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Interactions between pre-commercial thinning and climate in controlling black spruce productivity in two climate regimes of Québec, Canada.

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Pre-commercial thinning (PCT) is a silvicultural treatment in which young crop trees are released by removing less promising neighbouring trees hindering their growth. In black spruce (Picea mariana (B.S.P.) Mill.) boreal forests, it is unclear whether PCT simply reduces resource competition, or whether it also affects long-term site quality. Given that the black spruce forest domain of Québec (Canada) covers several climate regimes, it is also important to study possible interactions between PCT and climate regime in controlling site fertility and black spruce productivity. More specifically, we measured forest floor N dynamics, microbial activity, foliar nutrition, canopy openness and tree growth in PCT and control plots (ca. 15-20 years after treatment), in both a warm/dry continental climate (Abitibi) and a cool/wet maritime climate (Côte-Nord). Significant interactions were found between PCT and climate in controlling soil N mineralization per soil mass, microbial biomass, soil basal respiration and foliar N. More specifically, PCT had a positive effect on N mineralization per unit mass in Abitibi, but a negative effect in Côte-Nord. On the other hand, there were no effects of PCT, climate or PCT x climate interactions on N mineralization per soil surface area. In Abitibi, microbial biomass was higher in PCT than in control plots whereas in Côte-Nord, soil basal respiration was higher in control than in PCT plots. In Côte-Nord, foliar N was higher in PCT than in control plots. In Cote Nord, tree height and diameter were negatively correlated to canopy openness. These findings suggest that different factors control the growth response of black spruce to PCT in different climates: (1) in continental climate, the positive growth response could be due to increased soil nutrient availability via reduced intra-specific competition; (2) in maritime climate, PCT may ultimately reduce black spruce productivity by providing environmental conditions conducive to the spread of competitive understory vegetation such as ericaceous shrubs. Our results are useful for evaluating the effects PCT in the context of future climate change scenarios.