

Trees Unlike no Other? Age Structure and Tree Form across the Circumpolar Forest-tundra Ecotone

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The transition from boreal forest to tundra, or the 'forest-tundra ecotone', is often cited as being extremely sensitive to climate change. Despite this apparent role as an early responding region, ecologists still know very little about how trees at this ecotone are reacting to current changes in climate. Single location studies fail to address the underlying mechanisms and thresholds driving the variability that is observed across broad spatial scales. Results of age structure and individual trait-based data for six species (*Abies balsamea*, *Betula pubescens* ssp. *tortuosa*, *Larix laricina*, *Picea glauca*, *Picea mariana*, *Pinus sylvestris*) across eleven forest-tundra ecotone sites in the United States, Canada, Norway, Sweden and Russia, provide compelling evidence of an asynchronous response to recent climate warming. Using a combination of mixed models and descriptive statistics, we compared this variability within and between the eleven sites to investigate factors contributing to and detracting from a synchronous response of trees in the forest-tundra ecotone to climate warming. The oldest trees sampled were located in Alaska (572 yrs), Churchill, Manitoba (430 yrs) and Labrador (360 yrs) with often The oldest individuals were found in the forest or the lower forest-tundra ecotone, not the upper forest-tundra ecotone. Traditional allometric relationships like height:diameter and age:diameter are not appropriate metrics for use at the forest-tundra ecotone, perhaps because as trees approach their species range limit, growth becomes increasingly more subject to local climate and less dependent on conventional age driven relationships. Moving across the gradient from the forest to tundra, growth form of trees is more influenced by local climatic (e.g., temperature, wind, snow) with the response potential being strongly influences by reproductive life history traits. Climate and age alone are not enough to explain the variability across the forest-tundra ecotone at broad spatial scales. Instead, more attention needs to be given to the interaction between age and climate, and to specific life history traits.