Photo 1: Field crew (UNB-ULaval) establishing the Massachusetts site in April 2025. Photo by S. Dumont.

KEY TAKEAWAYS

Objectives:

We planted populations of 10 key boreal and temperate species in 11 research sites across eastern North America – this experiment is designed to enhance our capacity to predict climate change impacts on our forests, and to inform adaptive silviculture.

Desired outcomes:

By studying how translocated tree populations respond to a natural climate gradient, we are collecting critical information to improve model predictions of species performance under a changing climate. This experiment will also help to inform the development and implementation of assisted migration strategies for species and populations.

TRANSX: TESTING THE CLIMATE VULNERABILITY AND ASSISTED MIGRATION POTENTIAL OF NORTHEASTERN TREE SPECIES

Sébastien Dumont[1] and Jacob Ravn[2]

[1]Centre d'étude de la forêt, Département des sciences du bois et de la forêt, Université Laval (sebastien.dumont.2@ulaval.ca)
[2]Faculty of Forestry and Environmental Management, University of New Brunswick (jravn@unb.ca)

As the changing climate continues to reduce favourable growing conditions within tree species ranges, large shifts in the composition, structure, and function of forests are expected. Enhancing forest resilience to climate change requires accurate predictions of species responses to climate change, and how responses vary among populations. In turn, targeted management approaches such as assisted migration can be used, where future-adapted tree populations are planted in areas where existing tree populations are projected to face climate-related declines. However, model predictions, and resulting management efficacy, are constrained due to limited information regarding species and population responses to both warming and translocation to cooler, northern conditions. The TransX research experiment is a network of 11 provenance trials ranging from Québec to North Carolina and is designed to address these problems by monitoring the long-term responses of varying populations of ten tree species planted along a mean annual temperature gradient of 14.5℃ (Figure 1). Spanning from Nova Scotia to Ontario, these 11 sites also represent an annual precipitation gradient of approximately 600mm.
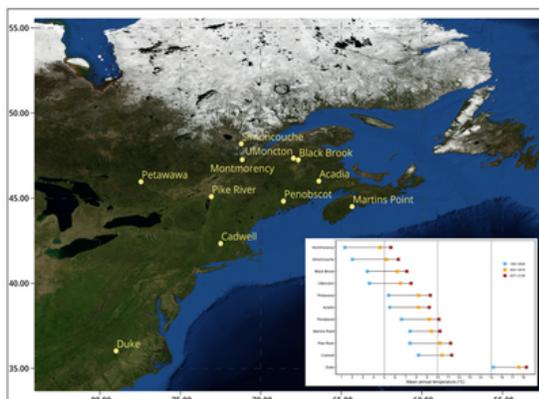

Figure 1. Location of the 11 study sites. Inset figure panel shows the historical and projected mean annual temperature and at each site for the intermediate climate scenario SSP 2-4.5, obtained from an ensemble of 13 general circulation models (Wang et al. 2016). Picture credit for basemap: NASA/Goddard Space Flight Center Scientific Visualization Studio The Blue Marble Next Generation data, courtesy of Reto Stockli (NASA/GSFC) and NASA's Earth Observatory; picture taken in June 2004.

OVERVIEW & SITE ESTABLISHMENT

Through a collaborative effort involving research teams from the University of New Brunswick and Laval University, along with local partners at each site, we established all 11 provenance trials between 2022 and 2024. Each site contains 11 to 16 blocks, with each fully randomized blocks containing 10 boreal and temperate tree species, each with six populations. The selected tree species for the project are balsam fir, black spruce, white spruce, red spruce, white pine, white birch, yellow birch, red maple, sugar maple, and red oak. These species were selected due to their economic and ecological importance to northeastern North America, while the populations for each species were selected to represent range-wide climate ranges and genetic variation (Figure 2).
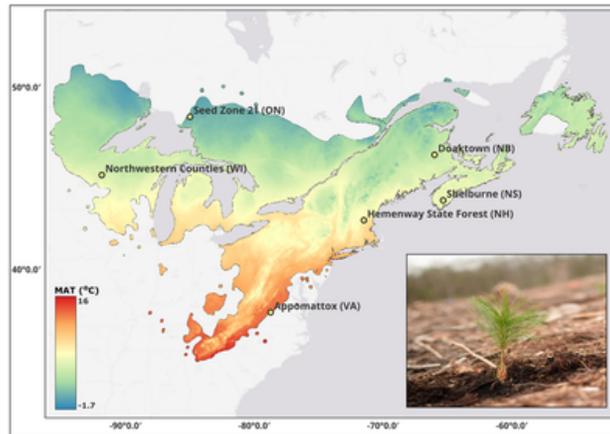

Figure 2. Location of the six white pine provenances selected for the TransX project. Coloured regions represent the 1961 – 1990 mean annual temperature (Wang et al. 2016) across the range of the species (Little, 1971). Inset figure showing a white pine seedling planted at the Massachusetts site. Photo by S. Dumont.

While the planting of certain hardwood species and populations will be conducted in 2026, most seedlings are already planted. Ongoing data collection efforts are already underway for planted seedlings, including annual monitoring for factors such as growth, survival, and damage (i.e., animal browse, insect boring & defoliation, and frost events). Additionally, all sites have been equipped with air weather stations, soil moisture probes and cameras that track seedling leaf phenology, which will help to enhance our understanding of tree responses to climate at a fine resolution. For example, tracking how leaf phenology adapts to the local climate and site conditions can provide crucial information about growth onset timing, and spring frost vulnerability (Photo 2).

EXPECTED OUTCOMES FOR ADAPTIVE MANAGEMENT

With the long-term monitoring of species trait variation, growth, and survival responses to large gradient of climates and latitudes, the TransX project will improve our capacity to predict forest responses to climate change and will contribute to accurate species-specific assisted migration guidelines. In turn, forest managers will be able to better mitigate forest climate vulnerability and have greater reliability when selecting species and populations for tree planting programs. As this experiment ages, there will be many further research opportunities to address critical questions involving forest resilience to climate change and will be able to provide critical insights to guide adapted forest management.


Photo 2. Red spruce seedling that completed its budburst at the Montmorency Forest site. Photo by S. Dumont.

This note was written by Sébastien Dumont and Jacob Ravn to summarize the original publication by Ravn et al. (2026) and has not been peer-reviewed. Any citations should be made to the original article.

Original publication (click thumbnail to read)

Jacob Ravn, Guillaume Moreau, Rafaella Mayrinck, Malcolm Itter, Cédric Albert, Lynsay Spafford, Dan Knee-shaw, Alexis Achim, Marie-Pier Perron, Sébastien Dumont, Gabriel Rogers, Mackenzie Good, and Loïc D'Orangeville. 2026. The TransX project: A latitudinal network of provenance trials across eastern North America to test the climatic vulnerability of northeastern tree species and their potential for assisted migration. The Forestry Chronicle. 102(1): 6-14. https://doi.org/10.5558/tfc2026-004
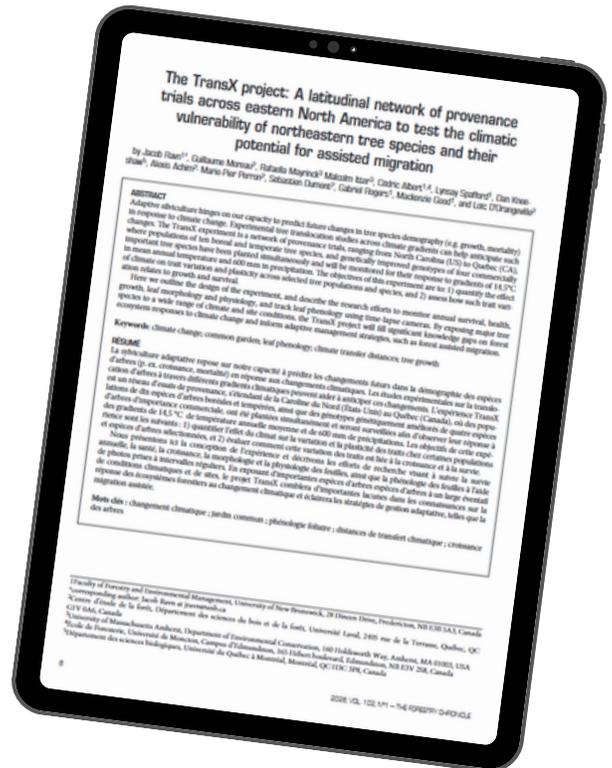
Other sources:

Wang, T., Hamann, A., Spittlehouse, D. and Carroll, C. 2016 Locally Downscaled and Spatially Customizable Climate Data for Historical and Future Periods for North America. PLOS ONE. 11, e0156720 https://doi.org/10.1371/journal.pone.0156720.

Little, Elbert L., Jr. 1971. Atlas of United States trees. Volume 1. Conifers and important hardwoods. Misc. Publ. 1146. Washington, DC: U.S. Department of Agriculture, Forest Service. 320 p.