

B4WarmED: Warming X Rainfall Manipulation Shifts Integrated Soil and Plant Community Processes in a Boreal Ecotone Experiment

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The Boreal Forest Warming at an Ecotone in Danger (B4WarmED) experiment addresses the potential for projected climate change to alter many aspects of forest function at the boreal-temperate forest ecotone. The study includes thousands of juveniles of multiple tree species growing intermixed with native vegetation on a total of 72 plots at two sites in northeastern Minnesota, with two canopy conditions (open and understory), and three levels of both aboveground and belowground warming (ambient, +1.7°C, +3.4°C) implemented for ~8 months each year since 2009. In 2012 and 2013 we began a sub-experiment whereby half of the open plots received ~45% fewer summer rain events (and rainfall) by using moveable rain curtains. In this presentation we discuss impacts of warming and rainfall manipulation on integrated soil and plant processes. The warming (infrared lamps aboveground, buried cables below) manipulation did not directly influence the amount of water vapor in the air in the plots (i.e. the vapor pressure was similar) or the relationship between air and leaf temperature, hence vapor pressure deficit (VPD) differences were solely a function of temperature differences. Therefore, at each rainfall level, the experiment is effective at testing potential impacts of warming (including indirect effects by increasing evaporative demand) in a future world where the total amount of atmospheric moisture was unchanged. Warmed plots had lower soil moisture during dry periods due to greater VPD (and secondarily due to differences in leaf area index) and as expected, such periods were heightened in the low rainfall treatment. We examined interactions of warming x rainfall on soil moisture, soil CO₂ flux, and soil microbial and animal communities, and how these collectively shape the warming treatment effects on growth and survival of the planted tree seedlings and the phenology of both those seedlings and of native herbs and low shrubs.