Spatial structure: a way to understand the dynamics and to model the growth of mixed stands. Ngo Bieng M.A.,

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Since a few years there has been a growing interest for uneven-aged or mixed forest stands. This interest is the result of both changing in demands from the society and also changing in forestry practices. Unfortunately, due to their high complexity, the dynamics of these stands is more difficult to understand than pure and even-aged stands, which rises new research questions in terms of stand description, stand dynamics and growth modelling. Existing management tools, such as stand level models, are not relevant for this kind of stands. The use of individual based models seems more appropriate, because of the individual variability within heterogeneous stands. However, this kind of models can not easily be used by forest managers, especially because they require to know the localisation of each tree in order to run simulations.

Spatial structure analysis can be used to have a better knowledge of these stands. Indeed, the observed spatial structure results from past biological processes (especially birth and mortality of trees), and in return it defines the variety of local neighbourhoods of each tree, which influence future processes such as competition and mortality. Consequently, spatial structure analysis could be used in order to infer some information on the biological processes involved in the growth and the dynamics of heterogeneous stands.

The aim of this paper is to show how spatial structure analysis can be used to improve our knowledge of heterogeneous forest and to provide some perspectives for modelling them.

In order to answer this question, we applied an analysis of spatial structure to a mixed stand of Oak and Scots pine from French Centre area. We used the classical Ripley function L(r), and intertype function L12(r) to characterise the specific spatial structure of each population, and the structure of the interaction between populations. We then used the results of this analysis to build a typology of these stands. We identified five main types, and used the general observed spatial structures to make assumptions about ecological processes and historical factors influencing the dynamics of these stands.
In a second step, we used the typology in order to build a model of the spatial structure, that can simulate realistic virtuals stands from data at the stand scale classically used by forests managers.

We finally discuss the advantages of using such realistic virtual stands as initial states for distance dependant individual based models, when simulating the growth and the dynamic of mixed stands.