

## Introduction

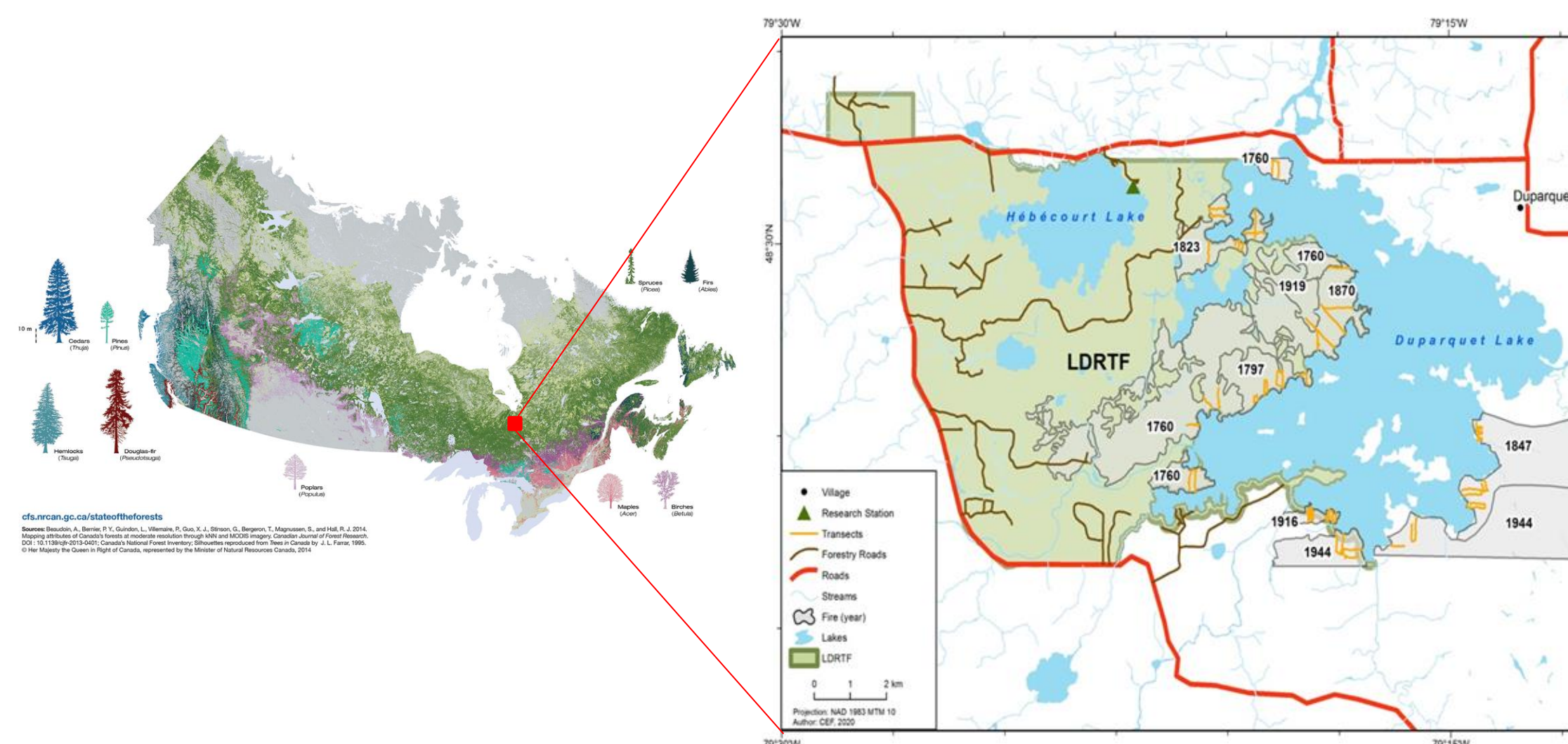
- The spatial configuration of individual trees can affect the forest composition and structure at the landscape scale.
- The spatial pattern of the forest stand also determines the level of severity, caused by natural disturbances.
- Modelling the spatial pattern of a forest stand will assist in developing 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.

## 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

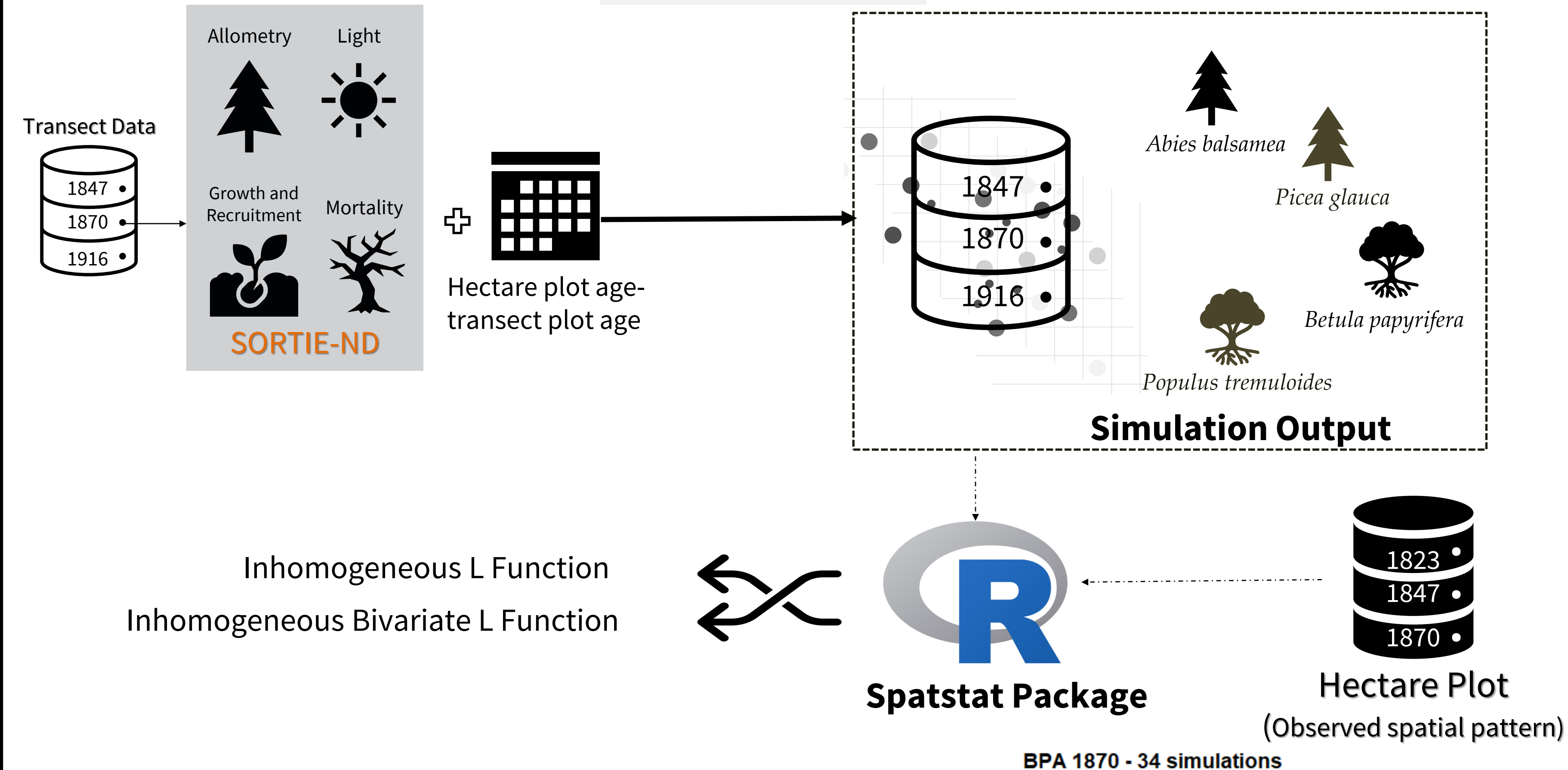
## Data

- 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 m<sup>2</sup> plot from 1847, 1870, 1916). Here, the year refers to the last fire year for that stand.

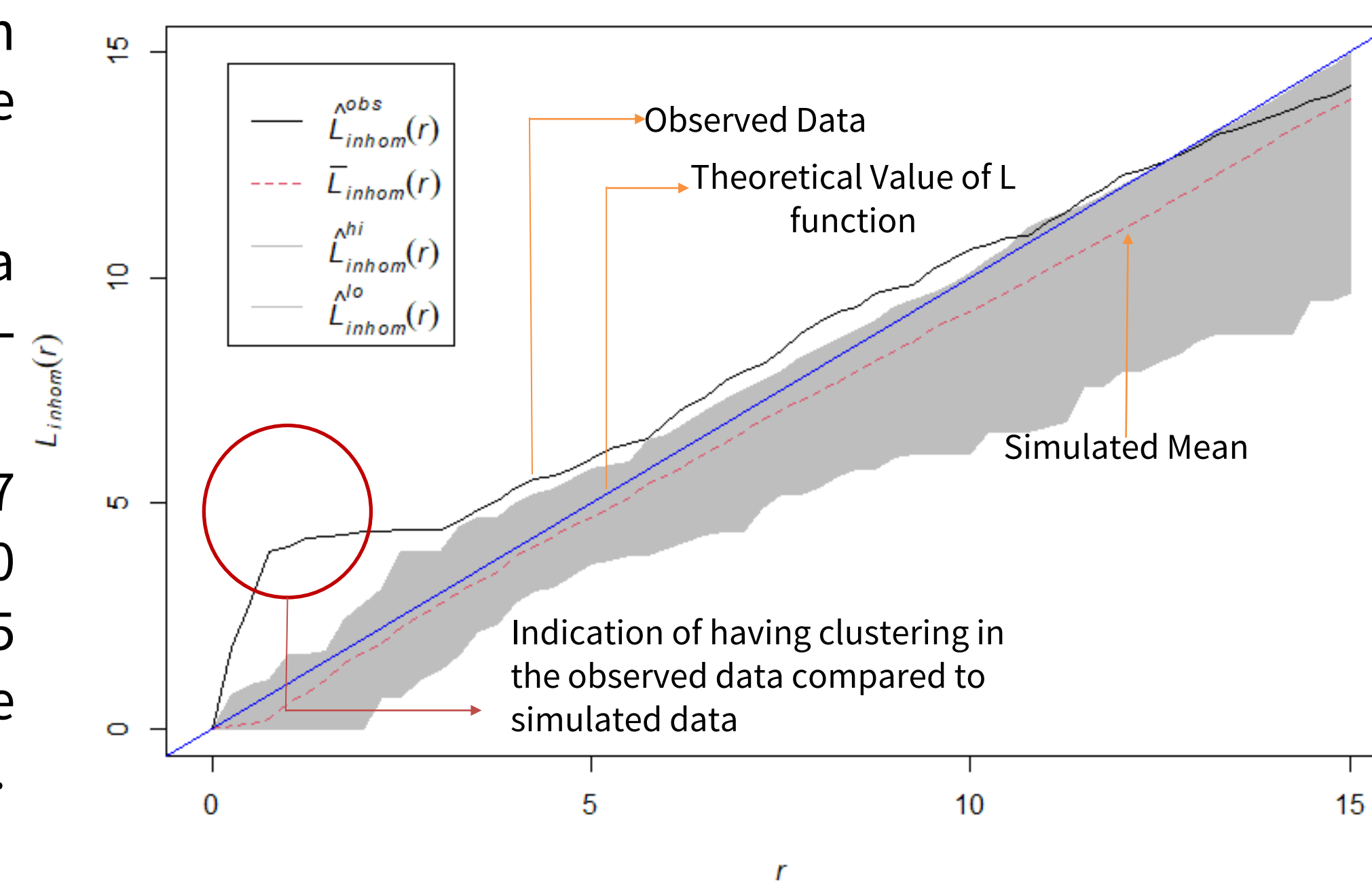
## Analyses



**L Function:** Accounts for the mean number of neighbors around a tree in the pattern to detect clustering or repulsion.

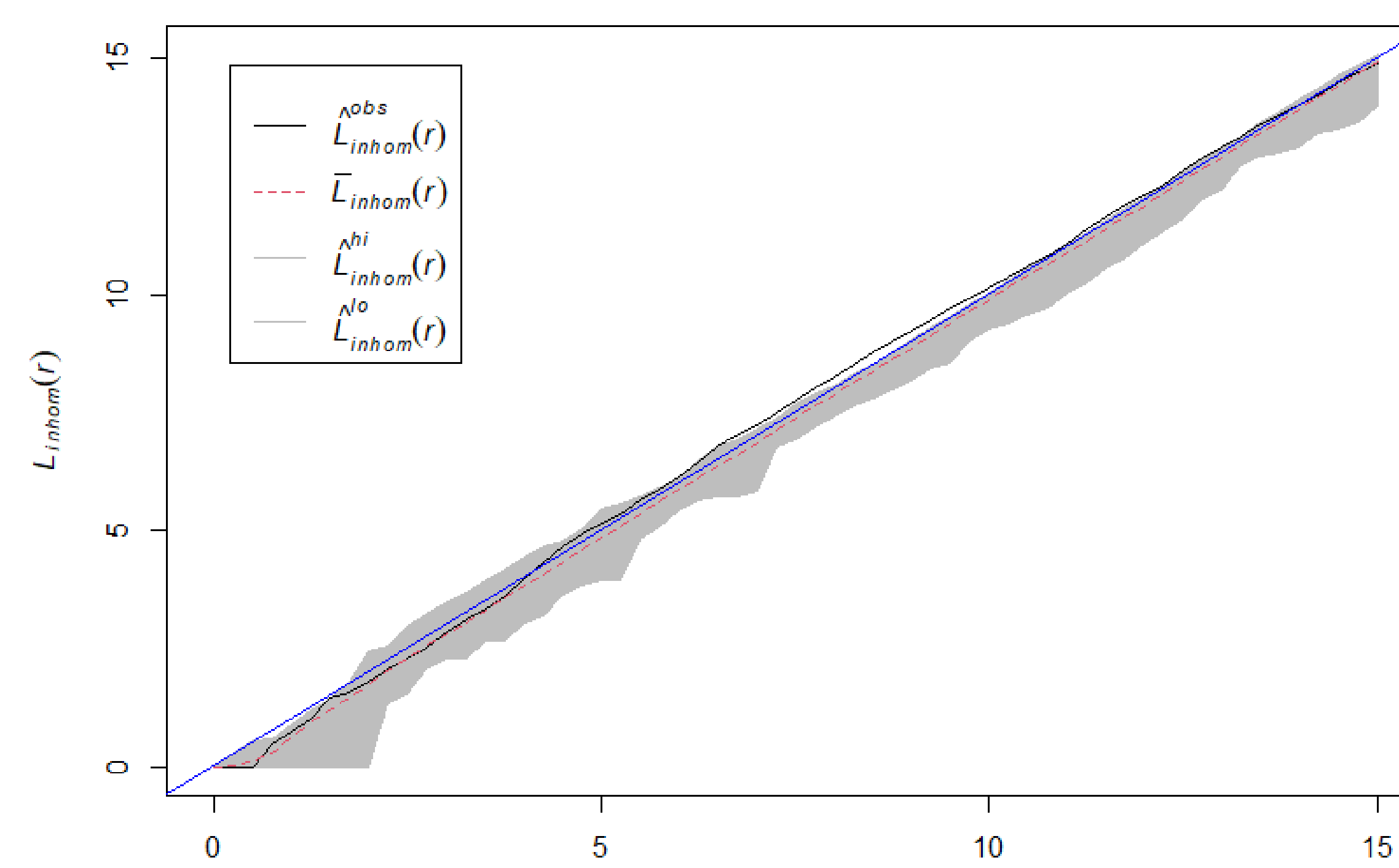
The observed pattern is compared to a set of simulated patterns from SORTIE-ND.

45 years simulation timesteps for 1847 and 1870 transect data; 65 years for 1870 and 1916 transect data, 90 years and 115 years for 1916 transect data to get the similar age hectare stand spatial pattern.



## Results

ABA 1847 - 76 simulations

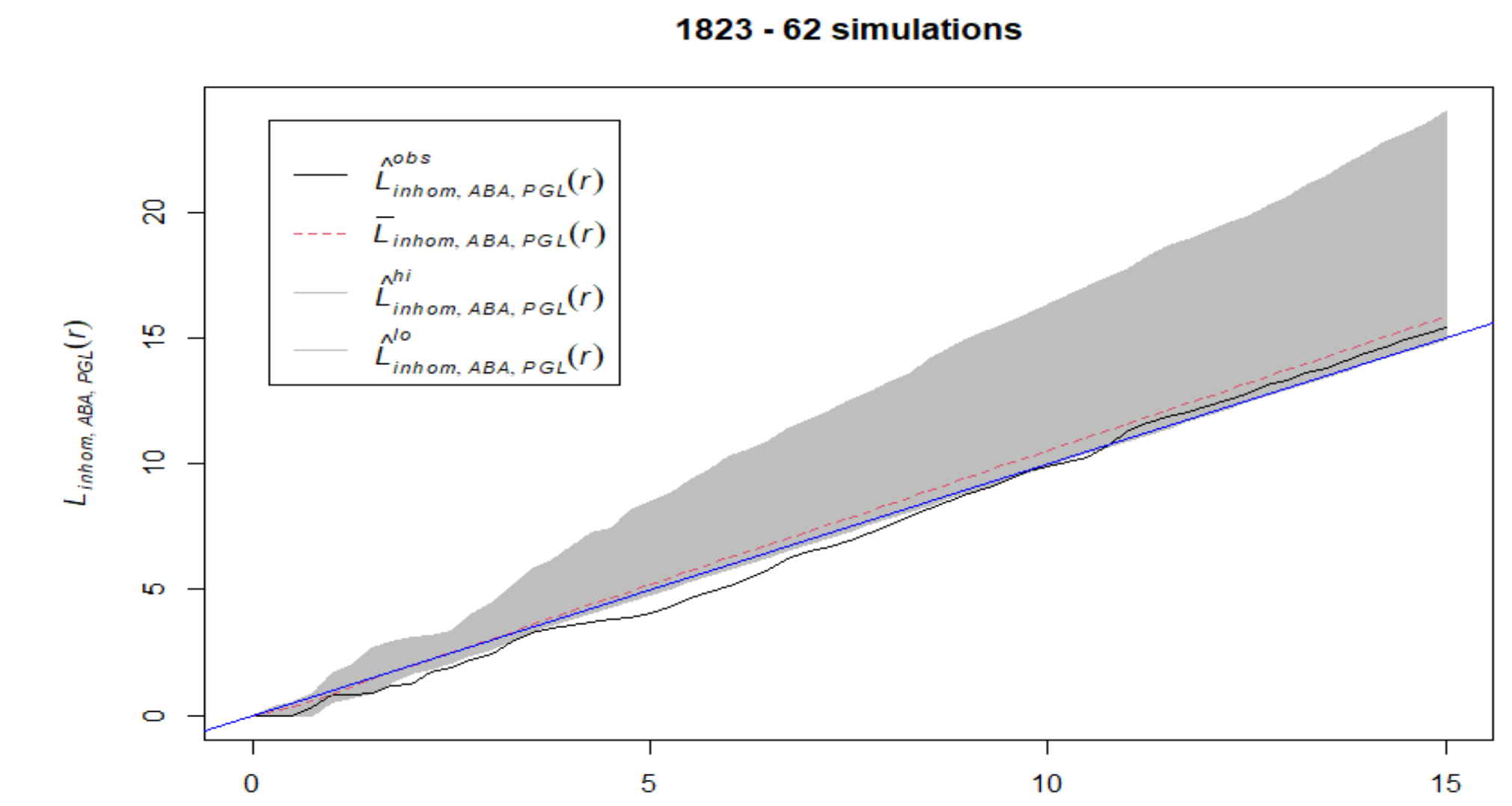


Inhomogeneous 'L' function analysis for the 1847 fire year hectare plot and 1870 transect plot (65 years simulation) \* ABA=Abies balsamea

- For example, *Abies balsamea* showed repulsion at distance,  $r < 4$  m, and after that distance it showed clustered pattern.

## Results (contd.)

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



Bivariate inhomogeneous L statistic for the transect year 1847 and hectare year 1823; \*ABA=Abies balsamea; PGL=Picea glauca

## 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 be 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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