

Lodgepole pine population adaptation to extremes

Implications for assisted migration

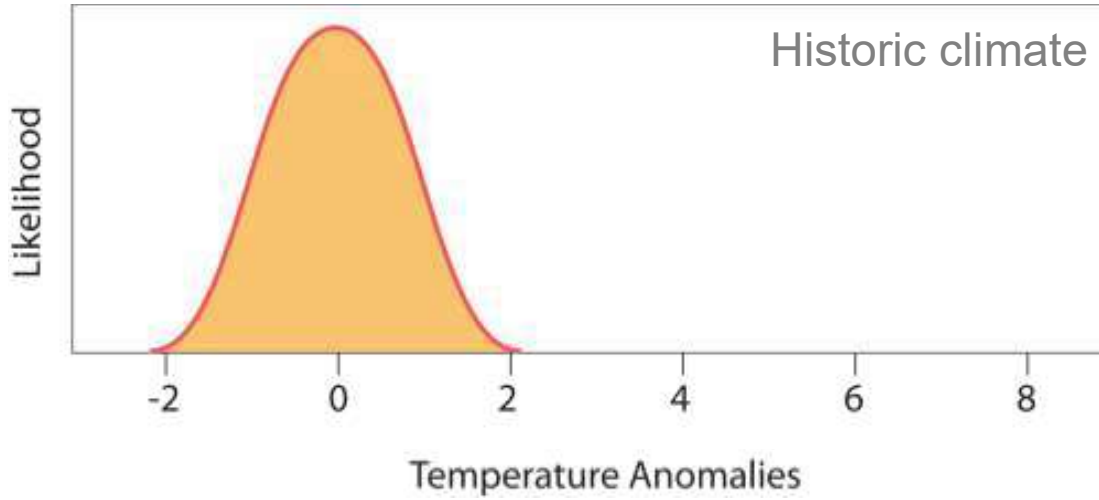
Interior Technical Advisory Meeting
Miriam Isaac-Renton

January 31, 2018
Vernon



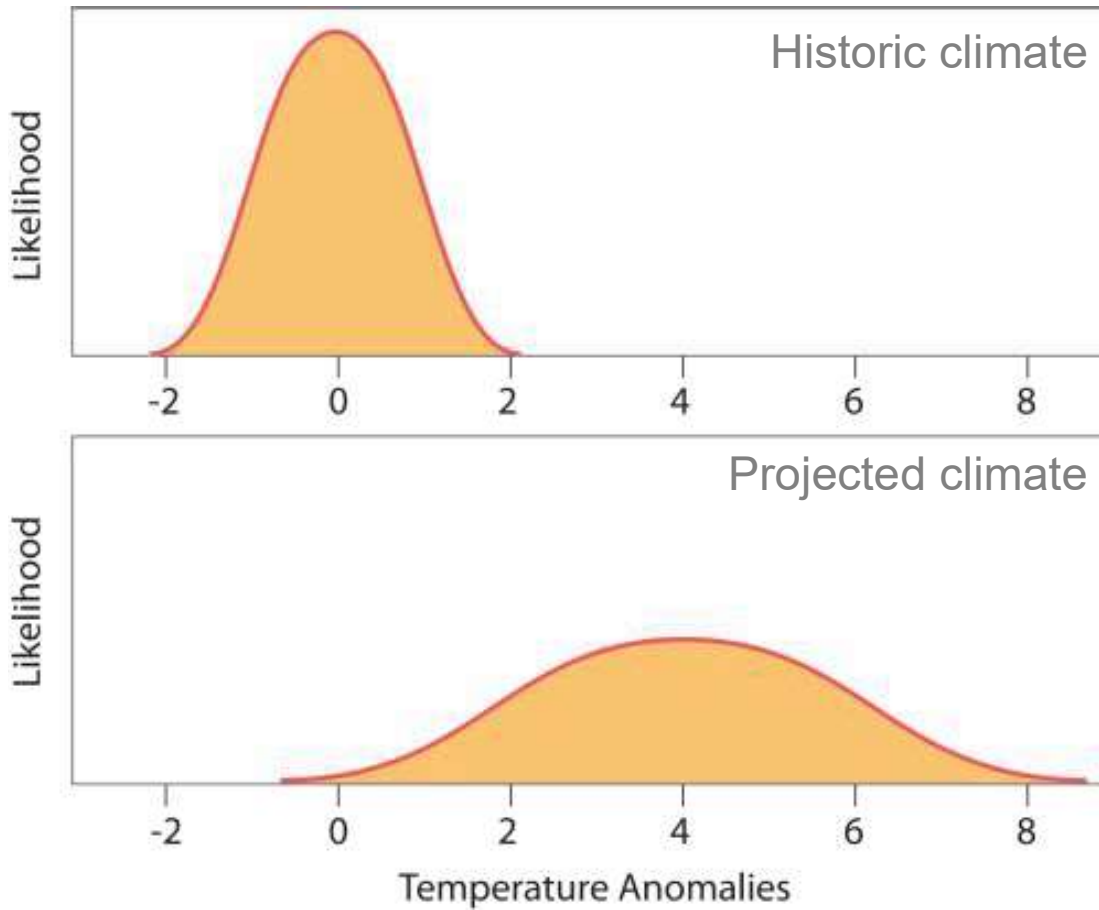
Maladaptation of forests to climate change

Increased warming and probability of extremes



Maladaptation of forests to climate change

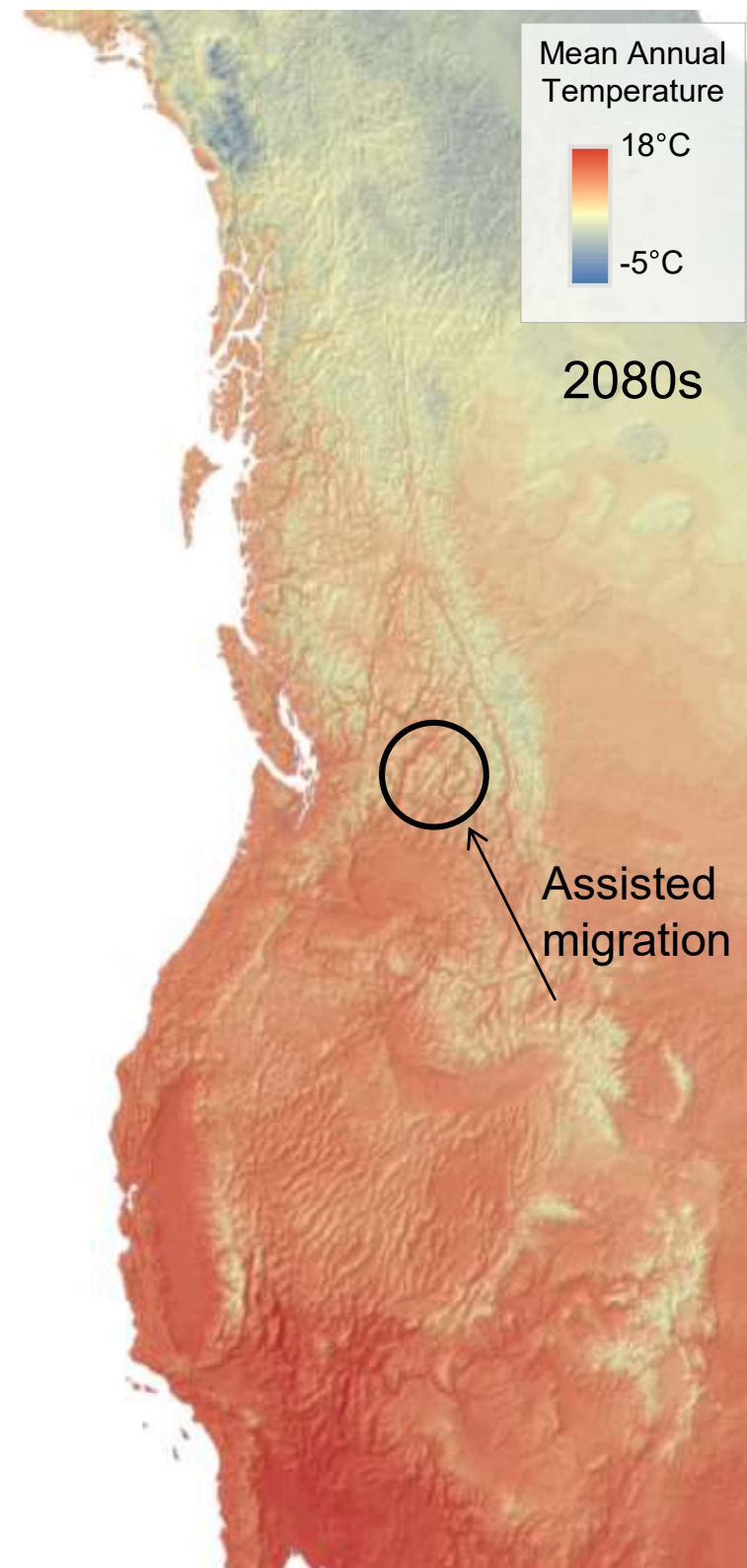
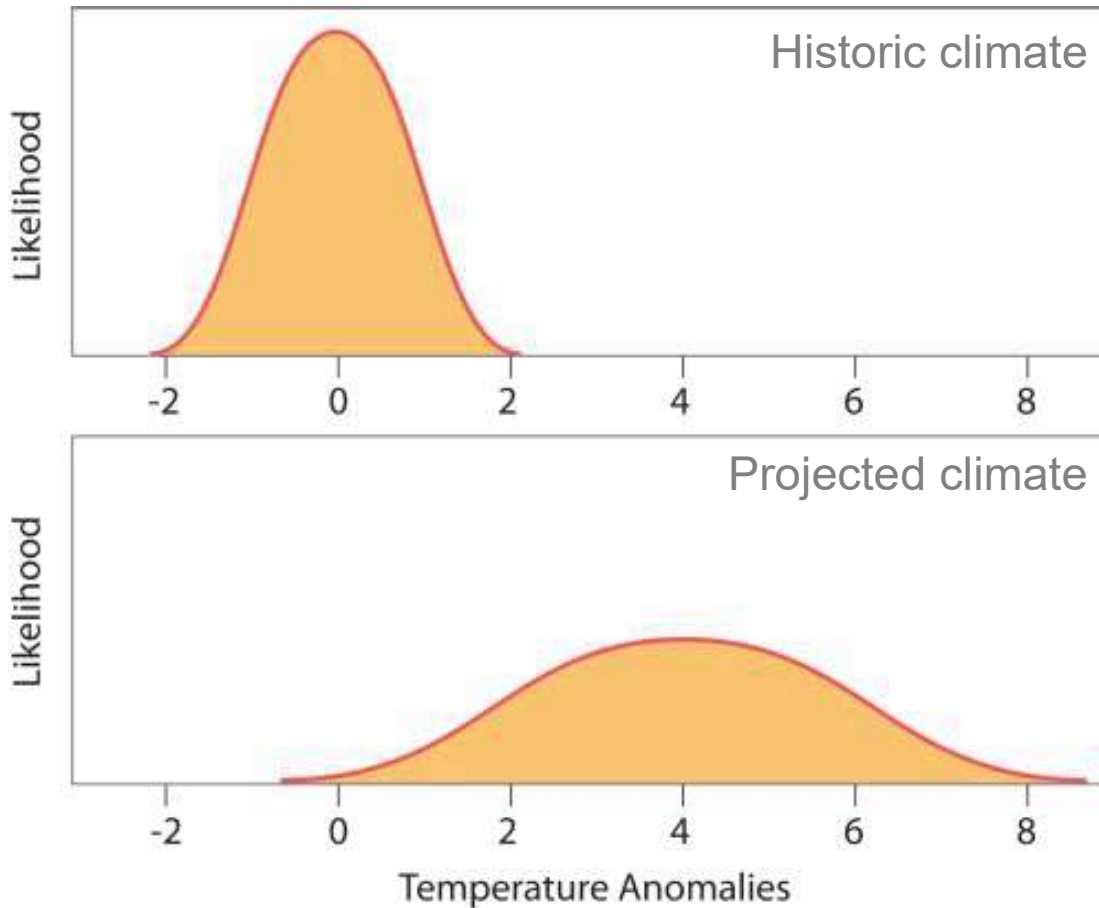
Increased warming and probability of extremes



2080s

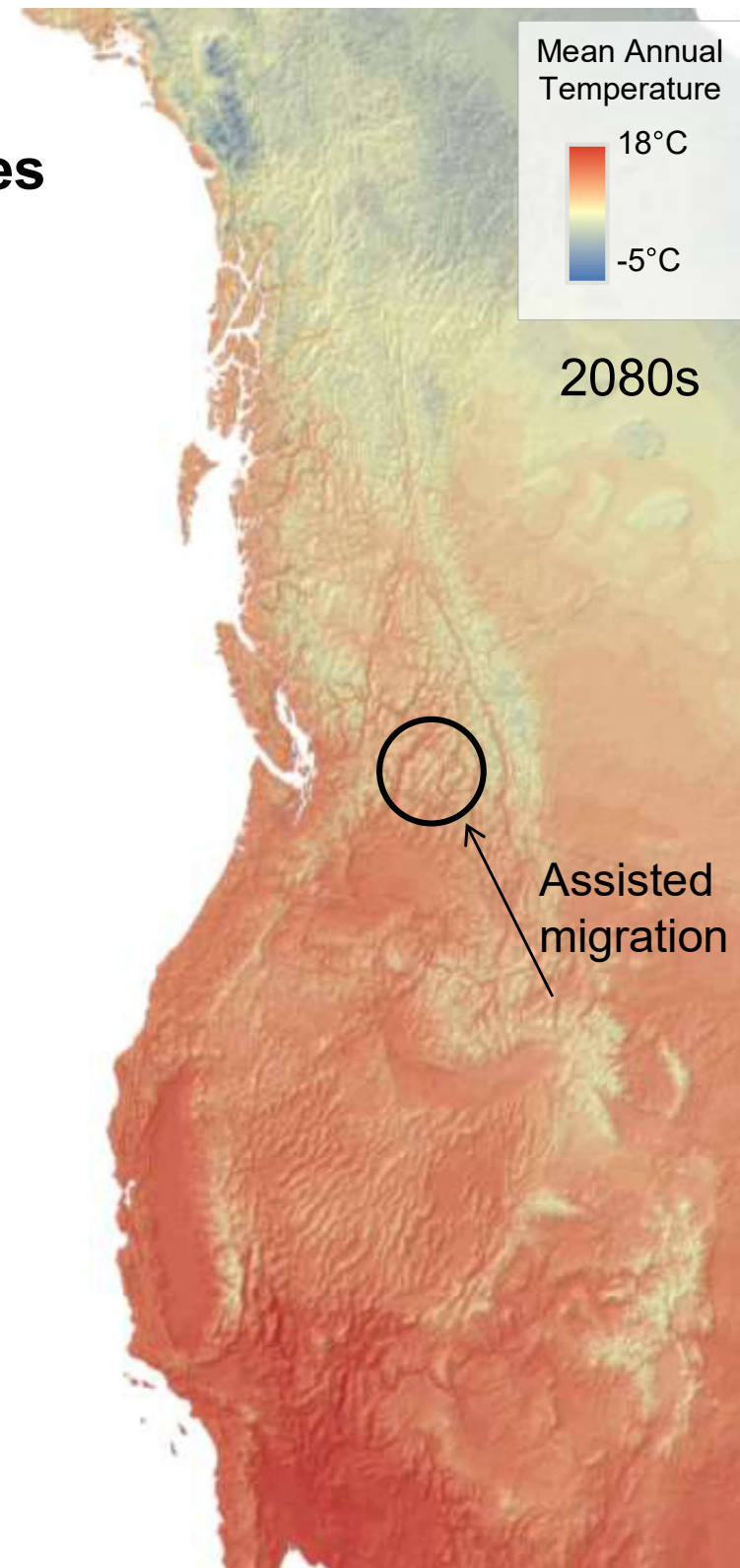
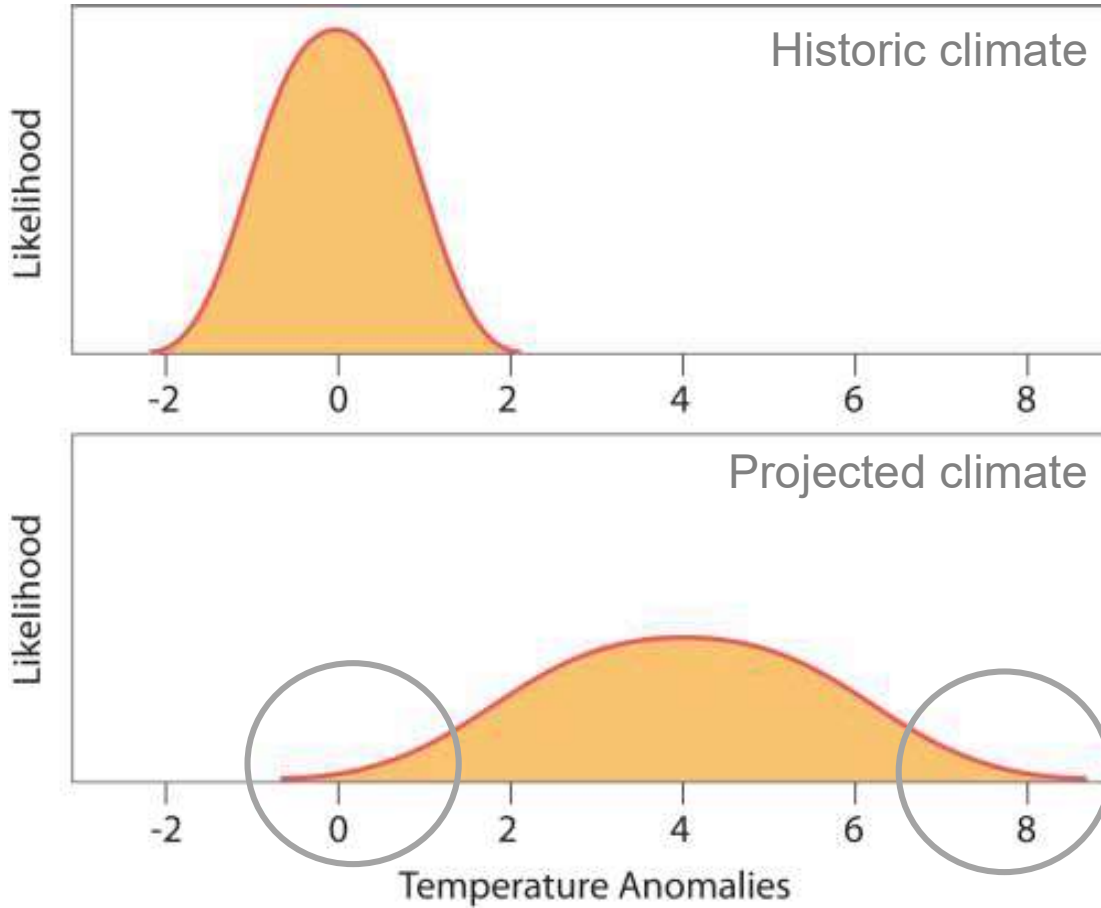
Maladaptation of forests to climate change

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Increased warming and probability of extremes

Implications for forests

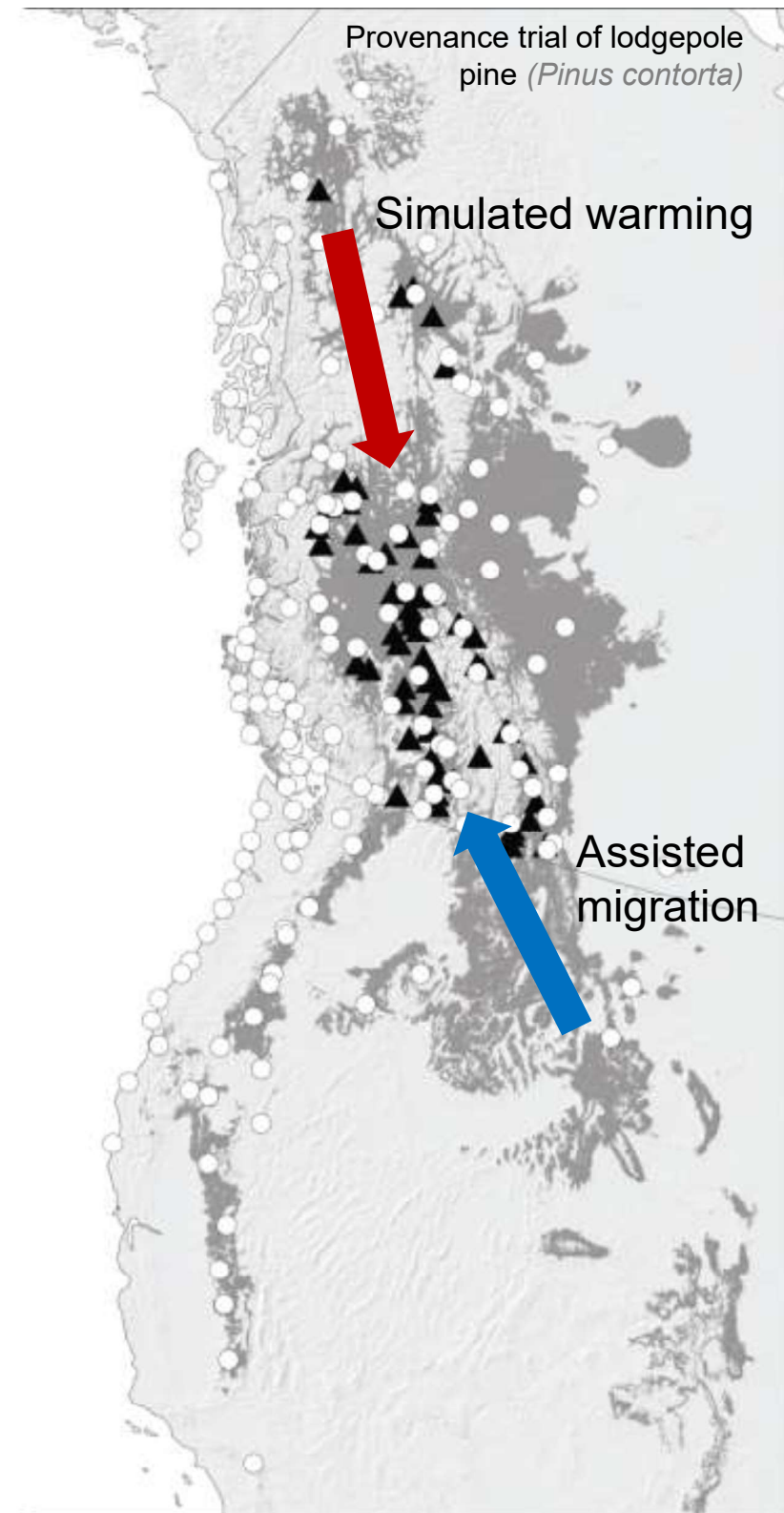


2080s

Assisted migration

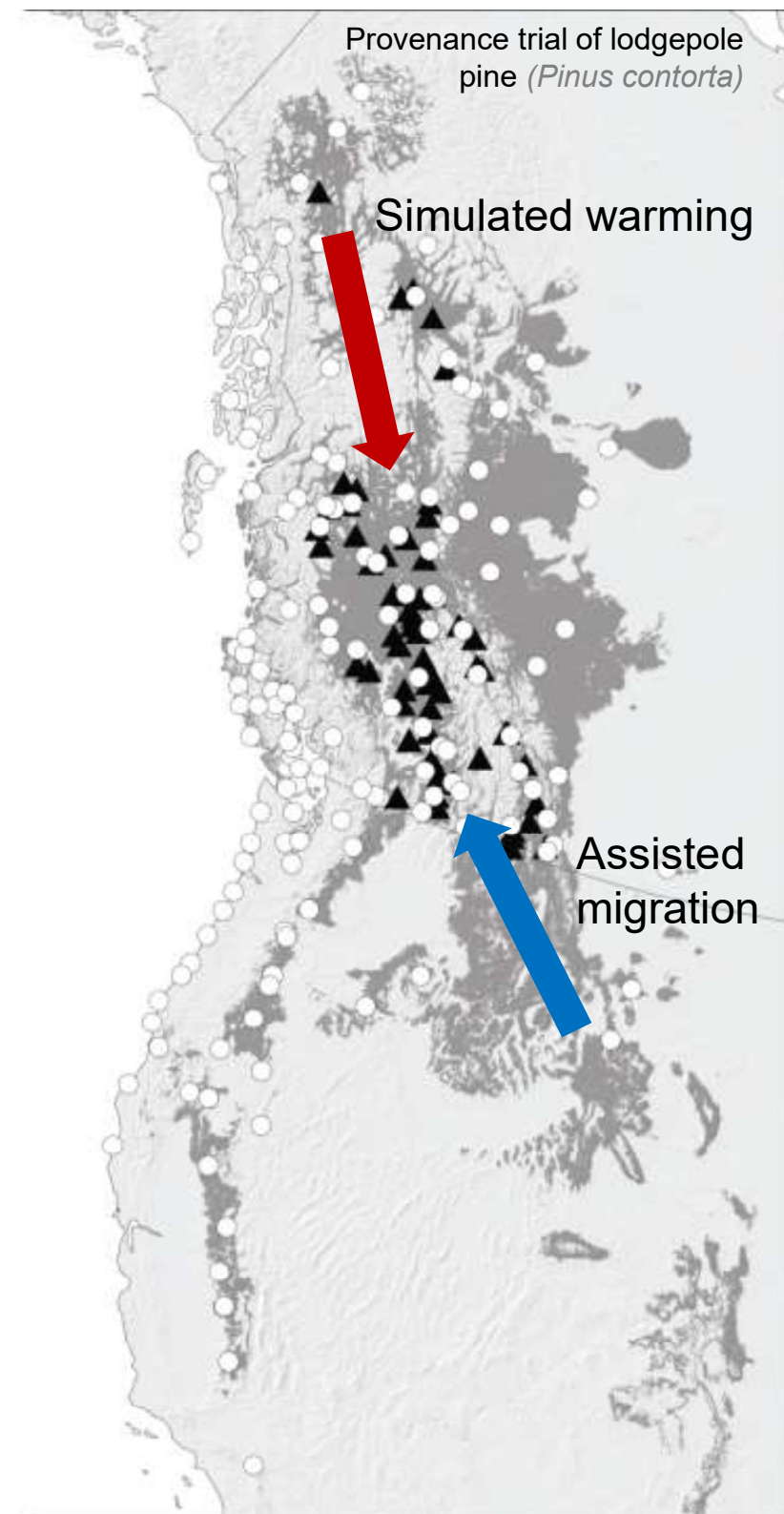
Provenance trials

- Seeds collected from across a species range grown at multiple planting sites
- Climate change laboratory:
 - Moving seed south \approx climate warming
 - Moving seed north \approx test assisted migration



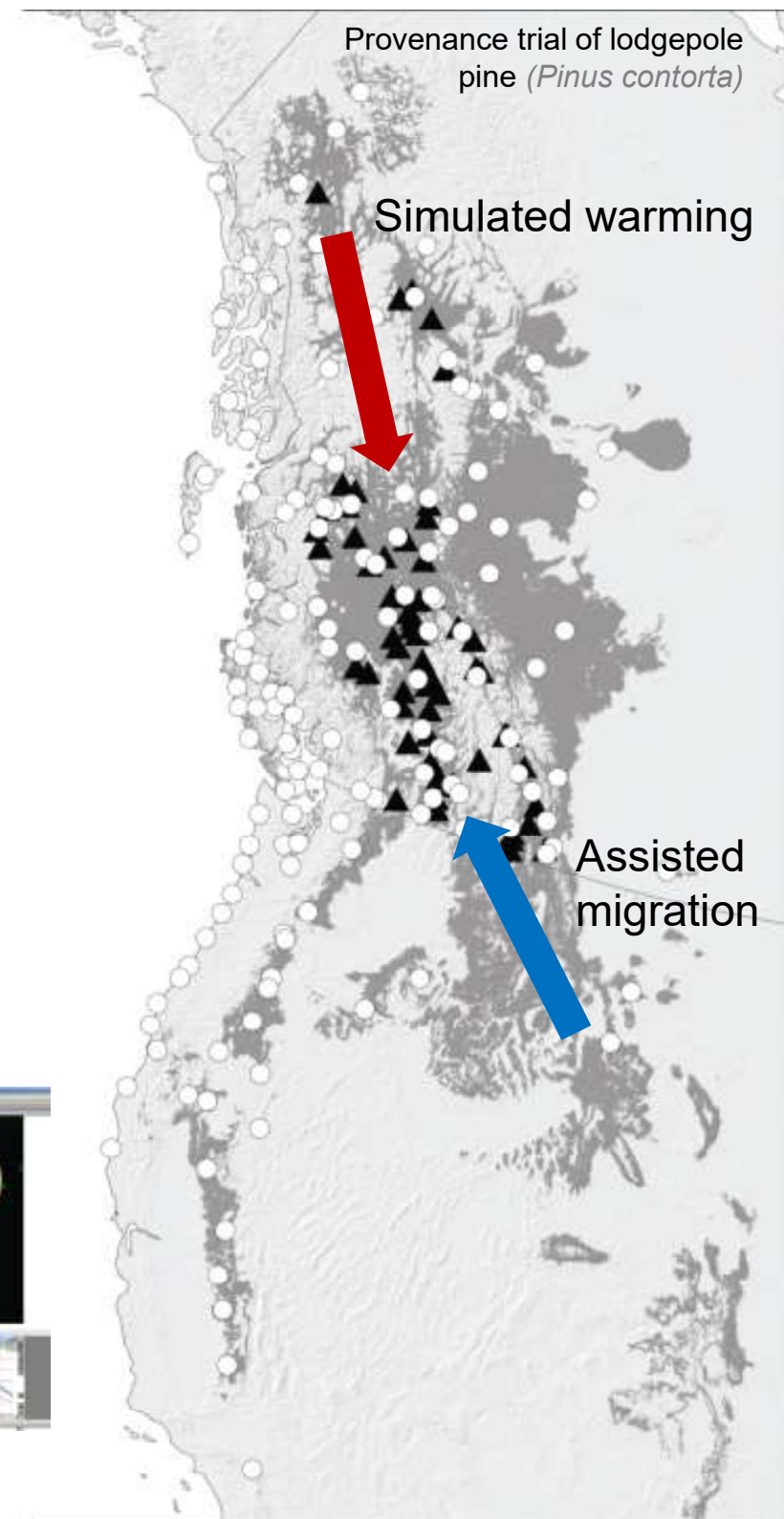
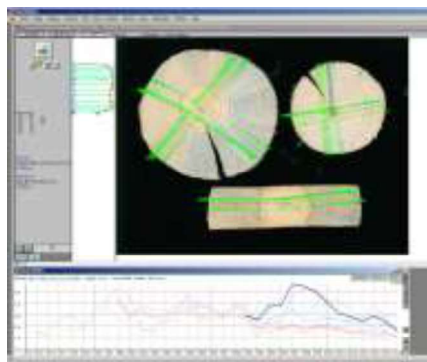
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 - Observe responses in an experimental structure



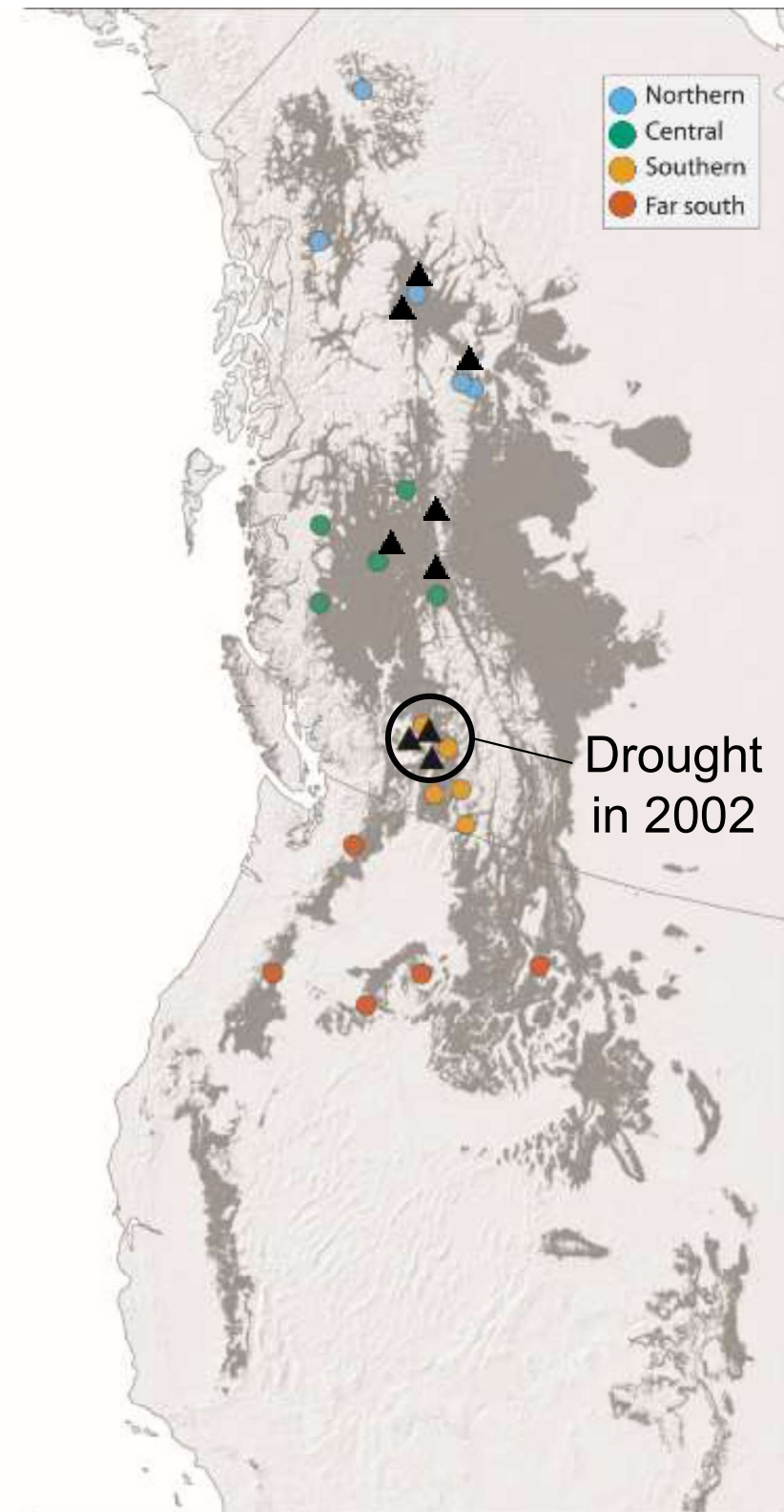
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- Seeds collected from across a species range grown at multiple planting sites
- Climate change laboratory:
 - Moving seed south \approx climate warming
 - Moving seed north \approx test assisted migration
- Tree-ring analysis:
 - Observe responses in an experimental structure
- Design:
 - 23 provenances grouped into 4 populations
 - 9 sites, 3 with drought

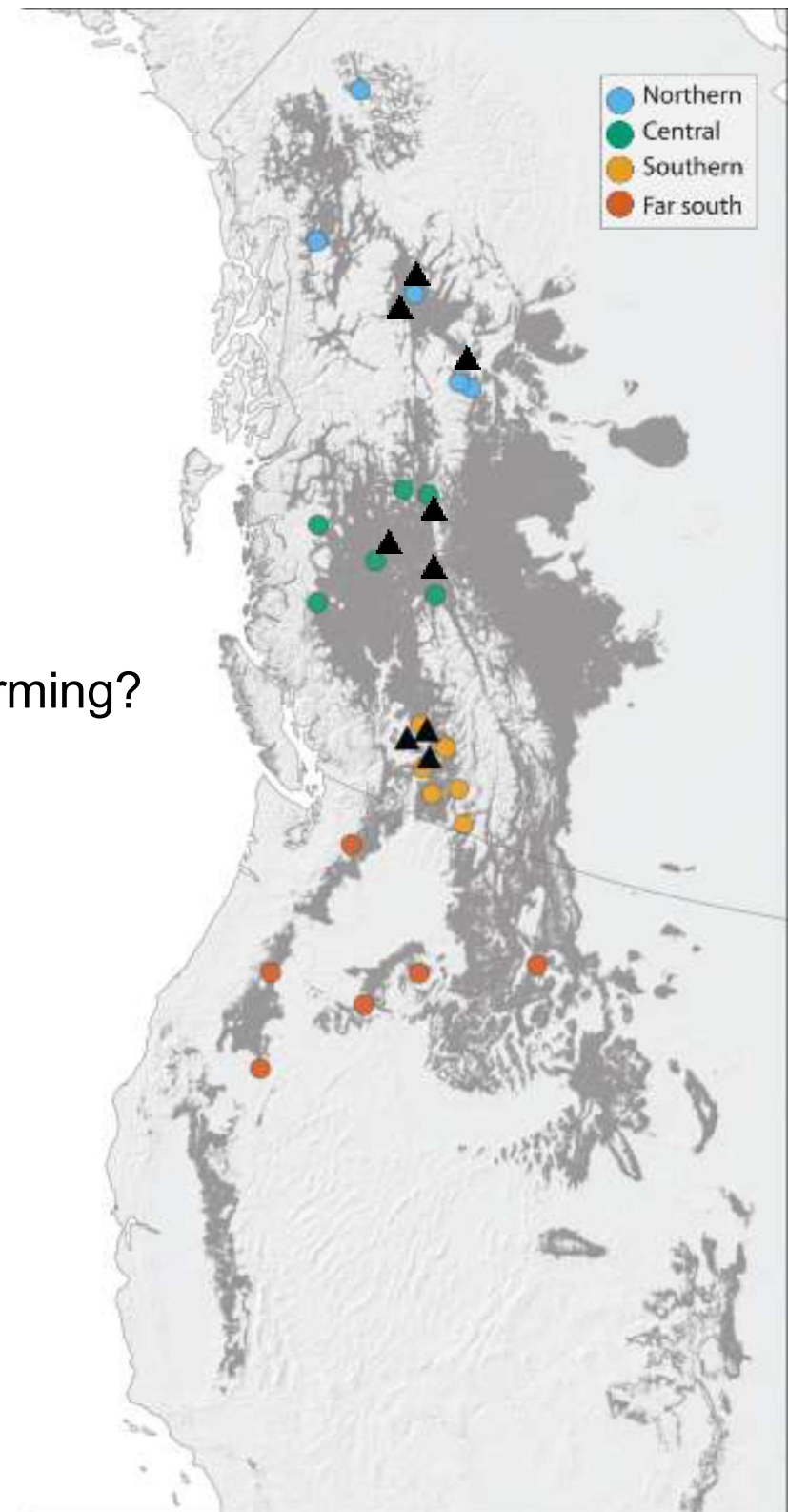


Questions

Q1) How do populations respond to drought?

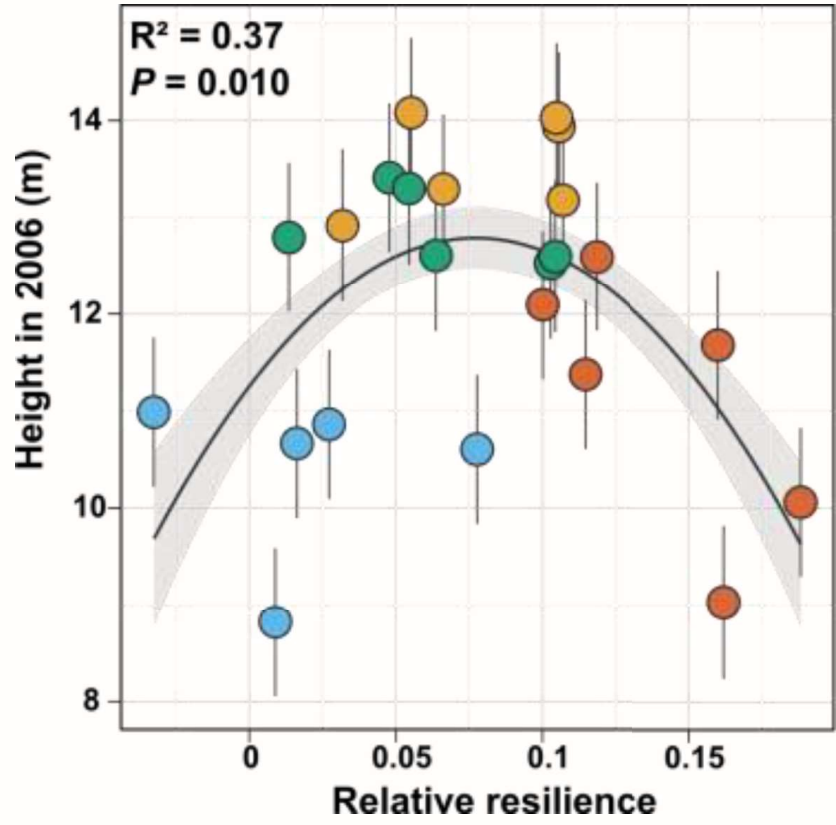
Q2) How do populations respond to cold?

Q3) How can seed transfer help under climate warming?



Q1) Response to drought?

Growth vs. drought trade-off

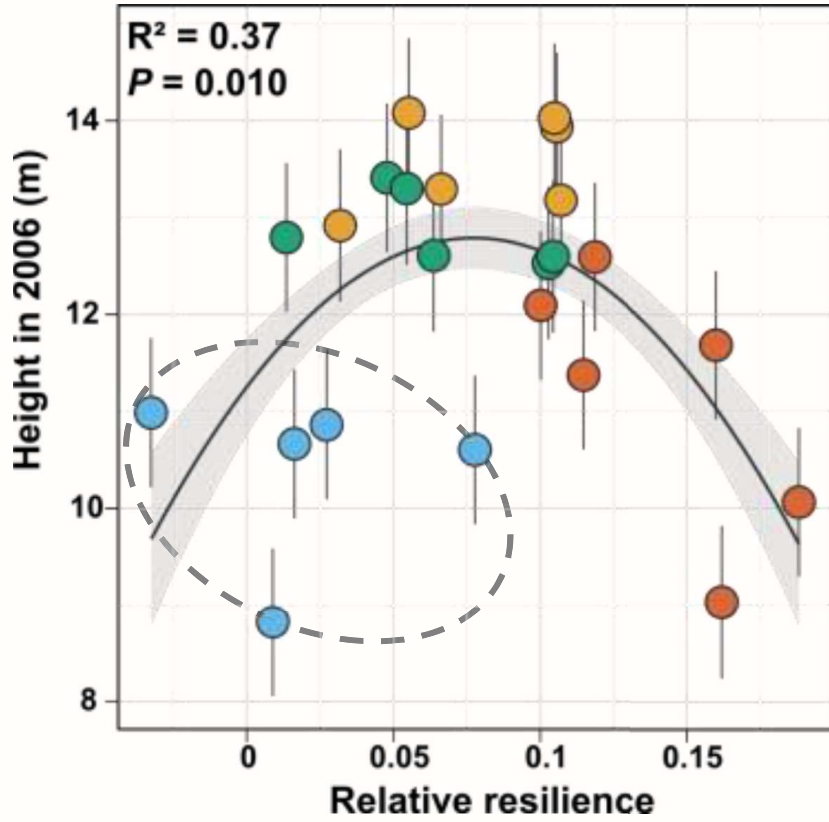


(Drought tolerance)

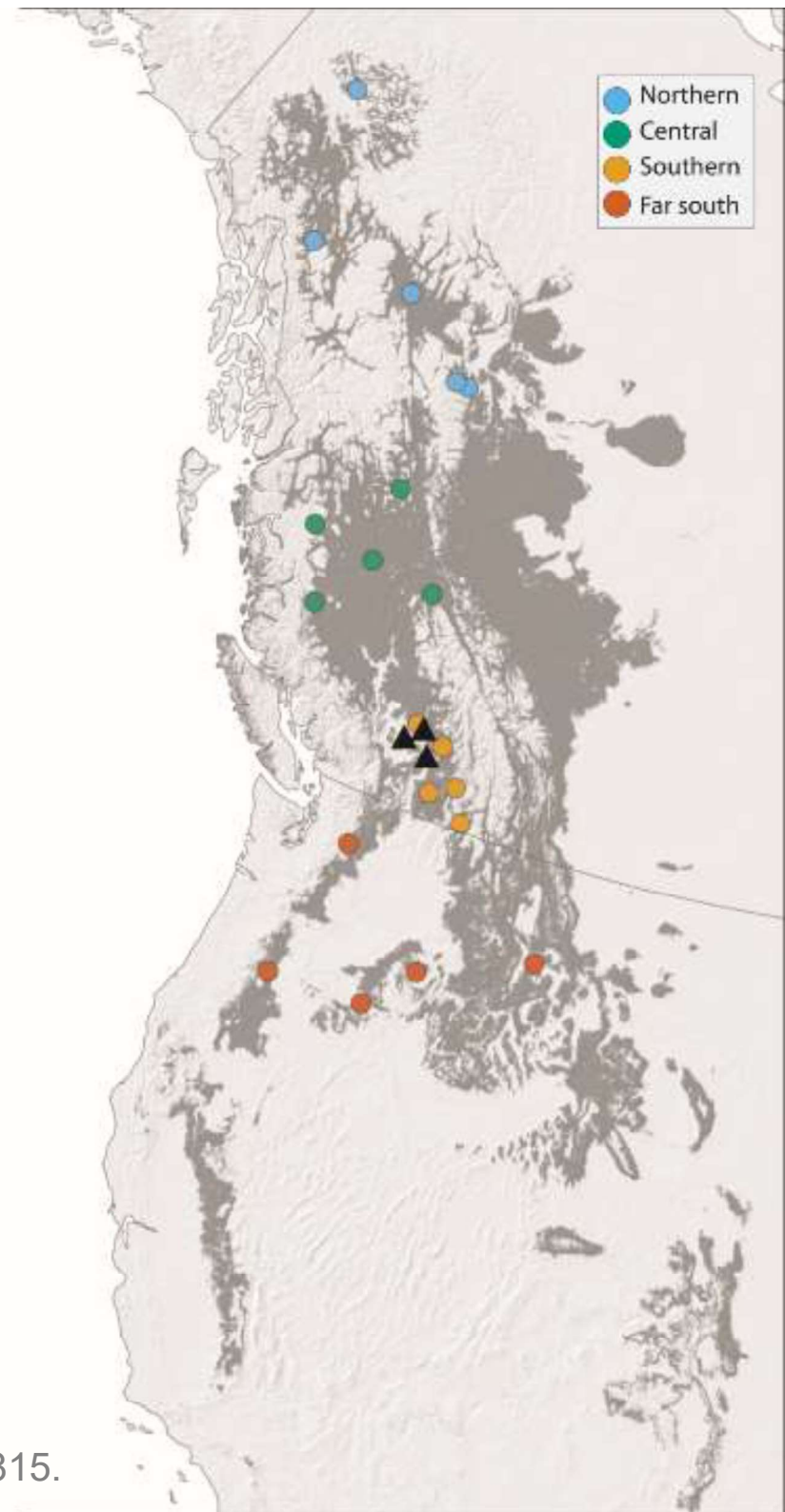


Q1) Response to drought?

North at risk under drought

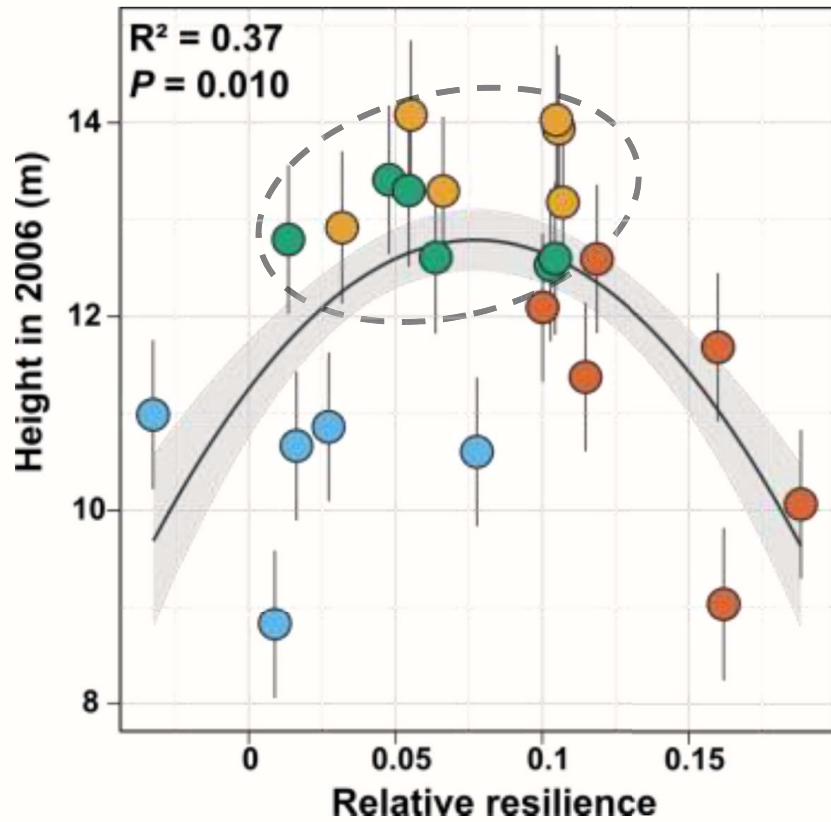


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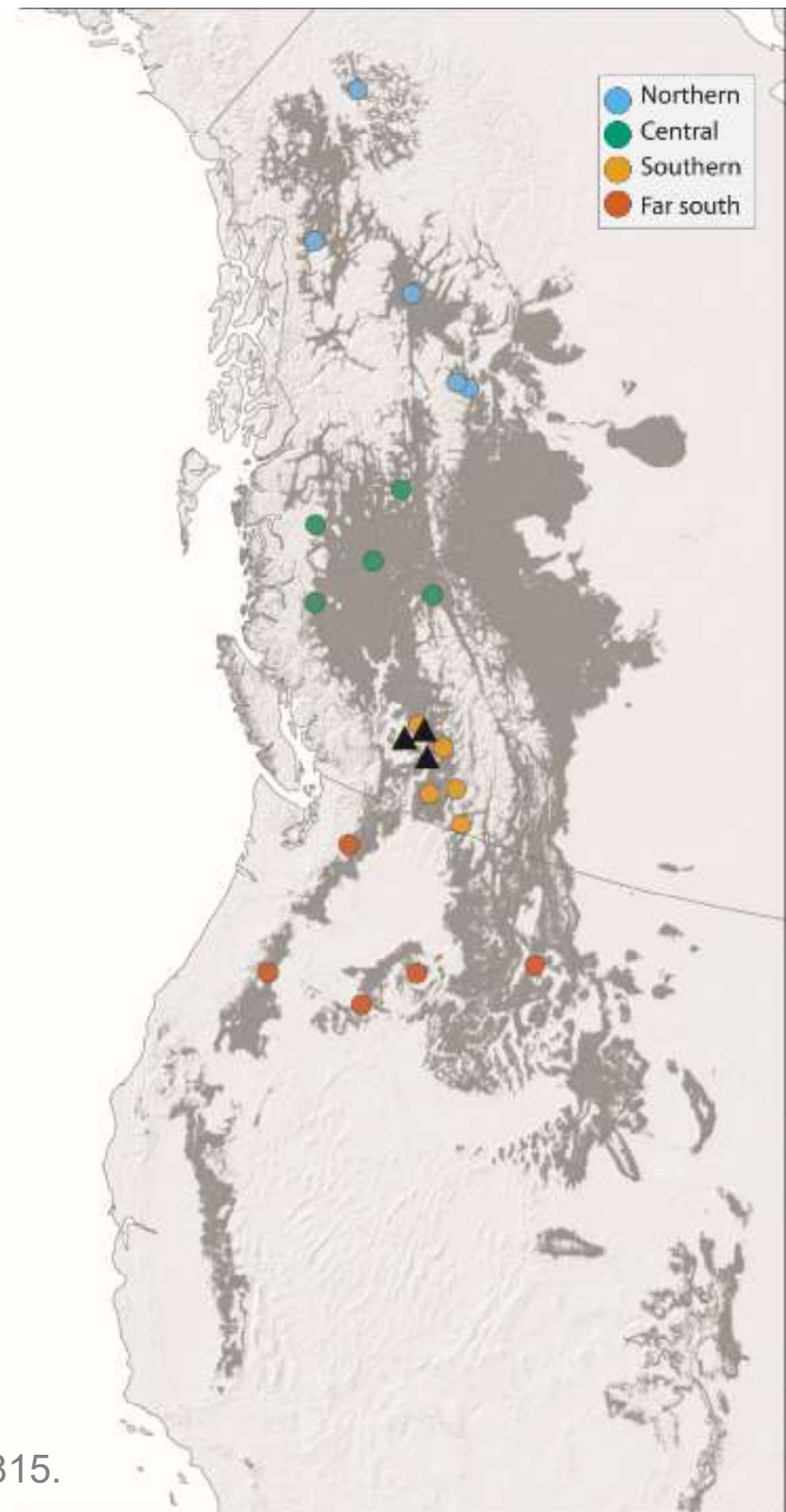


Q1) Response to drought?

Moderately drought tolerant

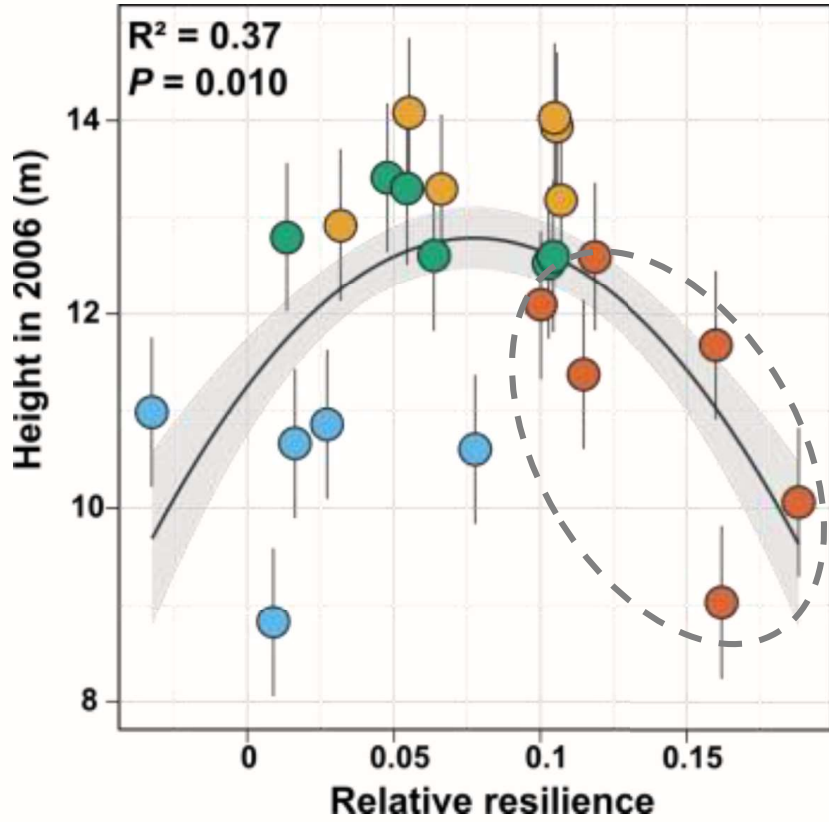


(Drought tolerance)



Q1) Response to drought?

Assisted migration reduces growth

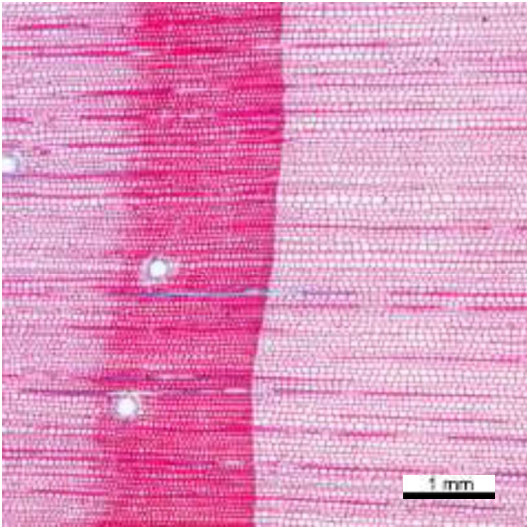


(Drought tolerance)

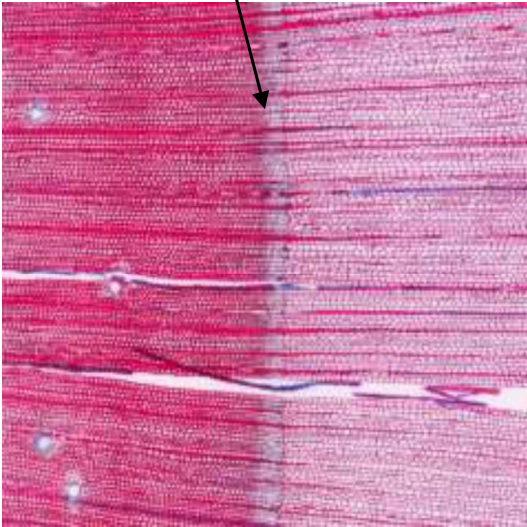


Q2) Response to cold?

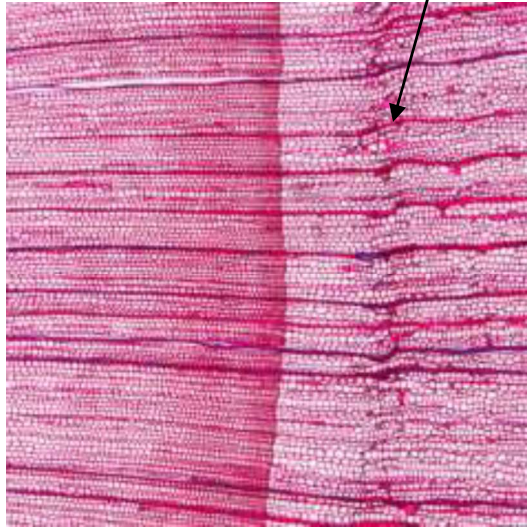
Normal ring



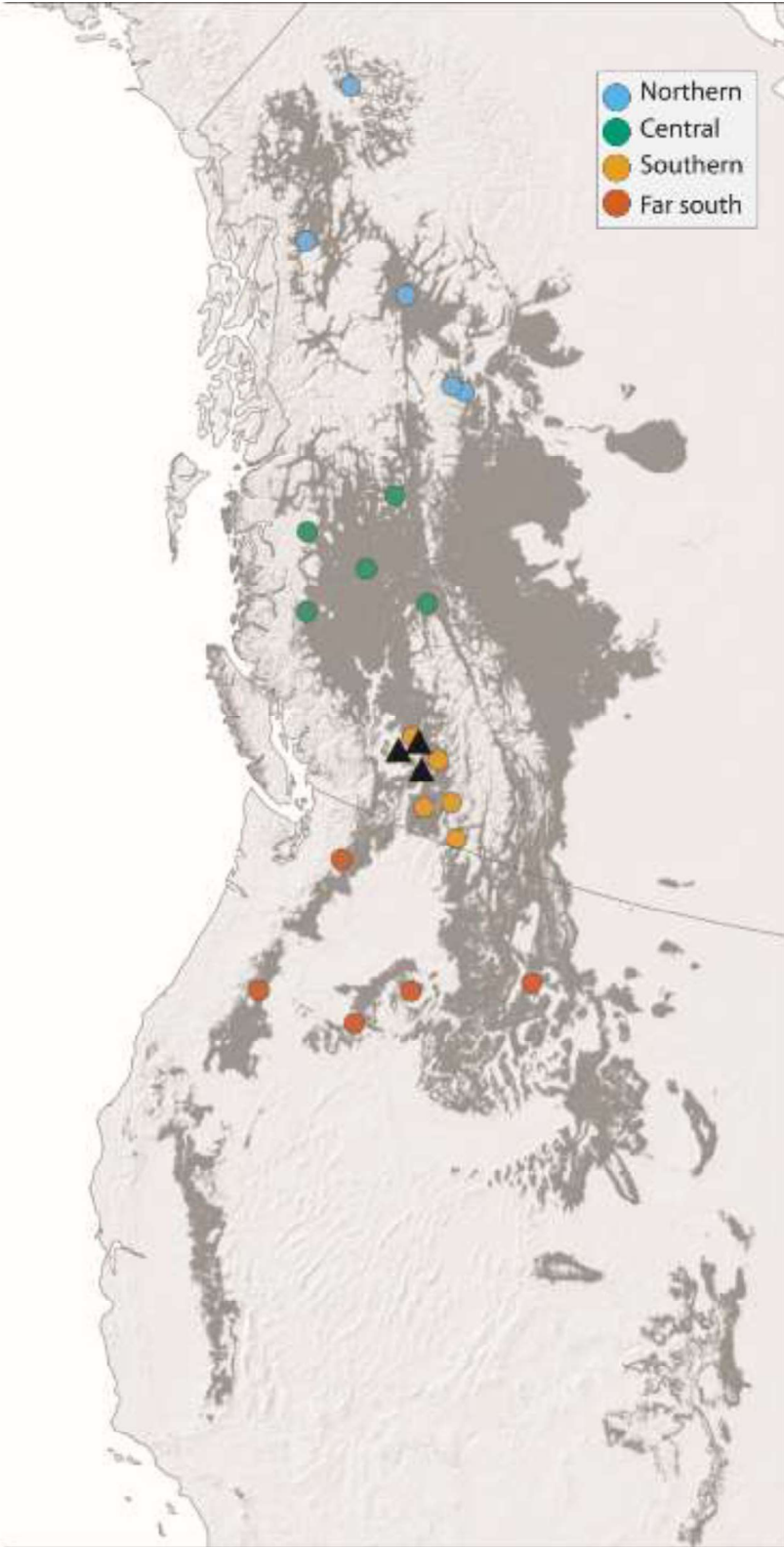
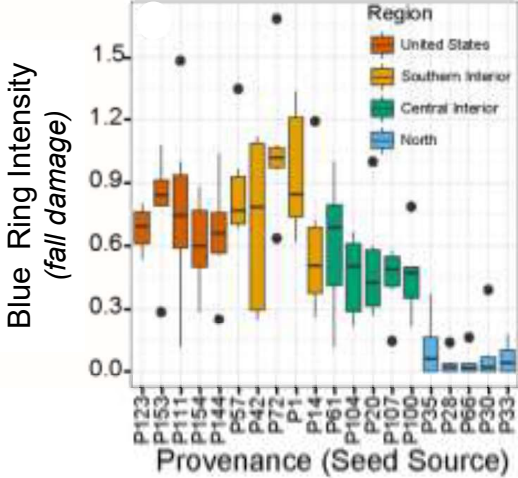
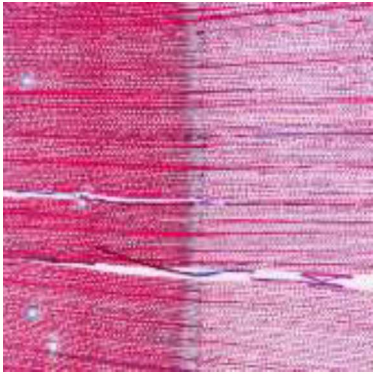
Blue ring
(fall cold damage)



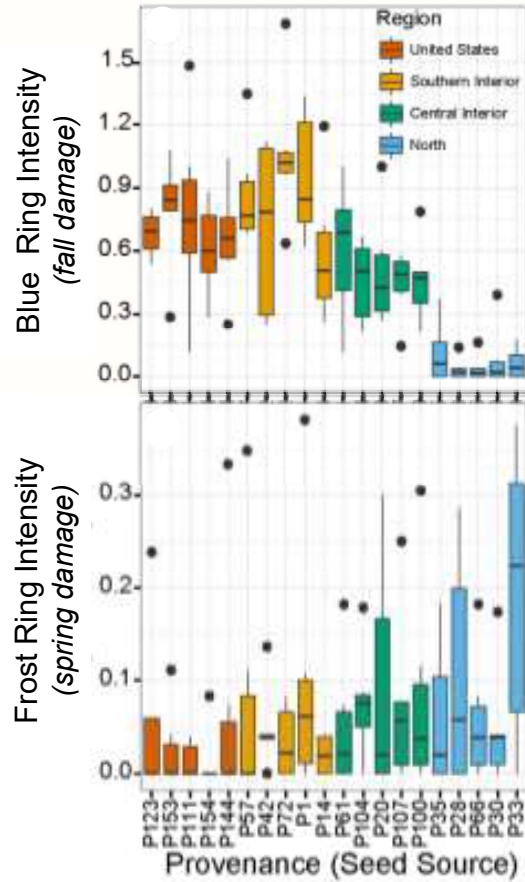
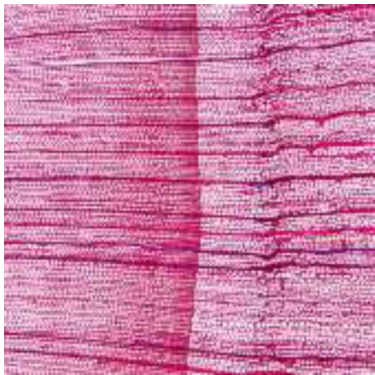
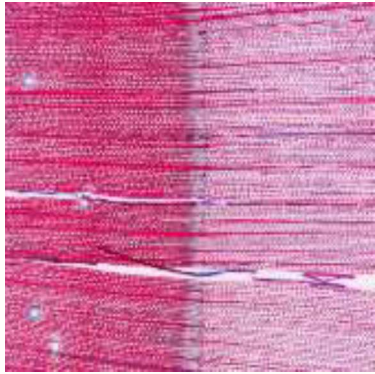
Frost ring
(spring cold damage)



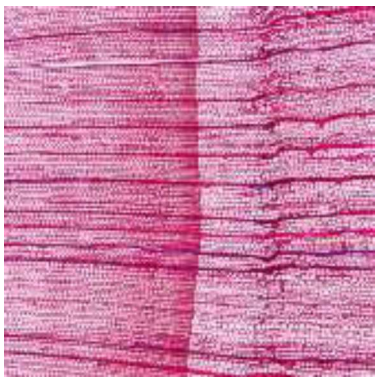
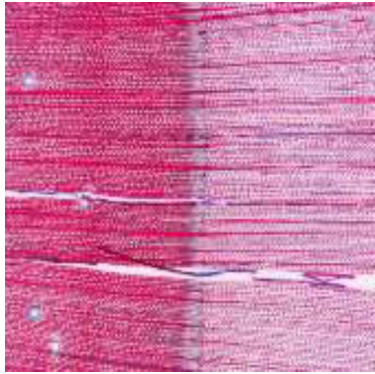
Q2) Response to cold?



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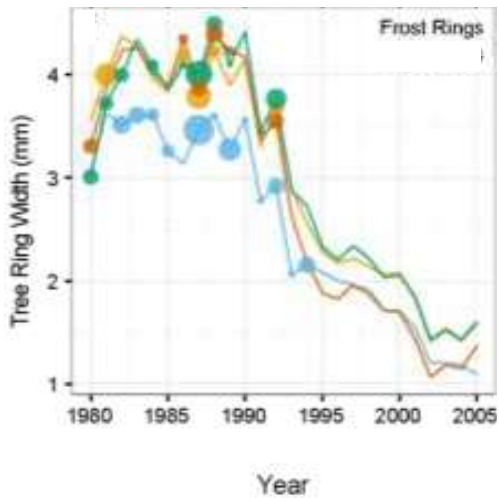
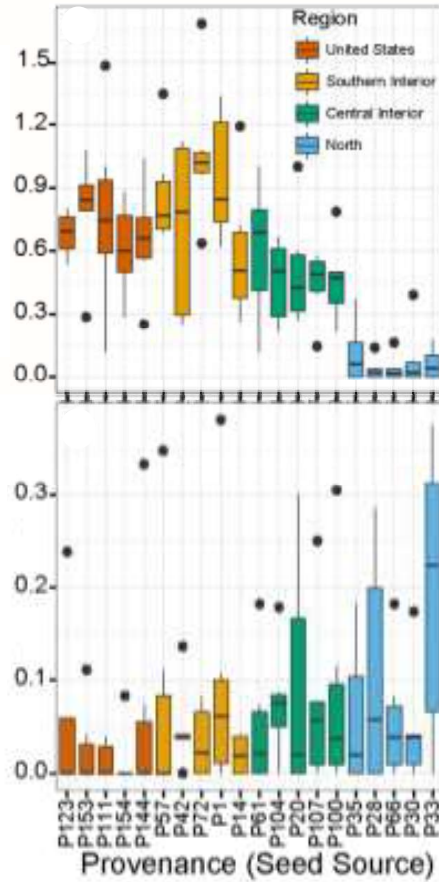


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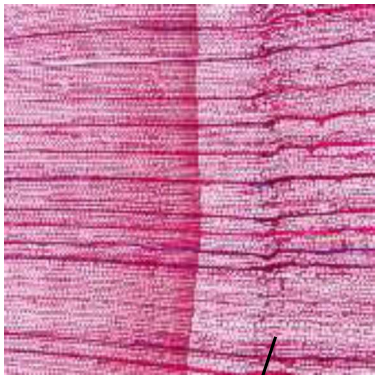
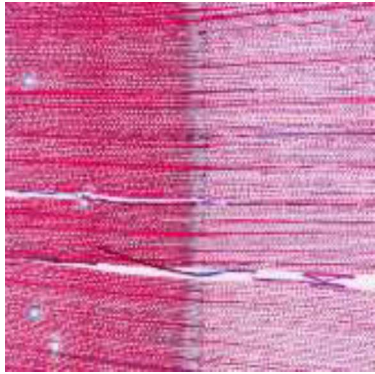


Blue Ring Intensity
(fall damage)

Frost Ring Intensity
(spring damage)

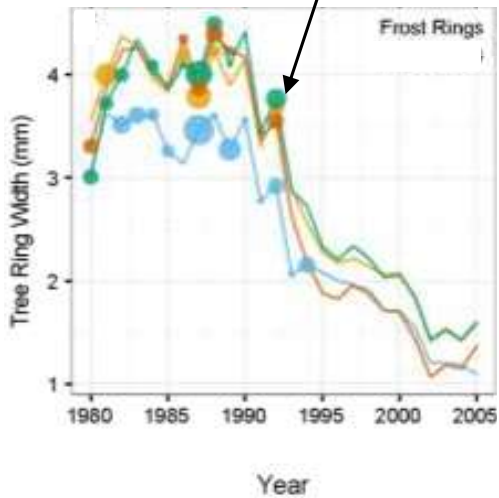
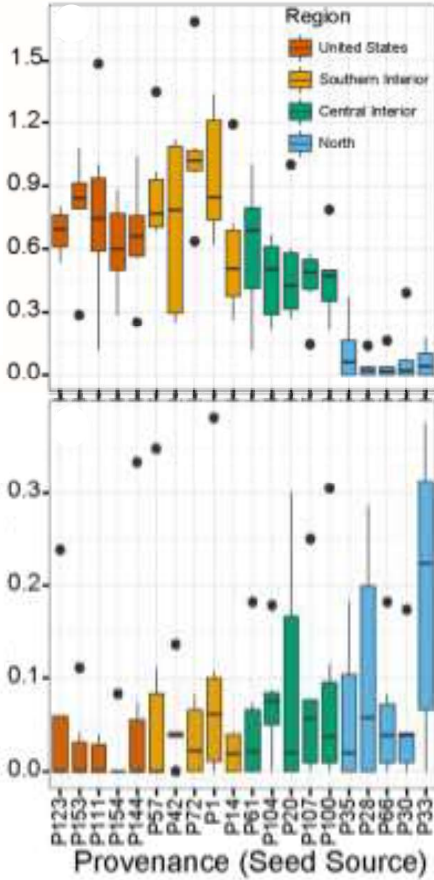


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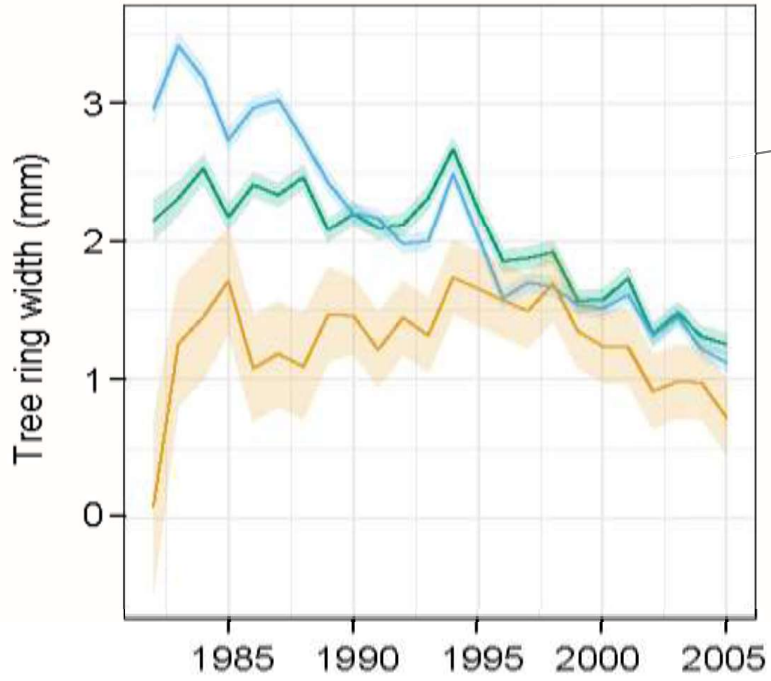


Blue Ring Intensity
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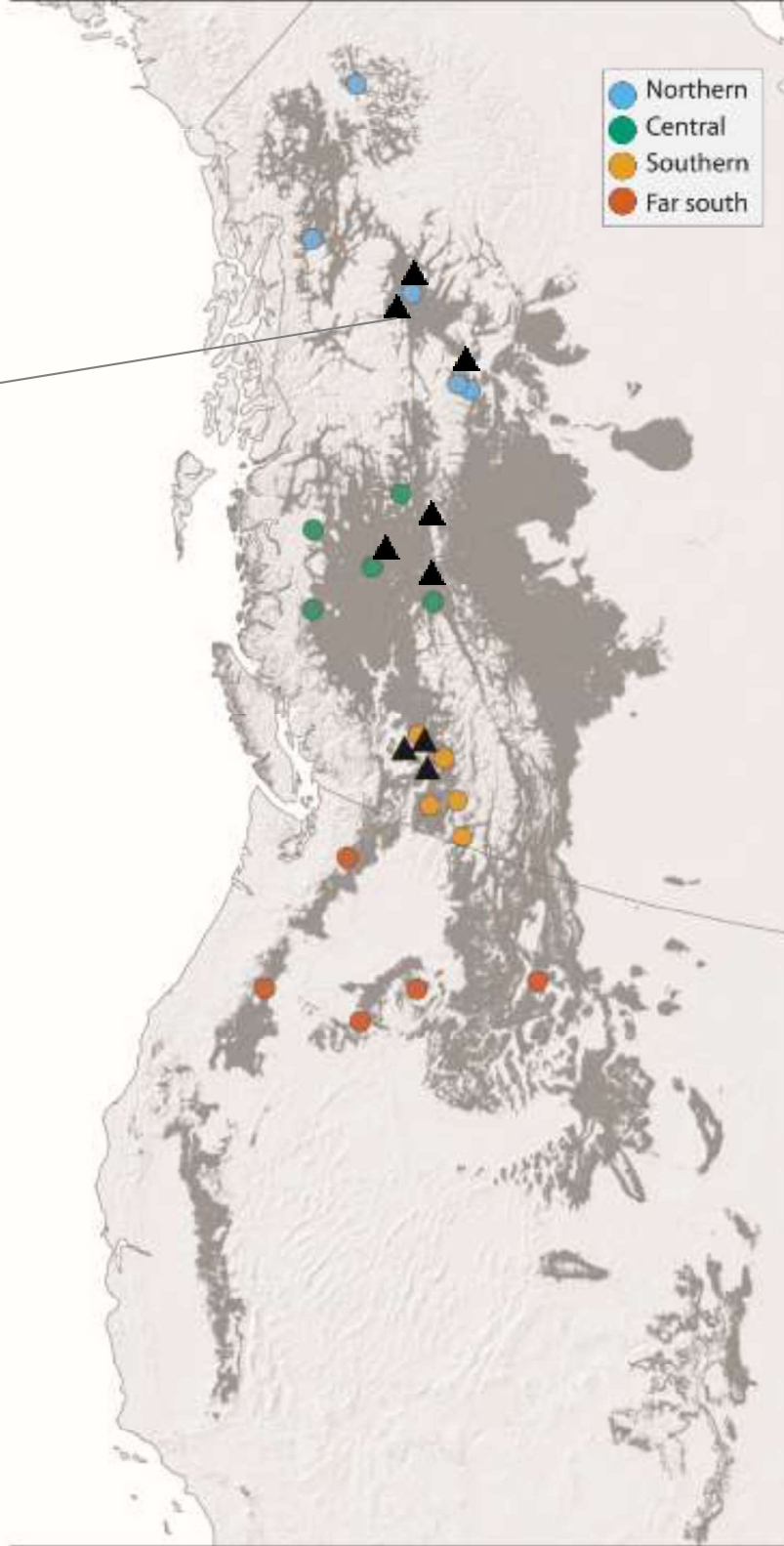
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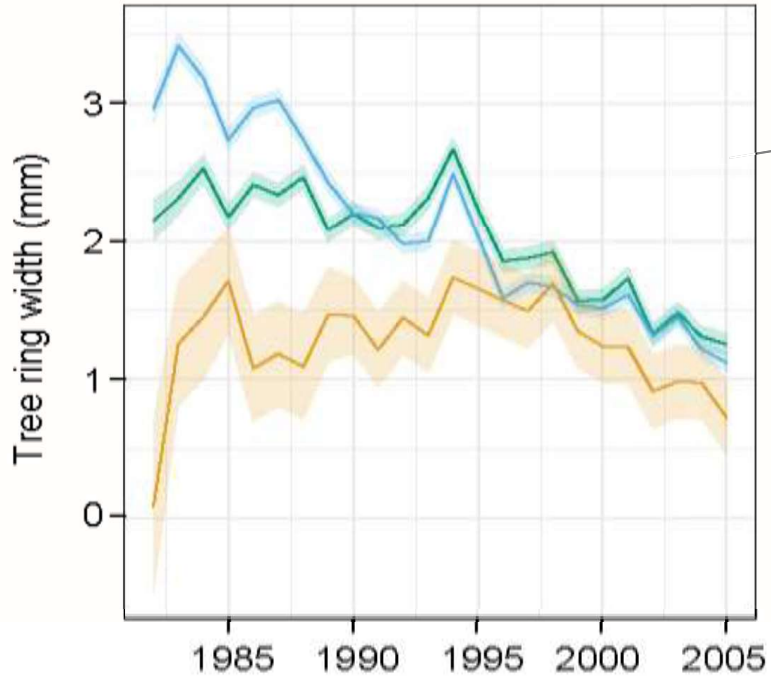
Q3) Can seed transfer help?



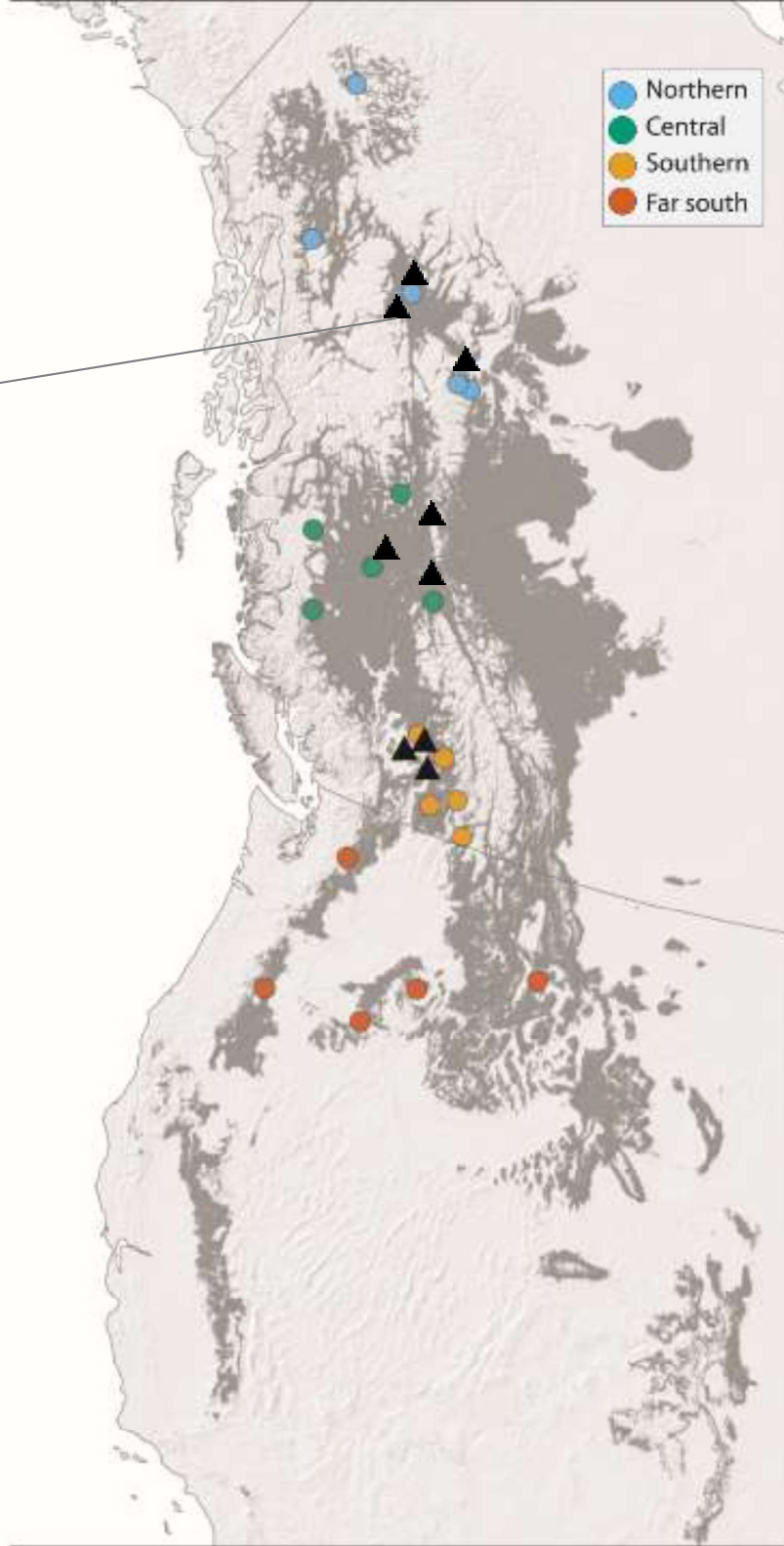
Northern planting sites



Q3) Can seed transfer help?



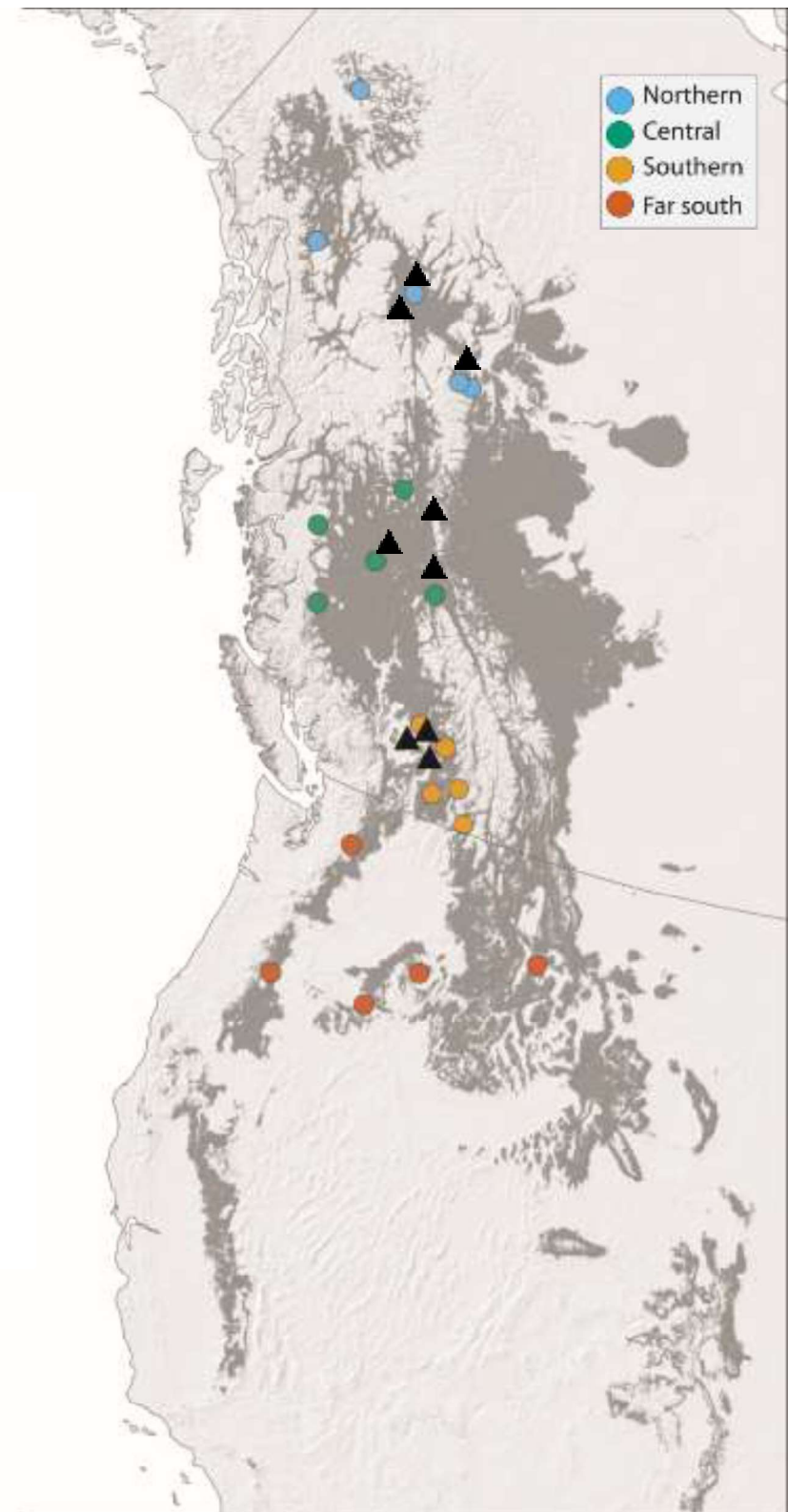
Northern planting sites



Yes, it can...

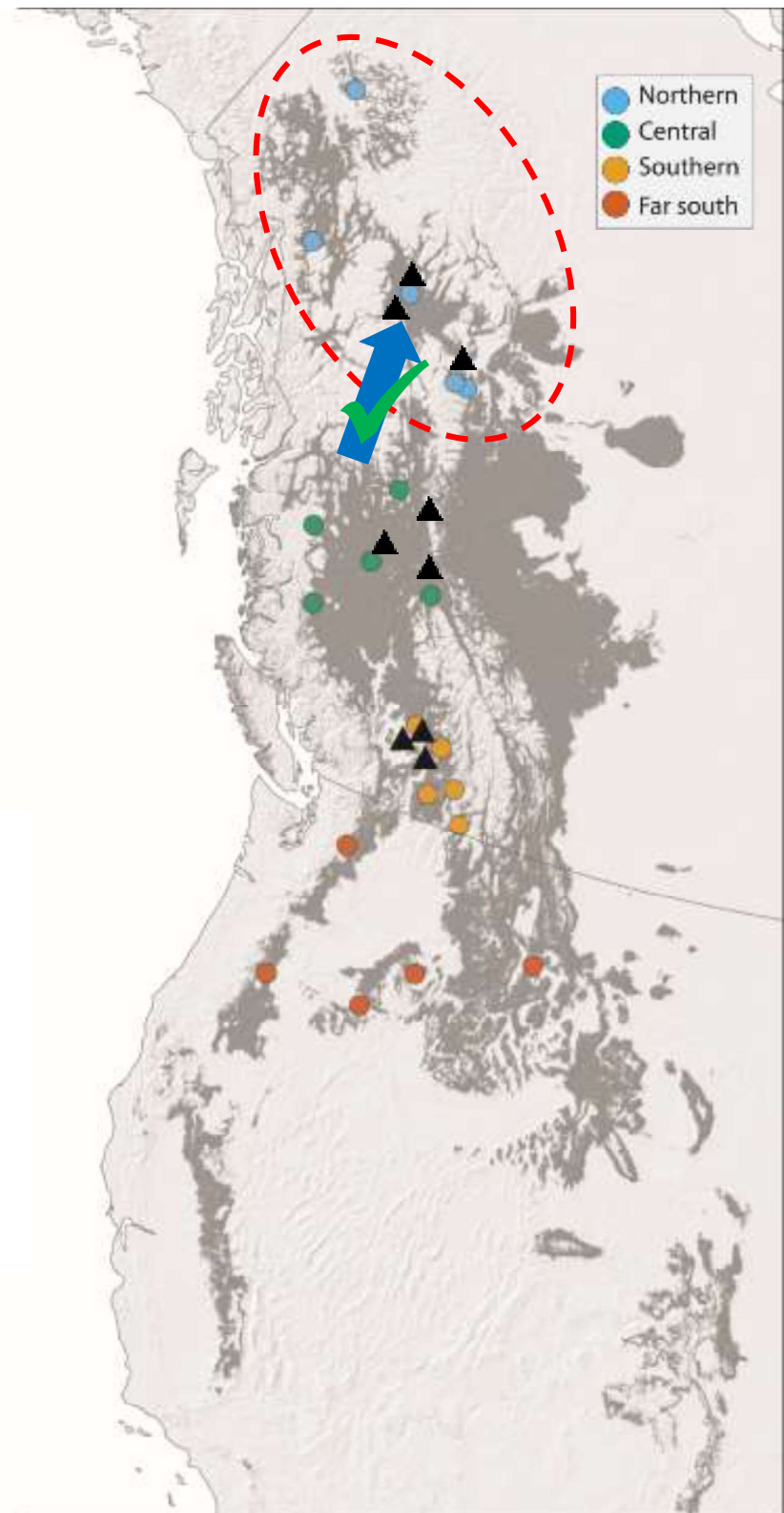
Implications for assisted migration

- Extreme events more impactful than warming



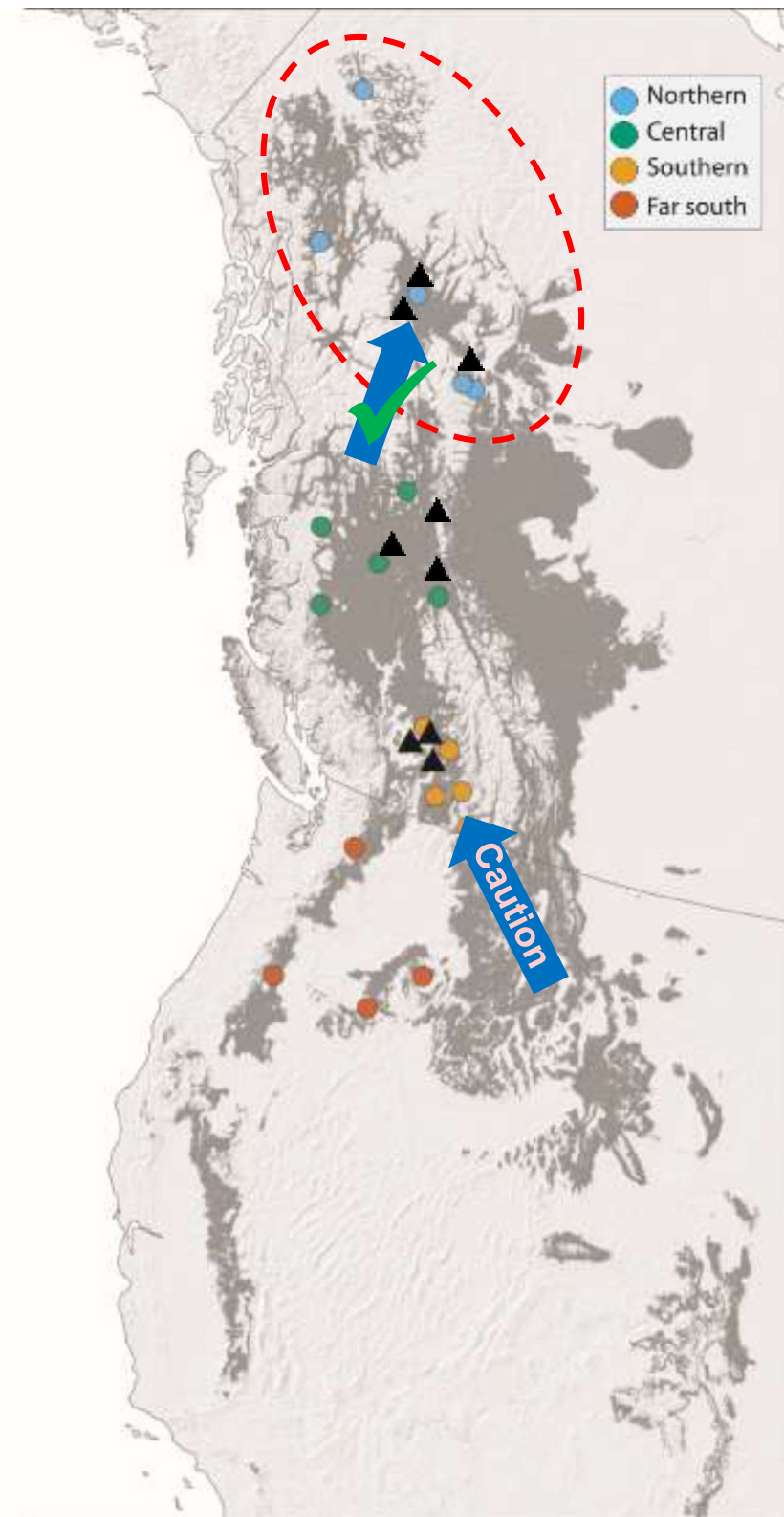
Implications for assisted migration

- Extreme events more impactful than warming
- North: Assisted migration is low-risk
 - North: most at-risk due to extremes
 - Central: no undue cold damage in north



Implications for assisted migration

- Extreme events more impactful than warming
- North: Assisted migration is low-risk
 - North: most at-risk due to extremes
 - Central: no undue cold damage in north
- South: Cold may limit long-distance transfers
 - Central forests have some drought tolerance
 - Far south: can increase drought tolerance...
 - ... but risk damage and growth loss from cold



Questions?

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