ForestBIOTA

Executive summary and conclusions

1. Introduction

ForestBIOTA (Forest Biodiversity Test-phase Assessments) was a project co-financed under the EU Forest Focus regulation and mainly coordinated by the Federal Research Centre for Forestry and Forest Products, Hamburg, Germany. The central coordination included 97 intensive monitoring plots located in 12 European countries. The project aimed at the further development of monitoring methods for some aspects of forest biodiversity as well as towards correlative studies between some compositional, structural and functional indices of forest biodiversity. ForestBIOTA mainly included the development and test implementation of monitoring methods in the fields of (i) ground vegetation and (ii) epiphytic lichens (iii) forest deadwood and (iv) stand structure. A forest type classification was applied in addition.

The project took into account policy requirements stated by a number of political processes and institutions including the Convention on Biological Diversity, the Ministerial Conference for the Protection of Forests in Europe, the Environment for Europe Ministerial Conference and the European Union. The development, implementation and evaluation of the methods and data was successfully completed before February 2007. All methodologies developed as well as detailed technical reports of the project are available under www.forestbiota.org.

2. Main results and conclusions for different thematic areas

2.1 Ground vegetation

Percentage of ground vegetation cover was assessed on 400 m^2 areas and species lists were produced for 500 m^2 areas. The methods for ground vegetation were implemented in 11 countries on 89 plots. Geographic location of the plots and/or forest type information showed most frequent correlations with diversity and composition of ground vegetation. There were hardly any relationships between diversity indices of ground vegetation and stand structure. Overall, parameters reflecting species composition were more expressive than species numbers or classical diversity indices such as e.g. Shannon index. This shows that it is more relevant to know which species are growing on the forest floor in spite of just deriving information on species numbers, because ground vegetation depends on many factors like the recent and historic disturbance regime or floristic influences from adjacent areas or the surrounding landscape. All in all, the project substantiated ground vegetation as a valuable bioindicator and thus justified its large scale assessment e.g. under Forest Focus, the ICP Forests and the BioSoil project.

2.2 Epiphytic lichens

Frequency of epiphytic lichens was assessed on at least 12 trees per 2500 m^2 plot. Sample trees were selected following a randomized sampling approach with pre-stratification based on existing tree species information. Epiphytic lichen monitoring was carried out in 10 countries on 83 plots. Epiphytic lichen species richness and/or evenness correlated with altitude, soil pH, deposition and stand structural indicators indicating clustered tree distribution. Different multivariate models could explain up to 52% of the variation of epiphytic lichen species diversity, mainly with altitude, stand age, soil pH and deposition as predictors. After stratification into aggregated forest types, R^2 values were even higher. The main achievement within the lichen component of the ForestBIOTA project was the development and successful implementation of a harmonized monitoring method applicable in forests from the Arctic Circle to the Mediterranean. Well known correlations of epiphytic lichen diversity parameters to geographical parameters, deposition and stand structure were largely confirmed. Compared to ground vegetation, epiphytic lichens depend more directly on the trees and the stand structure, thus it is in line with expectations that they show closer relationships to stand structure than plants growing on the forest floor.

2.3 Deadwood

The methods were implemented on 91 intensive monitoring plots of the EU/ICP Forests. They proved to be feasible and operational in all countries and are recommended for wider use. Deadwood results revealed large variation of deadwood volumes across the plots; however, 77% of the plots that were mostly located in managed forests had volumes of less than 25 m^3ha^{-1}. There is no doubt that deadwood is an essential parameter for monitoring of forest biodiversity and also plays a role for carbon sequestration. Even though it may hardly be possible to come up with any particular amount of deadwood that is desirable at the forest stand level, it is obvious that from an ecological point of view the main aim of forest management in most regions of Europe is to increase deadwood volumes. The specific method applied within the ForestBIOTA project is recommended for intensive monitoring plots and may need to be adjusted for application in e.g. National Forest Inventories. However, the deadwood components and measurement thresholds of ForestBIOTA may be identical in other inventories so that the volumes can easily be compared per hectare.

2.4 Stand structure

The harmonized methods were implemented on 89 intensive monitoring plots. The applied structural indices revealed structural differences between plots located in several forest types. Out of a larger number of indicators, number of tree species, Shannon index, Clark-Evans index and standard deviation of dbh are recommended for describing different aspects of stand structure. In a combined evaluation of deadwood and stand structural information total deadwood volume was linked to clustered tree distribution and the age of the stands. In addition, the number of tree stumps (reflecting management intensity) and diversity of tree species were linked. There were a number of very specific relationships between stand structure and epiphytic lichen and ground vegetation species composition. However, on the European scale these relations are overlaid by the stronger effects of the geographical influences and they are masked by the significant differences in stand structure and species diversity on the plots scattered across Europe. Thus, the aim of present and future correlative studies can only in exceptional cases be to give silvicultural recommendations in order to enhance diversity of certain species groups. The ecological net is too complex for such an undertaking. However, the methods and parameters developed within the project can be used to relate and compare specific forest stands to reference forests identified e.g. in the context of a naturalness classification, or to follow the temporal development of the structural diversity in European forests.

2.5 Forest type classification

In many statistical evaluations the forest type of the plots revealed relationships with different characterising parameters. The ForestBIOTA project was an important platform for the development of a new European Forest Type Classification published by the European Environment Agency in 2006.

3. General conclusions

3.1 Identification of thematic areas for forest biodiversity monitoring

A first basic achievement of ForestBIOTA is the selection of five thematic areas relevant and feasible for monitoring forest biodiversity in a large number of countries in Europe and over a large geographical scale, namely deadwood, stand structure, ground vegetation, forest type classification, and epiphytic lichens. Related projects that were initiated after ForestBIOTA, like BioSoil and Cost E 43 have already built on this experience by making a similar selection of core biodiversity parameters.

3.2 Implementation of European-wide monitoring

It has been shown that the newly developed methods were fully functional. The assessments were largely implemented within one summer field season. This reflects the high national interest in biodiversity assessments which was also encountered in other phases of the project. Also, the joint monitoring programme of Forest Focus and ICP Forests, which is one of the largest of its kind world-wide, has shown the flexibility and adaptability to react towards new user needs. The required experts for ground vegetation and epiphytic lichens were available in almost all countries. Only in one case were lichenologists employed from another project partner. Over large areas of Europe lack of expertise is not in general an argument against biodiversity assessments.

The Level II plots offer a unique possibility to analyse data in terms of cause-effect relationships, because the data from different topic areas are collected at the same sites. This in not so in many case studies based on a lot of different nature reserves or forest reserves, or different NATURA 2000 sites. This basic advantage is especially important in view of future studies e.g. carried out under the LIFE+ regulation (EC No 614/2007).
Even though the implementation phase is primarily seen as having been a test for the methodology, the data gathered contribute valuable information on the state and processes of biological diversity on the intensive (Level II) monitoring plots. The data are regarded as baseline information against which results of future assessments on the same plots can be compared and interpreted.

3.3 Recommendations for future monitoring activities
The ICP Forests' infrastructure including the Level II plots is a good basis for the further development of monitoring. However, with respect to biodiversity the set of plots with ForestBIOTA assessments needs to be amended, specifically with plots located in mixed forests.
Additional monitoring related to other compartments of the forest ecosystems needs to be developed and implemented. The EU/ICP Forests experts in collaboration with experts from NFIs have already started discussions in this respect; the process needs to be carried on and needs appropriate financing. The recently published LIFE+ regulation is seen as an important financial instrument in this respect, as it aims at both the "monitoring and assessment of nature and biodiversity" and the assessment of "the factors, pressures and responses that impact on the state of the environment".
Present activities are mostly focussed on the stand level. Closer links to existing landscape level activities and possibilities need to be established. As concerns the genetic level, there exists at present little activity or knowledge. Level II plots provide a unique basis to proceed in this direction. The MCPFE criteria and indicators for sustainable forest management remain a main guideline for the identification of fields for additional monitoring.
ForestBIOTA assessments need to be repeated on the same plots. The application of comparable assessments on the much larger number of Level I plots as a logical next step is already ongoing within the BioSoil project. Links to the NFIs need to be intensified in order to ensure comparable data collection on denser national grids.

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