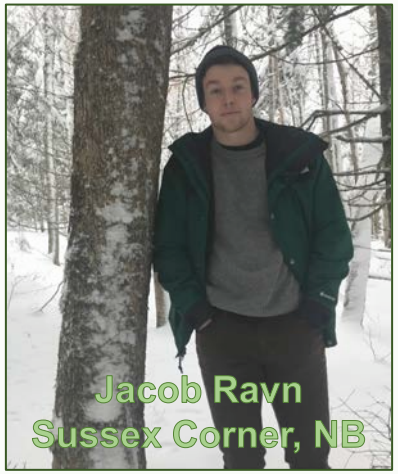

Balsam Fir (*Abies balsamea* (L.) Mill) Growth Response to Climate Change-induced Temperature Increases and Drought

Forest growth models project significant declines in balsam fir (bF) growth and abundance in its southern range due to climate change, however, a lack of empirical data limits the accuracy of these estimates. This limitation reduces our ability to mitigate climate change-driven forest declines.

1. Objectives

I. Determine the growth and physiological responses of bF seedlings to temperature increases and drought and gauge the extent of variation in response between sub-populations.

II. Determine how the treatments from the previous year impact the growth and physiology of the seedlings in the following growing season.

2. Experimental design

- 3,600 bF seedlings from four sub-populations will be subjected to 12 temperature levels and five drought lengths within 12 climate-controlled phytotrons.
- Each sub-population will be subjected to a minimum of +11^{o}C above their origin climate growing season temperature.
- All seedlings will be grown under the same conditions in the following growing season to test for lagged-growth effects.

3. Hypotheses

I. bF seedlings will have growth increases with moderate temperature increases above origin climate but will face growth declines with severe temperature increases.

II. bF sub-populations from warmer regions will be more tolerant to drought and temperature increases than seedlings from colder regions due to regional physiological adaptations.

III. Photosynthesis and respiration will decrease rapidly with under drought conditions due to drought-resistant mechanisms.

IV. Increasing intensities of both temperature level and drought length will reduce growth rates and biomass levels in the following year due to damage in hydraulic and photosynthetic structures.

V. The sub-populations from warmer regions will have the lowest growth declines of the prior year due to regional physiological adaptations.

4. Progress to date

- Seedlings have been germinated and will be subjected to experimental conditions within the newly constructed phytotrons in May 2021. Project will be complete by September 2022.

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Joint funding from NSERC Discovery to Dr. L. D'Orangeville & from Canadian Forest Service funding to Dr. A.R. Taylor 2020-2022