Growth, reproduction, and establishment of *Picea glauca* across the forest-tundra in the Mackenzie Delta region, Canada

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Climate is considered one of the most important factors controlling treeline ecotone dynamics. As climate change continues the northern location of forest and trees is expected to shift northwards. Central to this prediction is an increase in the growth, establishment, and reproductive capacity of trees throughout the forest-tundra zone. The main objective of this research was to characterize and determine how climate influences the ecological patterns and processes of *Picea glauca* (Moench.) Voss. (white spruce) in the Mackenzie Delta region of the Northwest Territories, Canada. White spruce tree growth, establishment, and reproduction were assessed using the latitudinal gradient as a proxy for an approximate 3ºC increase in temperature and remeasured sites that were studied in the early 1990s.

A total of four forest stand sites and eight tree island sites (clonal populations beyond present treeline), examined in the early 1990s, were located and re-examined in the summer of 2009. Cone production has increased since the early 1990s and cone production decreases northward across the forest-tundra. Germination rates significantly decrease with increasing latitude but have not significantly changed since they were last examined 15 years ago.

In June 1994 seedlings were transplanted at three tree island sites, survivorship of these seedlings ranged from 3 to 20%. No true seedlings were found at the tree island sites in any year. Basal cores were obtained from numerous individuals within each of the sites and an age structure was developed. Establishment of individuals coincided with decades classified as cool and wet.

The yearly diameter growth of trees representing the forest and tree island environment was determined via ring width measurements and two chronologies were built, one for forest stands and one for tree islands. The chronologies were correlated to climate data of temperature and precipitation from the Inuvik airport. The climate-growth responses indicate that temperature is the primary factor controlling growth throughout the forest-tundra ecotone.

We believe that our findings are relevant to the understanding of vegetation change throughout the forest tundra zone in response to climate change. Under warmer and drier conditions, the growth and reproductive capacity of individuals will likely increase, promoting an increase in establishment from seed. However, tree islands are not likely to be important in supplying viable seed for the infilling of trees in the forest tundra, rather infilling will more likely occur from increased seed production in trees at or just south of treeline.