Spatial Analysis in Forest Protection
using the visual modelling tool MapModels

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Subject

Serious risk assessment and pest management in forestry need practicable tools based on profound knowledge about triggers of insect outbreaks. At the Institute of Forest Entomology a rating system was established which facilitates the evaluation of a given region with respect to its potentials for bark beetle development.

The concept of predisposition of forests to disturbing agents assumes that the probability of damage is influenced by the occurrence of certain site and stand characteristics. The pattern of infestations by the 8-toothed spruce bark beetle *Ips typographus* (Coleoptera; Scolytidae) in our research area corresponds well to the spatial distribution of selected hazard indicating factors.

The assessment of (long-term) predisposition was based on parameters available from the DEM and a set of stand data. The assignment of scores to single indicators was approached by Fuzzy Logic, as a contribution to an overall predisposition is not the result of statistical calculations but follows empirical approximation. In order to deduce the predisposition pattern of the study area the appropriate scores of included indicators are summarised for each locality and related to the maximum total (most unfavourable) amount. Site- and stand- related parameters are treated separately, which allows a distinction between naturally given danger spots and conditions changeable within the scope of silviculture. There is a strong correlation between the deduced status of predisposition and the probability of infestation.

Method

The practical and empirical work has been carried out mainly by means of MapModels – a graphical modelling interface based on ArcView® which supports easy development of analysis procedures by means of flowchart representations.

Flowcharts proved to be valuable for visualisation of model structures and analysis processes. Within MapModels they provide a visual encapsulation of analysis procedures and data objects. Input data and analysis operations are represented by labelled icons connected by edges which characterize dataflow (Fig. 1). Since

flowcharts in MapModels contain executable code, specification and implementation of the analysis model is done simultaneously in only one step.

The analysis model is easily “drawn” with the mouse via drag-and-drop operations. Currently a basic function library is implemented which contains a steadily increasing number of standard analysis operations. This stock of functions is extensible for all users with Avenue™ programming skills. Once implemented users can apply this new functions in the modelling process according to their specific needs. In contrast to comparable systems this unique extensibility together with the recently implemented option of “nesting” models add flexibility to MapModels for use as a valuable spatial decision support tool.

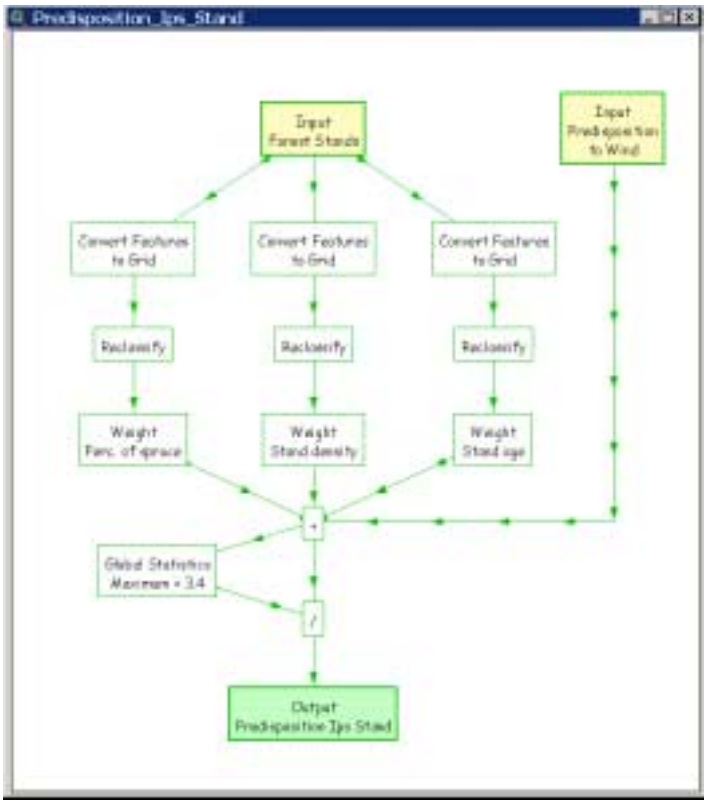

Fig. 1

MapModel for the assessment of stand related predesposition (example)

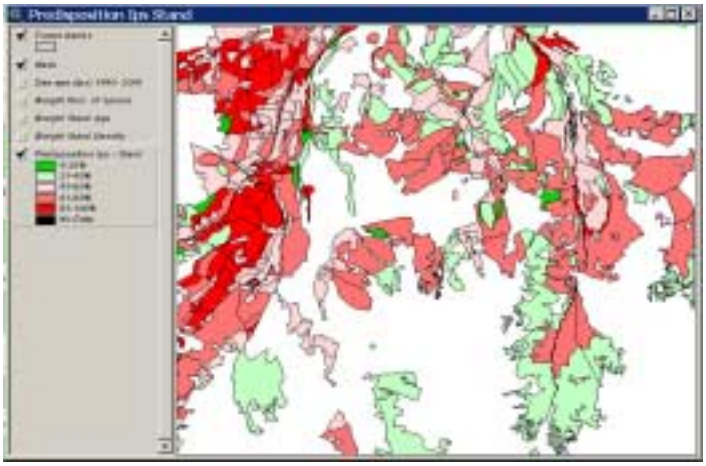

Fig. 2

Model result

For more about MapModels see: http://srf.tuwien.ac.at/MapModels/MapModels.htm