



## **Early drivers of upland forest development and associated hydrology in a reconstructed landscape on a boreal oil-sands mine site**

Simon Landhäusser (1), Sean Carey (2), Kevin Devito (3), Frances Leishman (1), Maxwell Lukenbach (4), Carl Mendoza (4), and Morgane Merlin (1)

(1) University of Alberta, Renewable Resources, Edmonton, Canada (simon.landhausser@ualberta.ca), (2) School of Geography and Earth Sciences, McMaster University, Hamilton, Canada, (3) Department of Biological Sciences, University of Alberta, Edmonton, Canada, (4) Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Canada

The restoration of forest ecosystems is a complex process subject to topographic and climatic conditions driving the development of soils, hydrology, and biota. The establishment of forest cover in these landscapes is a priority, as the quick development of a continuous tree canopy helps establish basic forest ecosystem functions and supports growth of forest understory communities. Variations in site conditions, such as topography and soils can be used as design variables or management tools to control and guide vegetation development in reconstructed and reclaimed landscapes. However, the impact of these responses on the hydrology of these landscapes are poorly understood.

In this landscape-scale study, we examined early forest development on upland areas of a reconstructed watershed (~57 ha) in the Athabasca oil-sands region, Canada to explore their impact on hydrological processes. We studied tree growth and the establishment of colonizing vegetation in response to different reclamation soil cover types (coarse versus fine textured soil) and their associated legacies, topographical variability, and reclamation practices (e.g. planting density, tree species selection, coarse woody debris placement) from 2013 to 2017. The recovery of tree cover and vegetation was subsequently related to water use and soil-moisture and groundwater dynamics.

In the first year of establishment the growth of planted seedlings was largely related to initial seedling conditions (nursery); however, subsequent seedling growth and leaf area development were influenced by edaphic and climatic conditions, controlled by soil type and topography. This variability in edaphic and climatic conditions also had direct and indirect effects on the vegetation cover, diversity, and plant community development and closely interacted with the developing tree cover type and its stem density.

Continued monitoring of variables in this reconstructed landscape will be necessary to untangle some of these complex relationships and interactions and will contribute to a better understanding of the development of functional processes in time and space. This interdisciplinary understanding will lead to improved models that can guide the restoration of natural ecosystem processes towards sustainable and integrated reclamation landscapes.