





Project Schematic





Activity 1: Douglas-fir climate adaptation





All pools (case control and populations) will be sequenced for about 30,000 genes (in progress).

Douglas-fir climate adaptation





Rafael Candido Ribeiro



ndido Christine Chourmouzis



Pia Smets



One of three Douglas-fir common gardens

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87 seedlots sampled for climate adaptation in Douglas-fir



20 case-control populations for identifying stress-related genes in Douglas-fir

Sampled provenances - case control



* Normal: 1961-1990 - Climate NA (Wang et al, 2016)

Rafael Candido Ribeiro, PhD student



Douglas-fir common gardens







P. menziesii

Sowed in May 2017



Grown in the greenhouse





 \approx 6 weeks outdoor temperature and blackout

P. macrocarpa

Chilling









Douglas-fir raised bed experiment for coldhardiness, growth and phenology





- Growth
- Phenology
- Fall cold-hardiness: artificial freeze testing (done)
- Shoot and root biomass (next year)



Variation in Douglas-fir cold hardiness



Large difference between coastal and interior varieties (tested at the same temperature)



Clinal patterns of variation within varieties (tested at different temperatures)

Selecting extreme phenotypes for identifying genes controlling cold hardiness (N=20 populations)



Douglas-fir drought experiments



Drought experiment 1: 20 populations; case – control sampling within populations





Drought experiment 2: 86 populations; control + drought treatments

Drought-hardiness 2 - All seedlots (87 provenances)



Assessed for growth, visual damage and chlorophyll fluorescence (photosystem damage) under drought



Variation in chlorophyll fluorescence under drought (preliminary results)





Drought experiment 1:

20 populations; case – control sampling within populations

Chlorophyll fluorescence under drought treatment varies with variety and population

Chlorophyll fluorescence under drought treatment varies among interior Douglas-fir provenances (preliminary results)



Activity 1.2 – Climate adaptation candidate genes in western larch

- Sampled 40 populations from existing western larch field provenance trial in July; DNA extraction underway
- 40-50 Mb sequence capture probes being designed (20-30,000 genes)
- Establishing seedling common garden in spring of 2019 (B. Roskilly, PhD student)





Beth Roskilly, PhD student



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Available seedlots for western larch common garden Act. 2 Lodgepole pine genetic tolerance of Dothistroma Needle Blight (and Swiss needle cast for coastal Douglas-fir)



Nicolas Feau with Richard Hamelin



Act. 3 Genomic variability in tree pathogens causing Dothistroma needle blight and Swiss needle cast



Activity 4 – Validation of markers and translation of results to inform CBST and breeding

Established common garden experiments with material from breeding programs:

- 56 full-sib families of **interior Douglas-fir** sown in spring of 2018 for phenotyping in 2019
- 50 FS families of **lodgepole pine** sown in spring of 2018 for Dothistroma inoculation in 2019
- SNP arrays for genotyping these materials will be designed after candidate genes for climate and disease responses are identified







Activity 5 GE³LS: Public support for different forest adaptation strategies





Guillame Peterson St.-Laurent

Ricardo Pelai

Climatic Change (2018) 151:573-587 https://doi.org/10.1007/s10584-018-2310-3



What risks matter? Public views about assisted migration and other climate-adaptive reforestation strategies

Guillaume Peterson St-Laurent¹ · Shannon Hagerman² · Robert Kozak²

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Shannon Hagerman

Rob Kozak

GELS: Reforestation strategies examined



Healthy Trees for Future Climates

Public acceptance of assisted migration and other options



Peterson-St. Laurent, G., Hagerman, S. & R. Kozak (2018). Climatic Change







Public knowledge of forest management in BC



In BC, reforestation after commercial logging is voluntary (F)

exist for most commercial tree species in BC (T)

It is currently illegal to plant tree species that are non-native to BC on public land (T)

> Employment in BC's forest sector has increased over the past decade (F)

Logs are the primary forest products that are produced and exported in BC (F)

In BC, Treaties provide a majority of First Nations with control over forest management on their traditional territories (F)

> Forest policy in BC allows for genetically modified trees to be planted on public land (F)

Lodgepole pine: Patterns of genetic variation versus BEC zones (AdapTree)



Analysis by Colin Mahony, manuscript in prep.

Identified spatial and climatic patterns of adaptive genetic variation in lodgepole pine (AdapTree Project)



Quantified levels of adaptive genetic variation in lodgepole pine (AdapTree Project)



Plans for 2019-20: Activities supported through FGC ITAC CTAC

Douglas-fir (Rafael Candido Ribeiro)

- Complete Douglas-fir raised bed common garden
- Analyze all Douglas-fir traits
- Complete sequencing of population pools and case control pools to identify candidate genes for climate adaptation and disease resistance
- Maintain and phenotype validation experiments (FS families)

Western larch (Beth Roskilly)

- Establish common gardens for cold and drought
- Sequence and analyze genomic data for population pools for patterns of local adaptation and candidate genes

Work on lodgepole pine and Dothistroma will continue but no funds will be requested through ITAC

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