Modelling the Effect of Within-Stand Spatial Structure on Mixed Boreal Forest Succession

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The spatial configuration of individual trees can affect the forest composition and structure at the landscape scale.

The spatial pattern of the forest stand also determines the level of severity, caused by natural disturbances.

Modelling the spatial pattern of a forest stand will assist in developing strategies for sustainable forest management.

SORTIE-ND, a spatially explicit individual-based forest simulator, allows predictions of the growth, mortality, and recruitment of individual trees at a stand scale by emulating gap dynamics.

The degree of the predictions made by the SORTIE-ND model to the spatial arrangement of species on a small scale are unknown.

Introduction

Objective

Determine the changes in the spatial structure of forest stands using SORTIE-ND and evaluate the model accuracy by comparing the spatial structure of simulated and observed stands.

Data

The data was collected from the Lake Duparquet Research and Teaching Forest (FERLD), based in the north-eastern Quebec (Canada).

Two sets of forest data: Hectares Data (1823, 1847, 1870 post fire stand-1 Ha/plot) and Transect Data (each plot size is 256 m² plot from 1847, 1870, 1916). Here, the year refers to the last fire year for that stand.

Results

SORTIE-ND model was not able to reproduce the similar spatial pattern of observed data.

Species showed different characteristics in term of spatial pattern.

- Bivariate L function showed the inability to reproduce spatial pattern by SORTIE-ND.

Takeaway Message

- SORTIE-ND could not always reproduce the same spatial pattern of the observed single-species and two-species patterns.
- The model also doesn’t describe the spatial heterogeneity of substrates which may affect the distribution of trees.
- Since it is not that accurate at a fine scale in the current version of the model, SORTIE-ND model will not able to predict the spatial pattern of a stand.
- The intensity and synergism of a natural disturbance would trigger the pattern which is not addressed in SORTIE-ND model.
- Incorporating predation by herbivory along with the existing parameter for natural disturbance and competition in the SORTIE-ND model may help to achieve the accuracy to predict spatial pattern.

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