**Guiding Assisted Migration Amidst Climate Change: Refining Site Selection for Sugar Maple with Fine-Scale Spatial Distribution Modeling**

Climate change poses uncertainties and challenges for forestry practices, necessitating adaptive measures to protect forests and their services. Assisted migration (AM) supports adaptation strategies to conserve ecosystems and maintain forest production. To facilitate its implementation, spatial distribution models utilizing multivariate approaches, incorporating climate, soil, and topographical factors, can help assess habitat suitability for tree species. In these models, high accuracy terrain data derived from LiDAR enables the characterization of variables such as elevation, slope, aspect, solar insolation, terrain curvature, topographic position and others, and in turn, allows climate data downscaling, which are key components of the fine-scale representation of ecological processes required to support silvicultural action. Previous research efforts suggest that the habitats of several tree species in North America are likely to expand northward due to climate change. However, this expansion may not occur linearly and uniformly in time and space. In this study, we use high accuracy terrain data to gain insights into the ecological requirements of sugar maple (SM) (Acer saccharum) and propose effective silvicultural strategies for its survival and growth in a changing climate. Sugar maple is a commercially valuable species in North America whose range is expected to shift northwards in response to climate change. We used a Random Forest classification model to investigate how climate, soil, and topographic features can help identify suitable SM habitats at a fine scale in the current climate. The study area (863 km²) was selected to encompass a gradient of conditions at the northern edge of the species’ range. It is located within mixed wood forests in Quebec, Canada, at the transition between temperate and boreal zones. Results revealed that soil variables and topographical characteristics were the most important determinants of SM presence at the landscape level, followed by local climate variables. Slope and tangential curvature showed that SM was more likely to be present at the top of the hills at the northern edge of its distribution range, where it can avoid damage from cold air drainage and/or accumulation. The model was then run using future climate projections to determine which sites may become more suitable to the species over time. Results suggest the species’ habitat may expand downslope towards valleys with minor increases in precipitation, degree days above 0 ºC and temperature averages. Despite a significant proportion of the area likely to remain stable, the study region shows an important increase in suitable sites, but also areas where SM currently occurs that will become less suitable to the species within 30 years under one of the most optimistic climate scenarios (SSP1 2.6, 2011-2040). Our results can support the implementation of AM at the stand level scale with spatially explicit representations that provide practical references for practitioners to guide silvicultural action. The results also highlight that certain changes in specific areas are likely to occur more rapidly than expected, necessitating swift silvicultural responses.