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Silviculture and Forest Health – An Industry Perspective

Forest Health in Oregon: State of the State 2020

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Silviculture Manger

Hancock Forest Management

What is Forest Health from an industrial perspective?

- Creating productive, resilient forests with a focus on timber production?
- Guided by the understanding that only a healthy, functioning ecosystem can provide benefits in the long-term
- Forest Practice Rules and Certification programs provide the ecological framework and benchmarking to operate sustainably (Objective #2: SFI Standard “Forest Health and Productivity”)

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How has Forest Health perspective changed over time?

PAST

- Spatially limited – root diseases, insect outbreaks
- Temporarily limited – insect outbreaks
- Tied to weather
- Forest land base “fixed”/stable
- Reactive

PRESENT & FUTURE

- Forest Health tied to climate change
- Increased globalization awareness (new pests/diseases)
- Forest land base may change (gains and losses over time)
- **No spatial or temporal limitations – ongoing consideration**
- **Proactive**

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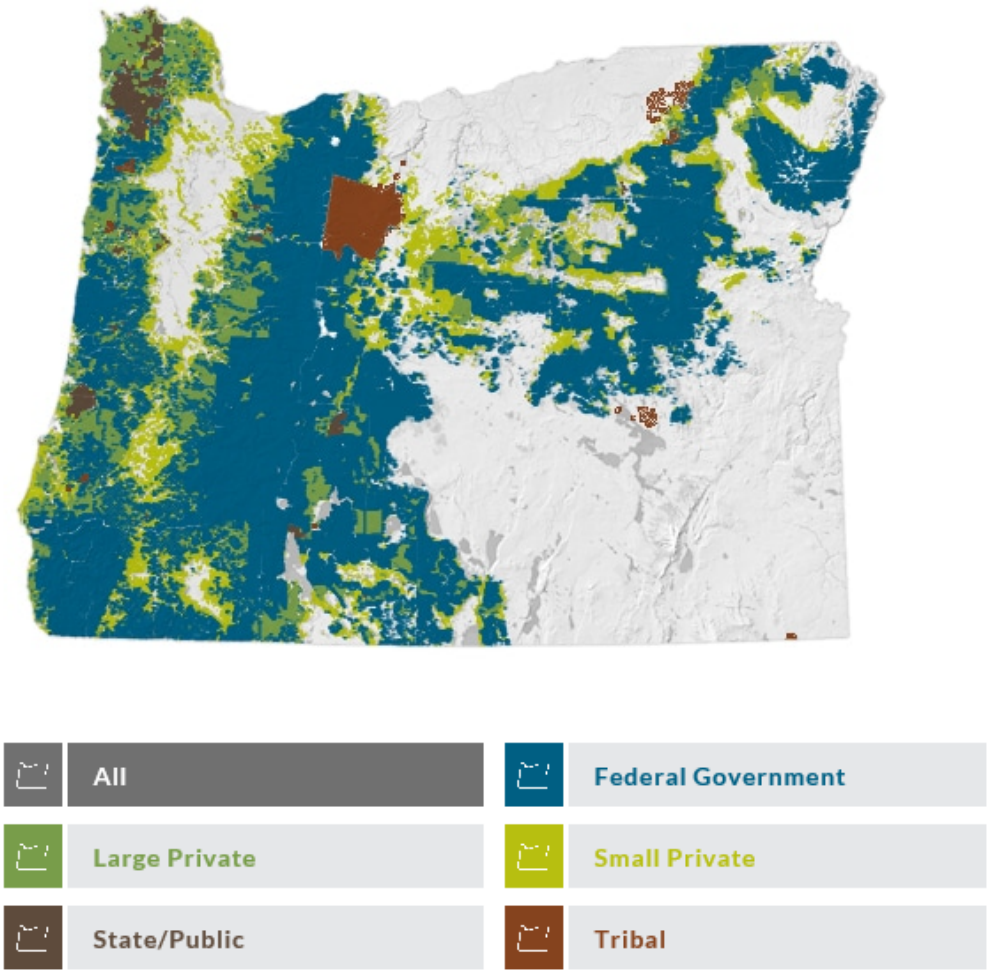
Why does forest ownership matter?

- Ownerships tightly intertwined
- 22% (6.6 mio acres) in large industrial landownership
- Fires, insects, diseases spread across ownerships



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Source – Oregon Forest Resources Institute

Forest Ownership

- Forest health perspectives change with forest ownership – i.e. research priorities
- Forest ownership drives management objectives – impacts neighbors

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Forest Ownership

- Large changes within industrial land ownership in last 20 years
- Industry consolidation and steady increase in Timber Investment Management Organizations (TIMOs)
- Investment ownership – short rotations; intensive silviculture
- Focused on increasing forest productivity (investor return)

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Forest Health – Goals

- **Minimize stressors** (species selection, stocking, etc.)
- Monitoring (diseases, insects, invasive species, etc.)
- Research (example Hancock)
  - 6 genetic cooperatives
  - 7 research cooperatives
  - internal research projects
- **Productive, healthy forests = resilient forests = best investor return** (i.e species choices in SNC affected areas)

- Focus on early establishment
  - Short rotations
  - Establishment period most challenging
  - Establishment period determines future value
  - Future resilience determined by species, genetics, density

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Few rotation age examples – change can be slow

How do we create productive and resilient forests?

Create Conditions for Successful Reforestation – Reduce drought-related mortality through silviculture and genetics

1. Species
2. Immediate reforestation
3. “Target” seedling (stock type and seedling quality)
4. Vegetation management
5. Stocking control (planting, thinning)
6. Invasive species management

Genetics

1. Climatic seed deployment – seed transfer
2. Insect/Disease resistance
3. Drought resistance

Photo Credit: Jacob Thiemens – 1st year hemlock seedling

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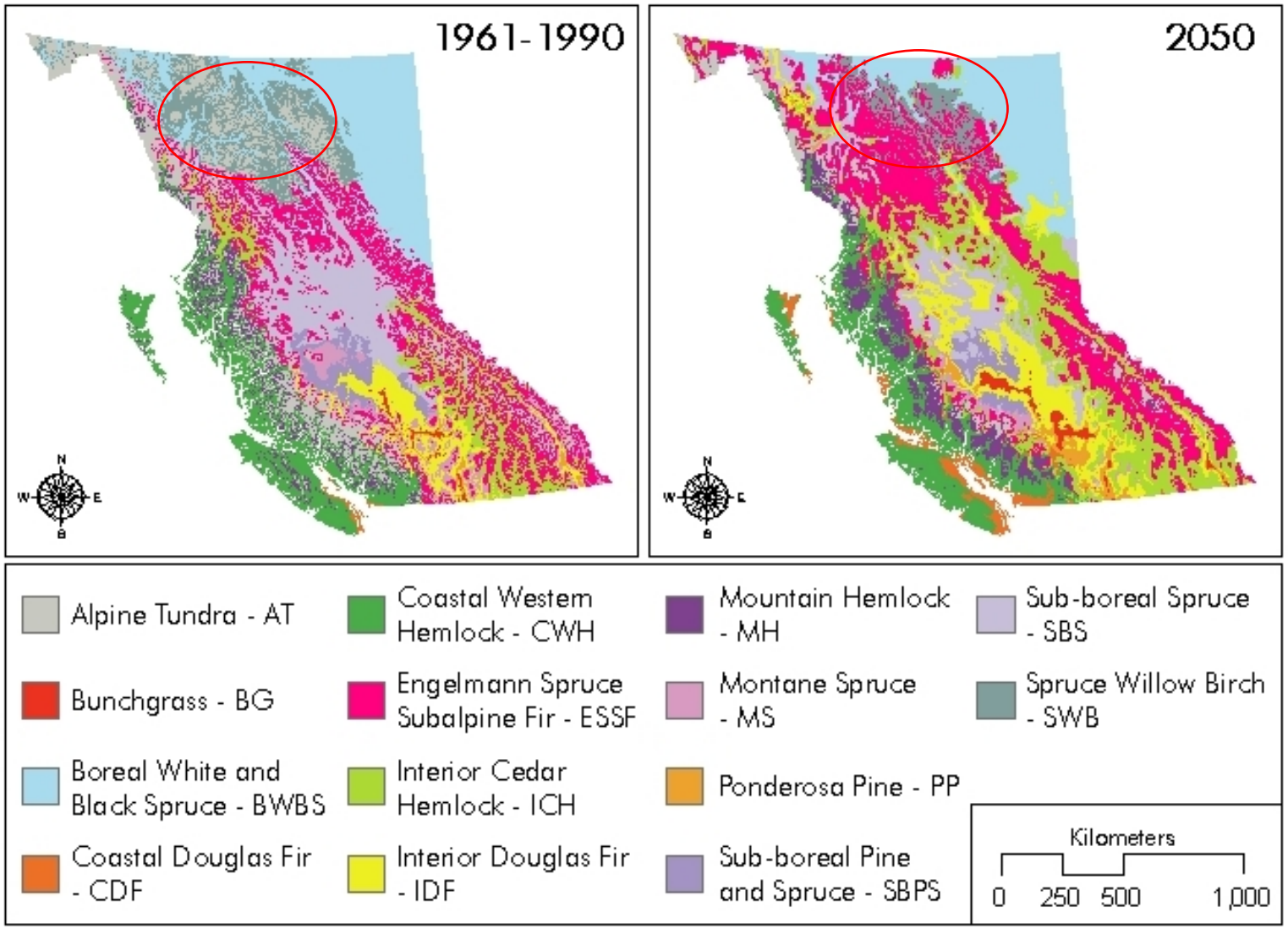
Examples

Species

Species



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https://ibis.geog.ubc.ca/courses/geob370/students/class07/bec_pred/
Prediction map of the 14 Biogeoclimatic (BEC) zones in 2050 using the CGCM2 A2x model.
Alpine tundra lost the most area while Engelmann Spruce-Subalpine Fir and Interior Coastal Hemlock gained the most area and Coastal Douglas Fir and Ponderosa Pine gained the most percent area. BEC zones moved to higher elevations, displacing alpine tundra.

Species

Target Seedling

- Limiting site factors – define “target” seedling
- Bigger ≠ Better (roots, R/S-ratio)
- The bigger the seedling = more vegetation control needed

Seedling Quality

Lack of Roots

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Nursery

7 weeks post-planting

Fall 1st Growing Season

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Vegetation Management

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3rd growing season

3rd growing season – same site

Genetics

Thousands of trees selected and bred for growth & form (wood quality, disease resistance)

Most landowners using seed from selected families (orchards)

Need to learn more about specific families (individual climate envelope?) and other traits (drought, frost, disease resistance)

Loblolly Pine PRS™
Performance Rating System

PRS™ Genetic Ratings for Loblolly Pine Families

Productivity Rating	30
Rust Resistance Grade	A
Stem Form Grade	B

PRS™ genetic ratings indicate that when compared to unimproved loblolly pine, the performance of this family is projected to be:

P = 30 --- Aproximately 30% more stem volume

R = A --- Excellent for resistance to fusiform rust disease

S = B --- Above Average for stem straightness

1. Climatic seed deployment – seed transfer/movement
2. Climatic orchard "composition"
3. Insect/Disease resistance
4. Drought & frost resistance
5. Breeding

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Genetics – Seed Movement

- PNWTIRC (OSU, Glenn Howe) working on climate-based deployment zones
- Seedlot Selection Tool – GIS-based tool to match seedlots to current and future climate

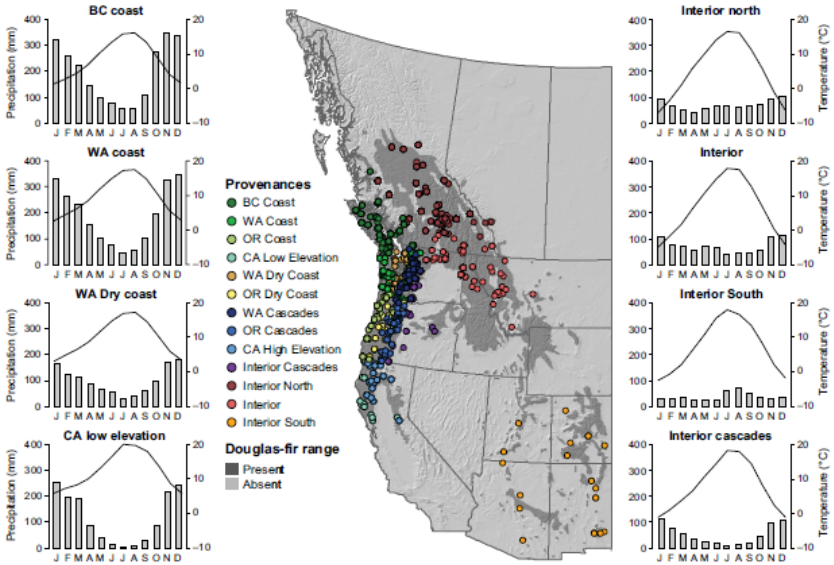
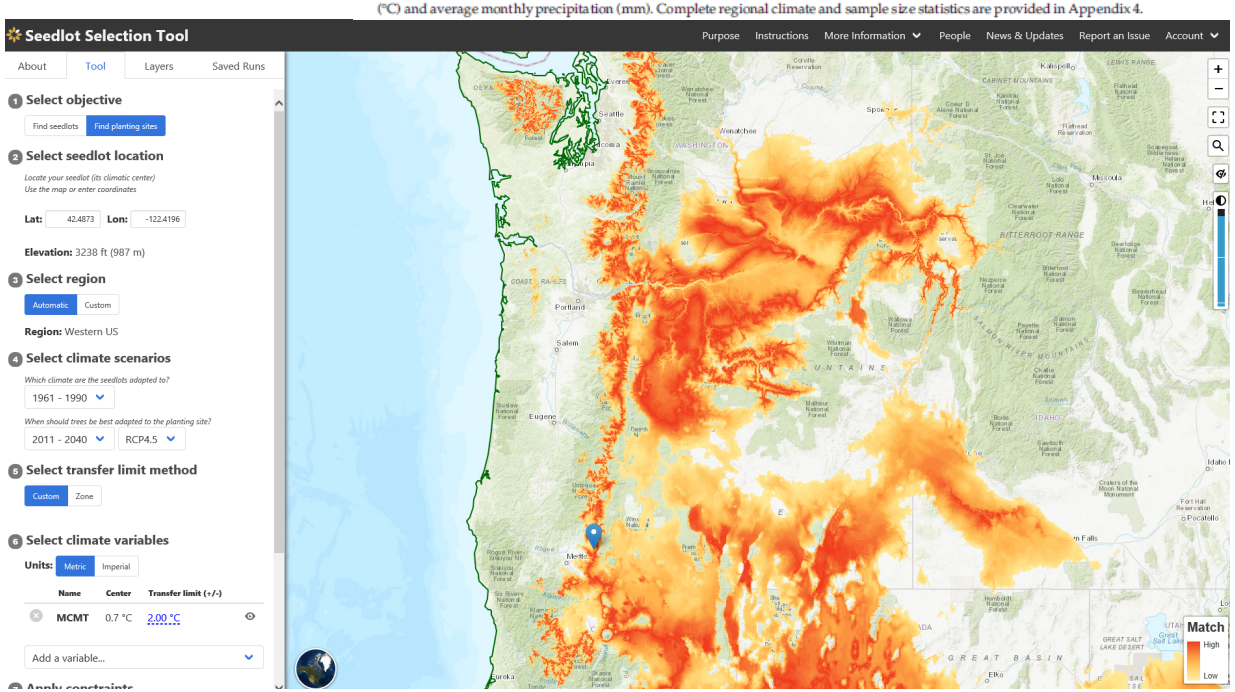


Fig. 2 Western North American seed collection sites, coloured by regional groups of provenances. The Douglas-fir species range is shown in dark grey. Selected climate graphs indicate regional averages for provenance locations for the variables average monthly temperature (°C) and average monthly precipitation (mm). Complete regional climate and sample size statistics are provided in Appendix 4.



Isaac-Renton et al (2014). Global Change Biology (2014) 20, 2607–2617

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Seed source -1.3 °C
Plantation -1.3 °C

Seed source -1.3 °C
Plantation 2.9 °C

Climate change is not good for trees!

↓ growth
↓ wood quality
↑ pest damage

} ↓ value

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Slide courtesy of Greg O'Neill, BC Ministry Forest Improvement and Research Management Branch

Climatic Orchard Composition

Using climate projections to inform selections for orchard composition

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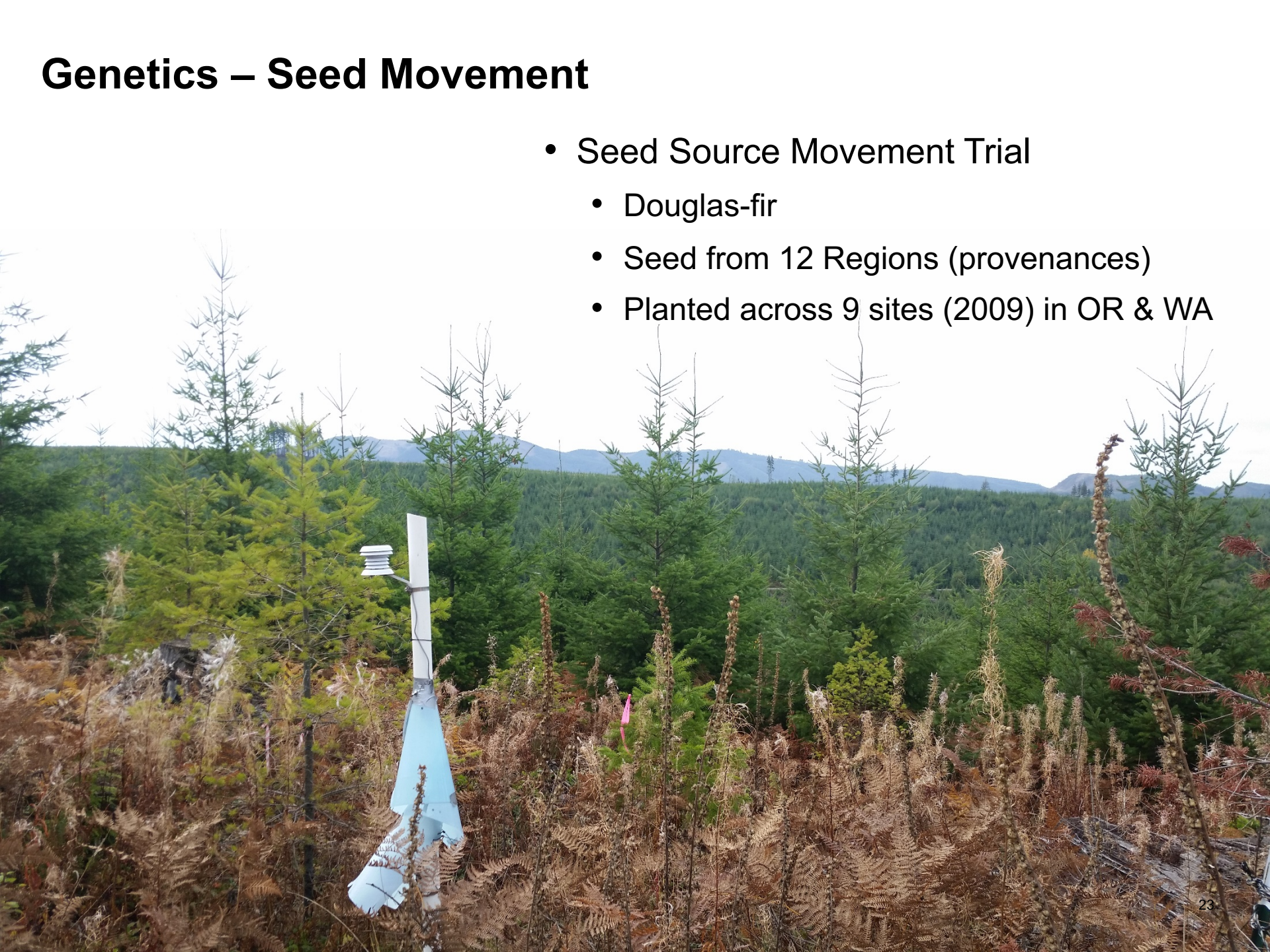
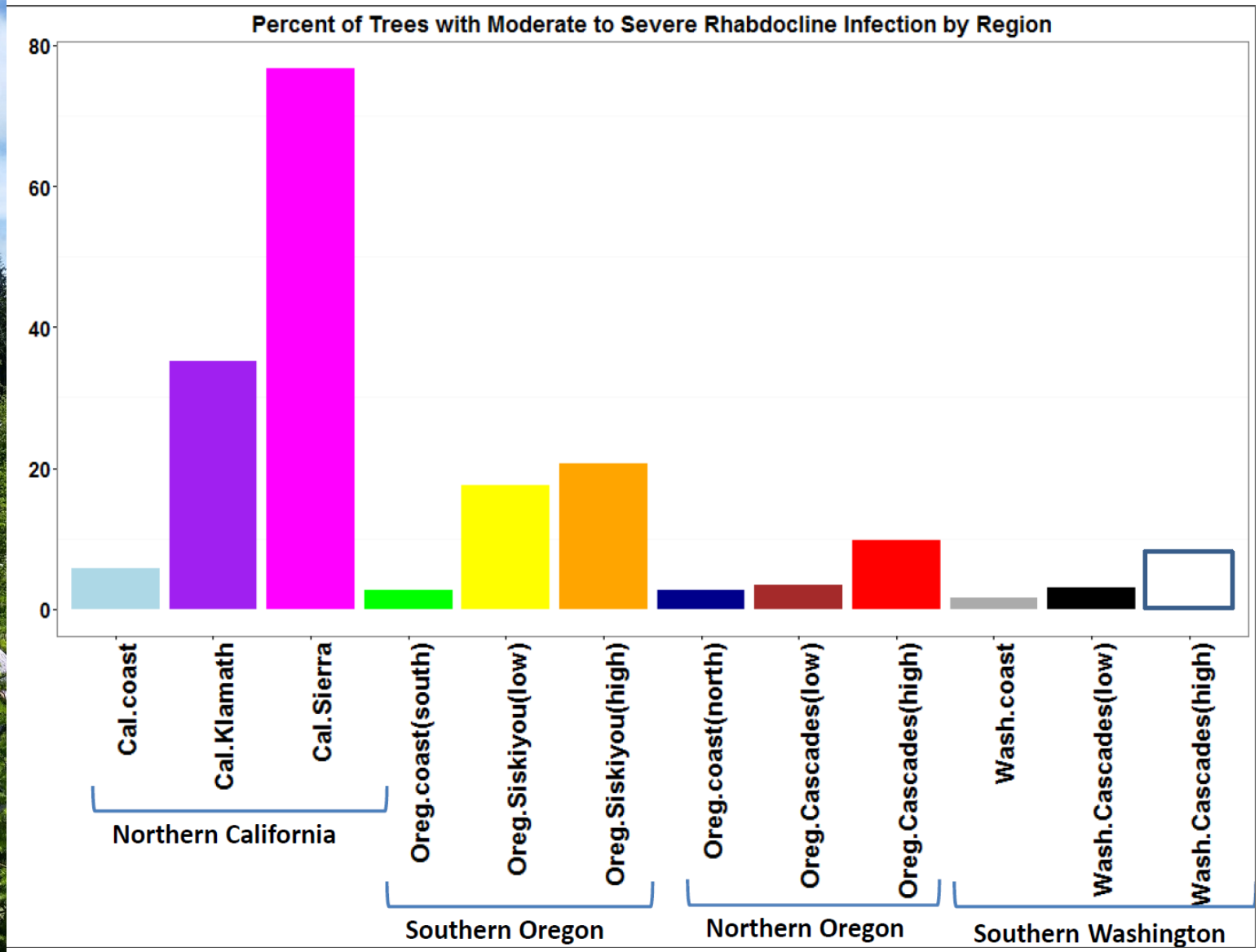
"Seed Trek" courtesy of Greg O'Neill, BC Ministry Forest Improvement and Research Management Branch

Genetics – Seed Movement

- Seed Source Movement Trial
  - Douglas-fir
  - Seed from 12 Regions (provenances)
  - Planted across 9 sites (2009) in OR & WA



Genetics – Seed Movement



Genetics – Insect & Disease Resistance

Need insect and disease resistance research on selected families

<u>BC Ministry:</u>

- Swiss Needle Cast
- Spruce weevil resistance – natural infestations & inoculations
- White pine blister rust – artificial inoculations & field tests
- Root diseases (Armillaria & Phellinus) – artificial inoculations
- Spruce budworm
- Mountain pine beetle

Non-genetic

- Role of endophytes

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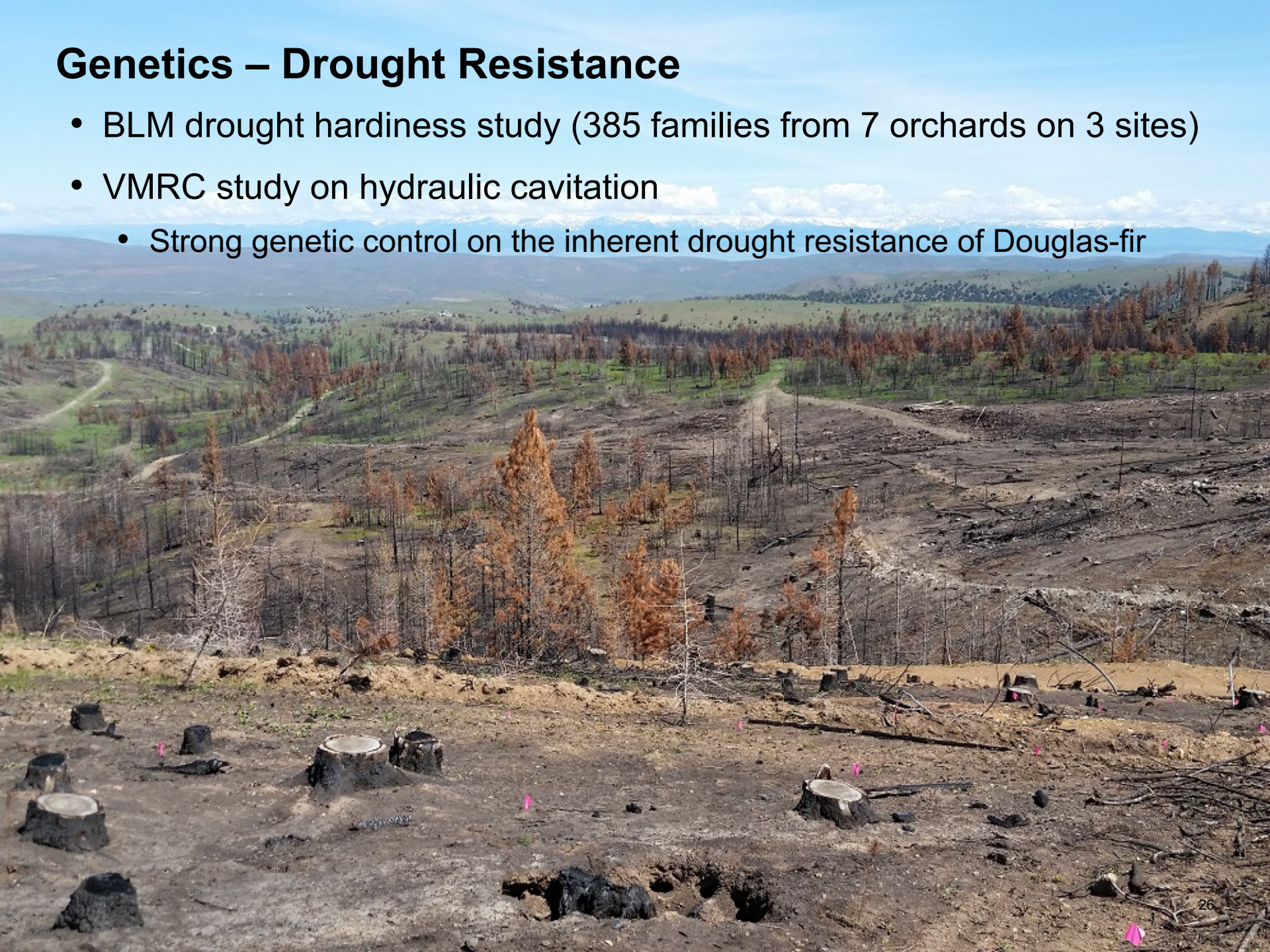
Trevor Doerksen - Armillaria; Ward Strong – Spruce Budworm

Genetics – Drought Resistance

- BLM drought hardiness study (385 families from 7 orchards on 3 sites)
- VMRC study on hydraulic cavitation
  - Strong genetic control on the inherent drought resistance of Douglas-fir



Forest Health Related Needs

1. Selection/Breeding/Testing for drought and frost resistance
2. Seed movement & genotype specific climate attributes
3. More investment in genetic disease and pest resistance research
4. Modeling of climate impacts on forest health (insects/diseases/species distributions)
5. Nursery production & seedling quality
6. (Fire) Reforestation (low cost, immediate & successful)*

- Expand research cooperation
- Investments in new approaches
  - Douglas-fir hybrids
  - Elle pots
  - Drone Seeding

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* Tree Planters' Notes 2018: Vol. 61, Nr. 2, p109

Forest Health – Silviculture – Summary

- Appropriate species
- “Right” genetics
- “As soon as possible”
- Healthy roots
- “Target” seedling
- Manage vegetation
- Keep out “invasives”
- Control stocking
- Cooperative research

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What have we learned?

What will we do next time?

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