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ASSESSMENT OF THE PREDISPOSITION OF SPRUCE-ABUNDANT FORESTS TO VARIOUS DISTURBANCES

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Introduction

Owing to the increasing limitation of personal and financial resources in forest management the role of preventive forest protection continuously mounts. In order to concentrate available means for forest protection efficiently on regions with a high danger potential, the detection of hazardous site and stand situations gains increasing importance. Within the last years several tools have been developed to provide an objective and operational handling with the constituent facts of various threats for forests ranging from mechanical to statistical models. In the following simple science based models for the identification of site and stand related sources of predisposition of forests to various biotic and abiotic destructive agents will be presented.

Model conception and types of models

The basic aim of the assessment system is pointing out site and stand characteristics which trigger the occurrence of predisposing tree states and associated pest infestations. With a widest possible applicability the system should work as a checklist of important impairing factors as well as a supporting tool for forest management decision processes. By detecting dangerous environmental situations the predisposition keys should focus attention on conditions, where monitoring and prevention efforts of forest protection should be primarily concentrated on.

The assessment of predisposition refers to various potential threat factors to forests such as *Pristiphora abietina* Christ. (Netherer 1997), *Ips typographus* L. (Wiefler 1998), windthrow, snowbreakage, pollutant loading in a broad sense, *Cervus elaphus* L., *Armillaria* sensu lato and *Heterobasidion annosum* sensu lato (Nopp 1999).

Model establishment

Using an "award-penalty-point system" (Speight and Wainehouse 1989 or Berryman 1986), relevant impact factors on the predisposition of forests such as altitude, slope or soil type as well as stand age, tree-species composition or stand density were listed up referring to the specialised literature. Beneath this first grouping of indicators, their relative strength of influence was represented by allocating a certain weighting number to each single criterion. Impairing factors with overlapping influence orbits were assigned to lower weighting classes to avoid false predication patterns. After splitting each indicator into classes, a specific score was assigned to every scale level, corresponding to its contribution to the overall predisposition. In consideration of the predisposition increasing or decreasing effect of those very scale levels, positive or negative signs were associated with every score. The assignment of scores was oriented on the principle form of the relationship function between destructive agent and its target, directly or indirectly described in literature.

As for *Cephalcia abietis* L., 12 site and 6 stand related predisposition criteria were selected according to the available literature (e.g. altitude, terrain features, wind exposure, aspect, duration of snow cover, geological substratum / base saturation of the mineral soil, soil type (podsol), soil pH, water supply, tree species composition, stand age, age structure, crown condition, cover and species diversity of herbaceous vegetation and cover and species diversity of shrub vegetation).

As both biotic and abiotic threat factors may exhibit mutually predisposing effects, an intensive interconnection of the various predisposition systems was carried out (figure 1).

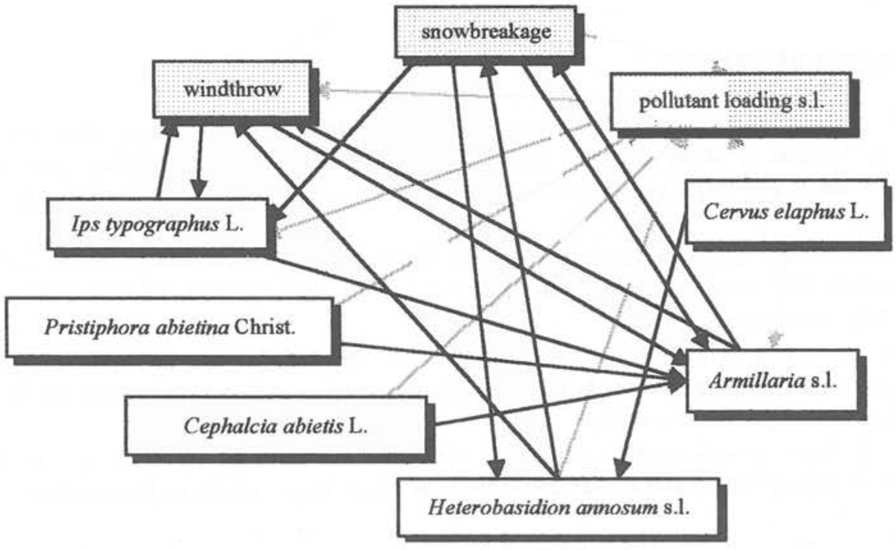

Figure 1: Interconnection of existing predisposition systems (grey lines symbolise indirect pathways or uncertain interactions)

Model application and model verifying

Applying the described systems to a given site or stand unit, the specific scores of each correct scale level of the indicator list are summed up to an actual total amount. The result is related to a pessimal total amount and this percentage can be interpreted as the relative predisposition of the assessment unit.

Principally, the application of the predisposition keys should reveal a right-skewed frequency curve with increasing predisposition level concerning damaged sites or stands and the other way round for undamaged assessment units. Proofing the selectivity of the systems, the relative frequency of damaged and healthy assessment units has to be compared for each class of relative predisposition. The resulting frequency tables should exhibit a similar distribution pattern as described for model verifying activities. As for *Pristiphora abietina* Christ. some verifying attempts have been carried out and the results are evaluated as promising.

Referring to the observed uncertainty of knowledge in the domain of predisposition, the presented systems should be regarded as a first step towards operational predisposition assessment.

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