

## Abstract of Thesis

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Thesis title: Application of a  $u-w$  method for the detection of growth response of boreal forests to environmental changes in Northwest Territories, Canada

(北西部カナダにおける環境変化への北方林の成長応答検出に向けた  $u-w$  法の適用)

### Abstract of Thesis

Boreal ecosystem management is enduring numerous challenges in the era of climate change. Frequent and severe droughts followed by fire incidences are projected to increase as a result of climate change, especially in Northern Canada. Thus, robust and empirical knowledge on climate change-induced drought impacts is vital both at tree and stand levels to project ecosystem dynamics for sustainable forest management in the face of global warming. To understand the impacts of environmental changes on boreal forests, I applied the  $u-w$  method, which describes tree growth, both at tree and stand levels to detect growth shifts triggered by the environmental changes. Also, I investigated empirical relationships between annual stem-volume growth and climate variables (precipitation, temperature, and climate moisture index) using the dendrochronological method. Three species (*Picea mariana*, *Picea glauca*, and *Populus tremuloides*) of various sizes and ages were sampled in a boreal forest in northern Canada, and their annual stem-volume growth was examined. Growth shifts, detected changes in the phase of volume growth, were observed in every tree, and some shift years were common among plots and species, suggesting the same environmental change impact in trees across multiple stands in the region. Such shifts were observed after severe drought years associated with fire incidences. I conclude that the  $u-w$  method is useful for detecting multi-year climate impacts on tree growth. I also found a significant positive correlation between annual stem-volume growth and precipitation and climate moisture index (CMI) of current and previous summer months (especially June and July); which suggest that water metrics (precipitation and CMI) drive the annual growth variation, and shortage of water the key limiting factor of tree growth

**Keywords:** Climate changes, boreal forest, tree ring, stem volume, growth shifts.