

Convention on Long-Range Transboundary Air Pollution
International Co-operative Programme on Assessment and Monitoring
of Air Pollution Effects on Forests (ICP Forests)
& European Union Scheme on the Protection of Forests against Atmospheric Pollution

European Forests and the Environment

The work and achievements of EU/ICP Forests



ICP Forests

International Co-operative Programme on Assessment
and Monitoring of Air Pollution Effects on Forests

European partners

preserving and protecting Europe's forests

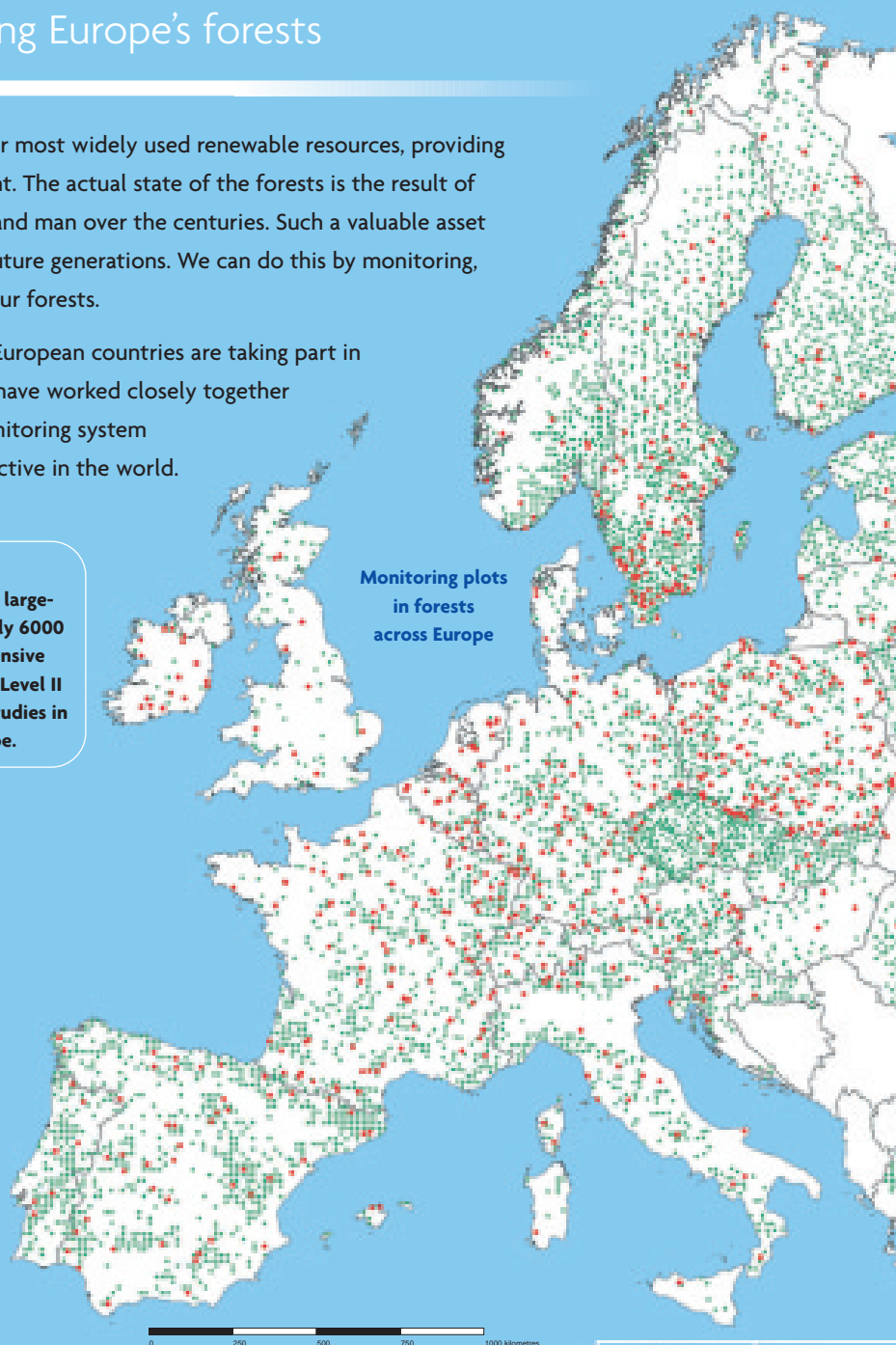
Throughout Europe, forests are one of our most widely used renewable resources, providing recreation and enhancing the environment. The actual state of the forests is the result of continuous interactions between nature and man over the centuries. Such a valuable asset and heritage needs to be protected for future generations. We can do this by monitoring, reporting and informing on the state of our forests.

Supported by the UNECE and the EC, 37 European countries are taking part in the joint EU/ICP Forests Programme. All have worked closely together to build an integrated environmental monitoring system which is one of the largest and most effective in the world.

The Programme works on two monitoring levels, comprising a large-scale gridnet with approximately 6000 Level I plots (green) and an intensive monitoring programme on 860 Level II plots (red) which enable case studies in the major forest types of Europe.



Level II plot at Grizedale, Cumbria, UK



The Programme:

- Provides an overview of the spatial and temporal variation in forest condition on a European and national large-scale systematic network. This large-scale monitoring is commonly referred to as Level I.
- Contributes to a better understanding of the relationships between the condition of forest ecosystems and both anthropogenic (in particular air pollution) and natural stress factors throughout Europe using a network of plots. This in-depth monitoring is known as Level II.
- Contributes to forest policy at national, pan-European and global level on the effects of air pollution, climate change and biodiversity for sustainable forestry.

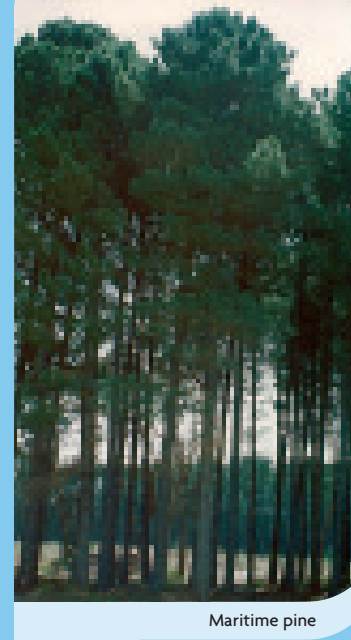
Recent studies and results

Forest condition

The 'backbone' of forest condition or health monitoring is crown density, a measurement of the amount of foliage that a tree carries. Since 1986, around 6000 plots, comprising over 135 000 trees, have been assessed annually. Quality assurance measures ensure comparability of the data. Datasets of crown condition, together with environmental factors that might affect it, are subject to rigorous study by European forest ecologists. These studies have revealed:

- Time trends for the main European tree species (see graph) indicate that for some, e.g. maritime pine, there has been a progressive deterioration, mainly in the Atlantic South region. Others, such as beech and oak, show considerable fluctuations from year to year, a result of weather extremes, seeding years and insect attack. Different regions of Europe demonstrate individual trends - for example, in Scandinavia crown condition has improved in recent years, but in eastern Europe a marked deterioration has occurred.
- A stabilization of the deterioration at a level of around 20% of trees affected.
- Detailed statistical analysis shows that climate, soil condition, atmospheric pollution and forest pathogens such as insects and fungi all have a synergic effect on forest condition. The importance of each can vary depending on region and from year to year.

Worldwide, forest condition has been recognized as a very important environmental indicator. It is vital that at a time when the state of the environment is changing rapidly we continue to use and develop this tool for use as a measure of present and future forest health.



Maritime pine

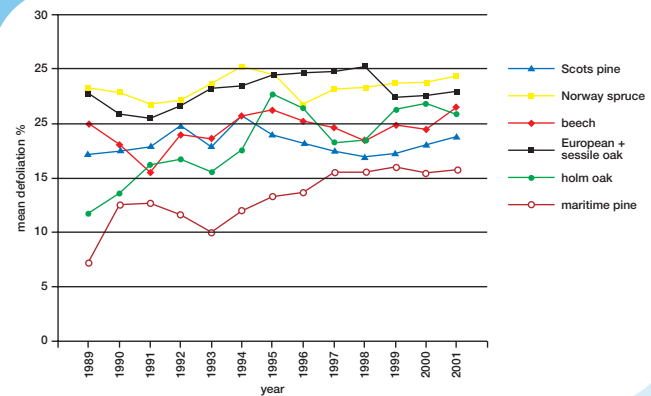
Carbon sequestration

Most authorities acknowledge that the world's climate is changing due to the increase in carbon dioxide from the burning of fossil fuels. In the Kyoto Protocol the governments of 84 nations agreed to reduce carbon emissions and/or increase carbon sequestration.

Forests contain considerable reserves of carbon both in the above-ground biomass and in the soil. Results from the monitoring Programme suggest that:

- The total carbon sequestered in European forests approaches 280 million tonnes each year.
- Net uptake of carbon by European forests may account for 40% of the Continent's total 'carbon sink'.
- Carbon sequestration is mainly due to a net increase in forest growth, while further sequestration in the soil is limited.

The Programme has supported strategic research on the scale of sequestration in European forests. However, it has clearly demonstrated that the value of forests lies in the provision of wood as a substitute for fossil sources in energy generation.



Development of mean defoliation for European main tree species calculated for trees that were continuously monitored during 1989–2001.

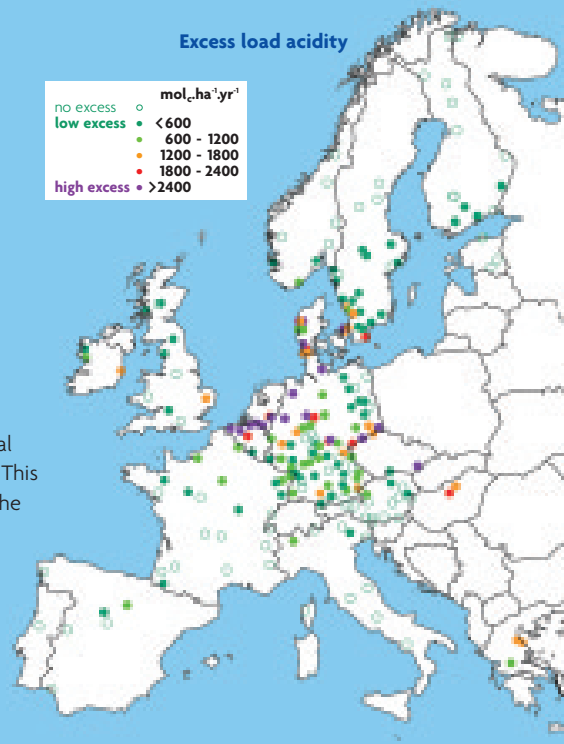
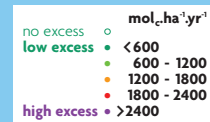


Fully foliated cork oak in Portugal



Norway spruce and birch in northern Finland

Excess load acidity

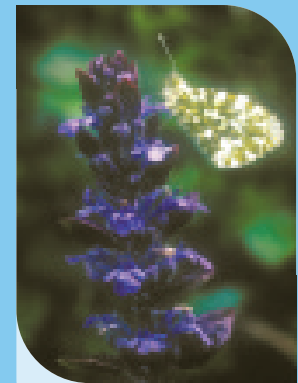


Deposition & critical loads

The term 'critical load' refers to the amount of atmospheric pollutant below which no significant harmful effects on the forest ecosystem are expected in the long run. Critical load exceedance is the difference between the critical load and the actual deposition. This concept has been at the centre of discussions on pollution emission reductions since the 1980s. Data from the Programme are used to determine the sensitivity of forest ecosystems studied. Important first results include:

- The sensitivity of forests to nitrogen depositions as shown by critical load exceedance in The Netherlands, Hungary and North Germany.
- The sensitivity of forests to atmospheric acidity as shown by critical load exceedance in The Netherlands, North Germany, central and eastern Europe.
- The identification of geographical areas at threat from heavy metals by using information on soil, climate and pollutant inputs.

Further detailed work, including the application of dynamic models to the data of the Programme's Intensive Monitoring sites, will help to provide information on the current status and future development of forest ecosystems and the possible need for further measures.



Orange tip butterfly on bugle

Biodiversity

The monitoring programme contributes to national and European policy initiatives and forest management planning by:

- providing data on diversity of species forming ground vegetation in forests;
- providing data on tree species, stand structure and tree health;
- assessment of key ecosystem factors.

Results have already helped to improve knowledge on the relationship between ground vegetation composition and environmental factors such as tree species, climate and soil. Relations between atmospheric pollution and its changes to the forest ecosystem, including soil acidification and eutrophication, are expected and are at present being investigated. The study also pointed to a weak but significant effect of atmospheric pollution.



Sensitive forest management encourages biodiversity and sustainability

Sustainability

Sustainability involves all the economic, environmental and social aspects of forestry, and the provision of scientific data to inform on sustainable management is vital in the evaluation process. Across Europe, the Programme monitoring data are already helping with:

- the control of forest quality by assessment of forest ecosystem health and vitality;
- the development of tools to monitor the biological diversity in forests;
- support for forest management decisions to ensure continuous protection of the ecosystem including its effects on soil and water.

The Ministerial Conference on the Protection of Forests in Europe has developed a system of criteria and indicators to evaluate the practice of sustainable forest management. The EU/ICP Forests Programme has been recognised as a vital source of information for the quantification of some of these indices. Further development is expected in the near future.

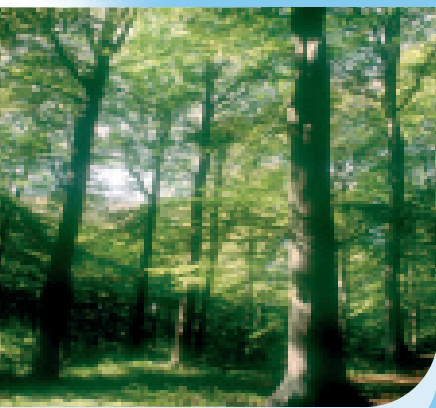


Frequent rainfall and wet soil causes problems for harvesting on erodible sites

What impact has the Programme made?

The Programme has been effective in many ways – as a driver, supporter and creator of awareness in scientific, political and public areas. It has:

- Provided data and scientific information for environmental and forest policy formulation, at national and international levels aimed at reducing air pollution and developing systems to monitor their efficacy.
- Established the monitoring network as an important tool for delivery of information on sustainable forestry by successive Ministerial Conferences on the Protection of Forests in Europe.
- Supported international conventions and regulations, e.g. Convention on Biological Diversity (UNEP 1992), Convention on Climate Change (UN-FCCC 1992) and the Protocol to abate acidification, eutrophication and ground-level ozone (UNECE 1999).
- Formed an international link to many national programmes and significantly improved the collaboration between scientists and policymakers of international bodies and organizations who collect data on forest ecosystem processes and forest condition.
- Increased public awareness of the environmental risks to forests.
- Improved scientific knowledge of the environment by assisting national and international research to define critical loads, carbon stocks and fluxes and long-term impacts on forest growth resulting from air pollution, climate and environmental change.
- Devised an early warning system to alert countries to any large-scale forest destruction and quantified effects of major events such as forest damage after the severe European storms in December 1999.
- Provided scientifically based explanations for environmental concerns about forest decline raised for large areas of Germany, Czech Republic and Poland in the 1980s.



Mature beech forest

What has the Programme accomplished to date?

By its holistic monitoring approach, the Programme has offered a unique source of information on the condition of forest ecosystems. So far it has:

- Established a common methodology for monitoring and studying forest ecosystems across Europe.
- Conducted annual assessments of the extent of European forest damage – a vital indicator of European environmental health.
- Assessed the amount of acidity received from atmospheric sources, and determined effects on forest functioning.
- Evaluated the degree of nutrient deficiency and nutrient imbalance in European forests.
- Revealed evidence of increasing risk of nitrogen saturation in many European forests with consequent risks to water pollution.
- Identified relationships between atmospheric inputs, soil solution chemistry and tree nutrition.
- Discovered enhanced levels of heavy metals (potentially toxic elements) in almost a quarter of the plots studied.
- Confirmed that biotic damage and climatic events are also primary causes of tree defoliation and these may increase with changes in climate.



Oak bud burst



Oak leaves emerging

Stable long-term monitoring – the key to the future

The increasingly complex environmental, economic and social demands being made of forests in Europe highlight the continuing need for rigorous scientific advice on their environmental protection. Such advice must be based in part on long-term monitoring of forest condition and ecosystem functioning.

ICP Forests has presented its strategy for the period 2001 – 2006.

Work is planned to strengthen the outputs of the Programme through:

- A strong focus on quality assurance across all areas of data acquisition.
- Supporting development and execution of further national evaluation strategies.
- An increasing emphasis on integrated evaluations of the various datasets fed by the data from the Programme, in combination with data from other sources.
- Promoting a wider interest in the value of the Programme as a provider of information in environmental and social policy areas.



Oak in full leaf

What can the Programme do for you?

The Level I and II monitoring networks have generated an unrivalled dataset of environmental information.

This is likely to be of increasing value for issues such as:

- Forest ecosystem recovery from air pollution
- Economic and environmental effects of climate change
- Role of European forests in carbon sequestration
- Land-use sustainability and land-use planning
- Risk evaluation and management
- Biodiversity monitoring.

Programme monitoring data are available to support your needs. Please contact ICP Forests or the European Commission (see addresses below).

The Programme is underpinned by the active co-operation of the governments of the European countries involved. Many national and international experts in the environmental and forest ecological sciences are actively involved. We can put you in touch with such expertise. Visit our websites or contacts at the addresses below.

Further Information

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Publications

On an annual basis, three important publications are produced under the Programme:

1. **Forest Condition in Europe. Executive Report.** This summarises the main findings from the two reports below.
2. **Forest Condition in Europe. Results of the Large-Scale Survey.** This presents results of the previous year's transnational Level I survey, and includes national reports from participating countries.
3. **Intensive Monitoring of Forest Ecosystems in Europe. Technical Report.** This presents results and evaluations from the Level II monitoring programme.

These Annual Reports and other scientific publications can be obtained from ICP Forests or downloaded from their websites.