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All Division 4 (Forest Assessment, Modelling and Management) Meeting

129 - Advances in multi-scale monitoring of forest biodiversity

K 8 (Konzerthaus Freiburg)

IUFRO17-2983 **Pan-European forest biodiversity monitoring through the ICP-level I network. First results from the BIOSOIL-BIODIVERSITY project**

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Abstract: The Sustainable Development Goal 15 of the 2030 Agenda for Sustainable Development aims at "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss". The EU Biodiversity Strategy contributes to the Goal 15 of the SDGs as its objective is to halt the loss of biodiversity and ecosystem services in Europe.
Forest ecosystems are some of the most biodiverse habitats. For this reason, it is very important to specifically monitor temporal and spatial trends of biodiversity in order to find those areas more affected by biodiversity loss and to guide land management and conservation actions. A vast monitoring program covering the comprehensive concept of biodiversity would be impossible or at least financially prohibitive. Thus a successful and statistically rigorous monitoring program able to track changes over time and space must be based on indicators. Even if scientists have investigated a large number of compositional and structural biodiversity indicators, a clear consensus on the definition of the best set of indicators was not yet reached.
In the framework of the two-years long BioSoil Forest Biodiversity Demonstration Project a large set of field data and information was acquired. The database includes data and information on living trees, deadwood and a complete vegetation survey. On the basis of raw data we calculated several forest biodiversity indicators and analysed their inter-relationships, and their variation in different forest types and environmental conditions. The analysis contributes to advance our knowledge towards the selection of an adequate set of forest biodiversity indicators to support the characterization of European Forest Types.
The results provide a fundamental and consistent support for the future implementation of multi-scale assessments of forest biodiversity.

ICP, biodiversity, forest monitoring

K 8 (Konzerthaus Freiburg)

IUFRO17-1084 **Using the k-Nearest Neighbors technique for multivariate forest structural diversity estimation**

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Abstract: Forest structural diversity is recognized as a fundamental component of forest biodiversity and is characterized by a larger number of plant and animal communities sharing a common multidimensional space of habitats and niches, thereby making greater use of available resources. Because forest structural diversity includes multiple components, rigorous assessment of structural diversity requires simultaneous assessment of these components via a multivariate approach to prediction. The k-Nearest Neighbors (k-NN) technique is well-suited for such problems because not only is it multivariate but it is also non-parametric which accommodates the non-Gaussian distributions of the diversity component variables. Optimization of the k-NN technique requires selection of an optimal subset of the available predictor variables, a distance metric for selecting neighbors, a neighbor weighting scheme, and the number of neighbors. For a study area in north central Minnesota in the USA, two optimization criteria were considered: (i) maximization of the sum or pseudo-R2 values for the structural diversity components, and (ii) minimization of hyper-volume of the joint confidence region. The criteria were compared with respect to each other and to inferences in the form of a confidence interval for an index that combines the components.

K 8 (Konzerthaus Freiburg)

IUFRO17-998 **Logical consistency and accuracy using single-step versus multi-step processes to monitor forest biodiversity**

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Abstract: Biodiversity has been defined simply as the "variety of life" and is linked to ecosystem and environmental health. To practice ecosystem management, forest managers must be able to evaluate past management practices and to choose future forest management activities that sustain biodiversity. However, many indicators of biodiversity have been proposed for forest land areas and most of these are difficult to monitor over time, especially for large forest land areas. In this paper, we propose a vector of stand-level measures as biodiversity indicators, namely tree species richness, tree species evenness, and structural diversity that have collectively been shown to be related to animal diversity (i.e., via habitat diversity) and to overall plant diversity. We use multi-source data, here digital color infrared aerial photographs, LiDAR data, ground-plot data, and other measures from existing map layers (e.g., topographic measures) to map this vector of biodiversity indicators using a single-step multivariate approach compared to a multi-step recursive approach. We then discuss: 1) Are there trade-offs in accuracy for each measure versus logical consistency among measures and does this vary for these two approaches? 2) What are the spatial and temporal scaling issues associated with this vector of measures? and finally, 3) What recommendations can be made for monitoring forest biodiversity based on this research?

biodiversity indicators, consistency vs accuracy