Applied Practices for Reforestation Under Changing Climate and Forest Conditions

6th Annual PNW Forest Vegetation Management Conference

Robert Slesak, USDA Forest Service PNW Research Station

KBZK BOZEMAN

WEATHER

Drought slowly worsening over Montana

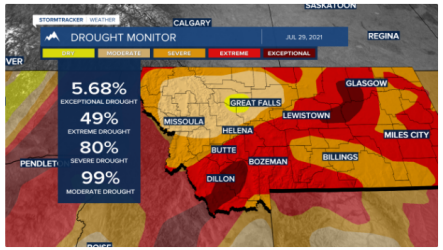

Photo by: kbzk

By: Mike Heard

Posted at 1:37 PM, Jul 29, 2021 and last updated 12:37 PM, Jul 29, 2021

BOZEMAN – Latest update on the Montana drought monitor shows conditions worsening from SW to NE Montana.

The pe
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Drough

Washington Examiner

Washington state farmers sweat out wildfire season as state issues drought emergency

rmers sweat out wildfire season as state issues drought emergency

Tim Gruver, The Center Square

uly 16, 2021 · 4 min read

Between a global pandemic and raging wildfires, farmers like Janelle Moses wonder when the world will give them a chance to catch their breath.

The Wapato resident runs one of nearly 100 dairy farms in Central Washington's Yakima Valley with her husband. A farmer's daughter, Moses acts as a supervisor for the South Yakima Conservation District, where she says up to 800 dairy cows died

ABC NEWS VIDEO LIVE SHOWS CORONAVIRUS JAN. 6 RIOT

How climate change could hinder reforestation efforts, according to experts

Warming temperatures could contribute to the maladaptation of species.

By Julia Jacobo
January 11, 2022, 3:03 AM • 8 min read

Climate change explained by Ginger Zee

ABC News Chief Meteorologist Ginger Zee discusses the global impact of climate ch
Andre Penner/AP, FILE

Scientists are researching how to promote global diversity ami
temperatures, but some of the methods that could prove effect
further hindered by climate change, according to new researc

The mass-clearing of trees is occurring around the world due t
of culprits, including wildfires, logging and clearing developm
than 18 million acres of forest are lost every year, according to
Ecological Society of America, and the forests that remain are
weakened by severe drought and disease. All of these things ar
exacerbated as the earth warms.

CNBC

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A severe drought is gripping the Western U.S. as wildfire season begins

PUBLISHED FRI, JUN 4 2021-11:41 AM EDT | UPDATED MON, JUN 7 2021-8:48 AM EDT

Emma Newburger
@EMMA_NEWBURGER

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KEY POINTS

- Nearly three-fourths of the American West is grappling with the most severe drought in the recorded history of the U.S. Drought Monitor.
- Hot and arid conditions will exacerbate the threat of wildfires and water supply shortages this summer. Conditions this spring are much worse than a year ago.
- Parts of California, Nevada and Washington State experienced sweltering triple-digit temperatures over the past week and states released excessive-heat warnings and heat advisories in some areas.

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American west stuck in cycle of 'heat, drought and fire', experts warn

Smoke envelops trees as the Sugar fire, part of the Beckwourth Complex fire, burns near Doyle, California. Photograph: Noah Berger/AP

Wildfires in several states are burning with worrying ferocity across a tinder-dry landscape

As fires propagate throughout the US west on the heels of record heatwaves, experts are warning that the region is caught in a vicious feedback cycle of extreme heat, drought and fire, all amplified by the climate crisis.

Most viewed

Remains of 'world's largest Jurassic pterosaur' recovered in Scotland

AUGUST 10, 2021

U.S. West hit with extreme heat, drought and unrelenting wildfires in July

by John Bateman, NOAA Headquarters

A fire cloud over the ridgeline rising from the Bootleg wildfire in Oregon, July 7, …

July turned out to be an exceptional month of triple threats for the western U.S., with record heat, drought and raging wildfires. The nation as a whole had a hot July—with extreme rainfall in areas already saturated while sparing others that needed it most.

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'Really tight water year': Drought, low snowpack may foretell Idaho's climate future

Ian Max Stevenson, Idaho Statesman

Weather Published at 3:05 pm, February 21, 2022 | Updated at 3:16 pm, February 21, 2022

Low precipitation and a hot summer in 2021 led to low water conditions at many reservoirs, including Lucky Peak northeast of Boise. | Jordan Rodriguez, via Idaho Statesman

BOISE (Idaho Statesman) — Much of Southern Idaho, cut through in scythe-like fashion by the Snake River Plain, relies on the frozen water stored in the state's mountains to fill its rivers. When winter ends and summer's broiling heat arrives, it is these snowy peaks that serve as the state's reservoir, filling the Salmon, Snake, Big Lost, Boise and other tributaries with cold, clear water.

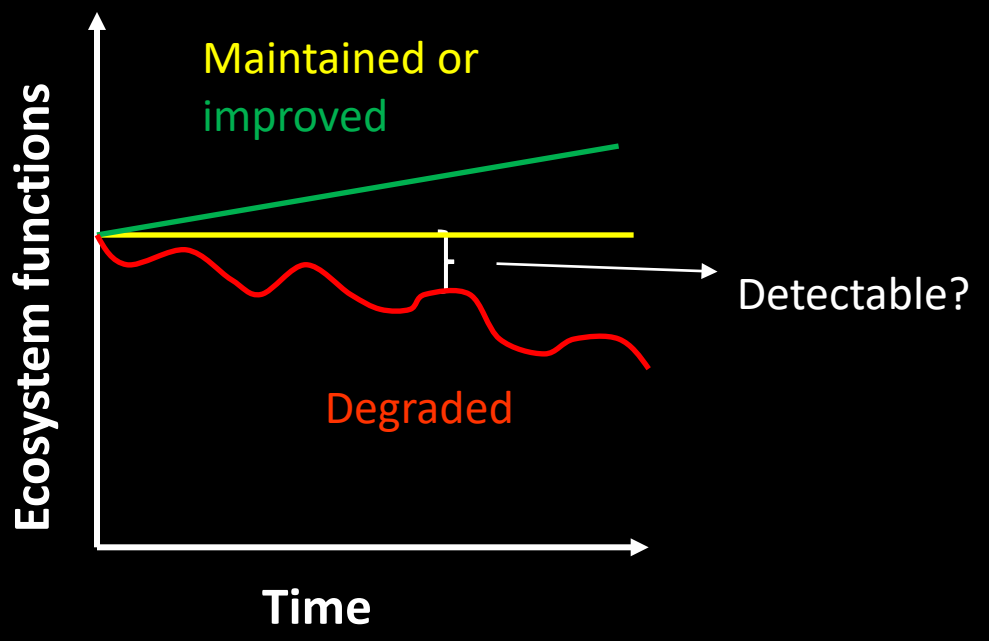
But as the amount of snowfall declines, with scientists citing the effects of climate change as a key contributor, major problems arise for the state's ecosystems, residents and agriculture industry.

Changing conditions increase uncertainty

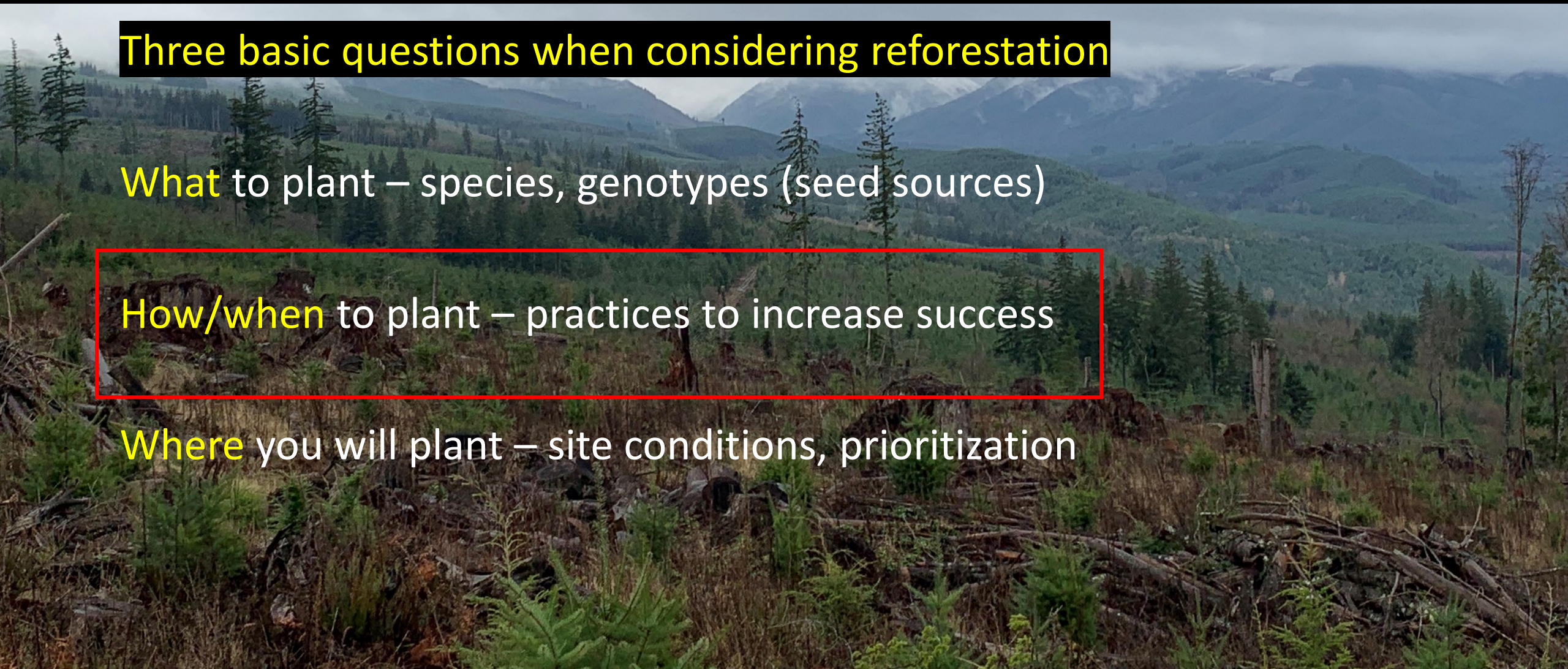
Long time horizon, changing markets, shifting objectives, high variability

Ability to detect change in ecosystem functions, or predict change over time is constrained

What should be planted today that will align with achieving my management objectives of the future?



Reforestation Context



Three basic questions when considering reforestation

What to plant – species, genotypes (seed sources)

How/when to plant – practices to increase success

Where you will plant – site conditions, prioritization

How to plant – establishment practices for reforestation success

- Slash manipulation
- Competing vegetation control
- Time of planting (fall vs. spring)
- Stock type – root development
- Density at planting (lower than typical)
- Configuration at planting (e.g., clumped)

Challenge: using common practices in new ways and developing new practices to achieve the desired adaptation strategy

Slash and vegetation control

Slash typically piled and burned, or utilized

- Facilitate planting, reduce fire risk, “just what we do”
- Potential benefits of slash retention

Vegetation control commonly used for site prep

- Channel limiting resources to crop trees
- More intensive vegetation control may be needed

Testing practices on contrasting site qualities

High quality site

Total C – 220 Mg ha^{-1}

Total N – 9.8 Mg ha^{-1}

WHC – 19.3 cm m^{-1}

Site index - 38

Low quality site

Total C – 125 Mg ha^{-1}

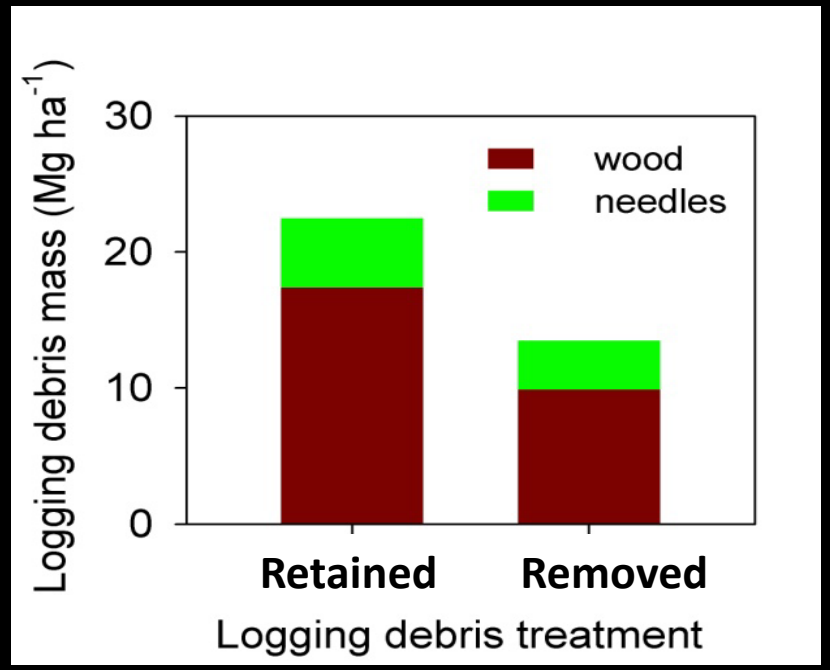
Total N – 4.5 Mg ha^{-1}

WHC – 6.5 cm m^{-1}

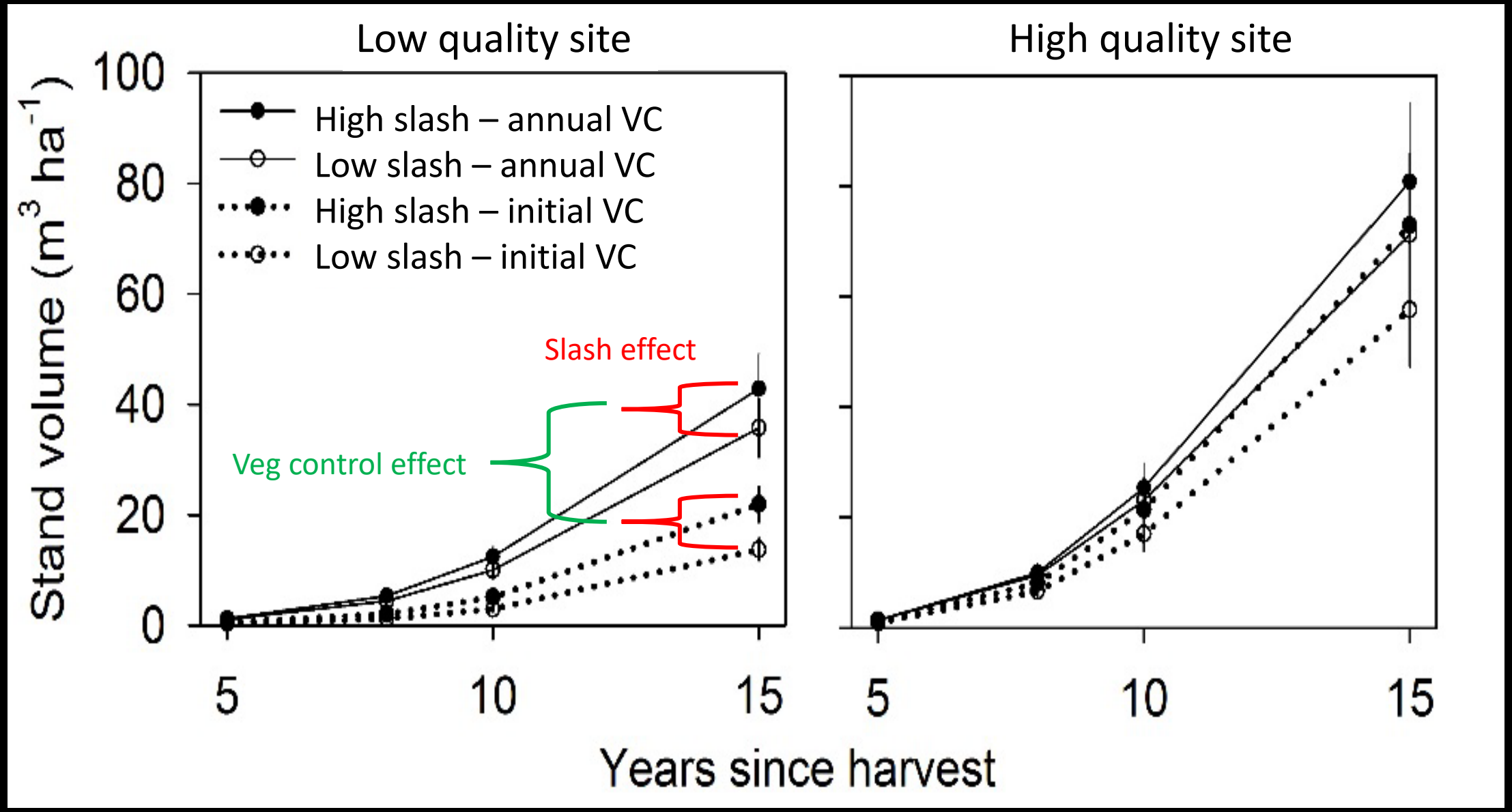
Site index - 34

Two treatment levels:

- Veg control – initial (IVC) or annual (AVC) control
- Slash – removed or retained



Slash retention and veg control are effective



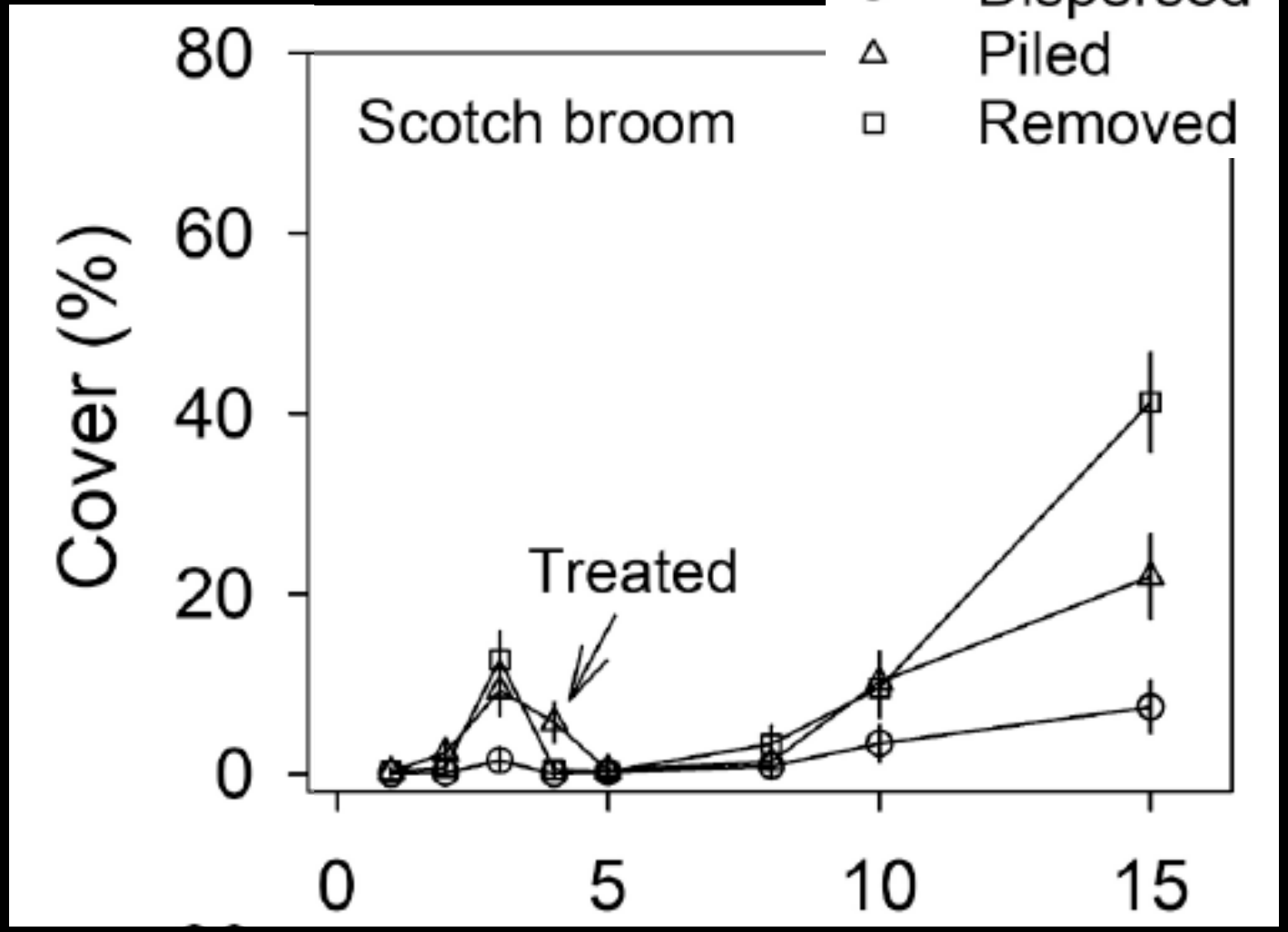
Harrington et al. 2020

Slash removal effects on Scotch broom

Broom present in understory at harvest

Logging debris removed = large increase in broom

Continues to dominate after aggressive control

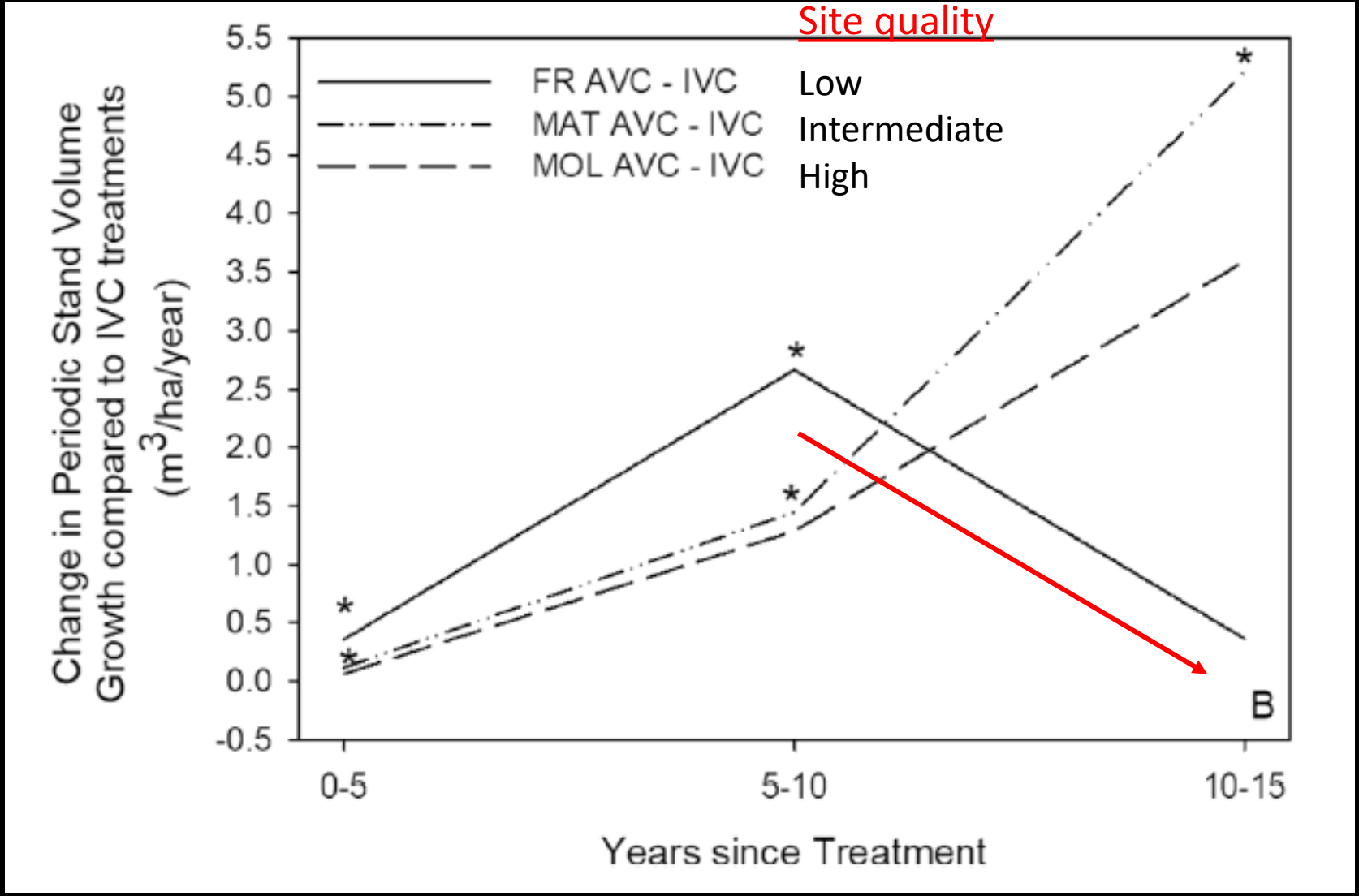


Harrington et al. 2020, FEM

Annual vegetation control not always needed

Short vs. longer-term response vary with soil quality

Reduced efficacy over time at higher quality sites

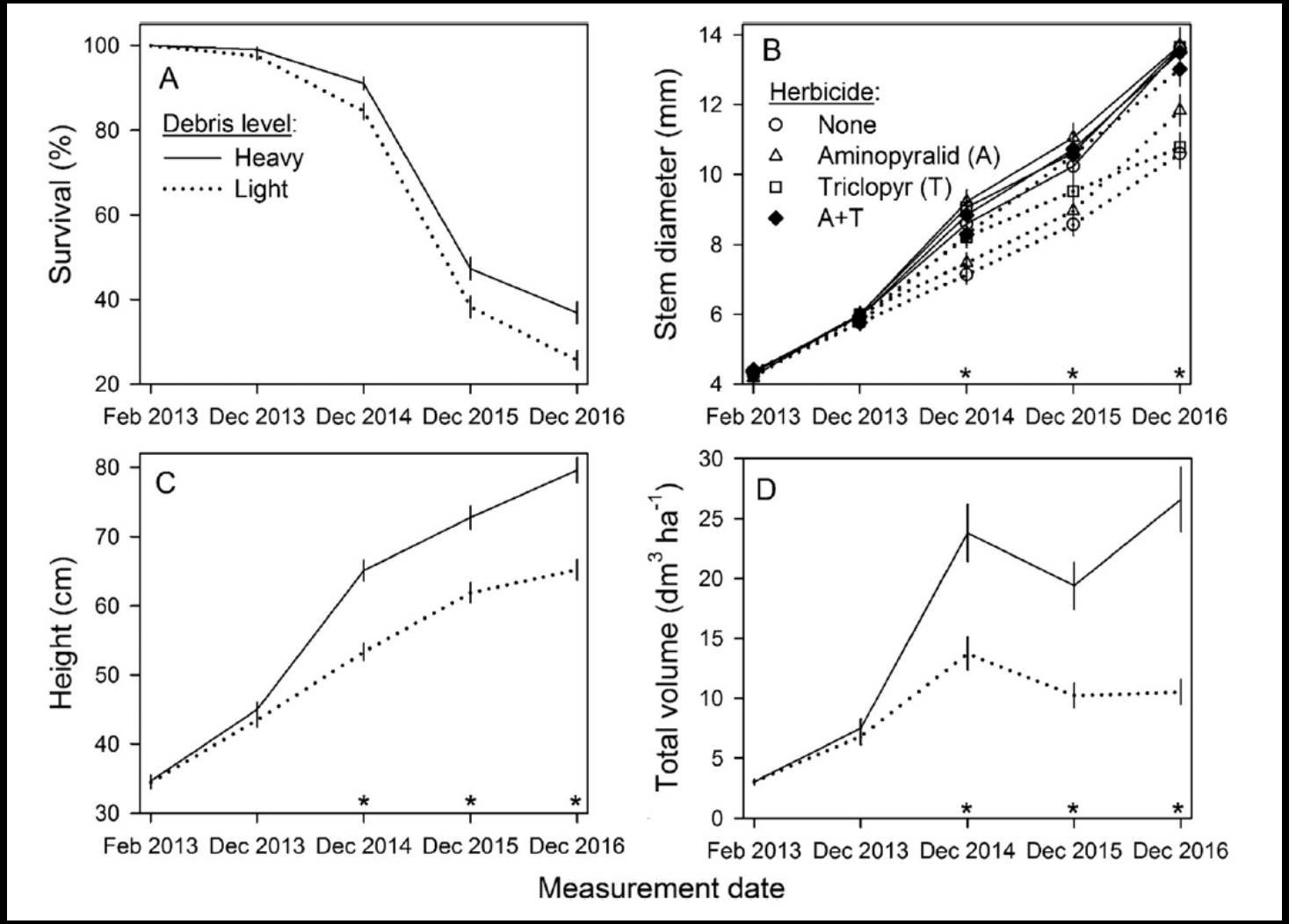


Littke et al. 2021

Validating the results – Dry Bed Creek Study

Experiment installed to validate findings on slash effects

Results align with previous findings showing critical importance of slash retention on droughty, nutrient poor soils



Harrington et al. 2018, FEM

Give slash a chance

"Mini-piles"

- Facilitate planting
- Reduced fire risk

Variable	Higher quality		Lower quality	
	Pile	Not a pile	Pile	Not a pile
Soil total C (%)	13.3	10.6	7.1	7.8
Soil total N (%)	**0.52**	**0.43**	0.30	0.26
Net N min ($mg\ N\ kg^{-1}\ soil\ day^{-1}$)	**4.0**	**3.2**	**1.3**	**0.4**
Soil extractable Ca ($mg\ kg^{-1}$)	**2270**	**1390**	**670**	**370**
Soil extractable Mg ($mg\ kg^{-1}$)	**300**	**250**	70	70
Soil extractable K ($mg\ kg^{-1}$)	330	350	100	70
Soil extractable P ($mg\ kg^{-1}$)	**10**	**5**	**40**	**30**

Higher C and nutrients

~20% increase in survival after 15 years

Slesak unpublished data; Harrington et al. 2020

Planting density

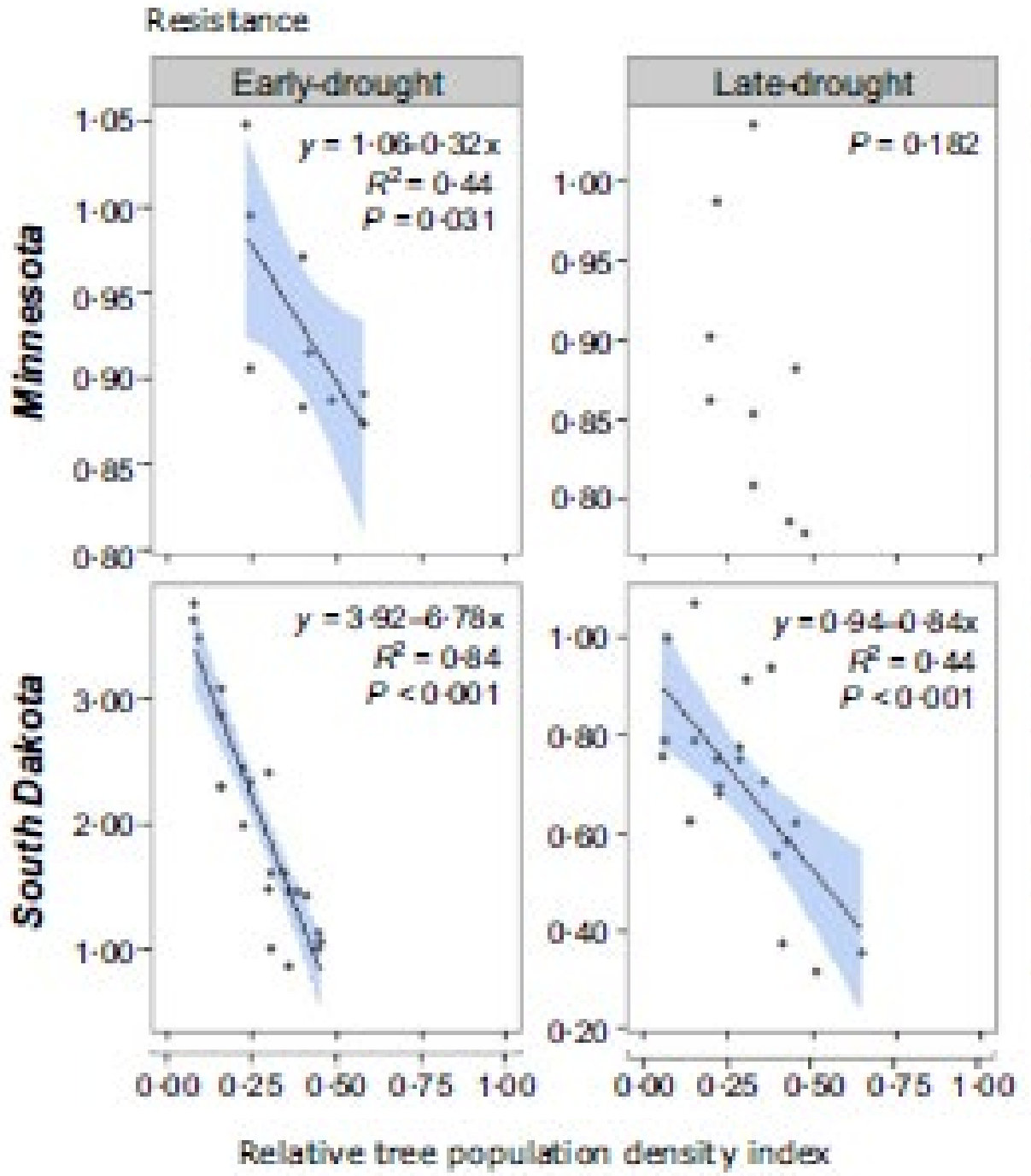
Planting densities that:

- Do not require intermediate treatments
- Increase resilience to extreme events

Generally lower than “standard”

Broad interest across ownerships

Bottero et al. 2017



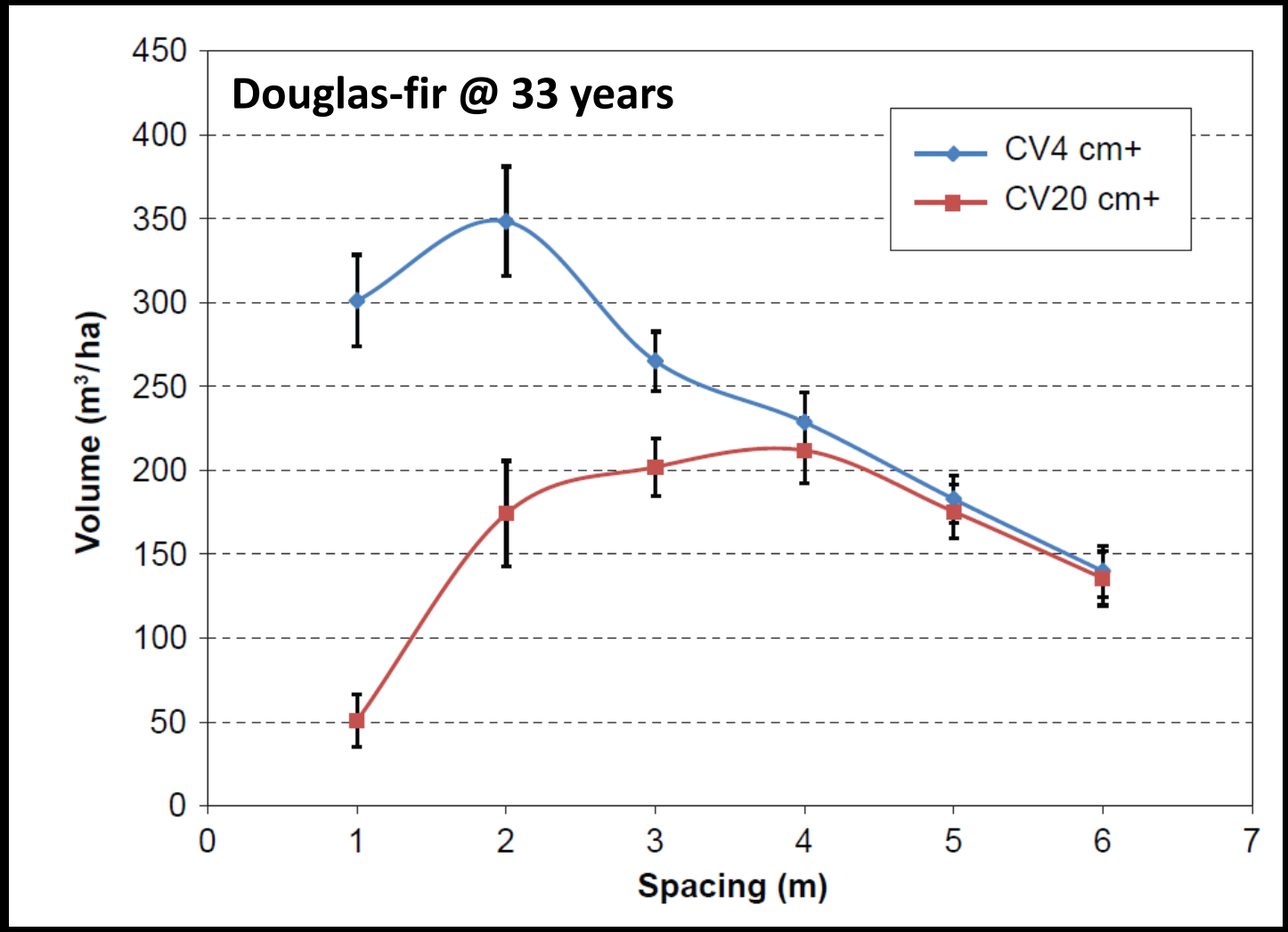
Spacing (density) trials – Wind River Exp. Forest

Spacing trial of 1-6 m

Doug-fir, W. white pine, noble fir, W. hemlock

Max merchantable volume at 4 m (~250 TPA)

40 year results pending for all species



Curtis et al. 2016

Planting density considerations

Management objectives!

- Max revenue
- Habitat
- Carbon

Site factors

- Fuels / Fire risk
- Site quality
- Veg communities

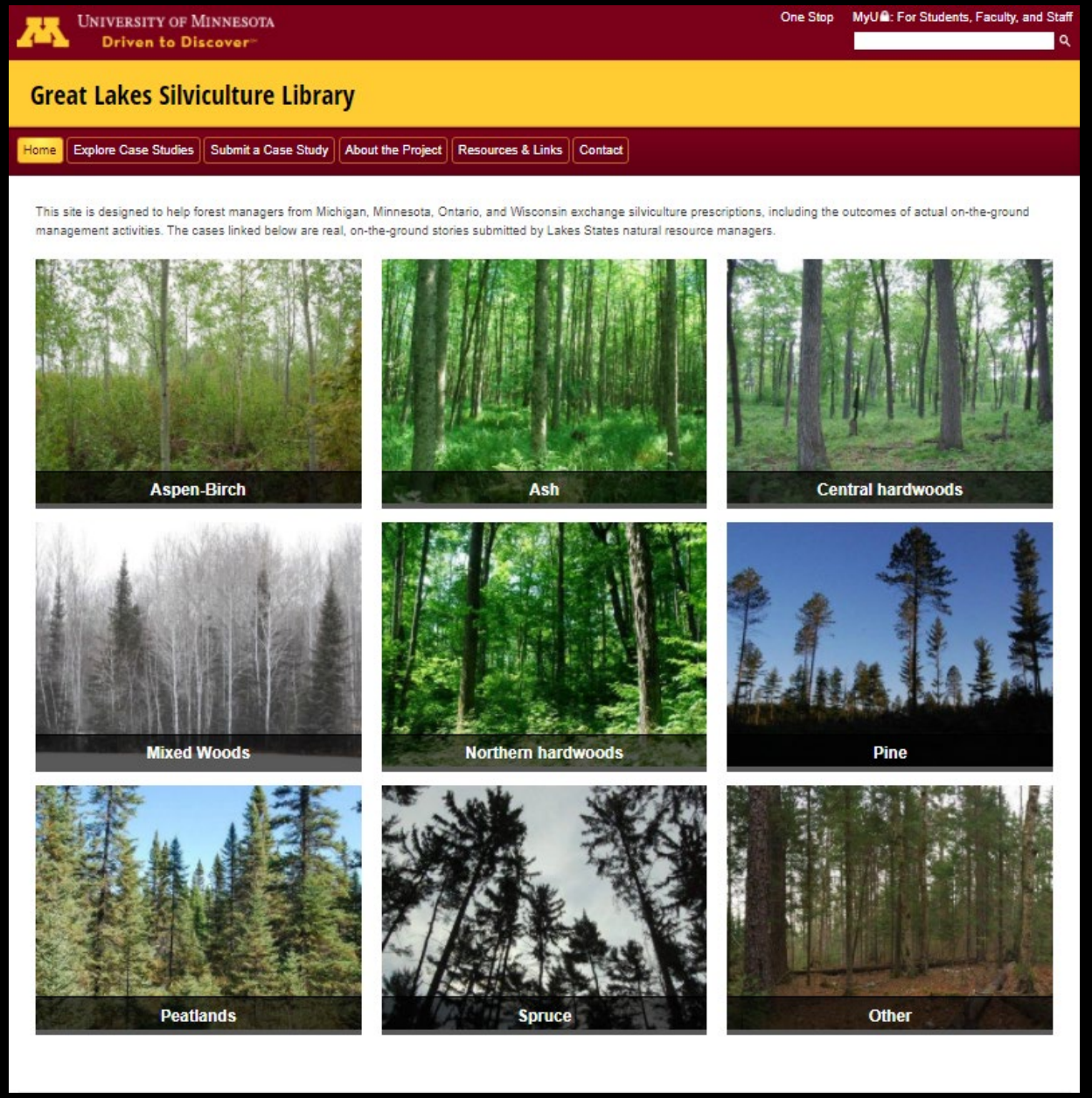
Wind River Spacing Trail
Douglas-fir 2021
4 m spacing

Moving forward

Information sharing will be key to success

Adaptive learning is needed to address uncertainty

Example: Case studies to highlight unique reforestation challenges and solutions



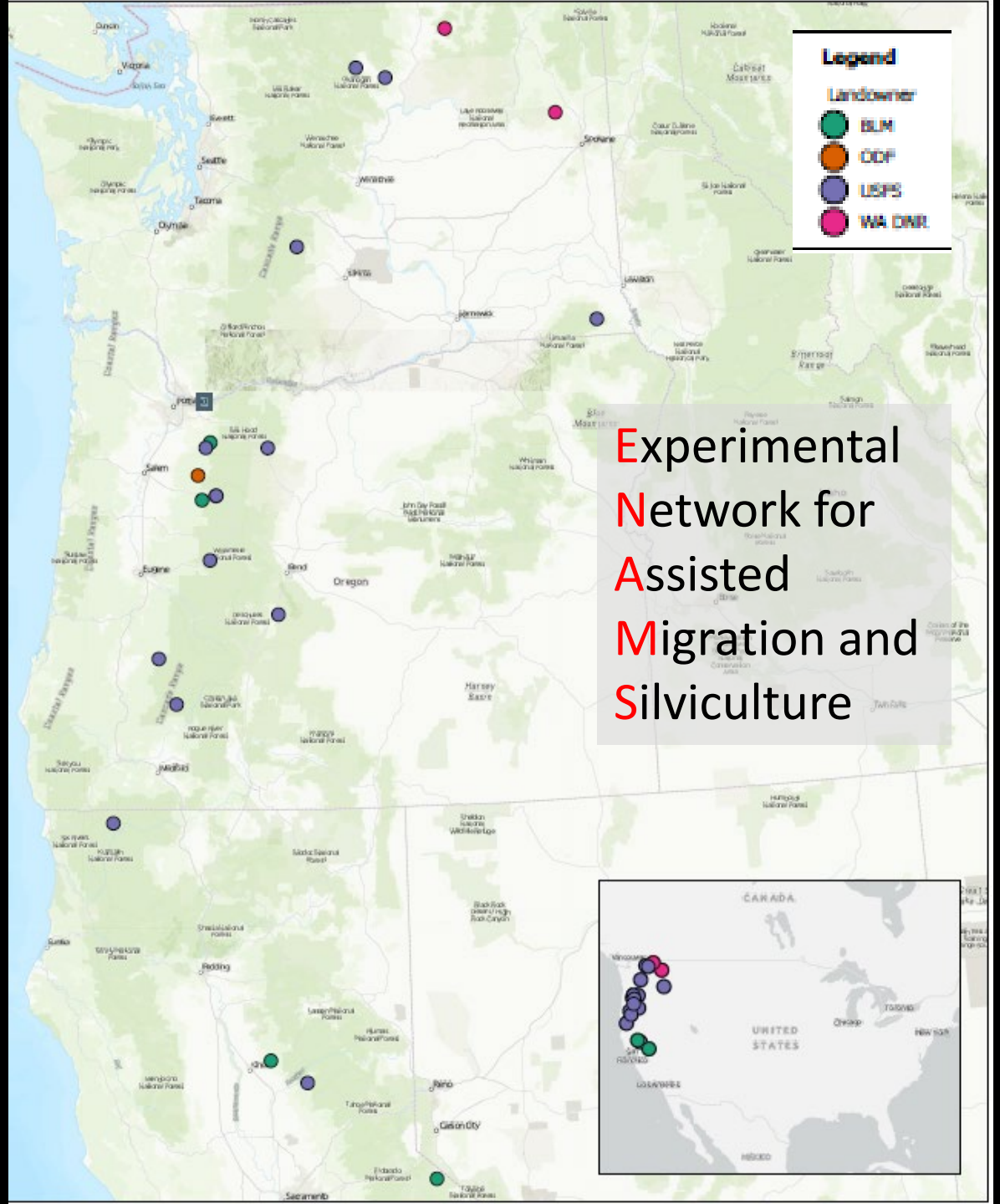
New research to address info needs

Research network focused on reforestation

- Assisted population migration
- Establishment practices

Managers and scientists co-produce experimental design and questions

Information made available in practical, easily-utilized formats



Summary

There is lots of uncertainty on what the future holds, but we deal with that all the time – make best decision with best available information

Clearly defined objective and adaptation strategy is essential

Inherent site quality will have strong control on options and necessary actions

Consider: more intensive veg control, slash retention, lower planting densities

Pulling together - Information and resource sharing

Absolute necessity for new approaches to information exchange among practitioners and researchers

Questions?

Contact

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