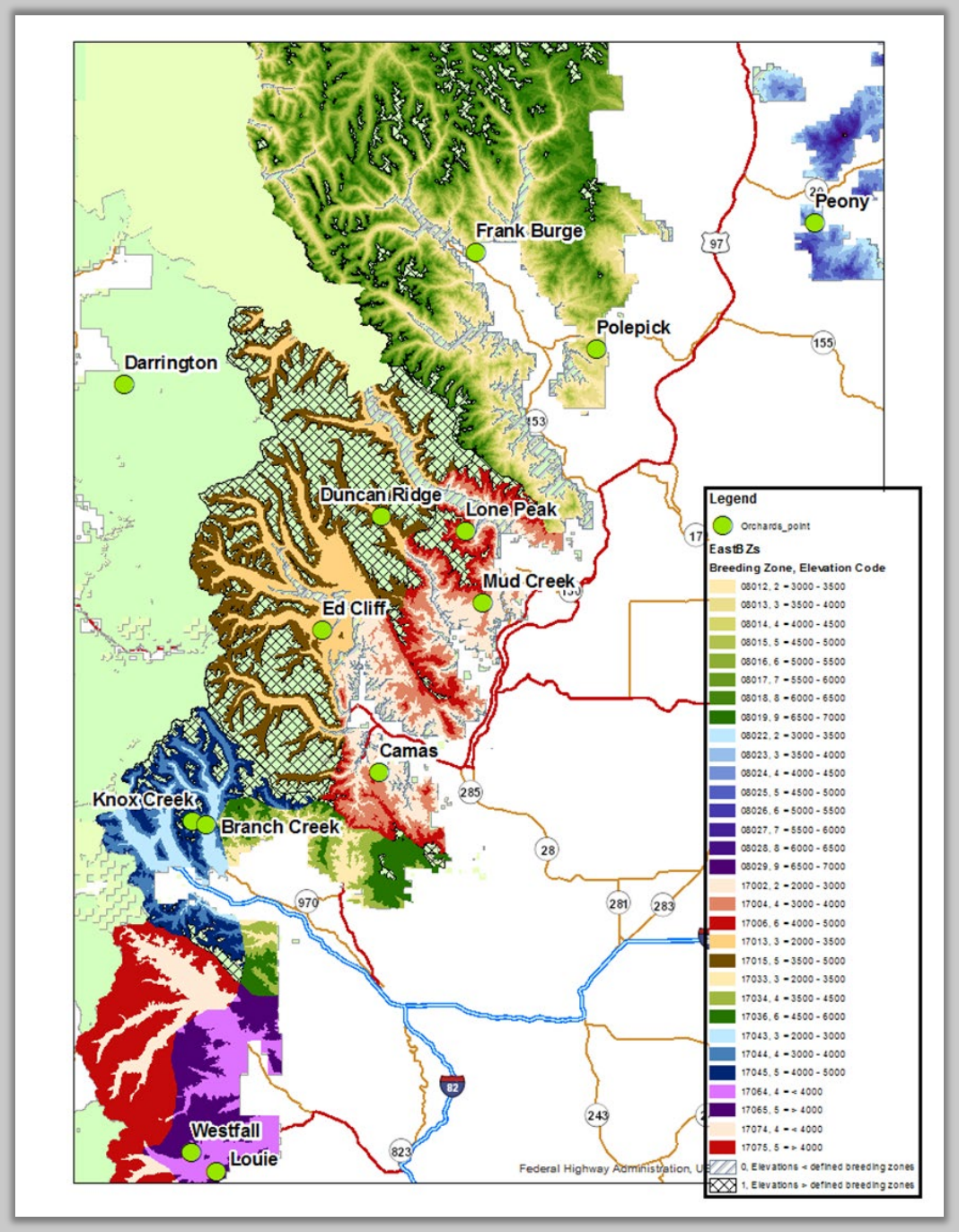
Cross-boundary climate matched seed orchard PIPO deployment planning for WA

Seed Orchard Gap Analysis

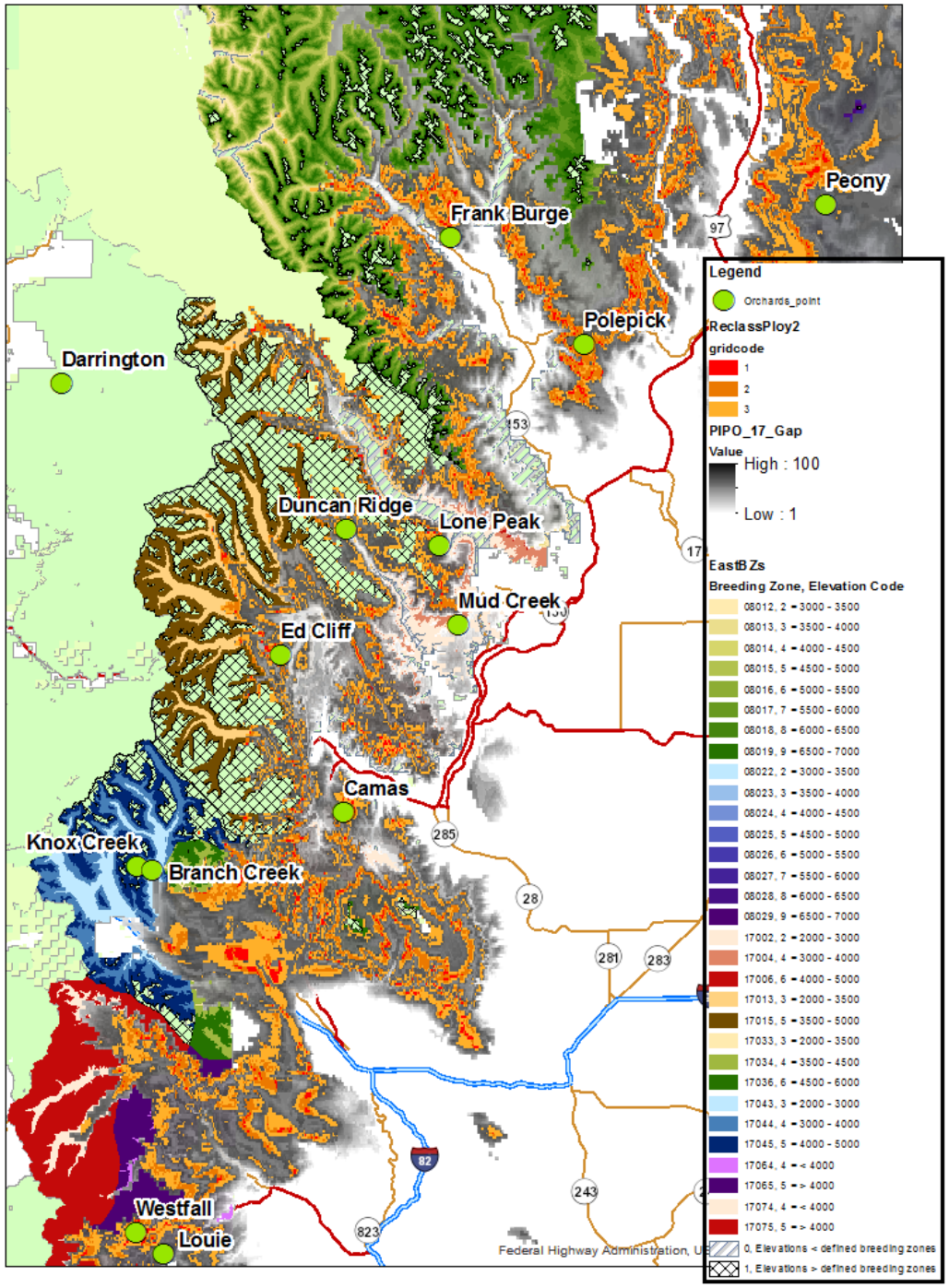
Okanogan-Wenatchee Breeding zones & Tree seed orchards

- Breeding Zone color display classified by BZ code & elevation



Okanogan-Wenatchee Breeding Zones and Tree Seed Orchards

- Seed collection areas ≠ deployment areas in predicted future climate scenarios
- Gap analyses can help you:
  - locate climate matched seed orchard seed
  - Identify where wild stand collections may be needed
  - Highlight gaps where new orchards could meet climate matched seed needs
- Important to consider non-FS land, especially for low elevations
  - May be closer geographically
- MOU with WA DNR – cross boundary seed planning & use
  - Future gap analyses: aim to include DNR orchard blocks



Resources

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Seedlot Selection Tool and Climate-Smart Restoration Tool: Web-based tools for sourcing seed adapted to future climates

John Bradley St.Clair, Bryce A. Richardson, Nikolas Stevenson-Molnar, Glenn T. Howe, Andrew D. Bower, Vicky J. Erickson, Brendan Ward, Dominique Bachelet, Francis F. Kilkenny, Tongli Wang
... See fewer authors

https://www.climatehubs.usda.gov/content/seedlot-selection-tool-guidebook-usfs-region-6-silviculturists

Summary

Climate change is a threat to Forest productivity and health

The Seedlot Selection Tool is a powerful analytical tool for climate matched seed sourcing