THE EUROPEAN FOREST MONITORING PROGRAM OF ICP FORESTS - AN EXAMPLE FOR CO-OPERATION BETWEEN EUROPEAN COUNTRIES

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ABSTRACT

Since the early 1980s when a severe deterioration of forest condition was observed in large areas of Europe, the condition of European forest is under close observation by ICP Forests and EU. With the increasing length of the monitoring time series, the improved quality of its harmonised data and the increased knowledge of the experts involved, ICP Forests and EU are in the position to document the effects of the most important stress factors as well as the forest ecosystem reactions. By this way the program provides reliable and up to date basic information for environmental policy decisions, it informs the public and the program offers a platform for continued research cooperation. Romania is one of the active members of the ICP Forests and contributes with its measurements to the overall European picture.

Key words: European forest monitoring program, forest condition assesement, air pol lution, stress factors, forest health.

INTRODUCTION

Forests have an important multifunctional role for society.Apart from the economic benefit of wood production and their significant role in the development of rural areas, forests have a major value for nature conservation and play an important role in preserving the environment. They are significant carbon sinks and thus relevant in the context of climate change. Forests also represent a controlling factor of the water cycle.

In 1985 the International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) was established under the UN/ECE Convention on Long-range Transboundary Air Pollution (CLRTAP). In 1986 the European Union (EU) adopted the Scheme on the Protection of Forests against Atmospheric Pollution and with the Council Regulation (EEC) No. 3528/86 the legal

basis for the co-financing of the assessments was provided. In 2003 this regulation was prolonged and modified through the "Forest Focus" regulation (EC No 2152/2003). ICP Forests and EU have been closely co-operating in monitoring the effects of air pollution and other stress factors on forests. Today 40 countries participate in the monitoring programme which contributes to the implementation of clean air policies at European and national levels.

PROGRAMME OBJECTIVES

The objectives of the monitoring programme are:

- To provide a periodic overview on the spatial and temporal variation in forest condition in relation to anthropogenic and natural stress factors in a European and national large-scale systematic network (Level I);
- To contribute to a better understanding of the relationships between the condition of forest ecosystems and stress factors, in particular air pollution, through intensive monitoring in a number of selected permanent observation plots spread across Europe (Level II);
- To contribute to the calculation of critical levels, critical loads and their exceedances in forests;
- To collaborate with other environmental monitoring programmes in order to provide information on other important issues, such as climate change and biodiversity in forests and thus contribute to the sustainable management of European forests;
- To compile information on forest ecosystem processes and to provide policy makers and the public with relevant information.

MONITORING DESIGN

In order to follow these objectives a systematic large scale monitoring network (Level I) and an Intensive Forest Monitoring Programme (Level II) have been set up.

The strength of the Level I network is its representativity and the vast extent of its approximately 6000 permanent plots, arranged in a 16 * 16 km grid, throughout Europe. Annual crown condition assessments are carried out at Level I. In addition, soil and/or foliage surveys were conducted on most of the plots. A repetition of the soil survey is under discussion.

For intensive monitoring more than 860 Level II plots have been selected in the most important forest ecosystems of the participating countries. A larger number of key factors are measured on these plots; the data collected enable case studies to be made for the more common combinations of tree species and sites.

Table 1: Surveys carried out at Level I and Level II

Surveys conducted	Level I	Level II	
Crown condition	annually	at least annually	all plots
Foliar chemistry	once until now[1]	every 2 years	all plots
Soil chemistry	once until now[2]	every 10 years	all plots
Soil solution chemistry	-	continuously	part of the plots
Tree growth	-	every 5 years	all plots
Ground vegetation	-	every 5 years	all plots
Atmospheric deposition	-	continuously	part of the plots
Ambient air quality		continuously	part of the plots
Meteorology	-	continuously	part of the plots
Phenology	-	several times per year	optional

[1] on 1497 plots; [2] on 5289 plots

RESULTS

Since the early 1980s when a severe deterioration of forest condition was observed in large areas of Europe, the situation and health status of European forests has been under close observation, and with the increasing length of the monitoring time series a differentiated view has become possible. Monitoring is today based on traditional indicators, like crown condition and forest growth. In recent times also the biological state of forests has received increased attention and the monitoring programme has reacted to the information needs.

Defoliation

Since one and a half decade thousands of trees throughout Europe have been routinely examined during the summer months each year. This large scale forest condition assessment is based on a systematic 16 x 16 km grid net and gives a good overview on the health status of the forest ecosystems. In 2003, 131503 trees were assessed in 30 countries including Romania. Defoliation is the main parameter within this survey. It is a single tree estimate for the lack of foliage, responds to many stress factors and is easily assessable over large areas. This makes defoliation a valuable overall indicator for

forest condition. On the other hand it is not possible to trace the influence of single stress factors by evaluating this parameter alone. Instead, main influences on forest condition, like insect damage, fungi infestations, atmospheric deposition or weather extremes are assessed additionally within the programme. Also, defoliation is not the only parameter that offers information on the biological state of the forests. Others are for example forest growth, stand structure or the occurrence of sensitive species groups like epiphytic lichens.

Large scale status

22.7% of all trees assessed in 2003 were classified as moderately or severely defoliated or dead. Crown condition in the EU Member States was slightly better than in Europe as a whole. Of the four tree species most frequently occurring on the plots, European and sessile oak were the most severely defoliated species (Fig. 1)

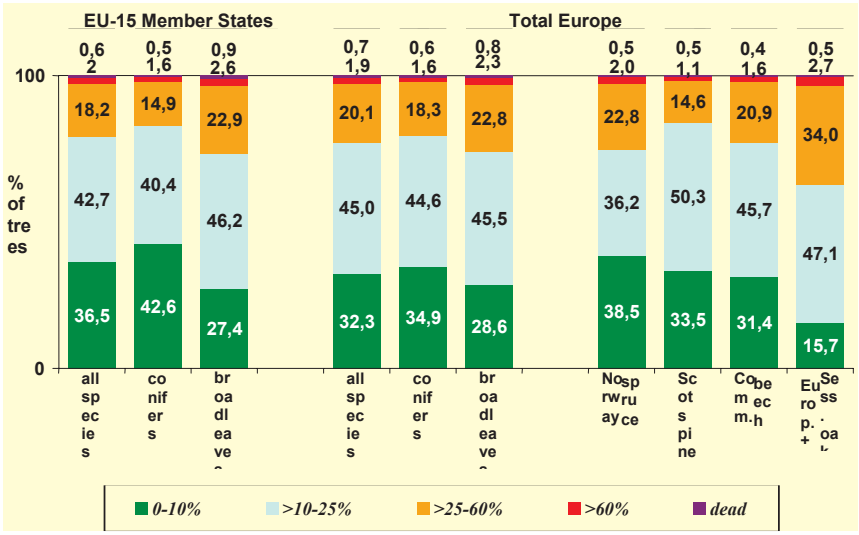

Figure 1: Percentage of trees in different defoliation classes for main tree species. Total Europe and EU, 2003.

Quality Control

The monitoring of forests and environmental interactions can only provide reliable and comparable information if data are collected on the basis of harmonised methods. Quality control plays an important role within the monitoring programme. In 2003, International Cross-Calibration Courses were held in Germany and Estonia. Here, defoliation of a larger number of trees was assessed by experts from different countries in

order to document the level of their scores and possible differences in the assessment methodology. In general, all assessments were significantly correlated as most trees were assessed with similar scores by all participants.

The courses already followed a new concept that was recently implemented including the combination with photo assessments during the courses. Photos can be re-interpreted after years and thus ensure time consistency of the assessments. If the photo interpretation proves reliable, it will partly replace costly field exercises in the future. A first evaluation of the photo assessments during the courses in 2002 and 2003 was encouraging. Photo and field assessments were highly correlated in most cases.

Time trends

Overall, crown condition during the last year has deteriorated to an extent unprecedented during the last decade. Time trends show an increasing mean defoliation since 2002 for all main tree species except for Norway spruce which remained on the same defoliation level. However, mean defoliation was generally still lower than in the mid 90s when most tree species showed the maximum defoliation since the beginning of the common assessments. Only beech reached the level of its previous maximum defoliation in 1995. The overall deterioration is also documented in the share of plots that show a distinct worsening since 1997. With 15.3% this proportion is bigger than the percen-

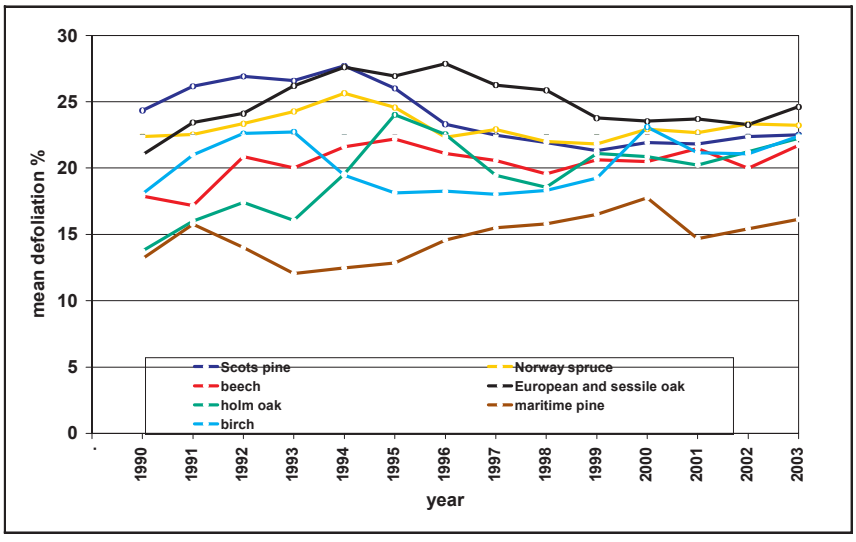

Figure2: Trends for mean defoliation of European main tree species. Calculations are based on those countries that were continuously participating in the assessments. Within these countries, all trees assessed in the respective years are included. Sample sizes vary between 1 161 trees for birch in 1990 and 11 924 for Scots pine in 1993.

tage of plots showing an improvement (10.7%). For 74% of the plots mean defoliation remained on the same level. The time trends for single plots show a belt with prevailing deterioration along the eastern edge of the Baltic Sea reaching from southern Finland to eastern Germany. Improvements were mainly registered in Belarus and southern Poland. Influences on crown condition are many and diverse; they are in more detail described in Chapter xx. Nevertheless, in view of such a clear overall trend, the existence of a large scale influence seems likely. The extreme heat and drought in large parts of Europe during late summer 2003 is a very plausible explanation for the deteriorating crown condition. It is even expected that these weather extremes will have a sustained effect on the health status of the forests in 2004.

Time trends for main tree species show that crown condition of common beech remained unchanged across large areas of Europe. Distinct worsening was registered in Southern Sweden, Belgium and Romania. In Southern Germany the beech trees on the plots recuperated after a worsening at the end 1990s. The deciduous oak species deteriorated mainly in Southern Sweden, Eastern Austria and central France. The latter region deserves particular attention as the situation has remained unchanged since years. The worsening of the needle tree species in Scandinavia was ascribed to root rot and needle rust fungi. Improving trends have been observed in Belarus in particular.

Air Pollution and other stress factors

Given by its mandate ICP Forests focuses mainly on air pollution effects on forests. The trend for decreasing sulphate and nitrogen deposition were confirmed, with ammonium concentrations being higher than nitrate concentrations throughout the measurement period. However on many plots the critical thresholds are still exceeded. This is particular true for ozone, which is regarded as one of the major pollutants nowadays affecting forest condition in large parts of southern but also central Europe. On average the critical levels were exceeded on 70 to 90% of the plots evaluated in the years 2000 to 2002. The ozone concentrations are expected to be even higher in 2003 given the extreme weather conditions last summer.

The high temperatures in 2003 being significantly above long term average and the extreme drought had a distinct influence for the forest in large parts of Europe. First data evaluations by ICP Forests reveals growth reductions and decreased health in many forests of central Europe. In higher altitudes, where low temperatures normally limits tree growth, the weather conditions had a positive effects as stem growth increased at sites above 1200 m a. s. l.. Forests in the Mediterranean region seem to be better adopted to these weather conditions, however unprecedented forest fires occurred in these region 2003 with catastrophic consequences mainly for Portugal but also for some areas in Spain and southern France. Beside the given extreme climatic conditions changes in land use practices had an effects on the increase of destructive fires.

Information shows that the unusual weather conditions has also effect for forest condition in 2004 and in the coming years. An indication is the increase of bark beetles

infestations in large parts of Europe. Other insects and fungi are of more local importance.

ICP Forests is also in the position with its data to follow up the medium term effects of such events. In previous reports the effects of the storm damage in the year 1999 had been documented. Specific studies showed now that storm damaged occurred more often on acidic soils giving an indication on the effects of deposition. In a Danish study the importance of the vegetation under story at a destroyed forest stand was documented to prevent for nitrate leaching. In stands with no or removed ground cover nitrate concentration increased strongly and remained high until late 2003.

Partnerships

Air pollution and extreme climatic conditions are not only a threat to European forests but also to forest in many regions of the world and thus deserve political actions at the global level. It is therefore essential for ICP Forests to continue its partnerships with comparable monitoring systems in Northern America and Eastern Asia in order to document the information needs for such global strategies. First results from the Acid Deposition Monitoring Network in East Asia (EANET) show severe tree decline only in sites of Japan and Russia mainly caused by natural environmental causes. However, estimations by the World Bank indicate a sharp increase of sulphur dioxide emissions in this region showing the need for further air pollution reduction also in this part of the world.

Outlook

This years results document that the monitoring network of ICP Forests has been developed in the past years towards a multifunctional network giving reliable information not only on the effects of air pollution but on all important stress factors on forest condition. In addition the short but also the medium term reaction of the most important forest ecosystems in Europe are documented. It will be essential for ICP Forests to build on partnerships also in future with partners inside the Convention on Long Range Trans-boundary Air Pollution, but also with partners in field such as for example sustainable forest management, biodiversity, climate change and nature conservation inside and outside Europe. Main partner in this respect will be the European Commission (EC). A renewed partnership with the Forest Focus scheme of the General Directorate of Environment of the EC will be vital in order to ensure the continuity of the monitoring program and to further develop the multifunctional approach of the ICP Forests.

Reference

UNECE, Geneva, Executive report 2003, ISSN 120-587

For further information: www.icp-forests.org