The ability to capture spatial variability in stand structure and species composition in our management practices could permit the maintenance of key processes that in turn maintain biodiversity and productivity in managed landscapes.

Concerns for multiple uses of forest resources span scales that are typically treated separately. To make effective forest management decisions, it is critically important that we develop tools that reconcile landscape-scale planning with stand-scale practices in order to improve our confidence that the sum of all the stand-scale operational decisions will meet the long-term landscape objectives.

We use an approach that makes use of information generated by two models designed to explore forest dynamics at different scales. Without data arbitrating among models no tests based on model comparisons can be used to decide unambiguously which model is better. Rather, comparisons of competing models can be used to (i) increase confidence in our understanding of ecosystem dynamics as represented by the models, and (ii) improve model structure.

**Objectives**

This is a simulation experiment that explores the ability of two modelling approaches to forecast the consequences across a landscape of compositional and structural complexity that is generated by local stand-scale forest management practices.

**Study Area**

The study area covers 11,061 forested ha in the Lake Duperquet Research and Teaching Forest (FERLD) (~48°30’ N, 79°22’ W) in the southern region of the Great Clay Belt in western Quebec, Canada. It is classified into 5 forested landscapes: poorly-drained, moist-clay, mesic-clay and well-drained coarse soils that determine species regeneration (Table 1). Composition is characteristic of the eastern boreal mixed wood, including the six species used in our simulations for which SORTIE has been parameterized: trembling aspen (Populus tremuloides), white birch (Betula papyrifera), jack pine (Pinus banksiana), white spruce (Picea glauca), balsam fir (Abies balsamea), and eastern white cedar (Thuja occidentalis).

**Methods – A simulation experiment with strict controls to isolate different consequences of two approaches to modeling succession**

Our ND approach is based on a version of SORTIE parameterized for Lake Duperquet to forecast stand-scale population dynamics that result from species-specific functions that determine competitive interactions among individuals for light. The model has a very flexible user interface and harvest specification module that permits precise specification of initial population composition and structure as well as a broad range of harvest regimes.

**Neighborhood dynamics (ND)**

We assembled the 300 ND succession trajectories into 1 look-up table (LUT) to form the basis of scaled-neighborhood dynamics landscape model (S-ND). The 300 simulations (5 landtypes x 5 initial conditions x 3 harvest regimes x 4 long-distance regimes for white cedar) represented the 3000 trees per ha varying between 1.3 and 1.35 cm DBH. Relative abundance of each species per landtype was weighted by establishment proportions (Table 1) after doubling the value for one species (“initial dominant”). Ignore white cedar — no initial presence.

**Neighborhood dynamics (ND)**

We used the FERLD stand age map to set equivalent initial conditions for both the S-ND and AC/SR cohort/succession model (AC/SR) derived from LANDIS.

We specified equivalent harvest regimes for both S-ND and AC/SR models. We let both models follow their successional trajectories and compared presence/absence results of each.

**Introduction**

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**Discussion**

This is a simulation experiment that explores the ability of two modeling approaches to forecast the consequences across a landscape of compositional and structural complexity that is generated by local stand-scale forest management practices. As such, it is a methods rich paper and I apologize for the length of the text. There are 7 conclusions we can make from this study:

1. Incorporating the effects of spatial interactions among trees within a stand adds important details that impact spatial heterogeneity of species composition at the landscape scale.

2. The concordance of adult tree dynamics between the two models in the timeframe that is important to forest managers reinforces our confidence that the general average forecasts of both approaches is likely reliable.

3. Unfortunately, the lack of understory response in the AC/SR approach to variations in partial harvest represents a serious shortcoming from a management perspective, because understory vegetation critically influences successional patterns, particularly following forest harvesting. Understory vegetation is also a key indicator of forest health and diversity for a variety of biodiversity values (e.g., songbirds, small mammals) (Simon 1998) and game species (e.g., moose (Alces alces) (Berger et al. 2001)).

4. The importance of model forecasts of understory dynamics is all the more critical when we consider the importance of disturbance to boreal forests (Chen and Poppadick 2002), and simulating natural disturbance is considered one important strategic approach to sustainable management of our forest resources (Cassel et al. 1998).

5. The impoverished understory dynamics of the AC/SR approach illustrate the need for the inclusion of more process detail that accounts for important fine-scale interactions among individual trees that can cascade up to the landscape scale. We suggest that a suitably parameterized probability-based rule would improve the ability of the AC/SR model to represent sapling dynamics.

6. This approach is practical, accessible to forest managers, does not incur undue computational costs or increase model complexity and, by carefully comparing different models, offers an approach for error analysis in the absence of long-term broad-scale empirical data.