4.3 EU/ICP -Forest Condition monitoring network[18]

The International Co-operative Programme on the Assessment and Monitoring of Air Pollution on Forests (EU/ICP -Forests) has been monitoring forest condition at the European scale since 1986 in co-operation with the European Commission (EEC 3528/86). Today, an extensive systematic network of approximately 6,000 field plots located across continental Europe are used to monitor crown condition on a selected number of permanent sample trees (*ca.* 15 – 25 on a plot) on an annual basis; the so called Level I network. These plots are systematically arranged based on a nominal 16 km x 16 km grid projected across Europe. The Level I network thus represents an unbiased statistically sound assessment tool for European forests.

EU/ICP -Forests and the European Commission also operate a second approach to forest health monitoring. Known as Level II, it is a more intensive approach than Level I but it is also carried out at fewer plots (approximately 860 plots). In this approach, annual crown condition surveys are complemented by continuous measurement of deposition and soil solution chemistry as well as ambient air quality and meteorological parameters. Other less frequent surveys include assessments of soil and foliar chemistry, estimates of forest growth and phenological observations and, finally, assessment of the ground vegetation component. Due to its non systematic nature, the Level II dataset is not representative for Europe in the statistical sense, but it does provide information on forest ecosystem stressors at the European scale.

Recently, EU/ICP -Forests has amended its mandate to include contributions by means of the monitoring activities to other aspects of forest policy such as carbon sequestration, climate change and biological diversity in forests. It is hoped to use data which are already collected routinely (according to a standardised manual), and, with the possibility also to include new assessment parameters to address the issue of forest biodiversity.

A working group set up by EU/ICP -Forests and the European Commission has identified parameters from the EU/ICP -forests Level I and Level II datasets which could be used for the purpose of forest biodiversity assessment (Table 15). These parameters are described as direct and indirect; namely those parameters which may be used directly to describe forest biological diversity, or those parameters which may be indirectly used to understand the influence of other agents, both biotic and abiotic, on biodiversity in forests. These indirect parameters may be used to identify pressure indicators which impact upon forest biodiversity, *e.g.* enhanced N deposition and the spread of nitrophilous grasses.

---

[18] Compiled by Pat Neville

Table 15. Possible contribution of EU/ICP Level I and Level II monitoring networks to forest biodiversity assessment using existing assessment parameters.

Level I		Level II	
Directly	**Indirectly**	**Directly**	**Indirectly**
Crown condition data	Site characteristics Soil characteristics Site co-ordinates Stand history	Crown condition data Ground vegetation monitoring	Site characteristics Soil physical and chemical properties Forest growth data Deposition data Soil solution data Stand history Phenology Remote sensing data Meteorological data

Furthermore, the wide range of structural characteristics recorded at the field plots could also play a vital role in biodiversity monitoring. Information on stand structure provides a picture of the complexity of the forest in terms of habitat heterogeneity. This information could then be analysed together with the ground vegetation dataset to examine the overall diversity within the stand and the ground flora, among other things. Structural parameters of interest include:

- Stand age
- Number of storeys (vertical structure)
- Canopy closure
- Tree species mixture
- Presence of large trees
- Variation in stem diameter (horizontal structure)
- Presence of open spaces
- Occurrence of natural regeneration
- Stand history (where available)
- Recording of invasive vegetation and tree species

Recently a study was carried out by Faculty of Forestry, University of Joensuu, for the EUROLANDSCAPE Project on the Evaluation of the suitability of the EU/ICP data set for forest biodiversity monitoring (Packalen and Maltamo 2002). The aim was to examine how well tree species detected in the Level I plots represent the statistical and spatial distribution of all the tree species found in Europe and in the single countries.

In this study is was found that the proportions and spatial distributions of different tree species obtained from the Level I plots are representative at the European scale when compared with the TBFRA-2000 database. Correspondingly, at country level the EU/ICP data are representative when compared to National Forest Inventory data in geographically large countries and in countries where the amount of forests is high i.e. there are at least few hundreds of EU/ICP-plots. Furthermore, the amount of mixed forests as well as the proportions of native and introduced tree species can in most cases be calculated accurately using the Level I information.

Although the Level I plots were found to be representative for the dominant tree species when compared with TBRFA-2000 database the description of 'Rare' or 'Occasional' tree species was considerably worse. The total number of the sampled tree species was 114 in the ICP plot data but the total amount of tree species is considerable higher in the TBRFA-2000 database. Especially many of these 'Rare' and 'Occasional' tree species may be of special interest with respect to biodiversity. If the stand is multi-layered it cannot be recognised from the data. The measurements of the plots does not include any tree size characteristics and also the age structure of the tree stock is unknown. Finally, the amount coarse woody debris is not known. All these characteristics are mentioned as important structural key factors of biodiversity (Puumalainen 2001). At the large scale, the data is also lacking on information *e.g.* about forest types, forest ownership, protection and afforestation/deforestation.

Because of the shortage of the characteristics in the existing forest condition survey with respect to monitoring different aspects of biodiversity, the EU/ICP sample plot network could be further used to address the topic of biodiversity only by the addition of new parameters, such as deadwood. The importance of deadwood in providing habitat, shelter and nourishment to a variety of both opportunist and specialist organisms is now widely recognised. Deadwood could be recorded at the plots in terms of both quantity and quality (degree of decomposition). Distinctions could also be made between standing deadwood (snags) and logs. Experience of deadwood assessment at large scales has already been obtained in several NFIs in Europe.

Although the EU/ICP -Forests monitoring programme was not designed in the first instance to measure forest biological diversity, the network of plots and the monitoring infrastructure is now well in place. Monitoring is carried out in over 35 countries according to a standardised assessment protocol (the EU/ICP -Forests Manual). The variety of abiotic parameters recorded and monitored at Level II, (while aimed at understanding the effects of air pollution on forests), might easily be used to investigate the effects of the abiotic environment on forest biodiversity and, in particular, on the ground vegetation. With the addition of a small number of new assessment parameters, the monitoring programme in its current form could be expanded to include the topic of biodiversity in forests. This could provide the first attempt at a true Pan-European forest biodiversity assessment.

4.4 Up- and down scaling: EU/ICP Level I and II[19]

Large-scale inventories such as the EU/ICP Level I are often extensive and restricted to a few assessed variables (*e.g.* crown condition, tree species and stand basal area). However, the spatial data on the structure and condition of a forest in a certain location offer further application possibilities, and through an appropriate combination with other existing data sources the original scope of the inventory can be extended. The application and combination of spatial data for instance on soil, climate and vegetation through GIS analysis is already an applied practice in Europe. In contrast, the derivation of knowledge by applying growth models on the spatial data is less developed. Through the combination of measured forest variables and estimated characteristics, value-added information can be obtained, for instance for an integrated analysis of biodiversity, vitality, productivity and carbon sequestration.

4.4.1 Growth models as a complementary knowledge base

Forest growth models contain a wealth of information about structures and processes. They abstract the reality and can be seen as an hypothesis chain relating the structures and causality within the system. They have been constructed and validated based on experimental data, and therefore entain considerable knowledge about a system. A range of approaches from eco-physiological process models to single tree and stand level models exist, depending on the temporal and spatial scale (Figure 6). The model approaches, which range over several scales are likely to be particularly useful for complementing the data from extensive inventories: They can serve to detect the link between the measured key variables (*e.g.* defoliation) and the reasons behind them (*e.g.* climatic conditions and lack of nutrients). Therefore, growth models should be seen as a knowledge base from which reliable information to complement the measured parameters can be drawn.

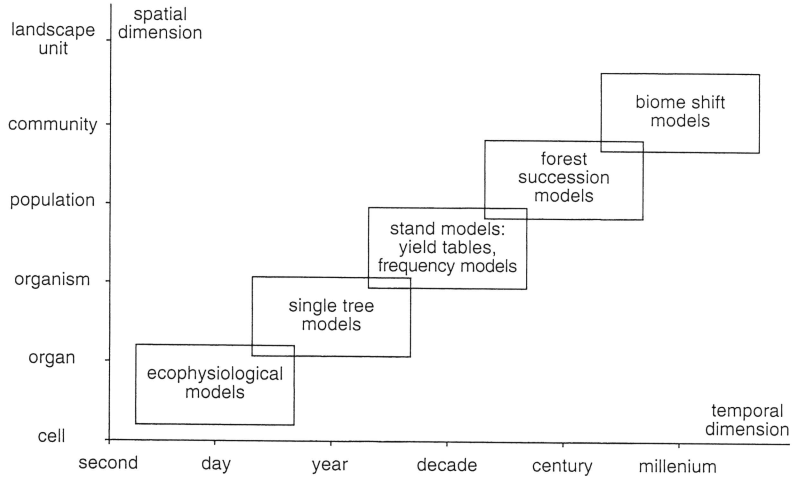


Figure 6. Different modelling approaches depending on the temporal and spatial resolution.

---

[19] Compiled by Hans Pretzsch and Janna Puumalainen

Inventories are normally carried out at a single level of the system hierarchy (Figure 6) to measure variables m_l ... m_n about the system characteristics s_l ... s_i. Differentiation is made between the measured variables m_l ... m_n (*e.g.* diameter, height and tree species) and the system characteristics s_l ... s_i, which are the final variables of interest in a forest inventory (*e.g.* timber volume, average needle loss or stand density). The final variables of interest can seldom be directly assessed in the field. Instead, they are determined in the calculation system of a forest inventory. Normally, only a selection of possible variables is measured in the field so that the knowledge of the system characteristics is incomplete. However, the overall knowledge can be complemented by the information, which is embedded in the growth models (*i.e.* theory of the system behaviour, natural laws and principals etc).

In the following, a concept for the practical combination of inventory data and model knowledge in a certain location, is described. The models allow, firstly, the complementation of the measured information and, secondly, the interpretation of the detected patterns and causal relations. The interpretation of the detected patterns is deduced from the process knowledge with respect to the ecosystem processes at the underlying hierarchical level. For the application of the concept, the geographical coordinates of the location, the data measured at this location and ecological coordinates of the location are needed. The ecological coordinates are related to the information such as rainfall, temperature, altitude, emissions and the stand composition.

4.4.1.1 Application of the models to complement measured data

The frame of the application of models and their combination with inventory data are shown in Figure7. The models require the input of some initial parameters related to the forests (*e.g.* the current stand structure described through the listing of the trees or the current storage of CO_2), to the geographical location and to the ecological frame of the location (*e.g.* rainfall, temperature, altitude). Based on these data – and the knowledge, which is compiled in the growth models – the forest ecosystem is re-constructed and projected into the future. The values for the measured and target variables can be predicted at any point of time.

Growth models can be used in two ways in connection with the extensive forest inventory data, such as the EU/ICP Level I. Firstly, the growth models and attached simulators can be applied to complement and integrate the inventory data and knowledge of the ecological frame of a site (Figure 7 b). Incomplete inventory data and ecological data can be used as input and complemented by using the built-in algorithms of the model system. For instance, real-like tree positions, tree heights, volume growth, value increment or natural mortality can be predicted from stand and ecological data. Secondly, the application of growth models together with the inventory data enhances the explanation, interpretation and the establishment of causal relationships of forest ecosystem variables. For instance, if the model predicts the relationship between the site data and defoliation realistically, it can be used to forecast the defoliation of a particular sample point for a certain period of time and also to compare and detect deviations from the expected pattern.

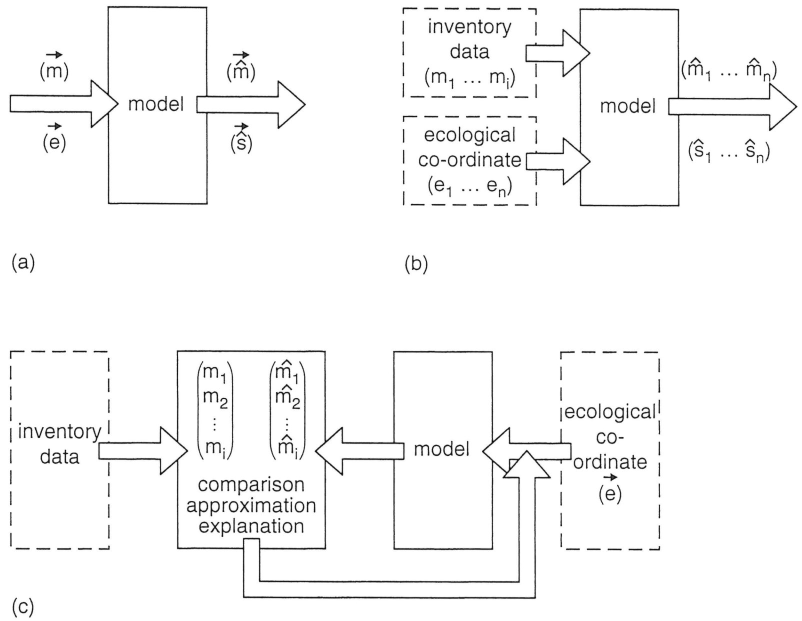


Figure 7. *Application of models and inventory data.*

4.4.1.2 Potential information for the long term ecological monitoring

Forest data have been systematically collected in some European countries since the 18th century. They have been focused on the collection of accurate, full-coverage and cyclical data of timber resources (Hundeshagen 1826, Heyer 1841, 1852, Hartig 1875) and reflect the realisation of the concept of sustainable use in the 18th and 19th century. In the 20th century, the data collection has been extended to soil conditions, vegetation, timber quality, tree vitality as well as protective and recreational functions of the forest. Due to this long tradition of data collection, there is a large pool of information available on the state and development of forests in Europe. This holds true especially for the State forests and for large private forest owners and to a lesser degree to the municipality forests. The small and privately owned forest areas tend to be inadequately covered. A further problem in the usage of the old data is that those are often available in the form of hand-made drawings or tables and not in electronic format.

In the last decades, a number of different monitoring networks has been established, partly to cover different temporal and spatial scales and different purposes. The establishment of the sample point grid net often does not include a careful consideration of how to derive the final variables of interest. The scope of the inventory may also have changed, or there may be a need to change it. Rich and diverse data are available for a certain location providing that the contents of different monitoring networks, remote sensing material and other spatial data sources can be combined. There are, however, both technical and organisational difficulties to overcome (*e.g.* technical data combination, assessment of the data quality, accumulation of the possible errors in the data, data ownerships and rights in the data sharing, etc.).

4.4.1.3 Site information as a link between the extensive and intensive monitoring data

The data of the ecological framework on a certain site can serve as a link between the extensive (*e.g.* EU/ICP Level I) and intensive inventories (EU/ICP Level II). The ecological framework, or ecological coordinates, refer especially to information about the forest site and stand and are expressed in parameters such as climate, soil, current and natural vegetation, status and development of the tree stocking and the history of a certain site. At European level applications, the ecological coordinates should be restricted to fairly simple parameters in order to be able to harmonise the nomenclature and definitions (Figure 8). The ecological coordinates form the link between the extensive and intensive assessment, in that they are included in the statistical analysis of the extensive inventory data, and used as variables in models, which are based on the data of the extensive inventories.

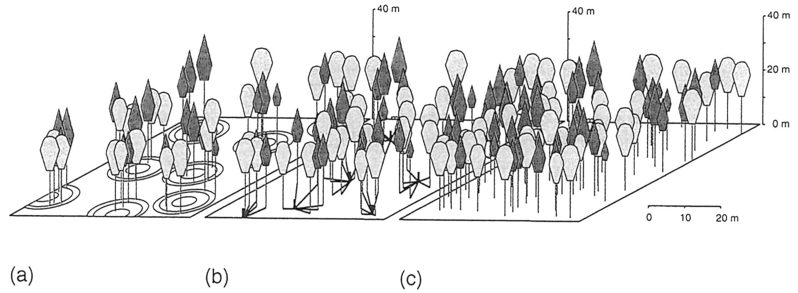


Figure 8. *Example of different ecological coordinates.*

4.4.2 Example of the model approach in up- and down-scaling

4.4.2.1 Complementing the inventory data and results

The principles of complementing, integrating and projecting inventory data (into the future) with the help of models is illustrated by using the forest growth simulator SILVA 2.2. SILVA 2.2 is a distance-dependent single tree simulator, which predicts the forest growth and stand development of single species and mixed stands as a function of within-stand competition, management actions and site and disturbance factors (Pretzsch 2001). The model system of the simulator serves the following purposes, which are relevant in the up- and down scaling of inventory data:

- Generation of additional information about the stand structure from the inventory data and ecological coordinates
- Reduction of all the measured and predicted data into a few stand variables
- Application of the measured and predicted data for forecasting in order to obtain further stand variables such as volume growth, economic development and changes in tree species composition.

Besides the ecological coordinates, single tree models require initial information about trees (*e.g.* diameter, height, crown height and coordinates of the tree position). On long term monitoring plots these parameters are normally available as measured data. In most practical inventories, however, these data are not directly available. Therefore, most simulators contain algorithms, which can create the missing information of tree dimensions and coordinates in order to facilitate forecasting.

The less detailed the inventory data are, the more there is a need to create additional information. For instance, if only the basal area and the minimum and maximum diameters of a certain inventory plot are known, the diameter distribution can be predicted by using the algorithm from Nagel and Biging (1985). Structure generators for instance from Deusen and Biging (1985) or Pretzsch (1997) can be used to derive further variables. Stand height curve is commonly applied to derive the heights and species-specific models for crown height and crown diameter to derive the crown dimensions for the trees. Finally, the trees are located on a stand by applying the Poisson-process, which creates close-to-reality distances between single trees so that the micro-structure of a stand corresponds to reality. In Central Europe, the algorithms used to create this kind of information are commonly site-dependent and based on long-term trials and measurements. As much inventory data as possible are used as input.

The completed inventory results nowadays provide a wealth of different knowledge. For instance, the standard results of the SILVA 2.2 simulator include data on:

- Timber resources (average diameter, basal area, stocking, diameter distribution)
- Economical assessment (timber quality and assortments, harvesting costs, turnover)
- Ecological values (structural indices, amount of carbon dioxide, stability indices).

The results can be used to compare different forest conditions and structures and to evaluate the effects of different management options and silvicultural treatments. Figure 9 presents the results of a single species and a mixed stand. Next to the structural indices (horizontal and vertical structure, species segregation), the values of a stability indicator[20] (h_g/d_g) mean annual value increment[21] and maximum of the mean annual volume

---

[20] h_g/d_g = mean height/mean diameter serves as indicator for the physical stability of trees against storm and snow damages.

[21] mean annual value increment, i. e. (value of remaining + removal stand)/age.

increment[22] are presented. The structural indices and the h_g/d_g-value refer to a stand structure at a stand height of 30 m. Similar profiles may, however, be generated for any point in time. It appears that the pure spruce stand is superior in volume increment and financial characteristics compared to the mixed spruce-beech stand. Conversely, the pure stand is inferior as regards structure and stability characteristics. The results apply for the selected site, given the thinning regime applied and the assumptions regarding wood harvesting costs, wood prices and risks.

The structural indices are of a particular interest for assessing biodiversity due to the relationship between the structural diversity and the diversity of habitats and single species. As an example, the values of the species segregation index A_{rel} are presented for single species and mixed spruce and beech *(Picea abies (L.) Karst. amd Fagus silvatica L.)* stands in Figure 9. The index A_{rel} (Pretzsch 1998) is based on the SHANNON-Index (Shannon 1948). For its determination, the stand is divided into three height zones ($j = 1$ to 3): 0-50 %, 50-80 % and 80-100 % of the maximum stand height. The number of individuals of each tree species i per each height zone j is calculated and the the index value defined as follows:

$$A_{rel} = \frac{-\sum_{i=1}^{S}\sum_{j=1}^{Z} p_{ij} \cdot \ln p_{ij}}{\ln (S \cdot Z)} \cdot 100$$

where

S = number of tree species

Z = number of height zones (in this example $Z = 3$)

p_{ij} = species proportions in the zones $p_{ij} = \frac{n_{i,j}}{N}$

n_{ij} = number of individuals of the species i in a zone j

N = total number of individuals

The maximum value of the index is defined, for a given number of species and zones, as $A_{max} = \ln(S \cdot Z)$. Thus, A_{rel} describes how close the given stand structure is to the maximal structural diversity (100%). In Figure 9, the index value grows with increasing structural diversity from the spruce stand (A_{rel} = 26,5 %) and from the even-aged spruce-beech stand (A_{rel} = 79,0 %) to the uneven-aged spruce-beech stand (A_{rel} = 92,1 %).

Besides providing a variety of inventory results, the growth simulator can be applied in its traditional function, in forecasting the stand development. Given the ecological frame of a site, the measured or complemented inventory results and a certain management scenario, the future development can be predicted, for instance, in five year cycles. Besides the traditional volume growth information, SILVA 2.2 yields forecasts on how the stand structure and habitat suitability in a given location changes in a particular time period and by applying a certain management scenario. Therefore, it possible to evaluate

---

[22] maximum of the mean annual volume increment, i. e. (volume of remaining + removal stand)/age.

not only the current state but also the future development on a certain location in terms of ecological and economical criteria.

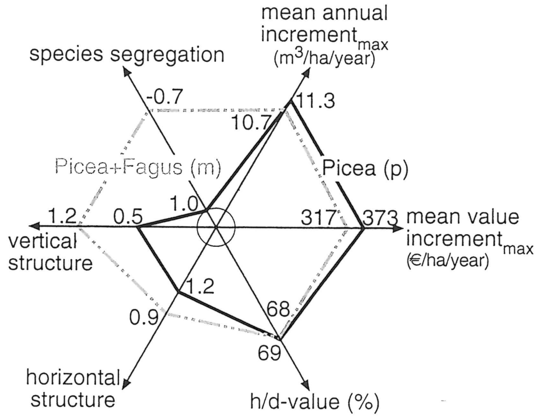
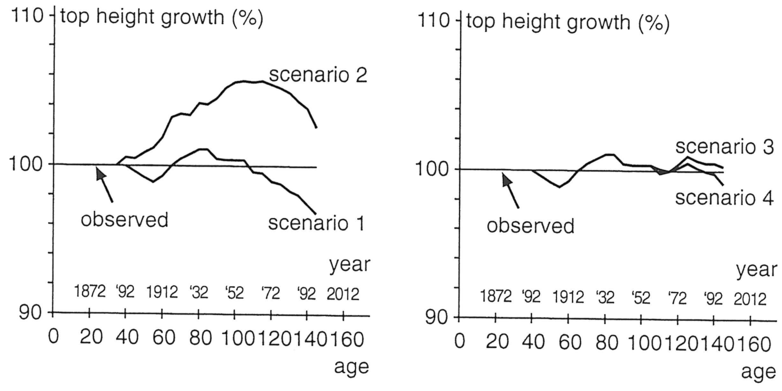


Figure 9. Holistic presentation of inventory results by using structural indices, stability indicator and economical data for a mixed and single species stand. See the text for detailed explanations of the parameters.

4.4.2.2 Analysis of causes

Dynamic growth models are suitable for the analysis and evaluation of measured development patterns such as time series of forest growth or of defoliation (Hari *et al.* 1984, Mielikäinen and Timonen 1996). In the following, an analysis with respect to the forest growth is represented on a permanent sample plot for spruce in Denklingen, Germany. In Figure 10, the measured growth of the stand height between the years 1882 and 1998 is contrasted with four different growth scenarios, which have been predicted by using the SILVA 2.2 growth simulator. The real height growth is given as the straight 100% line, and the predicted growth curves represent different site conditions. The simulations start with the real status of the stand in 1882, recreate the silvicultural operations as they have been carried out in the stand, and differentiate between the reality only in the different site conditions. The site conditions have changed during the prediction period due to the changes in climate and in the nutrition situation.



(a) (b)

***Figure 10**. Measured growth of the stand height between the years 1882 and 1998 is compared with four different growth scenarios, which have been predicted by using the SILVA 2.2 growth simulator (Pretzsch 2001).*

In scenario one, the site conditions are kept constant and correspond to the conditions in the end of the 18th century. Up to the age of 110 years, the SILVA 2.2. predicts the stand height growth very close to that of reality, but since the 1960'ies, there is a considerable difference between the real and the simulated growth. Since the mid-20th century, the real stand height growth exceeds the expected growth continuously. In contrast, if the site conditions of the 1980'ies and the 1990'ies are assumed for the whole simulation period (scenario 2), the stand height growth is overestimated. Only at the end of the simulation period, the real and the predicted height growth approach each other. These and further scenario calculations show that the real stand height development can be realistically simulated only when the change of the site conditions for the last third of the simulation period is taken into account.

The increase of the nutrient balance affects the simulation results in a realistic way, whereas the change of the temperature and precipitation values did not show the desired effect. The scenarios 3 and 4 (Figure 10 b) represent a situation where the availability of the nutrients has been improved from the stand age of 110 years onwards. The nutrient balance is described on a relative scale between zero and one, and up to the stand age of 100 years it is set to 0.2. From the stand age of 110 years onwards, the nutrient balance is set to 0.5 (scenario 3) or to 0.3 (scenario 4). Through this increase in nutrient supply, the stand height growth can be predicted realistically.

The differences between the model predictions and the actual measurements cannot be subjected to the *a priori* differences between the model and the reality, because the same initial situation and silvicultural measures have been applied. Instead, the actual development of the stand height curve seems to have been changed due to fundamental

changes in the growing conditions since the 1950'ies and the 1960'ies. If we take an increased nutrient supply into account, close-to-real growth patterns can be simulated (vs. Figure 10 b). In this way it is possible to detect whether, when, how much and due to which factors the growth pattern has changed in the long term monitoring plots.

4.4.2.3 *Interpretation of the defoliation pattern of the EU/ICP Level I plots*

The information potential of the EU/ICP Level I plots concerning the vitality of the forests can be extended by using an eco-physiological process model. The measured patterns of the defoliation since the launch of the monitoring programme (in Germany 1984) form the starting point. Such patterns are shown as an example for three different regions (1 - 3) in figure 11 a. By using an eco-physiological process model and the ecological data of a site as initial parameters, the leaf density is predicted for the same three regions (1' – 3'in Figure 11 b). These simulations are aimed at the normal development of the defoliation pattern so that the model is not guided by disturbance factors such as increased emissions or biotic stress factors.

The comparisons between the measured and predicted patterns show that in regions one and two the predicted and the measured pattern closely correspond to each other. However, this is not the case in region 3. Therefore, the patterns of region three are simulated again by using a number of different scenarios with respect to the disturbance factors (3' – 3'''). In this way it is possible to increase the understanding of the potential disturbance factors, which may cause the detected defoliation pattern (Figure 11 c). The scenario simulations, furthermore, assist in the creation of corridors for the "normal development" (Figure 11 d). Such corridors allow a better interpretation of the detected damages within a certain region as they take into account the fact that normal defoliation can vary considerably between regions. Only when the results exceed the limits of the corridor of a specific region, damage has been detected. In the current example this is the case for the region 3 since the year 1995.

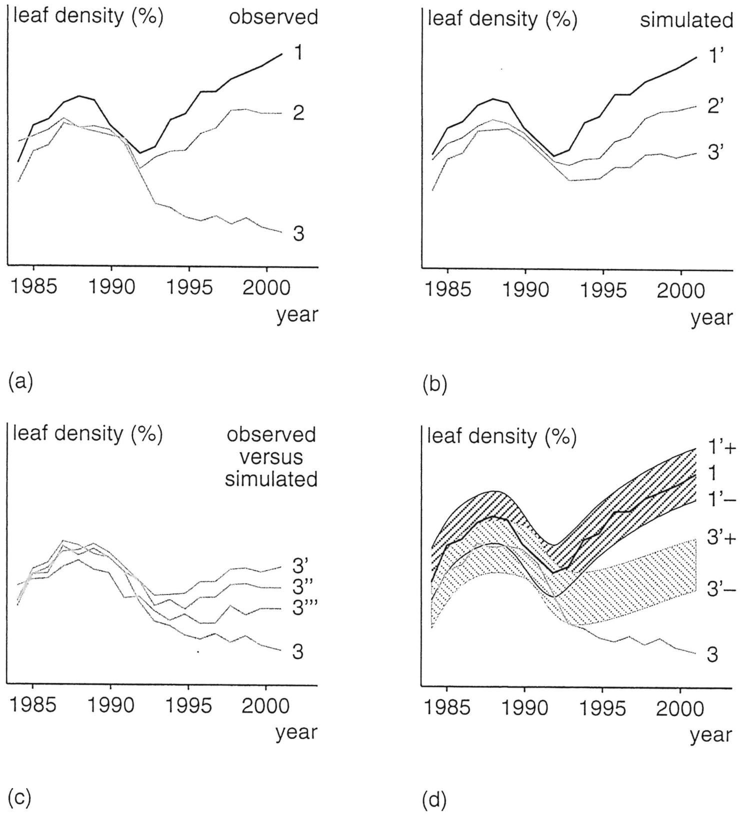


Figure 11. Investigation of the defoliation patterns in three different regions in Germany.

The development of the analysis approach of this example (Figure 12) is currently financed by the German Federal Ministry for the Agriculture in a project No. 00HS041 (Vitality and growth of economically important tree species on selected Level I and II plots)[23]. The EU/ICP Level I inventory data between the years 1984 and 2001 and the eco-physiological process model BALANCE are being used (Grote and Suckow 1998). The process model produces reference data about the regional defoliation patterns and allows a detailed analysis of the inventory results. In contrast to the traditional result calculation and the detection of the patterns, the process model allows a more detailed

---

[23] „Vitalität und Wachstum bei wesentlichen Wirtschaftsbaumarten auf ausgewählten Level I- und Level II"

investigation of the degree of damage within a certain region and of the potential reasons causing the damage.

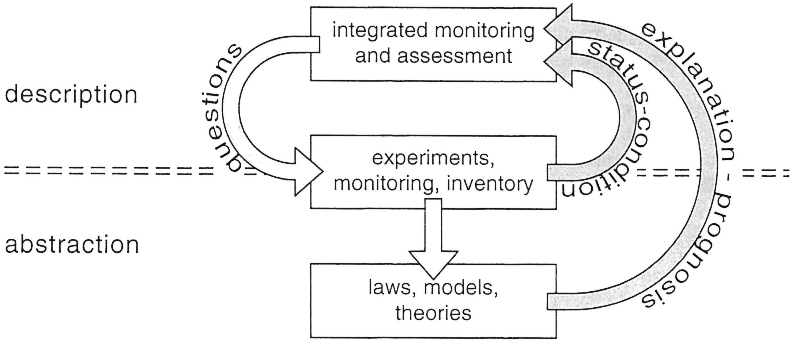


Figure 12. Approach to analyse defoliation patterns (after Grote and Suckow 1998).

4.5 Application of the Earth observation data[24]

In general, the use of remote sensing for the assessment of biodiversity is based on the premises that a relationship exists between the composition and structure of the landscape and its units and the diversity of ecosystems, species and genotypes that may be present within it or them (Innes and Koch 1998). Thus, remote sensing contributes to the indirect assessment of biodiversity by providing information on the structures and composition of landscapes. Principally, the coarse mapping of habitat and forest types, vegetation structure, landscape structure and habitat fragmentation is possible. In large-scale assessments, satellite imagery provides cost-efficient results and may be combined with different data sources to increase accuracy and information content.

In traditional forest surveys, remote sensing is used either to provide mapped information or to increase the cost-efficiency of statistical estimates. In habitat modelling or integrated approaches, for instance, it is the major data source for spatial analysis and modelling the potential of forests to provide sustainable timber and non-timber functions. Remote sensing becomes an essential data source for providing sound, reliable, cost-efficient and comprehensive information about forest ecosystems in a landscape context and for decision support in sustainable forest management planning.

In comparison to field-based assessments, remote sensing has advantages as well as disadvantages. Remote sensing methods generally cover large areas at low cost and provide spatially explicit data for large regions. Remote sensing also does provide an excellent foundation for studying the landscape changes over time. In a Pan-European

---

[24] Combiled mainly by Håkan Olsson

Forest Biodiversity
Assessment Approaches
for
Europe

Puumalainen, J.
Angelstam, P.
Banko, G.
Brandt, J.
Caldeira, M.
Estreguil, C.
Folving, S.
García del Barrio, J.M.
Keller, M.
Kennedy, P.
Köhl, M.
Marchetti, M.
Neville, P.
Olsson, H.
Parviainen, J.
Pretzsch, H.
Ravn, H.P.
Ståhl, G.
Tomppo, E.
Uttera, J.
Watt, A.
Winkler, B.
Wrbka, T.

EUROPEAN COMMISSION
JOINT RESEARCH CENTRE

Institute for
Environment and
Sustainability

MISSION STATEMENT

The mission of the **Joint Research Centre** is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Community. Close to the policy-making process, it serves the common interest of the Member States, while being independent of commercial or national interests.

European Commission
Joint Research Centre (DG JRC)
Institute for Environment and Sustainability (IES)
Land Management Unit
I-21020 Ispra (VA), Italy

Tel.: +0039 0332 78 9514
Fax: +0039 0332 78 9803

E-mail: ies@jrc.it
Website: http://ies.jrc.cec.eu.int/

Editors: J. Puumalainen, P. Kennedy, S. Folving
Original photographs: Rudolf Hummel
Cover: José-Joaquín Blasco

EUR Report 20423 EN

Printed in Italy

Forest Biodiversity – Assessment Approaches for Europe

Joint Authorship

Puumalainen, J., Angelstam, P., Banko, G., Brandt, J., Caldeira, M., Estreguil, C., Folving, S., Garcia del Barrio, J.M., Keller, M., Kennedy, P., Köhl, M., Marchetti, M., Neville, P., Olsson, H., Parviainen, J., Pretzsch, H., Ravn, H.P. Ståhl, G., Tomppo, E., Uuttera, J., Watt, A., Winkler, B. & Wrbka, T.

Table of Contents

FOREWORD AND ACKNOWLEDGEMENTS

Several legislative steps have been taken to wholly or partly protect forests and forest biodiversity in Europe. These include the European Biodiversity Strategy, the Biodiversity Action Plan for the Conservation of Natural Resources and the Birds, Habitats and Water Directives. The Community is also a signatory to the Convention of Biological Diversity (CBD). At the pan-European Level, the Community is committed to the implementation of decisions taken at the Ministerial Conference on the Protection of Forests in Europe (MCPFE). However, conservation and sustainable use of biodiversity in forests can only be discussed in the presence of sound and reliable reference information.

Clear statements about the current situation of biodiversity, changes over time and cause-effect relationships are needed. These data are currently poorly available at the level of Europe. National estimates for different indicator values of forest biodiversity are, in several cases of relevance and they are also the basis of the current international reporting. However, there are increasing needs for forest biodiversity to be assessed and reported at the level of Europe and only harmonised data, or a European-wide monitoring system in close co-operation with a research network, can fulfill the information requirements.

The Joint Research Centre of the European Commission provides scientific and technical assistance for Commission policies[1]. Currently, activities related to European forestry are being dealt with in the EURO-LANDSCAPE Project where the development of mapping techniques, information systems and the integrated analysis of European data currently focus on:

- ➢ Distribution and composition of forests in Europe.
- ➢ Forest ecosystem diversity.
- ➢ Forest condition and the impact of environmental stress factors.
- ➢ The development of a prototype European Forest Information System (EFIS) for international, national and regional levels.

Biodiversity-related activities have increasingly been emphasized, and the EURO-LANDSCAPE-Project is linked to all major efforts in Europe. These include the reporting of the European Environmental Agency on environmental issues, the up-dating and improving the existing set of pan-European indicators, the assessment of biodiversity by using the data of the UN-ECE/FAO Forest Resources Assessment of Europe, and numerous research and development projects at different scales. To define and guide this work, a series of expert meetings have been organised. The first meeting focused to the application of remote sensing and Geographical Information Systems to support

---

[1] The Joint Research Centre plans and carries out its research activities according to the Frame Work Programmes (FWP) of Research and Development in four-year cycles. Within the current 5th Framework Programme, forestry-related efforts are linked directly to the Council Resolution on a Forestry Strategy for the EU (and more specifically to Regulations EEC 1615/89 and EEC 3528/86).