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Year One Results from the Southern Alberta Silviculture Adaptation Project

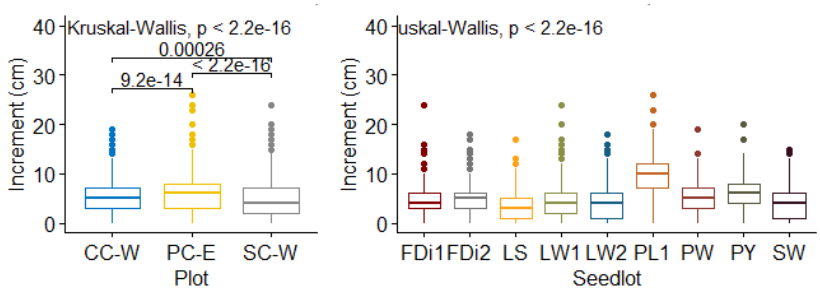
By Petra Albrechtova

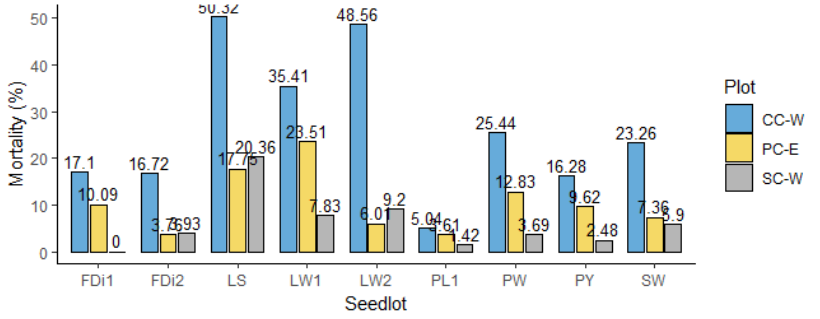
The effects of climate change on forest ecology have been the subject of increasing interest in recent decades. Climate trends for western North America reveal that forest tree species already lie outside their optimal climate niche by approximately 130 km in latitude (Gray and Hamann, 2013). Forest regeneration and growth is projected to be negatively influenced by many other climate change induced factors such as increasing frequency and intensity of forest wildfires (Lindner et al., 2009), disturbances caused by pests and pathogens (Dale et al., 2001), inter-species competition supported by both higher temperatures and CO2 fertilization (Allen et al., 2015), nutrient imbalance (Nietschke et al., 2012) and extreme weather events in general (Buma, 2018). Due to expected further habitat shifts, identifying tree species well adapted to conditions matching the anticipated climate and planting them outside their native range is essential (Wang et al., 2006). Alternative harvesting systems, which modify vegetation cover, offer a great opportunity to study tree species specific performance in various light, moisture and nutrient availability conditions (Raymond et al., 2006).

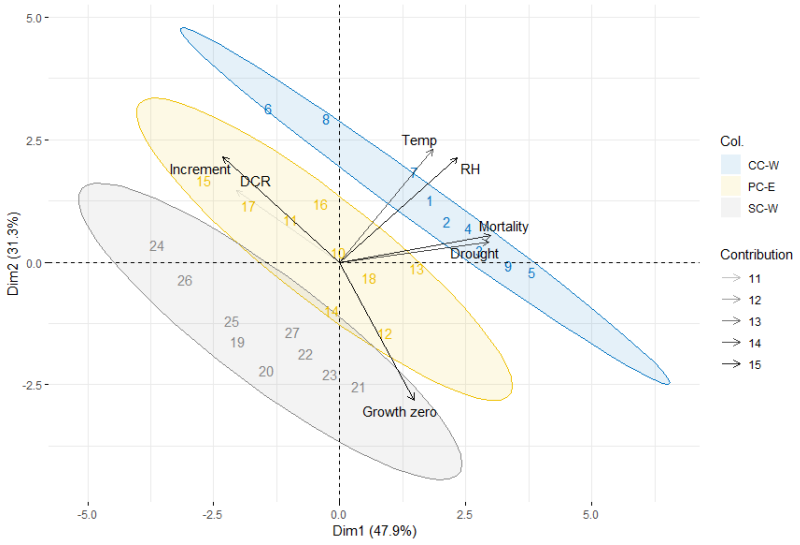
This project addresses the acute question of future development of conifers forests in the montane region of southern Alberta under climate uncertainty and the possibility of management strategies to establish stands able to remain productive in changing conditions. The aim is focused on evaluating establishment 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 conditions created by three alternative harvesting treatments in southern Alberta, Crowsnest Pass.

Results

Results of first year seedling growth show significant differences in growing conditions between the alternative harvesting systems. Overall, the best seedling growth was achieved in the Partial cut (PC-E) treatment (total height, 20.9 cm, height growth, 5.6 cm and survival, 90%). By comparison, height growth at Strip cut (SC-W) treatment (4.71 cm) was similar to that of Clear cut (CC-W) treatment (4.74 cm). Nevertheless, the Clear cut treatment had over 26% mortality and 5-20 times higher proportion of seedlings affected by damaging agents.







The seedling establishment success was confirmed to be seedlot specific. The most successful seedlot was lodgepole pine (PL1). It had the highest height growth increment, survival rate and good vitality across all alternative harvesting system treatments. Comparison of the three non-native species indicates good potential for successful establishment of both ponderosa pine (PY) and western white pine (PW) at Star Creek. In contrast, Siberian larch (LS), with the highest mortality, reduced growth and poor health, had the lowest establishment success rate. 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.

In conclusion, seedling establishment success after first growing season was related to microsite and seedlot. The alternative harvesting systems had a significant impact on seedling growth and survival. Although further monitoring is needed, most seedlots tested demonstrate good development and relatively satisfactory health condition. This indicates a potential to secure productive forests. The future survival and growth of Siberian larch pose an uncertainty though.

For more information on this or other Water Program publications, please contact: Axel Anderson.
Tel.: (780) 221–7050, Email: aeanders@ualberta.ca or visit wp.friresearch.ca