

FACTORS INFLUENCING THE GERMINATION, EMERGENCE, AND EARLY SURVIVAL OF NATIVE AND NON-NATIVE TREE SPECIES IN THE ACADIAN FOREST

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The Acadian forest forms the transition zone between the eastern temperate and the boreal forest. With the possibility of a changing climate, it will be important to predict how increasing temperatures and changing patterns of precipitation may influence the distribution of important native and exotic tree species. Although climate may act to limit the geographic distribution of a tree species at any of several points during its lifecycle, the influence of temperature and moisture on the sensitive early life stages may be particularly important. In addition, understanding how other factors such as seed predation, herbivory, plant competition, and season of dispersal can influence whether a seed is able to germinate, emerge, and survive the first year will help determine the relative importance of climate on these life stages.

The objectives of this study are to: 1) examine the effects of different temperature and moisture regimes on the germination success of important native Acadian tree species and exotic tree species; 2) quantify the effects of seed predation, herbaceous competition, overstory, and sowing date on the emergence and first-year survival of important native Acadian tree species and exotic tree species; and 3) determine if silviculture can be used to mitigate possible negative effects of global climate change on soil temperature and moisture to encourage the germination and establishment of desired Acadian forest species. These objectives are being accomplished using both growth chamber and field studies.

The growth chamber study is examining the germination patterns of nine tree species, representing boreal, (balsam fir, trembling aspen, white birch) temperate (eastern white pine, red maple, red spruce) and exotic species (hybrid larch, Norway maple, Norway spruce), under three temperature and moisture regimes in a factorial design. Moisture levels in the germination media were controlled using polyethylene glycol 8000 solutions with potentials of 0 Mpa, -0.6 Mpa and -1.2 Mpa to simulate wet, moderate and dry conditions, respectively. Temperature regimes included the 30 year average for Bangor, Maine from 1971-2000 [June high (23.5°C) and low (11.8°C)] and plus and minus 7.5°C from this baseline. This experiment provided control over temperature and moisture conditions, as well as observation of the timing of germination that is generally not possible in the field.

The field study includes seed of the same nine species in a 2⁴ factorial design, and is examining the influence of: 1) sowing date (fall vs. spring), 2) overstory canopy (overstory vs. no overstory), 3) vertebrate predator protection (cage vs. no cage) and 4) herbaceous plant competition (grass vs. no grass) on emergence and early survival. Emergence, mortality and cause of mortality, were tracked weekly during the first growing season in 2004. General patterns of soil temperature and moisture also have been monitored.