Assisted migration poleward rather than upward in elevation minimizes frost risks in plantations

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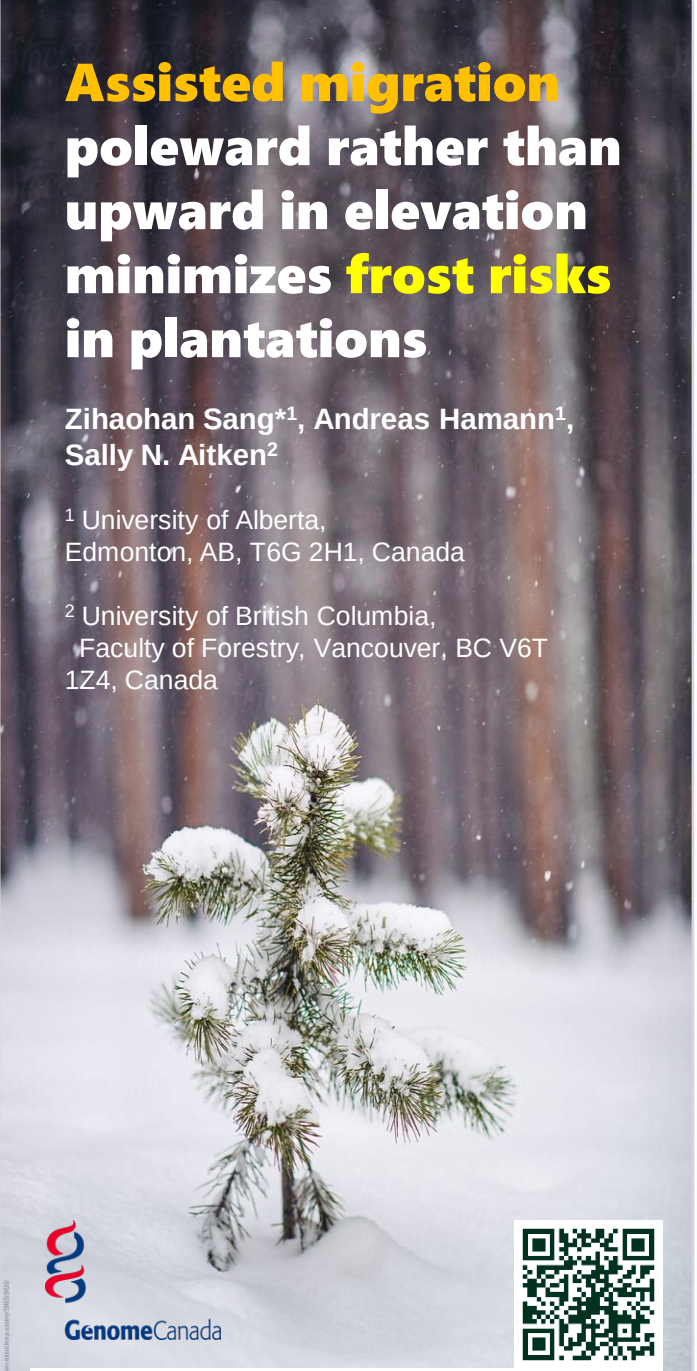

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Sang *et al*. 2021. Climate Risk Managemement (preprint)

Background

- When assisted migration is used to address climate change, tree seedlings may have to be moved to substantially colder environments poleward or upward in elevation in anticipation of climate warming over their life span. This may lead to frost exposure of seedlings.

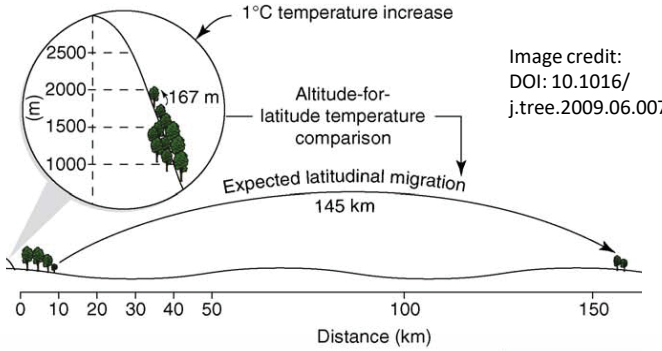


Image credit: DOI: 10.1016/j.tree.2009.06.007

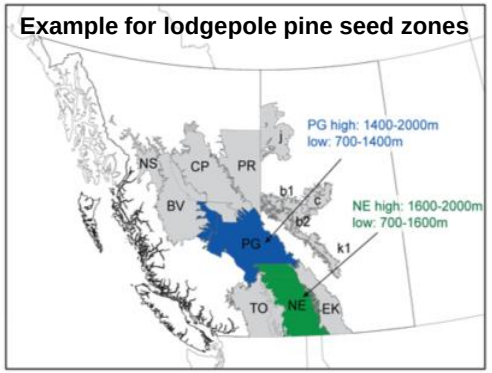
Objectives

- Determine the safety of assisted migration options by calculating the probability of late spring and early fall frost events in origin and target seed zones.
- Provide general guidance on how to minimize the risk of frost damage or plantation failure in reforestation

Methods

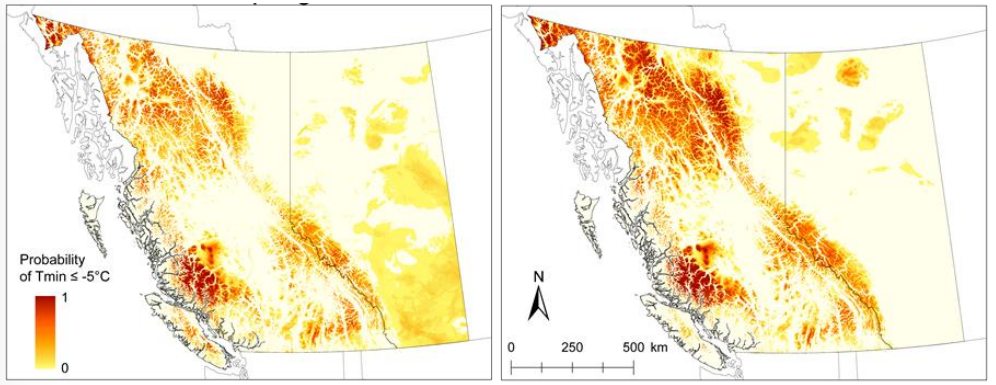
- We evaluated frost risks for four important conifers, when moved to adjacent northern and higher elevation seed zones that are cooler by approximately 2 °C, using historical daily climate data.
- The map shows one example for such a transfer to the north.

Example for lodgepole pine seed zones



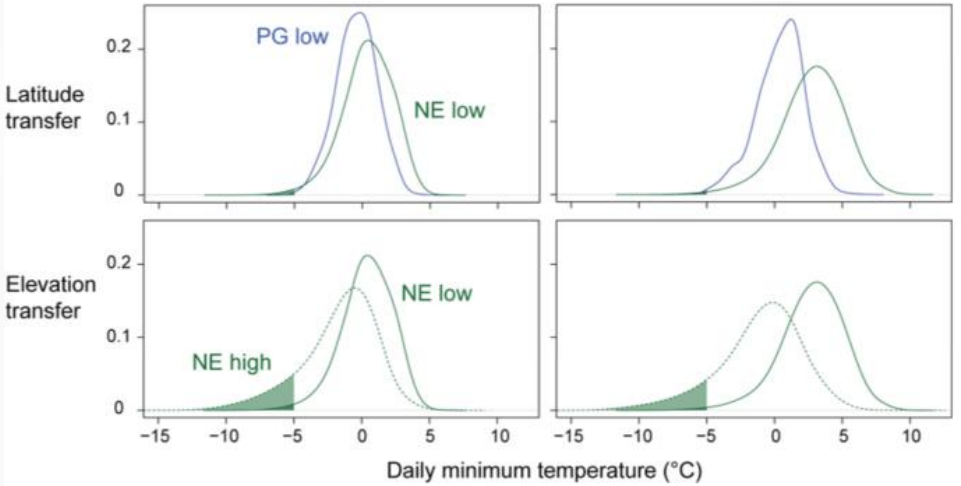
Results & Discussion

Late spring frost risks **Early fall frost risks**



- For 30 days subsequent to an estimated day of bud break in spring and growth cessation in fall, frost risks increase primarily towards higher elevation (Figure above). In an example for a seedzone transfer from NE to PG (northward). In contrast, transfers upward increase frost risks (second row of Figure).
- From a comprehensive evaluation of all plausible seed transfers among seed zones, we conclude that transfers toward the north are generally preferable to transfers up in elevation in reforestation of tree species in western Canada.

Late spring frost risks **Early fall frost risks**



- For more details and a comprehensive evaluation of seed zone transfers, see: https://doi.org/10.1016/j.crm.2021.100380