# Red alder productivity - growth, yield and economics

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# My Background

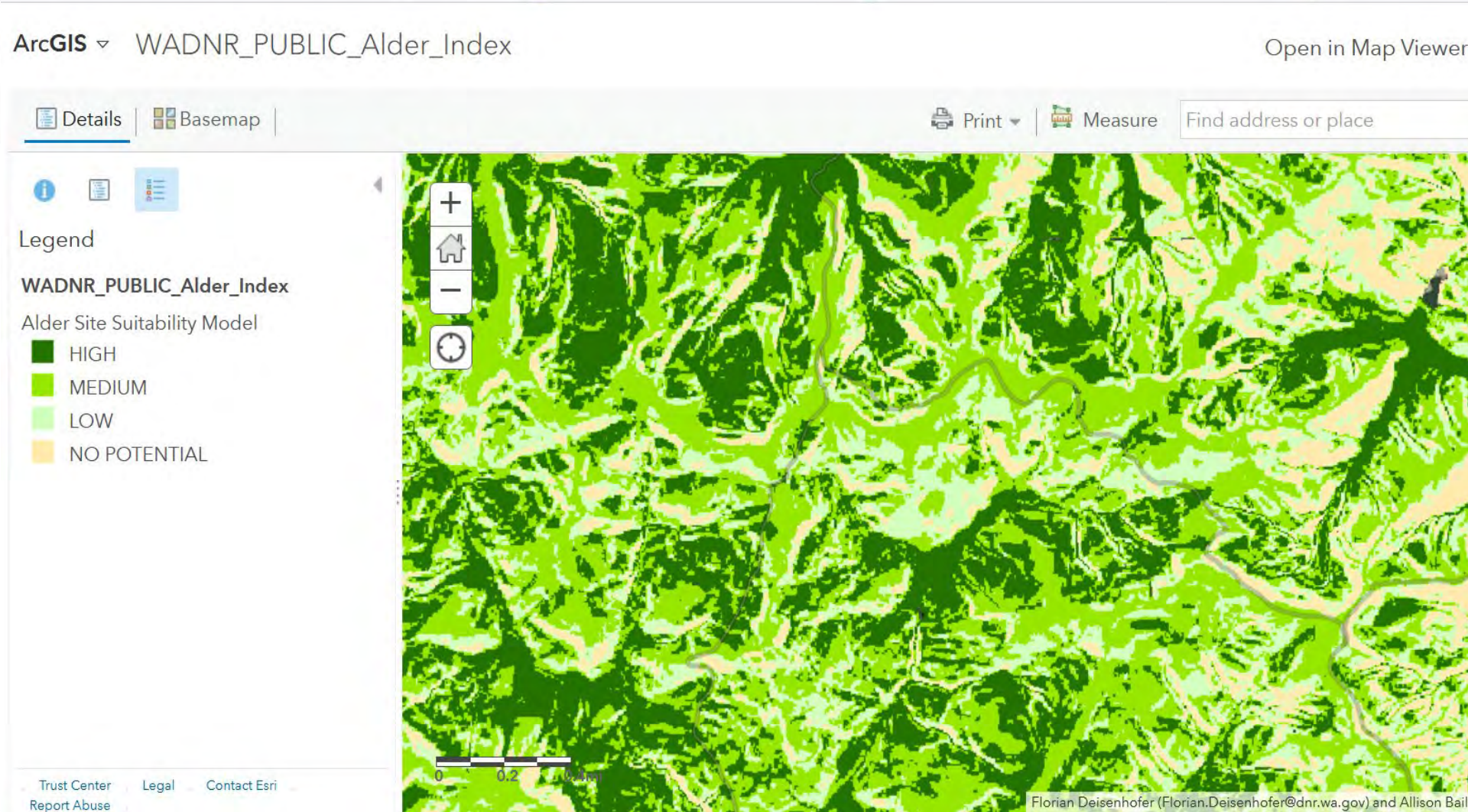
- **Ecology and Management of Hardwoods, specialty area since 1984.**
- **Research, Extension & Consulting**

Oregon State University
Extension Service

# Red alder productivity, yield, and value
# Science meets practice

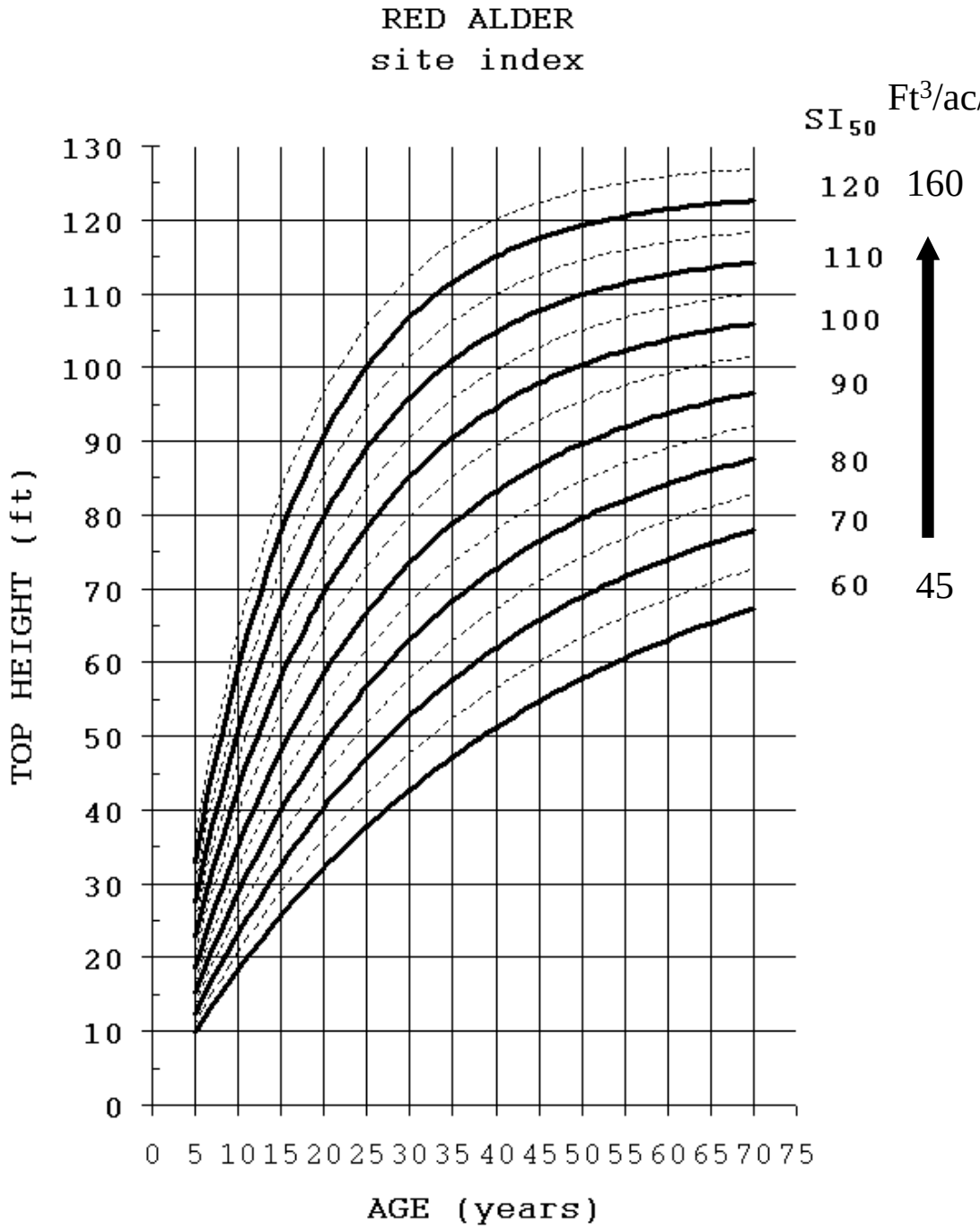
- Assessing site productivity and selecting sites for management of red alder. Methods, tools and challenges.
- Productivity, growth and yield in managed stands. Results of HSC red alder stand management study.
- Implications for economic and other values guiding land management decisions.
- Discussion, Q&A

# For landowners & land managers, assessing productivity and selecting suitable sites is the key - and the challenge.



# Methods and challenges for assessing alder site quality

- Observe growth and quality of existing trees to evaluate tree performance and suitability. E**stimate site index?**
  - Note that site index relies on the idea that how trees grew in the past is a predictor of how they will grow in the future.
- Examine all the key site factors: soil moisture and nutrients, topography, elevation, **climate, etc.**

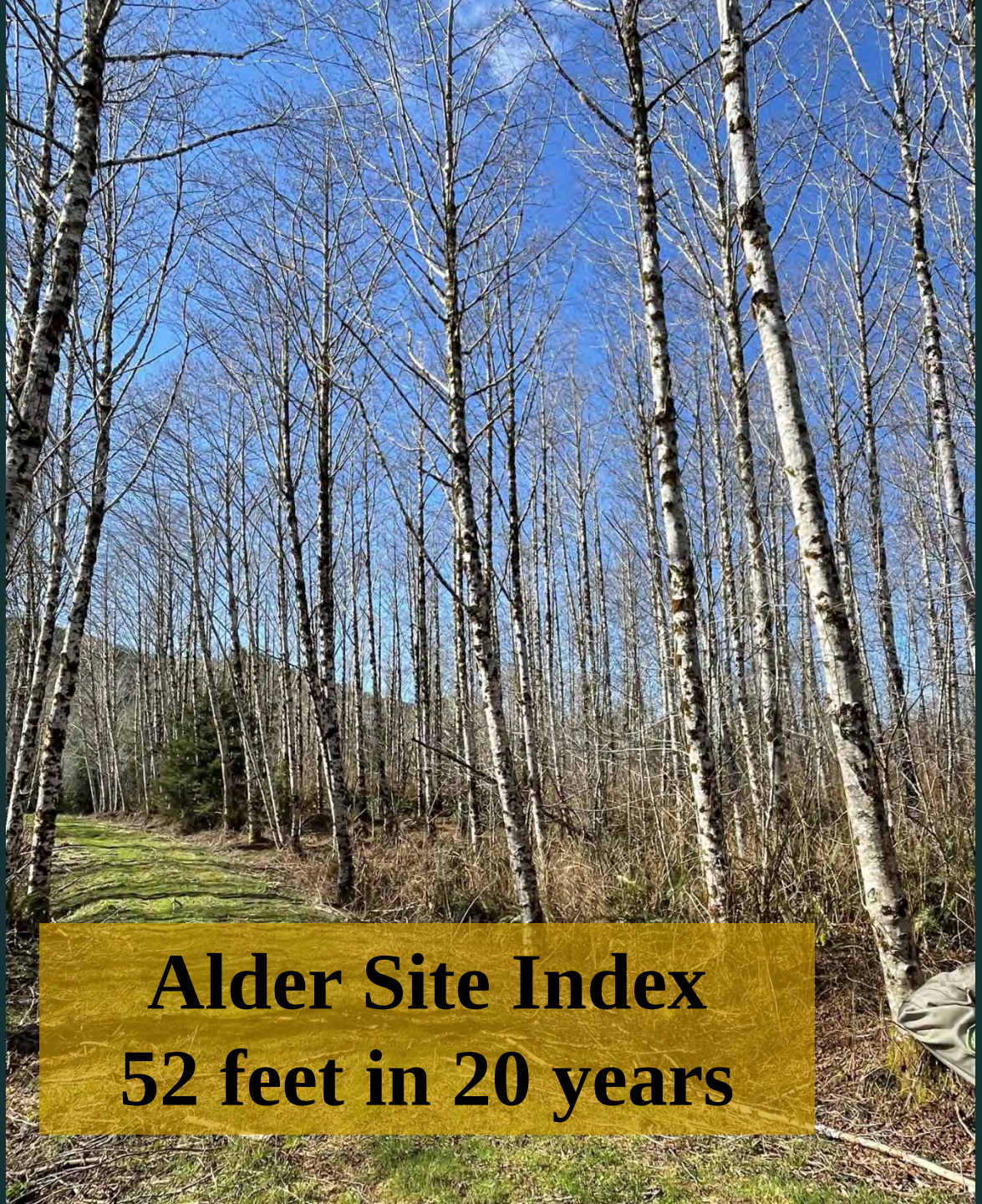



based on Thrower and Nussbaum 1991

# Age 8 – Low site quality


Age 8 – High site quality


Alder Site Index
78 feet in 20 years


Alder Site Index
52 feet in 20 years

# More methods for assessing site quality

- Connie Harrington's "Method of site quality evaluation for red alder" You can use it case by case
- WADNR alder site suitability model GIS online tool based on Harrington's method.
- OSU Site Index statistical model from mappable features for red alder and Douglas-fir (by Mainwaring Bormann et al 2023)

# Harrington's method for estimating SI scoring criteria

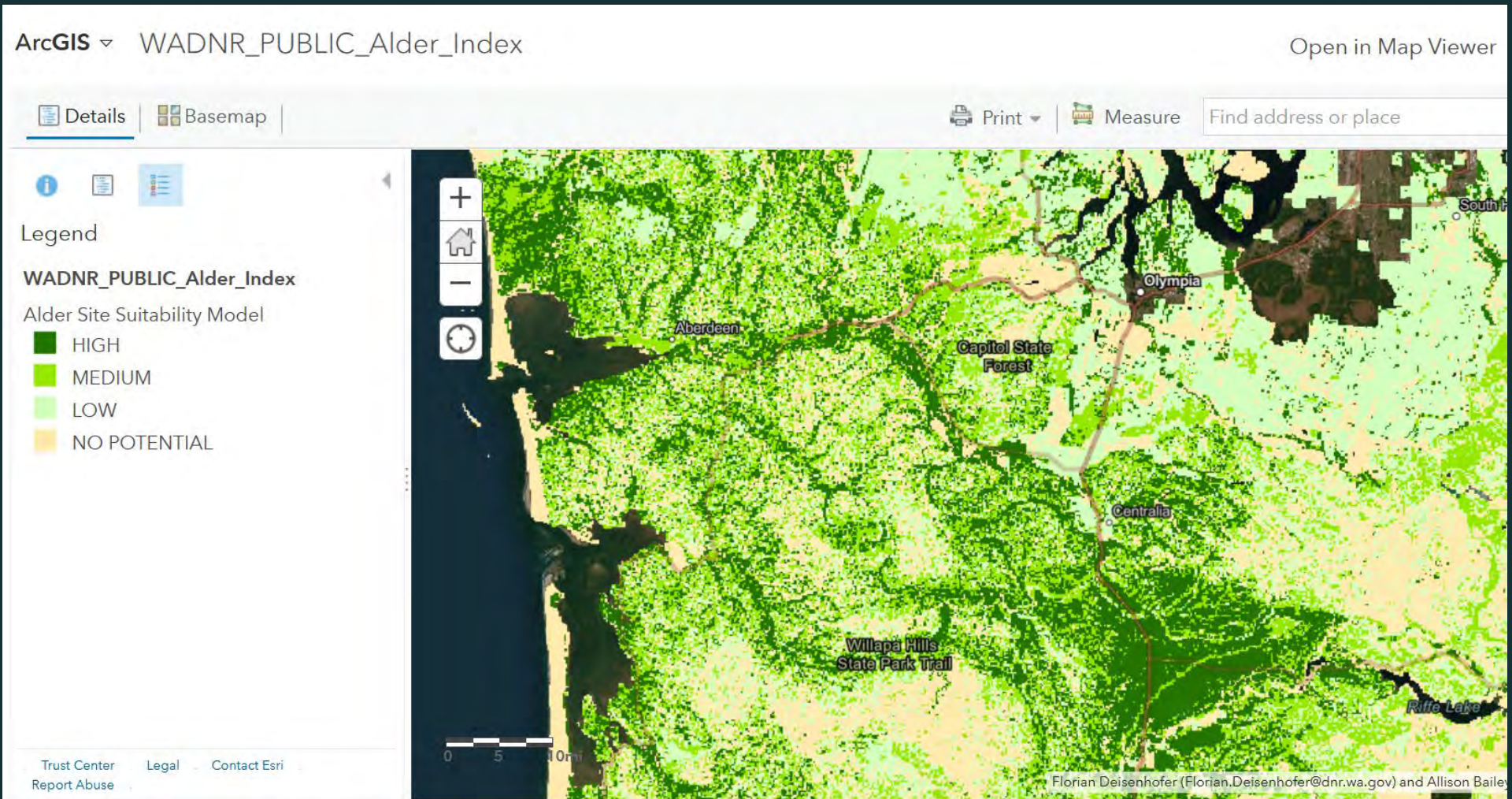
**Example for a good site**

- Elevation - Low
- Slope position – flat, lower slope, concave topography
- Slope - gentle
- Aspect – N-NE-NW
- Growing season precipitation (April-September) >12"
- Deep soil, well drained, silt-loam, <25% rock fragments, moderate organic matter, not-compacted, pH4.5-5.5, young soils
- Not a frost pocket, not exposed and windy

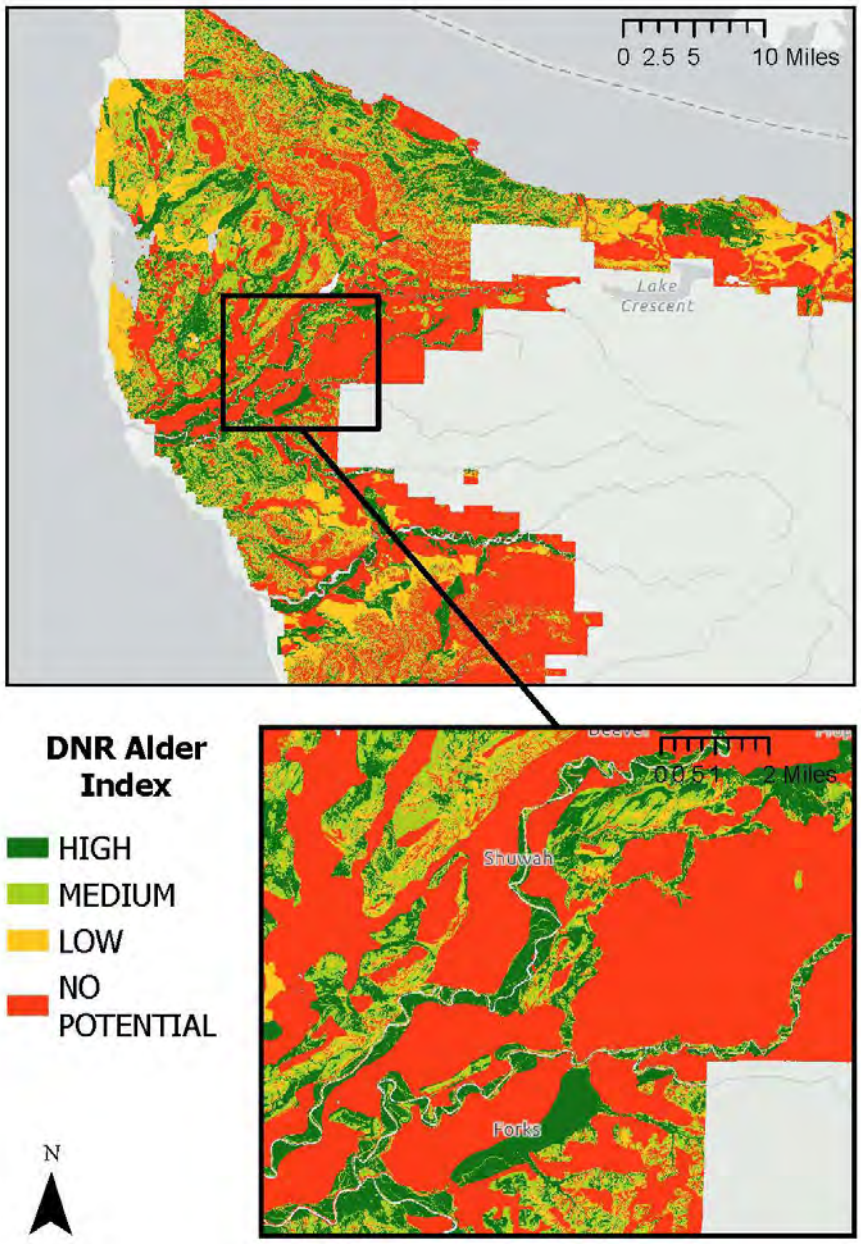
# Site Index and Site Evaluation Guides

# WA DNR Alder Site Selection Tool

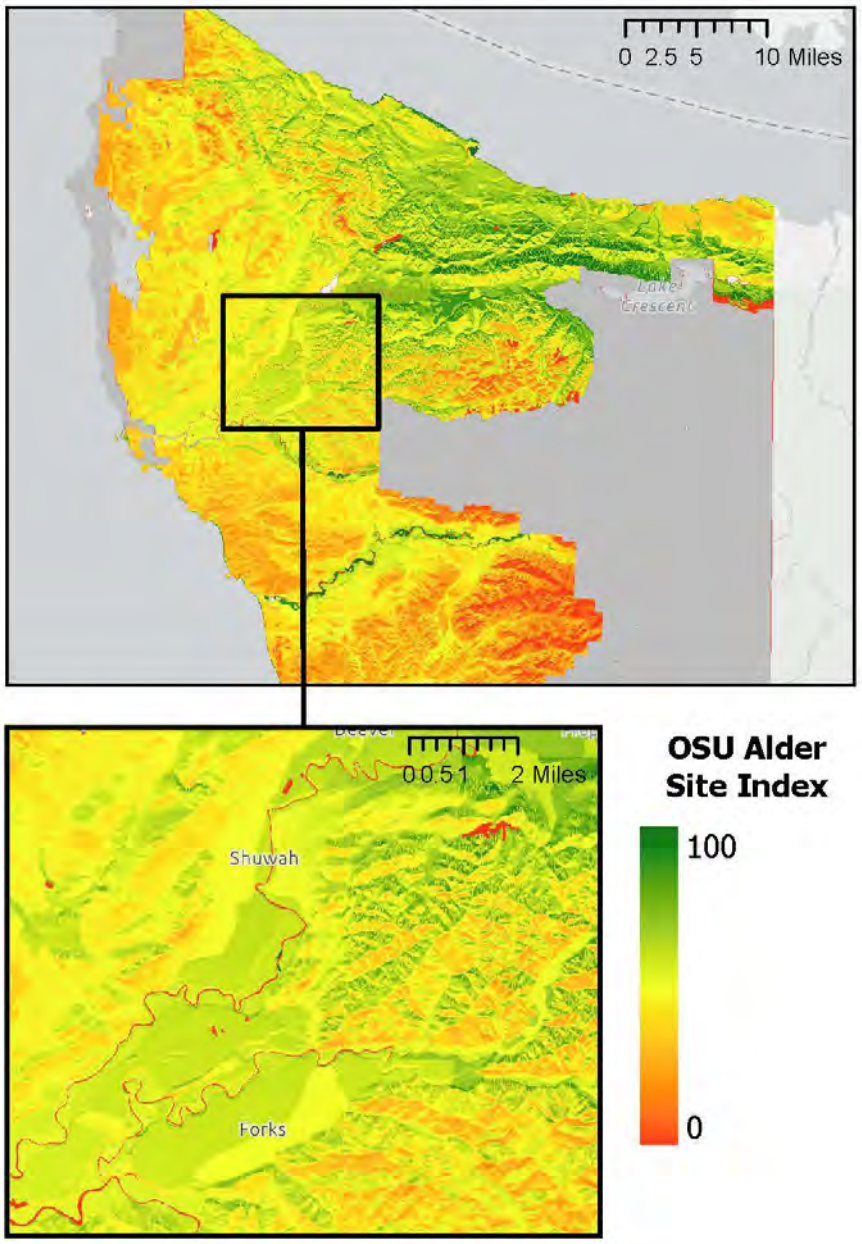
**https://data-wadnr.opendata.arcgis.com/maps/wadnr::wadnr-public-alder-index/explore**



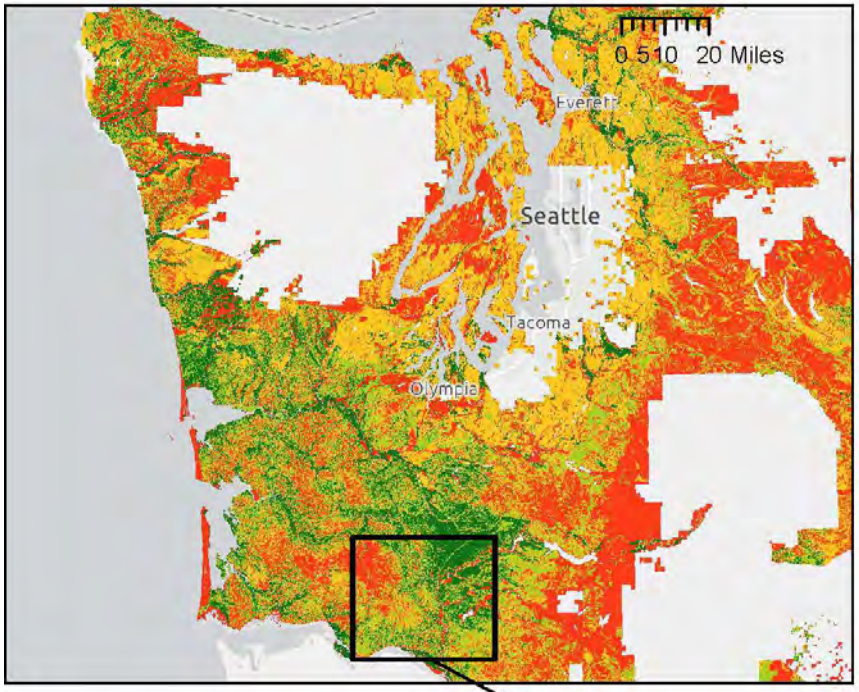
# DNR Alder Site Index

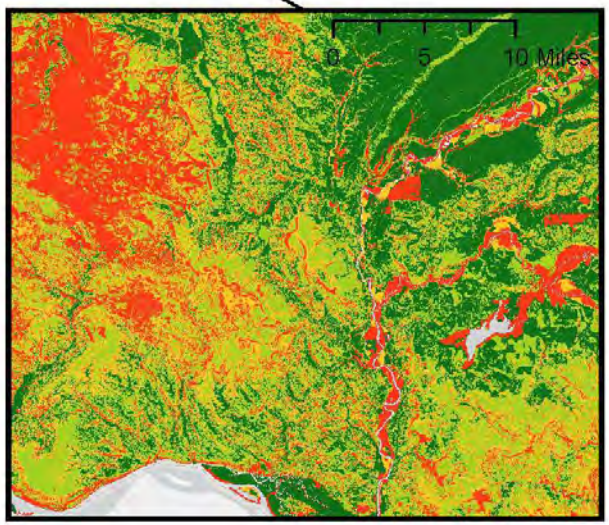



# OSU Alder Site Index



# DNR Alder Site Index



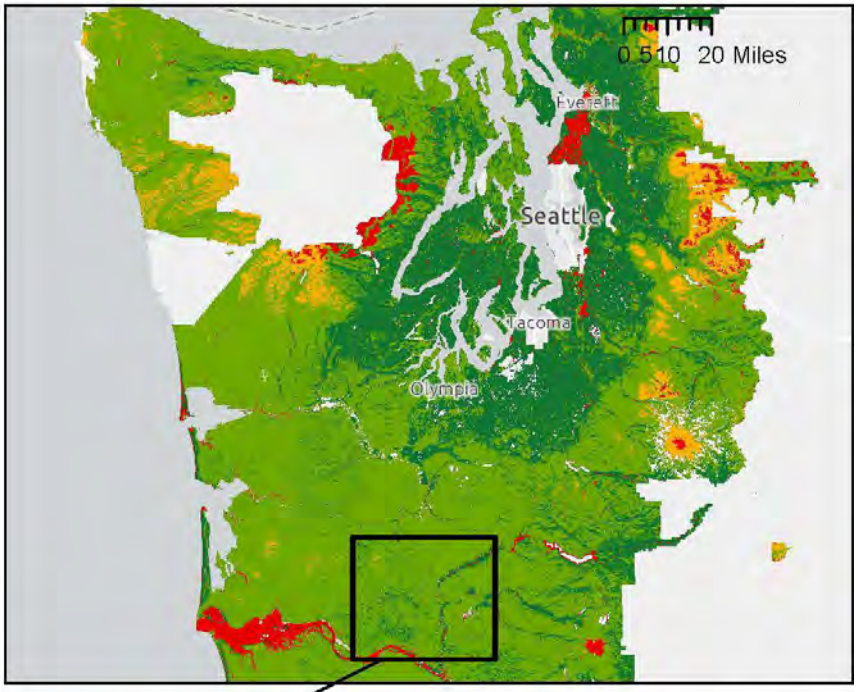



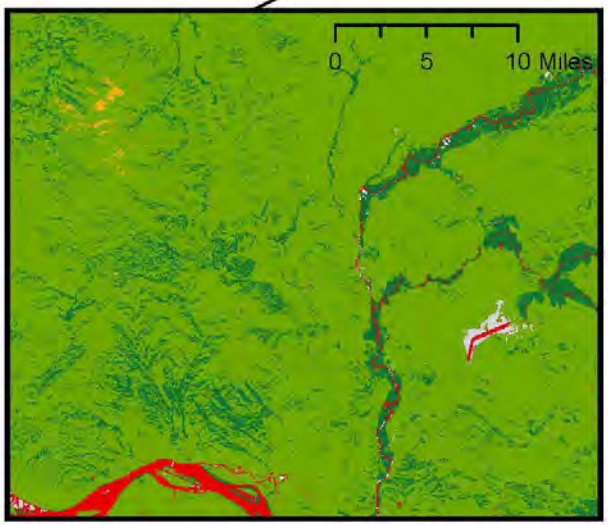

**DNR Alder Index**

- HIGH
- MEDIUM
- LOW
- NO POTENTIAL

N

# OSU Alder Site Index

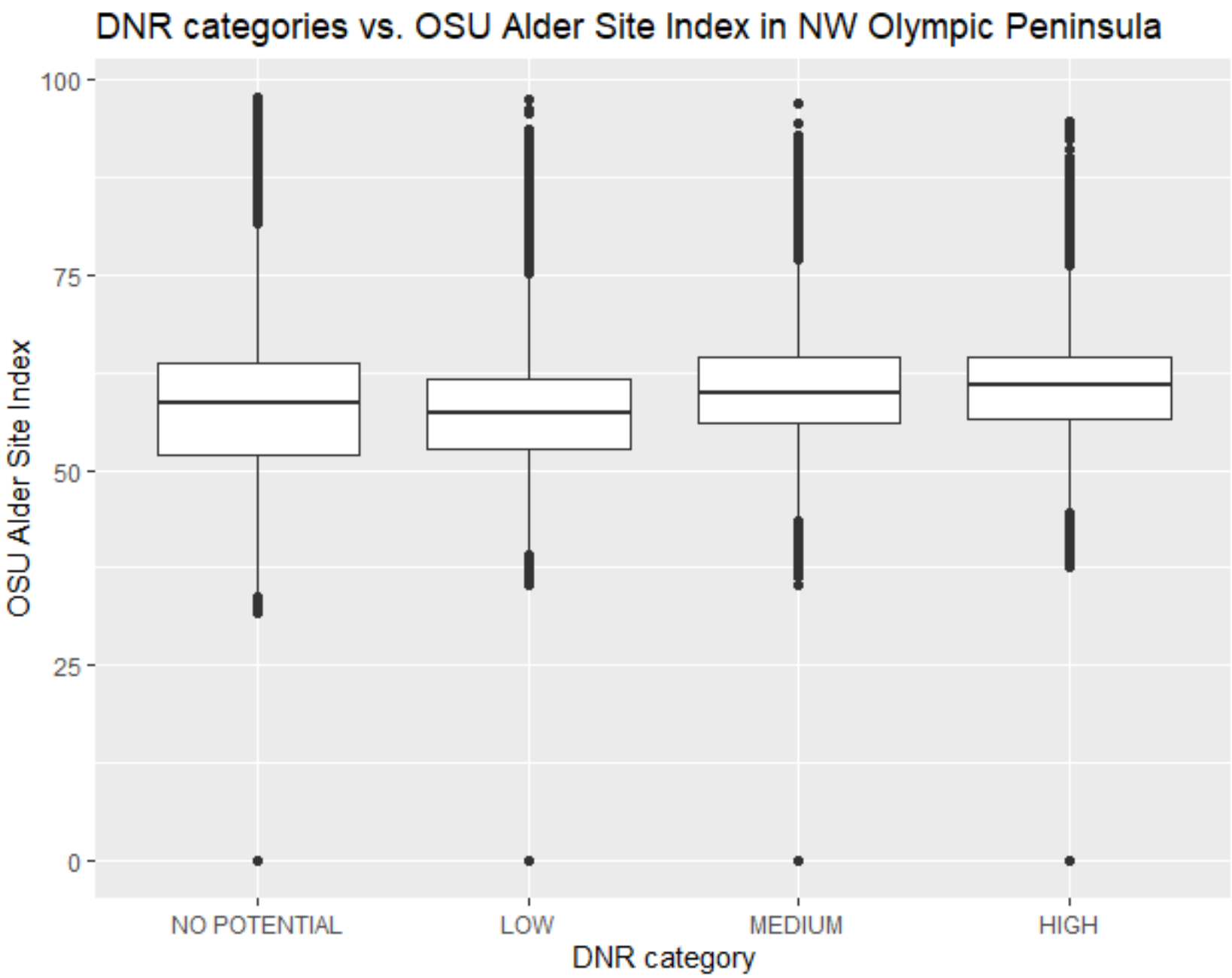


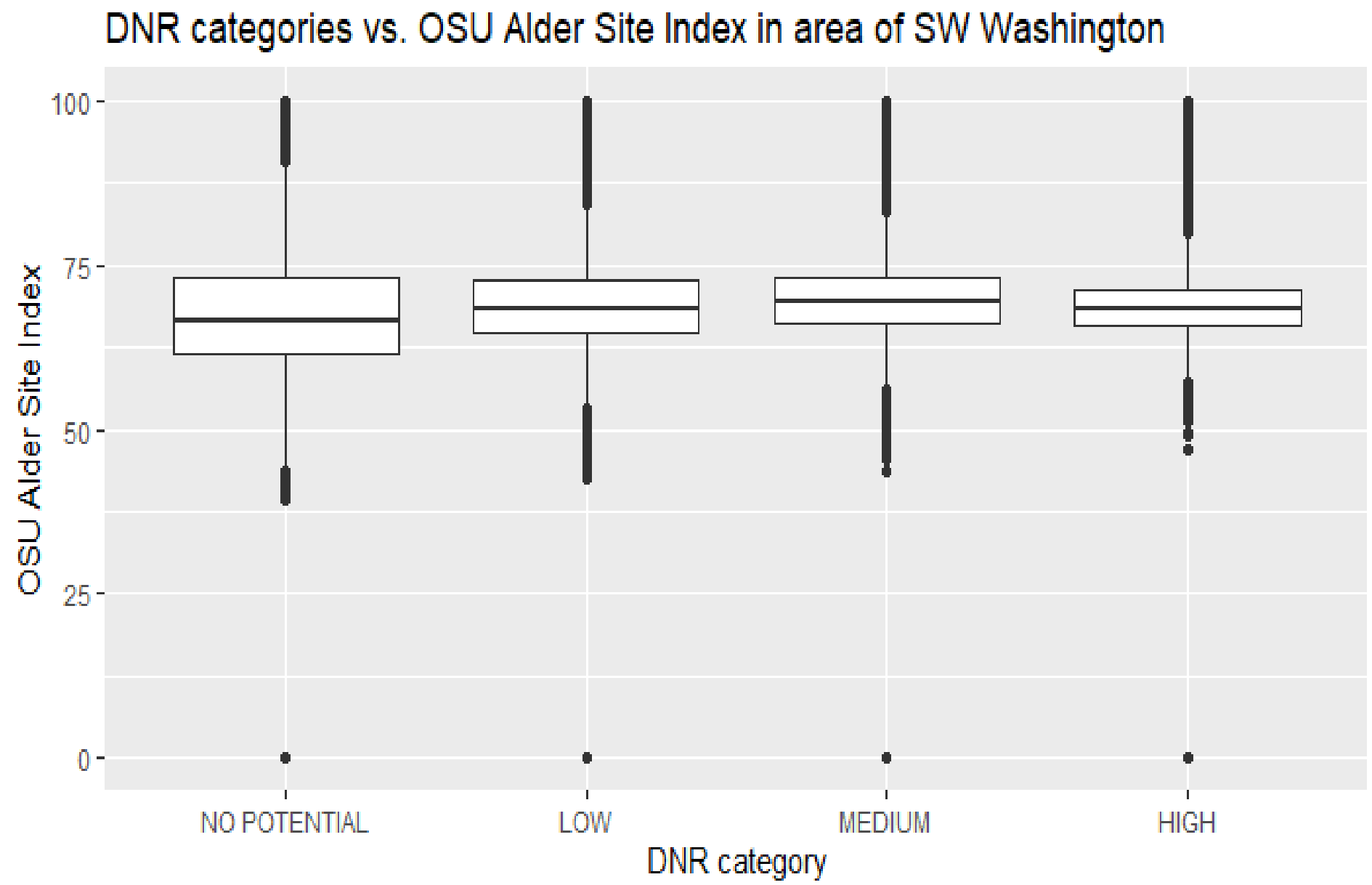



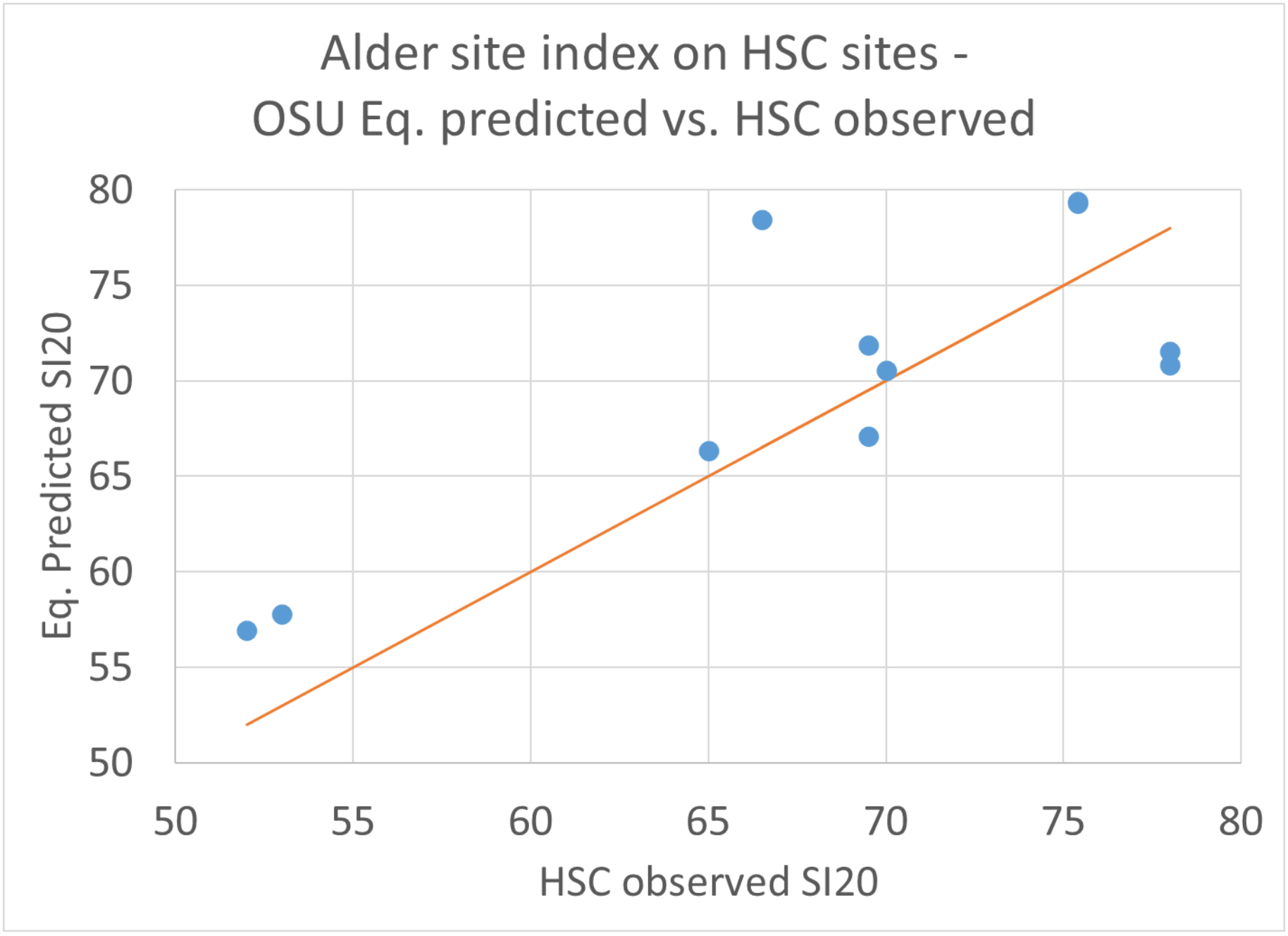

**OSU Alder Site Index**

OSU Alder Site Index (ft)

- 75+
- 50-75
- 25-50
- 0-25


DNR categories vs. OSU Alder Site Index in NW Olympic Peninsula
OSU Alder Site Index
100
75
50
25
0
NO POTENTIAL
LOW
MEDIUM
HIGH
DNR category


DNR categories vs. OSU Alder Site Index in area of SW Washington
OSU Alder Site Index
100
75
50
25
0
NO POTENTIAL
LOW
MEDIUM
HIGH
DNR category


Alder site index on HSC sites -
OSU Eq. predicted vs. HSC observed
Eq. Predicted SI20
80
75
70
65
60
55
50
50
55
60
65
70
75
80
HSC observed SI20

# Methods for assessing alder site quality and suitability for management

- WADNR Alder Site suitability model needs improvement…
- The OSU Alder Site Index equation also needs improvement, but it comes closer to observed…
- Models can be useful, but assessments should rely on site-specific data and observations.

# Methods for assessing alder site quality and site suitability for management

- Site-specific assessment should rely on inspecting representative trees and key site factors as directly as possible.
- Site/suitability assessment should include consideration of continuing warmer-drier conditions.
- Along with physical site factors, it’s essential to look at current vegetation conditions with respect to indicator plants and competing vegetation (grass, herbaceous, and shrub).

# Productivity, growth and yield in managed stands. Results of HSC red alder stand management study.

- Characterize range of yield estimates as a function of Site Index.
- Examine performance, variability and changes over the last 10 years.

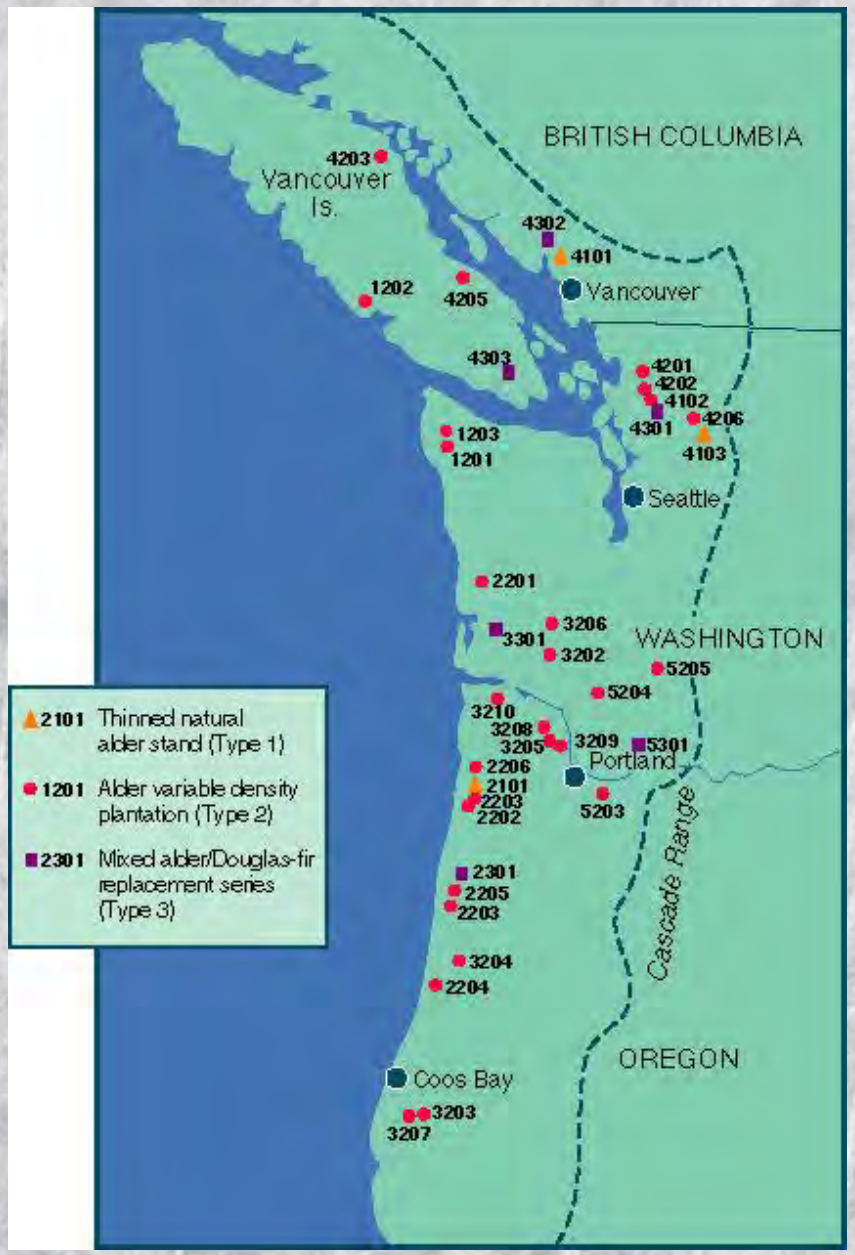
# Productivity, growth and yield in managed stands. Results of HSC red alder stand management study.

Discuss:

- Implications for growth and yield modeling going forward with HSC data.
- Implications for growth and yield expectations.
- Practical implications for land managers.

# Hardwood Silviculture Cooperative (HSC)

- The HSC is a research and education program focused on the silviculture of red alder and mixes of red alder and Douglas-fir in the PNW.
- Begun in 1988, the HSC is a combination of industry and both federal and state agency members.
- HSC red alder stand management study goals: to improve the understanding, management, and production of red alder.



# Red Alder Plantation Yield (BF per acre*)
# Plant 525 Trees/acre, No Thinning

| Age | SI 55** | SI 65 | SI 75 | SI 85 |
|---|---|---|---|---|
| 10 | 128 | 269 | 1,325 | 2,389 |
| 15 | 1,988 | 3,702 | 6,039 | 8,745 |
| 20 | 4,650 | 7,370 | 11,064 | 14,817 |
| 25 | 7,217 | 11,046 | 15,032 | 18,535 |
| 30 | 9,667 | 13,893 | 17,683 | 21,892 |
| 35 | 11,838 | 15,967 | 20,298 | 25,067 |
| 40 | 13,413 | 17,596 | 22,771 | 27,870 |

*Board feet Scribner (30ft log length, 5” minimum top dia.

**SI 20 in feet, 20 year base

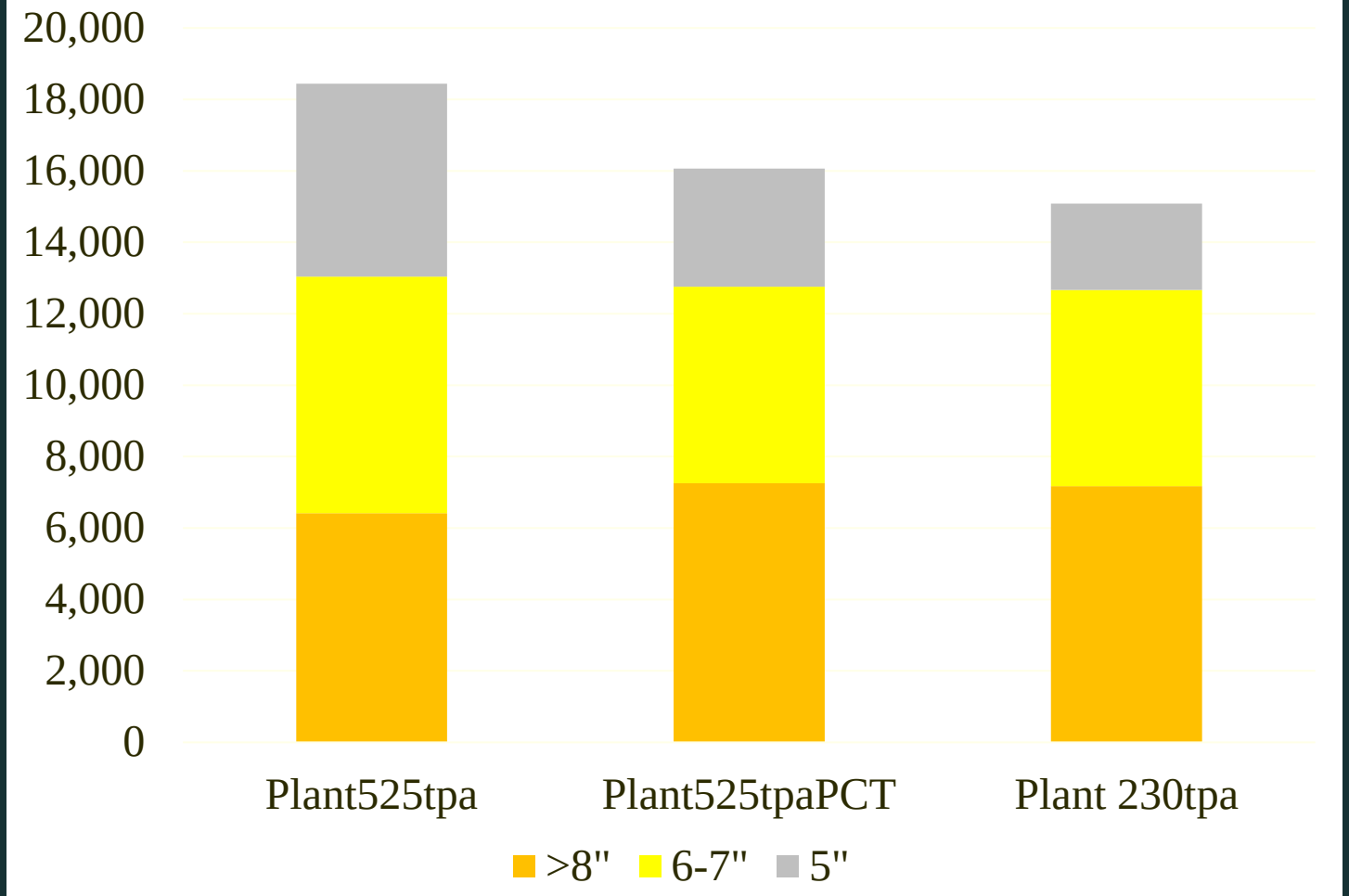
# Red Alder Plantation Yield (BF per acre*)
## Plant 525 Trees/acre, PCT age 6-8 yrs

| Age | SI 55** | SI 65 | SI 75 | SI 85 |
|---|---|---|---|---|
| 10 | 128 | 299 | 1,396 | 2,666 |
| 15 | 2,162 | 3,677 | 5,268 | 7,293 |
| 20 | 4,347 | 6,376 | 9,491 | 12,974 |
| 25 | 6,399 | 9,649 | 13,337 | 16,763 |
| 30 | 8,689 | 12,385 | 16,068 | 21,098 |
| 35 | 10,784 | 14,432 | 19,153 | 24,840 |
| 40 | 12,476 | 16,545 | 22,245 | 28,124 |

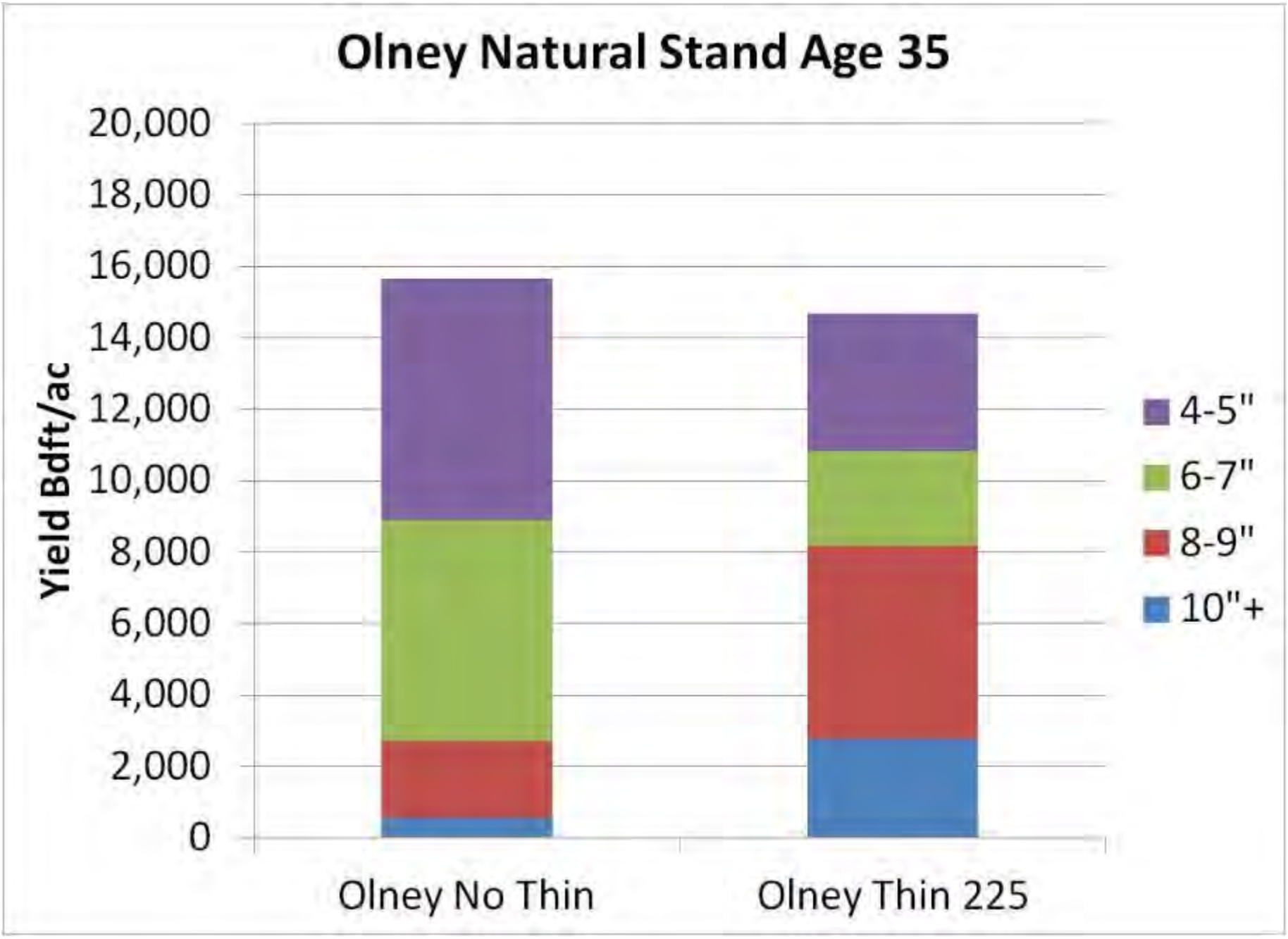
*Board feet Scribner (30ft log length, 5” minimum top dia.

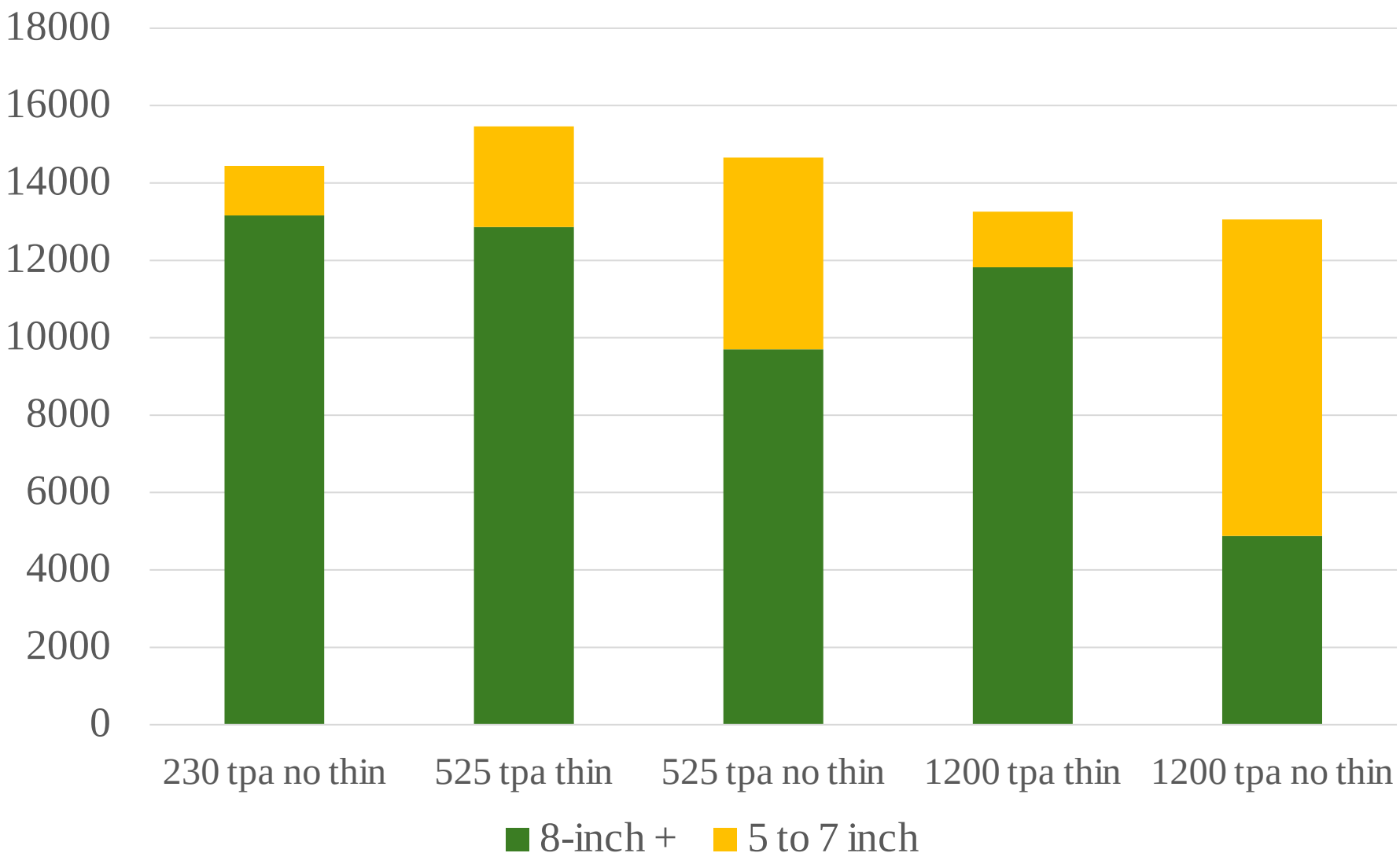
**SI 20 in feet, 20 year base

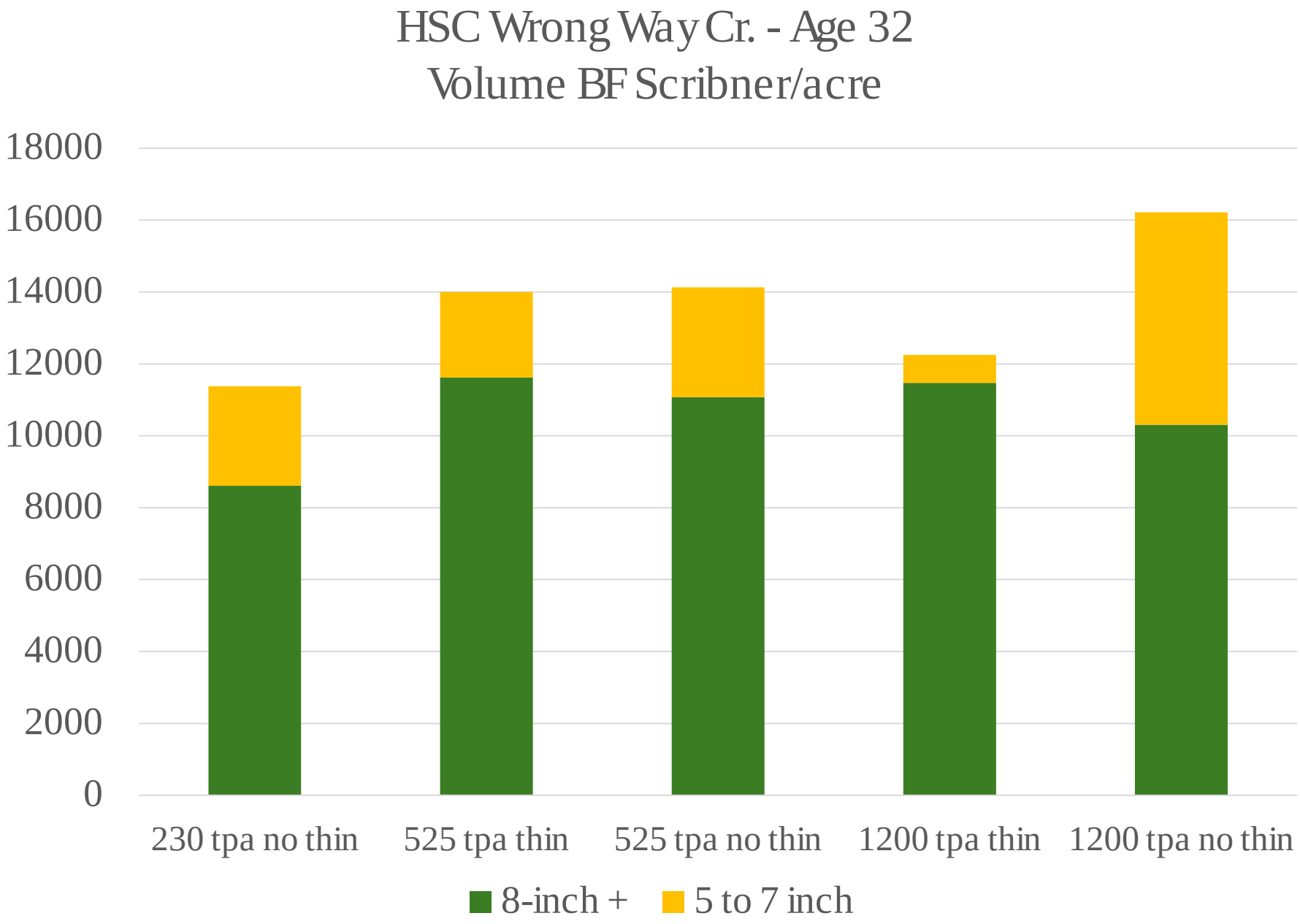
# Red alder platation yield SI 75
# Age 30 yr bf/acre by log scaling dia




Projections using Red Alder Plantation ORGANON growth and yield model based on OSU Hardwood Silviculture Cooperative, Red Alder Stand Management Study

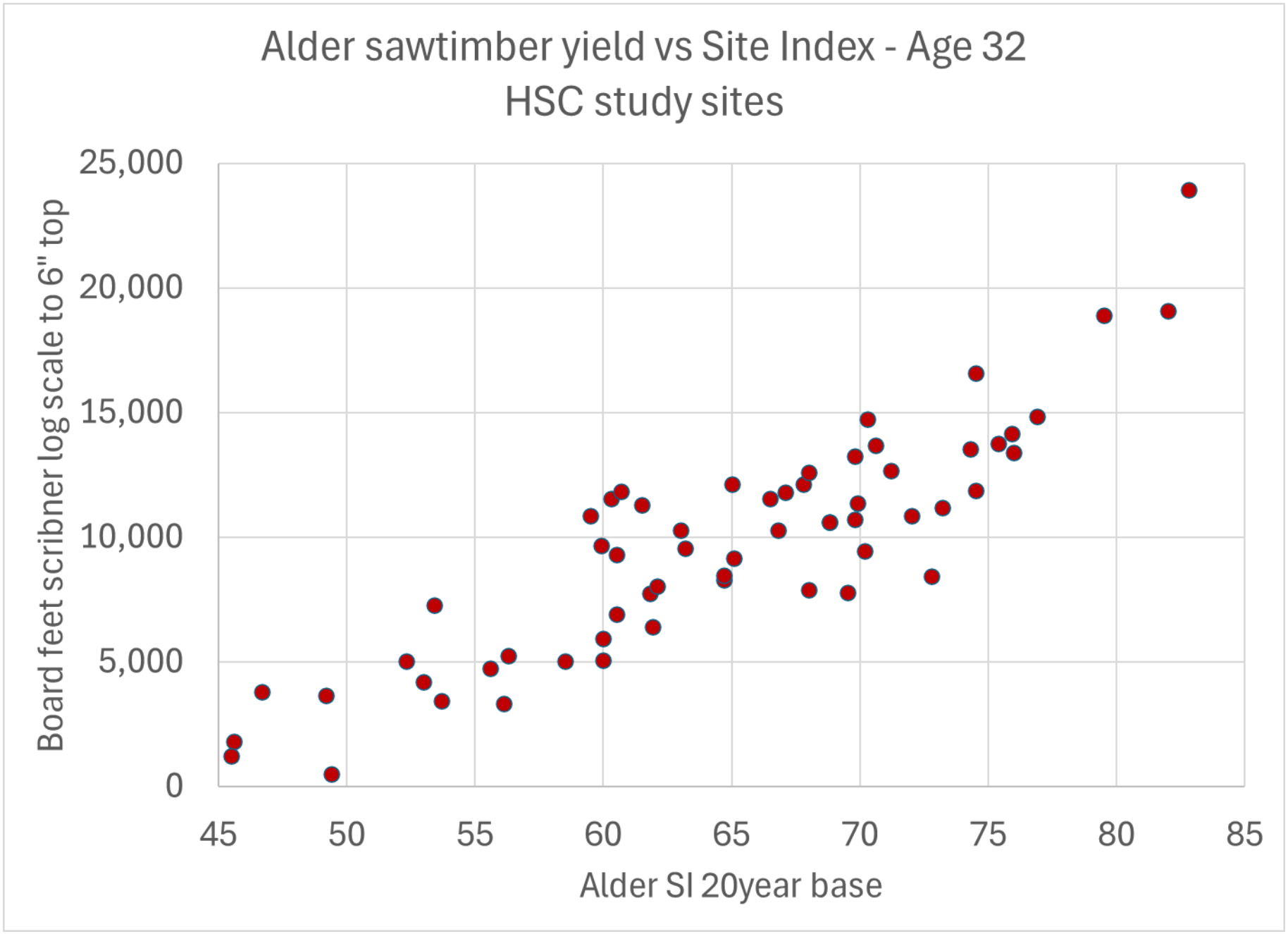

Olney Natural Stand Age 35
Yield Bdft/ac
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Olney No Thin
Olney Thin 225
4-5"
6-7"
8-9"
10"+

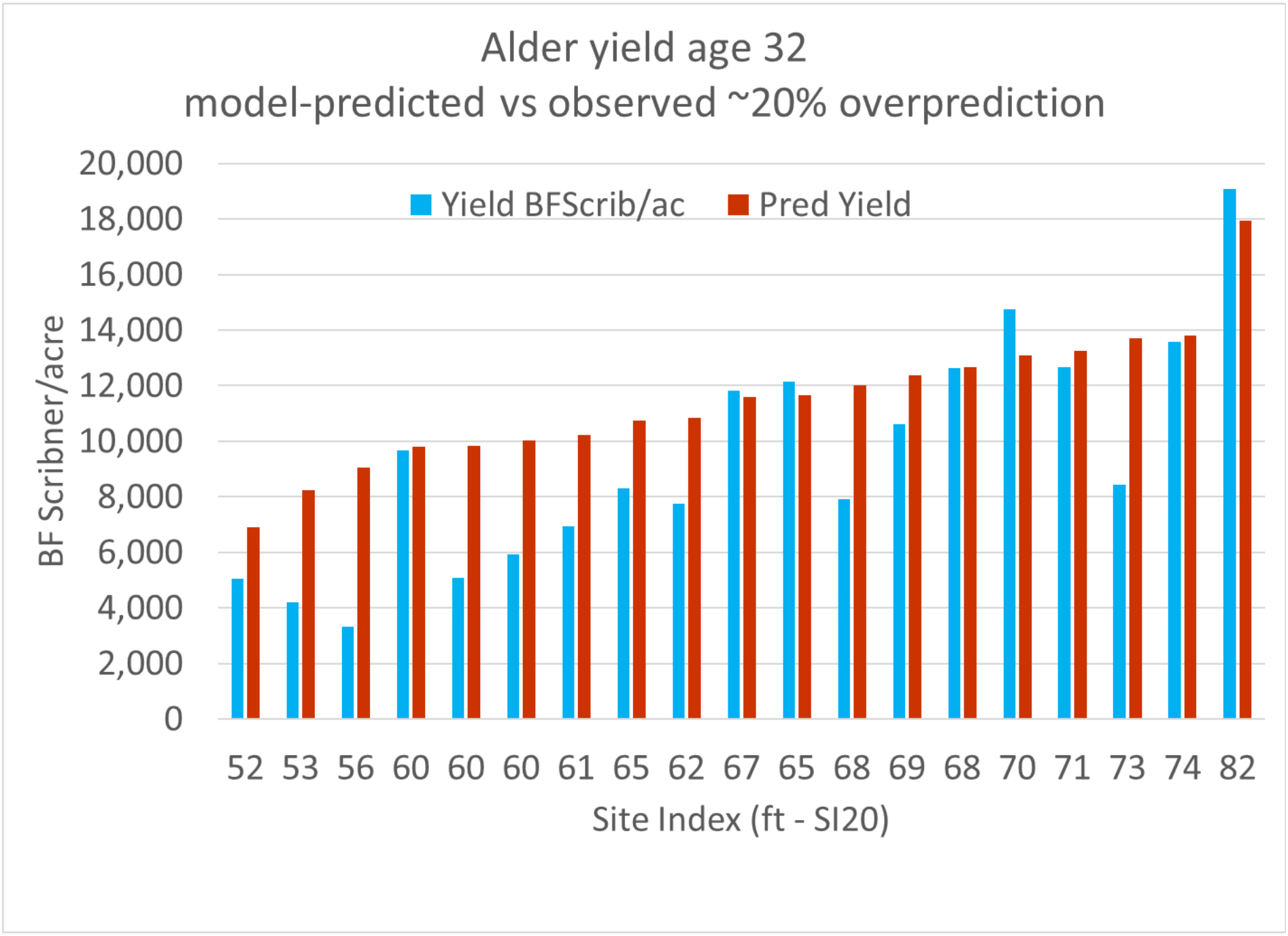

HSC 5204 Hemlock Ck. - Age 32
Volume BF Scribner/acre
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
230 tpa no thin
525 tpa thin
525 tpa no thin
1200 tpa thin
1200 tpa no thin
8-inch +
5 to 7 inch


HSC Wrong Way Cr. - Age 32
Volume BF Scribner/acre
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
230 tpa no thin
525 tpa thin
525 tpa no thin
1200 tpa thin
1200 tpa no thin
8-inch +
5 to 7 inch

# Growth and yield modeling going forward with HSC data?

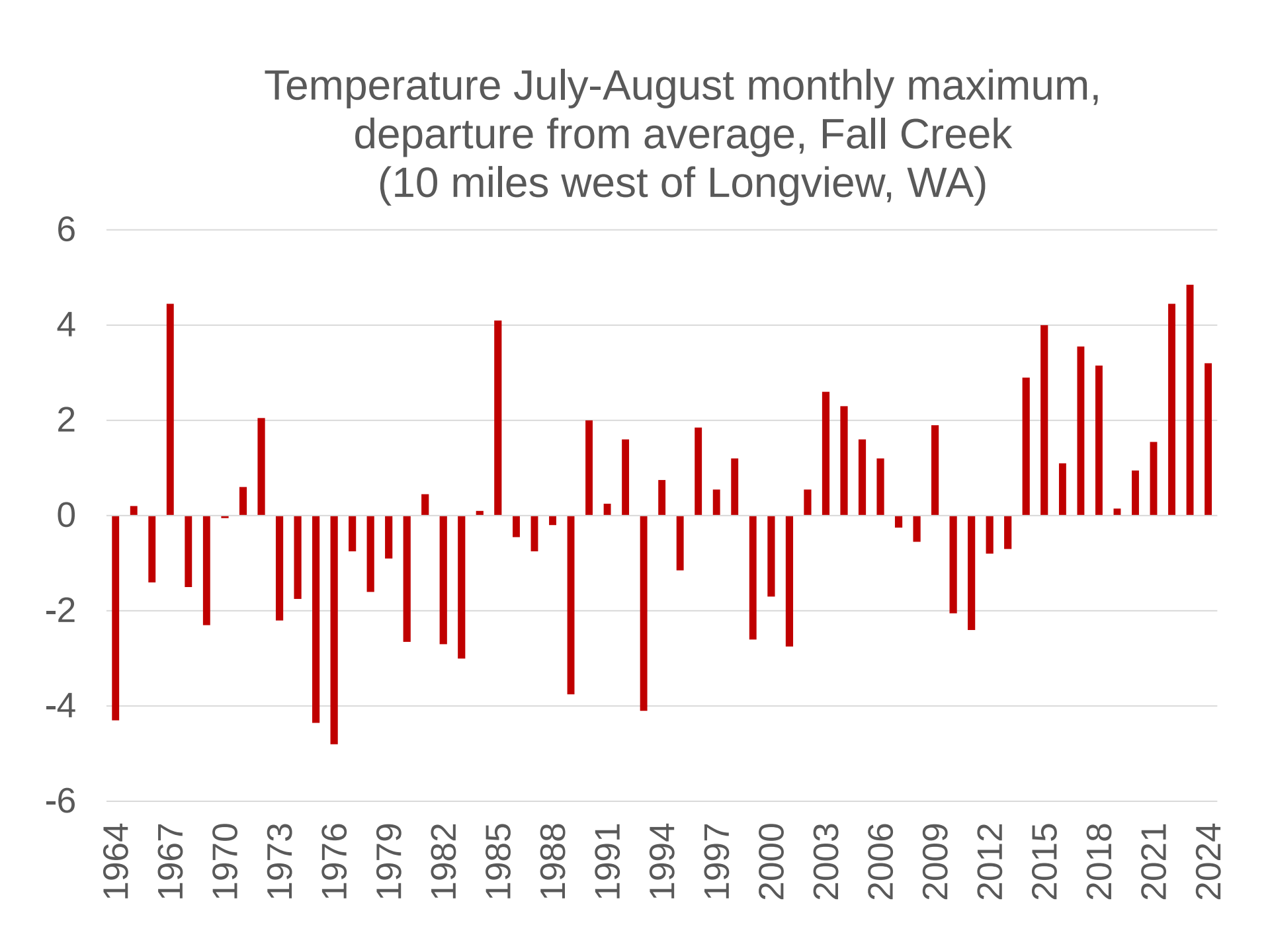
- Working with Doug Mainwaring at OSU, the last update of the growth and yield model used data up to age 22 years.
- When to update the growth equations with data from 27 and 32-year old sites - get us closer to representing reality at rotation?
- Based on the variability and declines in performance on some of the sites – need to look closer at what's going on at each of the sites.

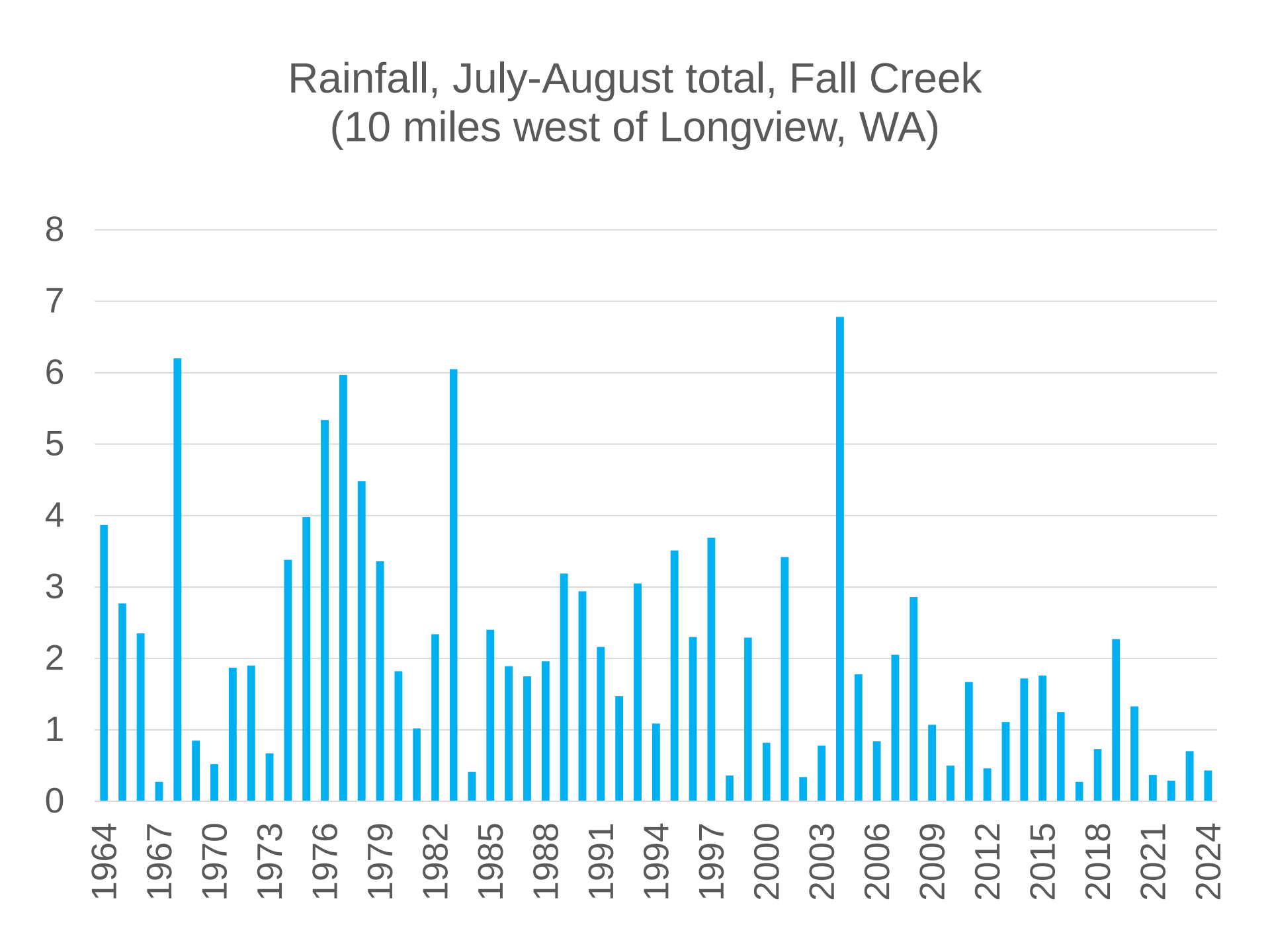

Alder sawtimber yield vs Site Index - Age 32
HSC study sites
Board feet scribner log scale to 6" top
25,000
20,000
15,000
10,000
5,000
0
45
50
55
60
65
70
75
80
85
Alder SI 20year base

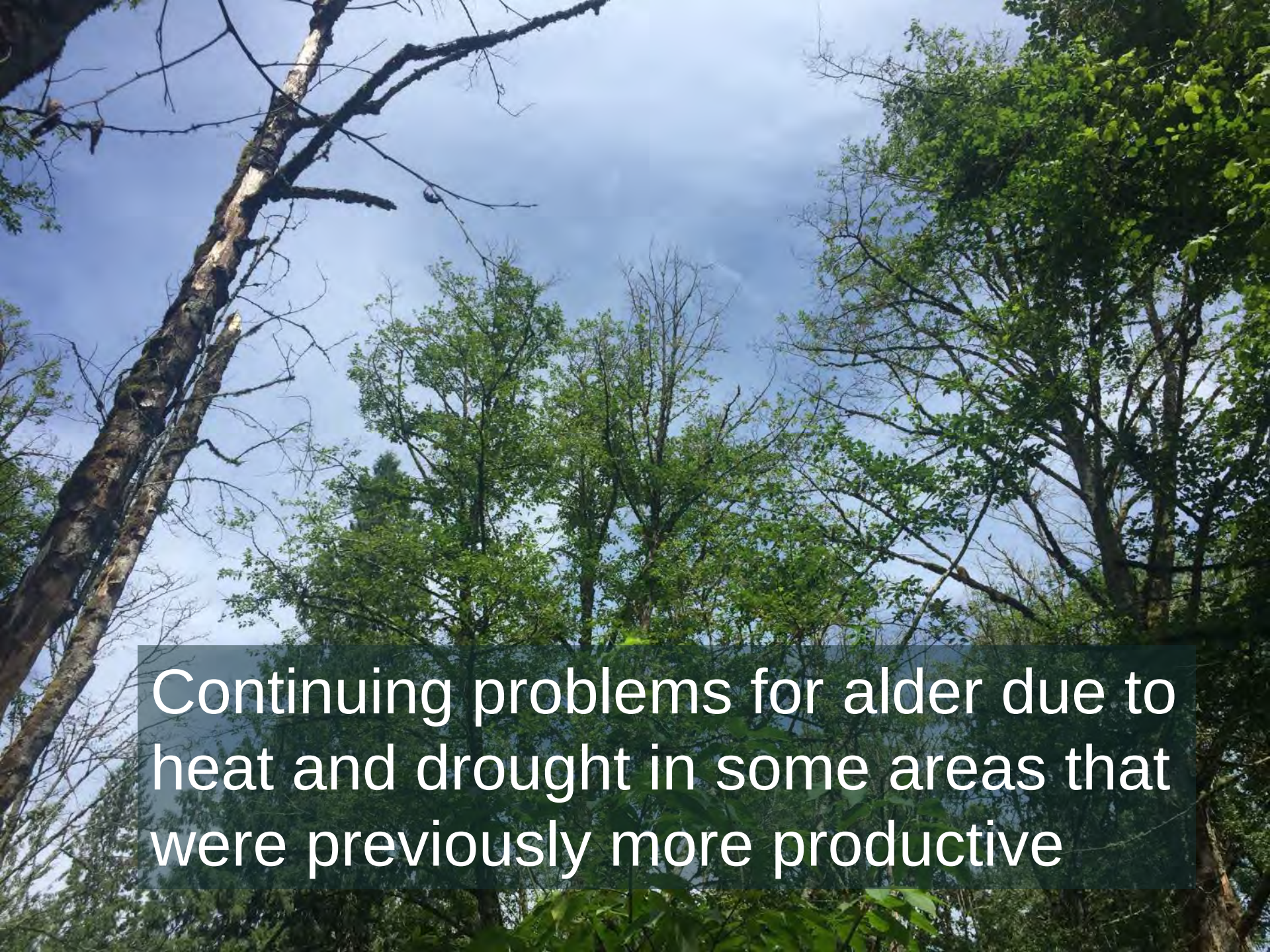

Alder yield age 32
model-predicted vs observed ~20% overprediction
Yield BFScrib/ac
Pred Yield
BF Scribner/acre
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
52 53 56 60 60 60 61 65 62 67 65 68 69 68 70 71 73 74 82
Site Index (ft - SI20)

# Ongoing observations of alder growth decline and tree mortality

- Average observed yields at age 32 are about 17% lower than yield predicted by the model that was based on data up to age 22. **A lot has happened over the last 10 years.**
- Causes include ice damage, drought and heat, bark beetles, and root disease. Competing vegetation also plays a role, especially salal and salmonberry.
- Greater effects for low-medium site class. Regional trouble spots – Willamette Valley, Puget Sound, Vancouver BC, near the ocean.


Temperature July-August monthly maximum, departure from average, Fall Creek (10 miles west of Longview, WA)
6
4
2
0
-2
-4
-6
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024


Rainfall, July-August total, Fall Creek
(10 miles west of Longview, WA)
8
7
6
5
4
3
2
1
0
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021
2024


Continuing problems for alder due to heat and drought in some areas that were previously more productive

Ice damage in 15-year-old alder plantation

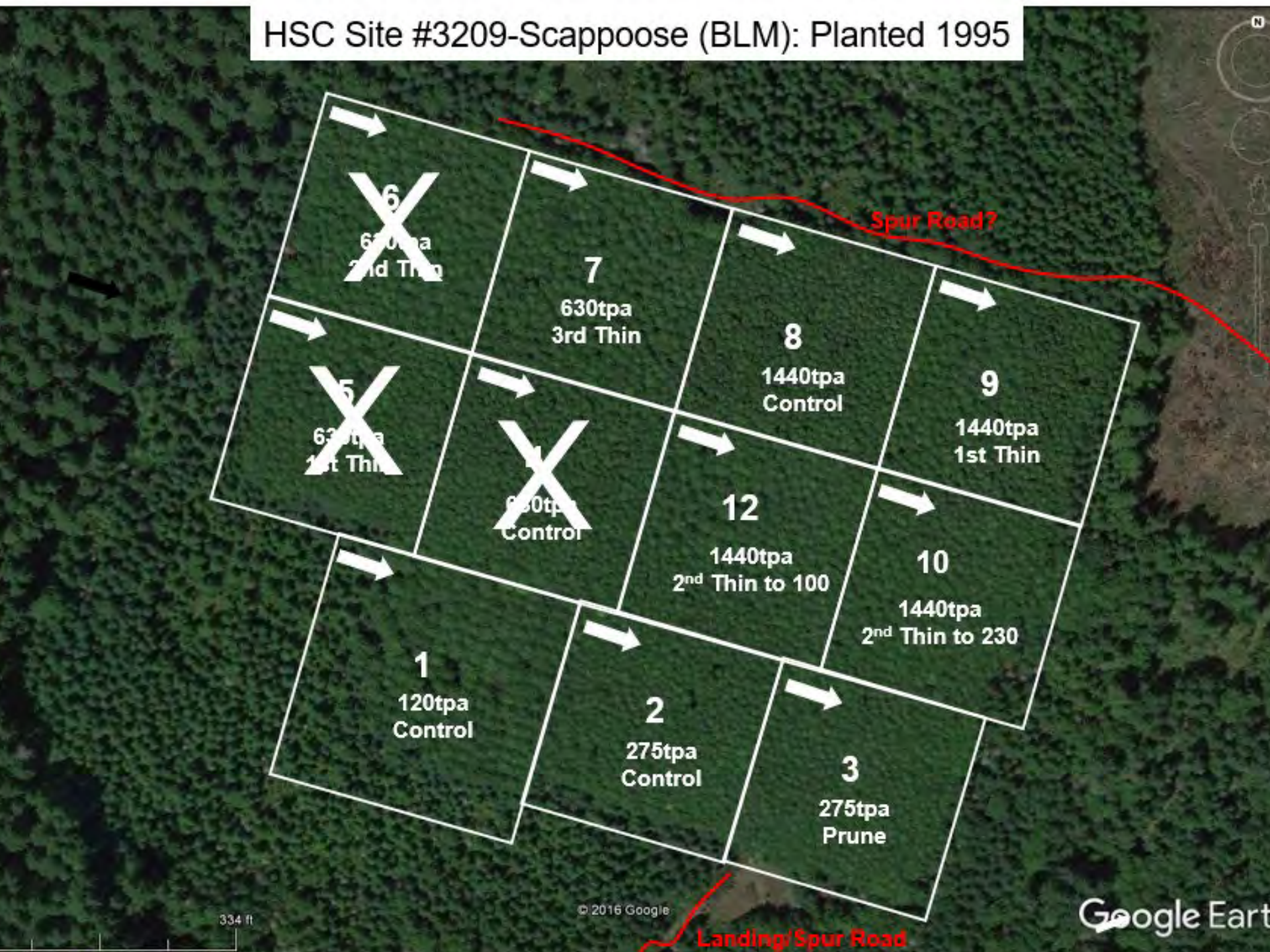
Ice damage in 32-year-old alder plantation

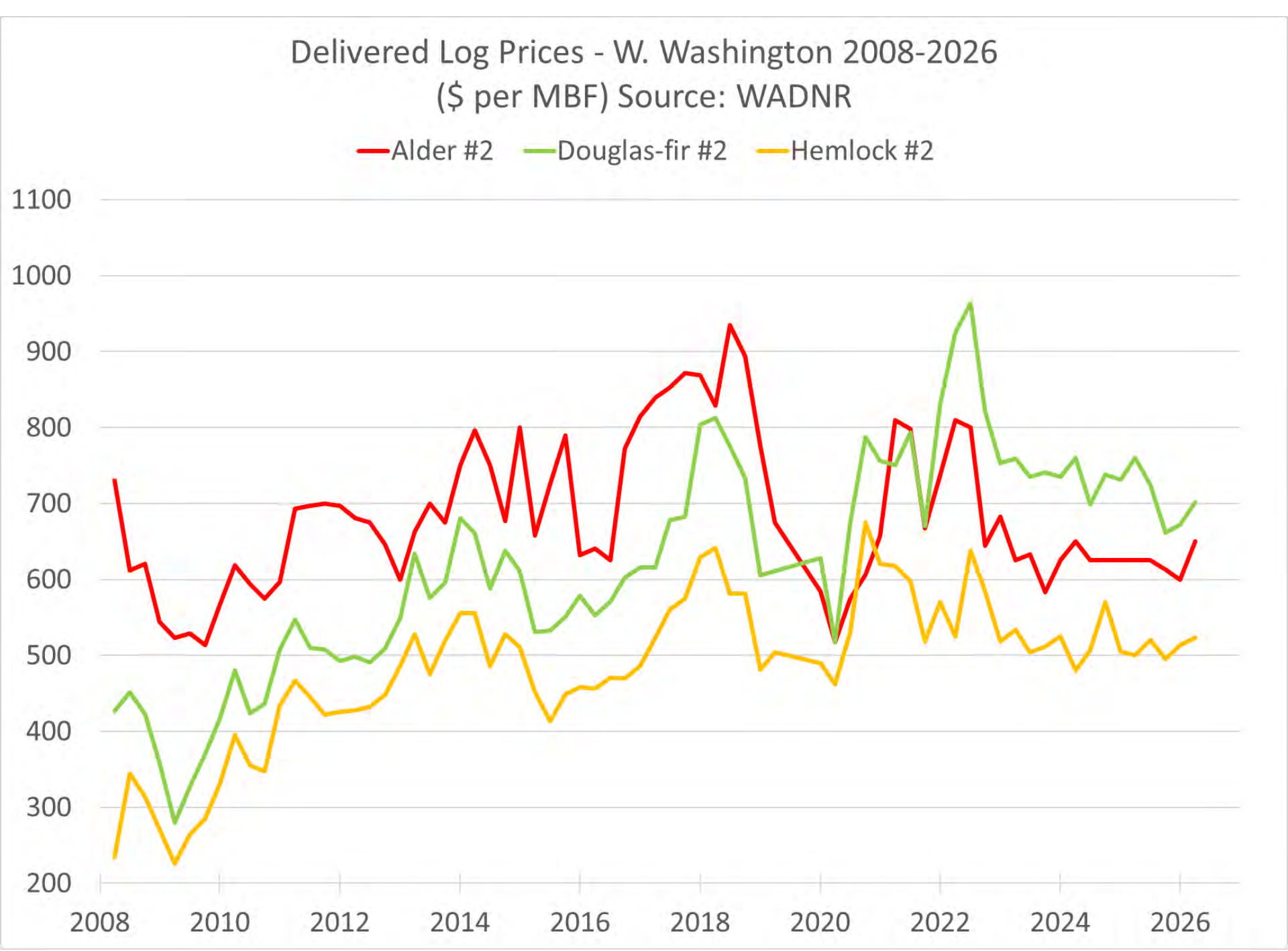
Annosus root disease in alder plantation


Salal with alder correlated with poor performance.

# HSC Site #5203 (BLM)- Thompson Cat. Planted 1992

# HSC Site #3209-Scappoose (BLM): Planted 1995



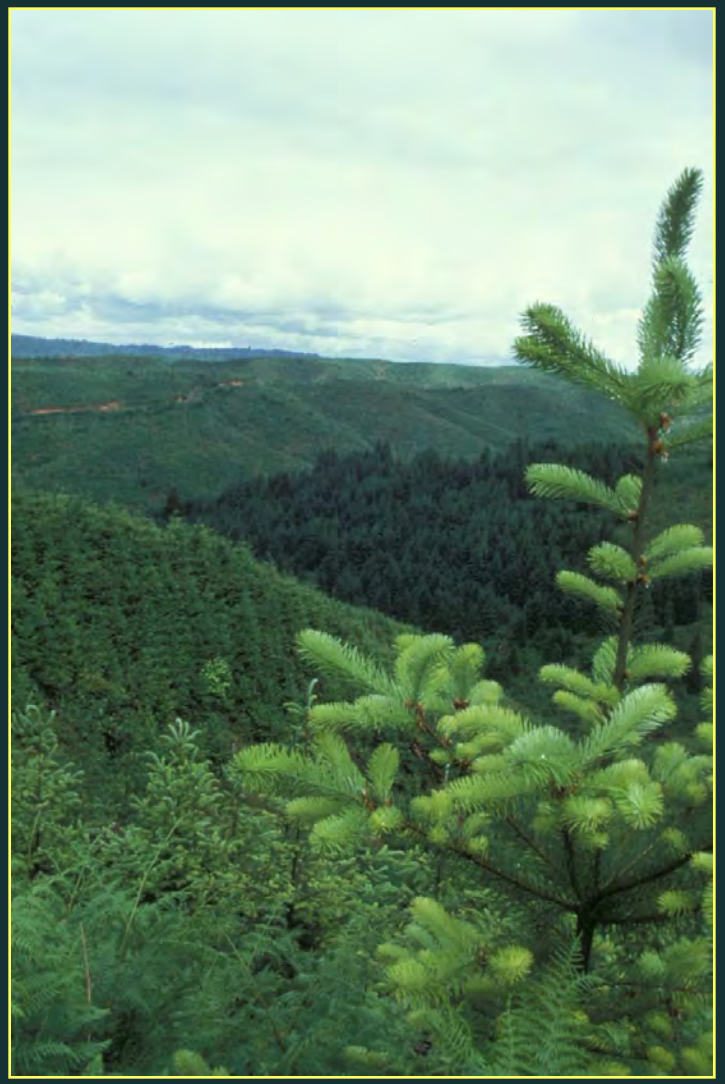

Delivered Log Prices - W. Washington 2008-2026
($ per MBF) Source: WADNR
Alder #2
Douglas-fir #2
Hemlock #2
1100
1000
900
800
700
600
500
400
300
200
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026

# Red alder plantation management for timber production

# Red alder plantation management for timber production

# Alder alternative to Douglas-fir on disease sites - Swiss Needle cast & Laminated Root Rot

# Alder component of the landscape for biodiversity, habitat, carbon sequestration, and fire resistance.



# Manage incidental young alder for multiple values, pure or mixed with conifer

# Practical implications for land managers, growth and yield expectations

- Variability in performance across operational sized management units.
- Variability and unpredictability between sites for a given site index class.
- “Fall-down”, adjustment for reality when looking at model or yield table predictions vs. actual harvested volume.

# Actual yield from harvest of most productive HSC study site in 2026?

# Actual yield from harvest of other operational alder plantations?

# Future direction for alder management?

- **Site evaluation and selection should be based on careful, direct site assessment.**
- **Updated yield tables and growth models will reflect lower yields at rotation than previous estimates.**
- **Performance is more predictable on high-quality sites.**
- **Consider genetic improvement to increase both yield and resistance to climate stress and other damage.**


Questions?

# For more information on Alder Management

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