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Southern Alberta Silviculture Adaptation Project: Results from 2018 & 2019

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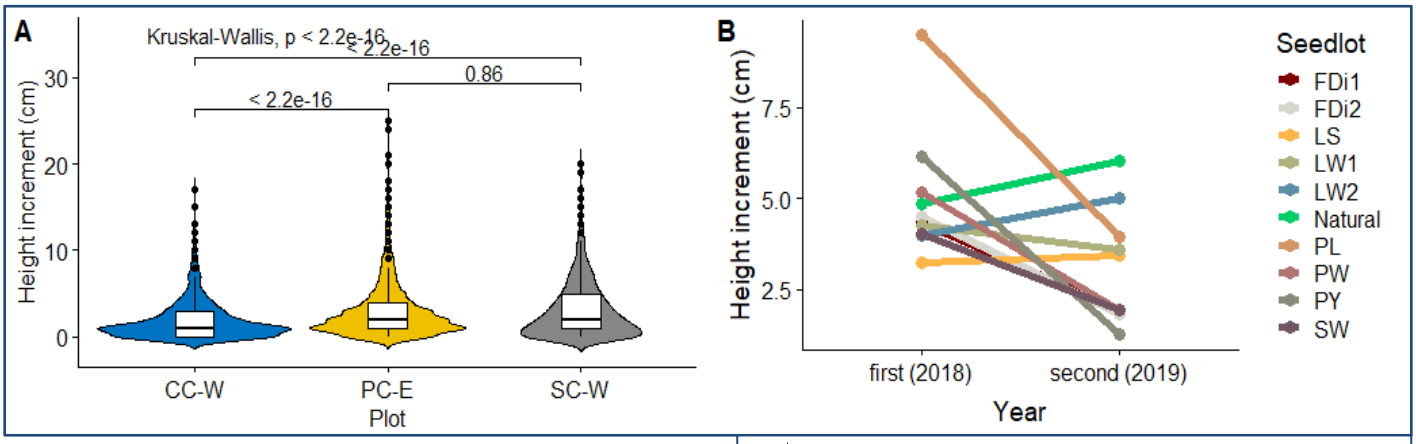
The acute question of future development of forests in conditions of changing climate have been the subject of increasing interest in recent decades. In general, climate change is anticipated to manifest mainly by rising temperatures, locally specific changes in precipitation distribution with increased frequency and intensity of drought and forest wildfires (Lindner et al., 2009), increased tree mortality rates (Allen et al., 2015), and disturbances caused by insects and disease (Dale et al., 2001). Forest tree species of North America already lie outside their optimal climate niche by approximately 130 km in latitude (Gray and Hamann, 2013). Due to expected further habitat shifts, identifying tree species well adapted to conditions matching the anticipated climate and planting them outside their current native range is essential (Wang et al., 2006). Alternative harvesting systems offer a great opportunity to study tree species specific performance in various light, moisture and nutrient availability conditions (Raymond et al., 2006).

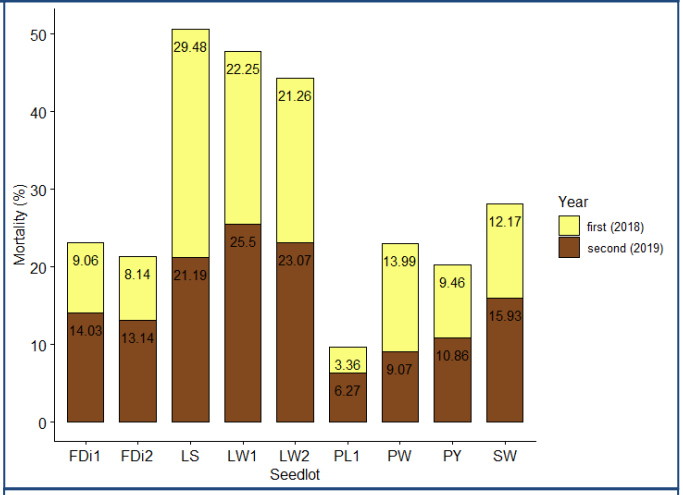
This project is focused on evaluating establishment success and growth potential of four native (Douglas fir – FD1 and FD2, lodgepole pine – PL1, white spruce – SW and western larch – LW1 and LW2) and three non-native (ponderosa pine – PY, western white pine – PW and Siberian larch – LS) tree species at various microsite conditions created by three alternative harvesting treatments (CC-E – Clear cut, PC-E – Partial cut with 50% dispersed retention and SC-W – Strip cut) in southern Alberta, Crowsnest Pass.

Results

Results of two growing seasons confirm assumption of significantly different microsite conditions at three evaluated alternative harvesting treatments and their significant impact on growth and survival of seedlings. Clear cut plot was the least suitable treatment for all tested seedlots without exception. Aside from lodgepole pine, all other seedlots establishment cannot be considered as successful with total mortality after second growing season reaching from 30% (ponderosa pine) to 74% (western larch LW2). Additionally, poor health state was in 2019 recorded for 41% seedlings. In contrast, overall best conditions were achieved at Partial cut plot with highest radial increment in both years, 87.5% survival and 94% seedlings classified as healthy.



The seedling establishment success was confirmed to be species specific. Lodgepole pine (PL) was by far the most successful seedlot and the only one that consistently showed above average growth and below average mortality across all three plots. Comparison of the three non-native species indicates relatively good potential for successful establishment of both ponderosa pine (PY) and western white pine (PW) at Star Creek. Both were characterised by lower than average mortality, above average increment in 2018 and lower than average increment in 2019. In contrast, Siberian larch (LS) achieved the highest total mortality and poor health. However, its performance was similar to results of western larch seedlots (LW1 and LW2). Surprisingly, both canopy cover and overtopping vegetation had positive impact on growth and survival of all seedlots. Additionally, drought stress was found to be one of the most limiting factors and connected to mortality and particular site conditions, especially at the clear cut treatment.



Seedlot	Treatment	
	Most suitable	Least suitable
FD1	PC-E** (SC-W*)	CC-W***
FD2	PC-E****	CC-W***
LS	PC-E**	CC-W** (SC-W*)
LW1	PC-E***	CC-W***
LW2	PC-E***	CC-W***
PL	PC-E*, SC-W*	CC-W*, SC-W*
PW	PC-E** (SC-W*)	CC-W** (SC-W*)
PY	PC-E**	CC-W***
SW	SC-W***	CC-W****

Conclusions

Results from second growing season confirmed our findings from first growing season that the alternative harvesting systems are having a significant impact on establishment success. Although more research is needed to confirm general trends, clear cut treatment seems to be unsuitable for survival and growth of tested seedlots in conditions of Southern Alberta under changing climate.

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