EUROPEAN FOREST MONITORING PROGRAMME (EFMP)

A vision for MS-activities under LIFE+

Vision

Improving our understanding of effects of climate change and air pollution on forest ecosystems, the development forest biodiversity and the underlying factors, the role of forests in the protection of soil, water, and infrastructure, and the implementation of measures for forest fires prevention.

Background

The current paper builds on the Finnish Presidency non-paper describing elements of the European Forest Monitoring System (EFMS) presented to the Standing Forestry Committee Meeting on December 18, 2006. The paper elaborates on project activities to be undertaken under LIFE+.

Justification

In the coming century, atmospheric CO_2 concentrations are expected to double and global average temperature may increase by 1.8 to 5.8 °C (IPCC, 2007). In parts of Europe increasing temperatures are foreseen to be accompanied by decreasing precipitation and more frequent droughts. It is very likely that Europe may have to ace the effects of climate change in the near future, including the alteration of natural ecosystems, changing agricultural, forestry and fisheries productivity, increased risk of floods, erosion, and wetland loss (EC DG ENV, 2006). Although (forest) species have responded to climate change throughout their evolutionary history (Harris, 1993), a primary concern for wild species and their ecosystems is the rapid rate of change (Root, et al., 2003; Parmesan and Yohe, 2003). A study on vulnerability and adaptation to climate change in Europe (EEA, 2005) identified the risks of adverse impacts from climate change on natural and human systems. Forests in Mediterranean regions and continental Europe may experience decreases in yield due to more frequent droughts, while yield increases will probably occur in commercial forests in northern Europe. In addition, in southern Europe the risk of fires will significantly increase. In regions in southern and central Europe, where forests are at the edge of their bio-geographical distribution, tree mortality will increase (Schröter et al., 2005).

Forests cover about 30% of Europe (UN-ECE/FAO, 2001). In a large part of Europe forests are an important land cover type and provide habitats for a wide range of animal and plant species. The forest-wood-chain contributes to the economic sector, is a major component of rural development, and provides a considerable potential for carbon sequestration. Tree species abundance over Europe is mainly driven by temperature and the availability of soil moisture. Natural biotic and abiotic disturbance regimes, such as insects, fungi, storm- and snow damage or fire, influence the structure and composition of

forests. Those key-factors are likely to be altered by climate change. In addition climate change strikes forest ecosystems which - in many parts of Europe – have to suffer from reduced health and vitality due to possible adverse effects of air pollution (UN-ECE, 2006). While the decrease of sulphur deposition reflects the positive effects of abatement strategies, atmospheric nitrogen inputs have remained unchanged on most forest sites. Ground vegetation assessments show that there are clear indications for nitrogen deposition influences onto species composition. Climate change and air pollution effects on forests will indirectly affect the provision of forest related goods and services
Even if greenhouse gas emissions would stop today, the effects would continue for many decades due to the historical built up of the gases in the atmosphere and time lags in response of climate and oceanic systems to changes in the atmospheric concentration of the gases (Wigley, 2005). The same holds for air pollution effects on forests; the accumulation of depositions in forest soils result in retarded reactions of forests to clean-air policies.

The 6th Environmental Action Plan of the EU (6th EAP) has a main focus on reduction of greenhouse gas emissions. The Council recently agreed on a reduction target after 2012 by further 20 % until 2020. In addition, there is growing recognition that Europe must adapt to the climate change impacts that inevitable will occur (EEA, 2005). Adaptation to climate change might lessen adverse impacts or enhance beneficial impacts. In the second phase of the European Climate Change Programme, launched by the Commission in October 2005, for the first time it was agreed to address adaptation issues. In April 2006 the development and environment ministers of OECD member countries[1] adopted the declaration on integrating climate change adaptation into development co-operations (OECD, 2006) that states that “both adaptation and greenhouse gas emissions mitigation are required to respond to climate change”.

Reducing greenhouse gas emissions is the most effective mechanism for preventing adverse impacts of climate change. However, environmental policies have to review the role of adaptation in addressing climate change, the options available for increasing our ability to adapt, and the extent to which adaptation can reduce the consequences of climate change to the European economy and natural resources. In addition, air pollution has to be further reduced. The Thematic Strategy on Air pollution aims, on the long term, to avoid any exceedance of critical loads and levels. The threat to the natural environment from both acidification and eutrophication is expected to be reduced by 55 % and ground level ozone by 60 % by 2020, compared to the baseline situation in 2000. An evaluation of the Strategy will take place in 2010.

The long-living forest trees and ecosystems are ideal to distinguish the effects of human-induced impacts from those of natural system variability. However, this requires the observation of forest ecosystems over long periods. The forestry sector is in the unique situation to have several monitoring schemes that provide long term observations for different scales, which will be utilized for the project:

[1] Including the European Community

- Level I systematic monitoring based on around 6000 points, which provides an annual overview on forest condition and additional soil and foliar analyses at European level,
- Level II intensive monitoring on around 800 selected sites at European level, which is the key for providing insight into causes affecting the condition of forest ecosystems and into effects of different stress factors,
- National forest inventories, which provide information on the multiple functions of forest resources at national level.
- Special assessment programs and studies initiated by the Commission, e.g. the BioSoil project (DBH, tree species composition, deadwood, ground vegetation, and soil condition on Level I plots).

Objectives

The aim of the EFMP is to provide focused information as required under international obligations, for EU-policy development and for the monitoring of EU forestry actions. Future EU forest monitoring is needed to improve our knowledge of the state of forests in Europe and to quantify as reliably as possible any changes that are taking place within forests and related ecosystems. Information about forest ecosystem functions and processes is, however, also necessary to gain an understanding of the causes underlying such changes and, subsequently, to model the future effects of natural and anthropogenic stress factors on our forests and derive the adaptation potential of forests to climate change and air pollution effects. In areas under the specific risk of forest fires studies on fire causes and the development and implementation of forest fire prevention strategies render necessary.

The provision of policy makers with scientifically sound and reliable information concerning the forest environment has to consider several aspects:

(1) to support the collection, analysis and dissemination of policy-relevant information concerning forests and interactions between forests and the environment
(2) to promote the effectiveness of forest monitoring activities and data collection systems; this includes measures for harmonisation and the use of synergies between different monitoring mechanisms at the national, regional and European level
(3) to stimulate synergies between specific forest related issues and environmental initiatives and legislation (e.g. Natura 2000, Flora and Fauna Habitat Initiative, Water Framework Directive, EU soil strategy, Clean Air for Europe etc.)
(4) to contribute to sustainable forest management (SFM) by collecting data related to the improved Pan-European Criteria and Indicators for SFM as adopted by the MCPFE
(5) to built capacities at the national and Commission level to provide structures to allow for guidance and coordination on forest monitoring
(6) to further develop the European Forest Fire Information System (EFFIS)
(7) to conduct studies on fire causes and prevention strategies of European interest

(8) to establish Demonstration projects
(9) to initiate information and awareness raising campaigns with a European dimension

Overall Strategy[2]

Under the Forest Focus Regulation MS had the obligation to conduct co-ordinated EU-level forest monitoring. The ending of the Forest Focus Regulation bears the risk that the process of settling harmonised EU-level monitoring is interrupted and replaced by uncoordinated activities. This would result in poor quality, non-harmonised data, which are an ineligible base for EU-policy development.

The presented project outlines a co-ordinated approach. The nucleus of EU-level monitoring will be the European Forest Data Centre, which implements harmonisation activities initiated by Forest Focus, ICP-Forests, UN-ECE and ENFIN. The backbone is a core framework of monitoring plots, which will be developed from the existing Forest Focus and ICP-Forests Network. A structure will be established that provides a co-ordination platform for major stakeholders (e.g., UN-ECE, MCPFE, ICP-Forests, ENFIN), Commission Services (e.g. EUROSTAT, DG- Env, DG-Agri, DG JRC) and MS to exchange information needs, discuss methodological aspects, implement monitoring activities and to prepare the four reports on climate change and forests, biodiversity in forests, air pollution and forests, and the role of forests in the protection of soil, water and infrastructure.

The vision is to develop an inventory, monitoring and reporting system capable of providing scientifically sound, reliable indicators of sustainable forestry at regional, national and international levels. The system is based on both, representative forest surveys and intensive monitoring on selected sites. To achieve this vision, a number of basic principles must be applied. These include that, redundancy of data collection and assessment is be avoided to the maximum extent, that synergies between different monitoring systems are enhanced, and that benefits from integrating different monitoring systems are sought. Whenever measurement of new parameters may become necessary, these should be incorporated into existing systems, as putting in place new systems has significant costs and increases the likelihood of duplication and inconsistencies.

Output

The main outputs under the EFMP will be:

- Regular supply of harmonised data and information on core variables obtained from a coordinated network, easily available on Internet and continuously updated
- Regular reporting for EU and candidate countries (in complement to the reporting made by the Member States) to forest fora, notably the SFC, other EU bodies and MCPFE, as well as to global FRA and forest condition under the CLRTAP

[2] The strategy has been developed on the base of the results of the study „Development and Review Concerning Forest Focus" (Contract N° C2-07 03 01/2004/3963/MAR/B3)

- Reporting as agreed and required on other forest related commitments, notably in the framework of CBD, UNFCCC and Kyoto Protocol
- Provide a sound data basis including long time series for causal inference and epidemiological studies in order to increase our understanding of ecosystem process, with special reference to climate change and air pollution

In line with key action 18 of the FAP, the European Commission will work in the context of the European Forest Monitoring System initiative on the development of a European Forest Information and Communication Platform (EFICP) to achieve the best use and dissemination of available information on the forest sector.

Five major thematic reports on priority topics, to be published by 2012, as follows:

Climate change and forests
- impact, adaptation and consequences
- mitigation, global deforestation and degradation
- substitution (energy, raw materials)

Air pollution and forests
- effects of air pollution on forest ecosystem health and vitality
- information on forest condition
- identification of driving agents influencing forest condition

Biological diversity in forests
- general status and trends
- protected forests areas, Natura2000
- effects of anthropogenic factors (air pollution, climate change, …)
- Payment and valuation of environmental services

Forest Fires
- General status and trends
- Forest fire causes and prevention strategies

The role of forests in protection of soil, water and settlements
- general status and trends
- protective function against natural hazards
- valuation of environmental services

The different reports will contain crosscutting information. To make the synergies and cross-linkage of the aspects treated in the individual reports most obvious, it is recommended to prepare a synthesis report.

Project proposal for funding under LIFE+

In the following a project for potential funding under LIFE+ is described. The project is organised in modules, allowing Member States to choose participation in the whole project or those modules of particular interest for them. The modules cover different thematic fields were information is needed for environment and forest policy, and for forest management. The list of modules was prepared by the German Presidency after consultation of MS and their relevant institutions as well as international programmes and initiatives, e.g. MCPFE, UN-ECE, or ICP-Forests. The following project modules are proposed:

Topic area: climate change and air pollution effects on forests

- Assessment and Analysis of Climate Change Effects on Forest Ecosystems in Europe (CCEFEE)
- Assessment and prediction of effects of deposition of acidity and nitrogen on forests in Europe (EDANF)
- Integrated Monitoring and Process-oriented Research for the Assessment of Ozone Effects on Forest Vegetation in Europe (OzEFV)

Topic area: biological diversity

- Future forest biodiversity monitoring in Europe (FutDiv)

Topic area: role of forests in protection of soil and water

- Enhancing Protective functions under changing environment and forest management (Protect)

Topic area: forest fire

not yet available; will be integrated later

Supporting Actions

- Further Development and implementation of an EU-Level Forest monitoring system (Futmon)
- European Forest Information and Communication Platform (EFICP)

Assessment Programmes utilized by the different propoject modules

	Assessment Programme				
Topic area	Level I	Level II	NFI	BioSoil	Others
Climate change and air pollution effects on forests	CCEFEE EDANF OzEFV	CCEFEE EDANF OzEFV	CCEFEE	CCEFEE EDANF OzEFV	CCEFEE OzEFV
Biological diversity	FutDiv	FutDiv	FutDiv	FutDiv	FutDiv
Role of forests in protection	Protect	Protect	Protect	Protect	Protect
Forest fires					
Supporting Actions	FutMon EFICP	FutMon EFICP	FutMon EFICP	FutMon EFICP	FutMon EFICP

Appendix I: Project modules

Topic area: climate change and air pollution effects on forests

Title of module
Assessment and Analysis of Climate Change Effects on Forest Ecosystems in Europe (CCEFEE)

Main objectives
The main objective of the module is to provide policy relevant information on effects of climate change on forest ecosystems in Europe and to give recommendations for adaptation measures at the forest management level. The data will in addition build an ideal basis for further research by the wider scientific community.
The project-module aims to install a set of intensively studied core sites (mainly EU/ICP Forests Level II) where cause-effect relations for climate-tree-pathogen/insect interactions will be studied. The information obtained at core sites is foreseen to be used for the calibration and validation of cause-effect models and European-wide transfer functions in order to analyse the extent of climatic stresses in European forests taking into account different tree species and various site conditions on EU/ICP Forests Level I and NFI plots.

Description (max. 2 Pages)

Background
Over the past 100 years, the global average surface temperature has increased by 0.74 ± 0.18°C (IPCC Report 2007). Depending on the model and scenarios used, temperature is expected to increase by 1.1 to 6.4°C until 2100. While past temperature change was mostly pronounced in winter months, current temperature increases in Europe also included spring and summer temperatures. Most of this increase occurred during the last 20 years. In general, it is expected that the daily and seasonal variability in temperature will change (minimum and maximum temperature, late frost, etc.). For precipitation an increase in winter precipitation is predicted for most of Europe, whereas summer precipitation is expected to decrease in southern and central Europe. At the same time more heat waves are expected in summer due to increasing variability in temperature during the hot season. For Europe, frequency and severity of drought is thus expected to increase. Winter storm frequency is also expected to increase in northern Europe and severity of storms over most of Europe.

Expected consequences
Forests respond in various ways to these predicted climate changes. The vegetation period and forest growth in general is expected to increase in areas where plant growth is limited by temperature, but not by water supply, i.e. in the north of Europe and in mountain regions. Where water is limited and during drought or extreme heat waves, trees will respond with reduced growth, early leaf fall, reduced foliage in the following year and increased mortality, as was observed in large parts of Europe during 2003 to 2006. In the long term, changes of forest vegetation structure including tree species composition have to be expected. Warmer temperatures are expected to favor the development of defoliating insects and bark beetles and

possible pathogens and allow their expansion to new geographic locations. Increased winter storm frequency on the other hand will lead to uprooting and stem breakage of trees and longer drought and heat spells will increase the risk of forest fires limiting the wood production and overall carbon stock in Europe. Climate change, in particular increase in temperature and drought, may alter nutrient cycles and thus the tree nutrition status.

Data and Methods

National Forest Inventories are usually repeated every 10 years and are ideal to observe long-term growth and stocking volume changes on a national and European level. They allow obtaining representative information on removal, ingrowth and tree mortality for a medium-term time scale. Annual monitoring on EU/ICP Forests Level I and Level II plots offers a suitable time resolution to detect short-term impacts such as effects of extreme drought years, winter storms, or insect calamities.

1. Installation of Level II core sites: Intensive monitoring data including time series for climate, soil, stand condition and tree response are an optimal basis for the determination of cause-and-effect relations between changing climate and tree condition (water balance, tree growth, crown condition, foliage nutrients, phenology etc.). The Level II programme covers the most important impact factors as well as reaction parameters of the forests at same sites. As, however, the focus of the monitoring had been on air pollution effects in the past, meteorological and hydrological measurements have up to now only been conducted at a limited number of Level II plots. Therefore, it is suggested to consolidate and amend the existing monitoring activities in order to build up a network of core plots within the Level II network which will encompass the total set of surveys like meteorology, soil moisture, phenological observations, forest growth assessment, biotic damage, soil solution and crown condition. Building up a network of core plots will include the upgrade of existing plots with additional surveys and in a few cases the installation of new plots. This will be necessary for certain forest types with a specific sensitivity to climatic changes and for certain geographic regions with a low coverage of Level II sites.

2. Transfer functions: At these core plots effects of climate change will be monitored and studied in detail. Results will be upscaled to remaining Level II plots and to Level I plots using common surveys conducted at all plots. To improve the basis for upscaling, transfer functions for meteorological parameters from national weather services stations to forest sites will be developed based on data from forest plots with meteorological stations. Such plots will be Level II plots and plots from the ICP Integrated Monitoring and the Carboflux network.

3. Water budget models: Water supply is one of the key processes in the context of climate change effects on forests. Many aspects of the water budget of forests cannot be measured but have to be modeled. Water budget models will be further developed and validated at the above mentioned core plots and will be applied to remaining Level II and Level I plots. The water budget models will yield drought stress indicators as an explanatory variable for different responses (growth, crown condition, pests and diseases) of forests to climate change.

4. Upscaling: Trees on the Level I 16x16 km grid have been monitored for crown condition, tree mortality and occurrence of pathogens/insects on an annual basis for more than 20 years. Through the BioSoil project, basic stand structural and soil information will become available for these plots. In some countries the plots are

also part of the NFI. Improved annual tree mortality recordings and retrospective annual tree growth assessment with tree cores will enable to upscale climate-tree relations to the Level I plots and thus allow a representative evaluation of climate effects using the transfer functions developed on the core plots. Upscaling to the denser networks of the NFIs depends on the availability of relevant core parameters within the different NFIs. The project-module will elaborate a catalogue of suitable core parameters, applicable within NFIs on national levels. Terrestrial data will be supplemented with remote sensing techniques such as laser sensing for foliage density (Lidar) and spectral satellite remote sensing to obtain estimates of net primary productivity and vegetation period (e.g. Modis sensor). While remote sensing techniques do not allow determining cause-and-effects, they allow to survey large areas and at more frequent intervals.

5. Climate change scenarios: the water budget models and upscaling techniques described under 3 and 4 will be combined with climate change scenarios to evaluate the effects of climate change on forest ecosystems

6. Regionalisation:
Assessments at regional (or even forest management unit) scale are a basis for the development of adaptation measures for forest management. of A prerequisite is however extensive information on site properties which can be used along with transfer functions and water budget models. Such information is available in geological and soil maps or from forest site mapping. The feasibility of such regional approaches can be demonstrated in pilot studies in selected regions across Europe.

Expected results/European benefit

The project-module will yield policy essential and relevant information on climate change effects on forest ecosystems. It will build on a network of core plots for the monitoring of climate change effects on forest ecosystems in Europe. Effects of extreme weather conditions and of different climate change scenarios on forest ecosystems will be evaluated.
Recommendations for forest management (e.g. tree selection and silviculture) and for decision makers (mitigation measures) will be given.

Deliverables

1. Selection of adequate core plots based on
- regional representativity
- existing equipment and time series
- sensitivity of tree species, forest ecosystems and sites for climate change effects
2. Completing the instrumentation of core plots for surveying
- Meteorology
- Soil moisture (TDR); physical soil properties relevant for water budget models
- Phenology (automatic cameras)
- Growth (permanent girth bands)
- Crown condition
- Soil solution
- Pest and diseases (insect traps and larvae or pupae counts)
- Remote sensing of crown condition and relation between net primary productivity and climate (Sensors: Lidar, Modis)
3. Development and applications of transfer functions for meteorological data and soil water balances

4. Parameterisation and validation of water budget models, development of drought stress indicators
5. Parameterisation and validation of climate – phenology and growth models
6. Development of storm hazard maps
7. Implementation of a database which is compatible to the existing Forest Focus data base.
8. Scientific evaluation of the results.
9. Upscaling and regionalisation; identifying regions at particular risk and deriving recommendations for forest management.
10. Dissemination of results by 2010 via a comprehensive policy report, executive summaries, scientific publications and via internet.
11. Installation of a quality control programme.

Participating countries and institutions

EU 27 and European non-EU countries, ICP Forests, NFIs, ICP Integrated Monitoring, Carbo-Flux Sites

Duration

2008 - 2010

Utilized monitoring network

☒ Level I ☒ NFI ☒ other: ICP Integrated Monitoring, Carbo-Flux Sites

☒ Level II ☒ BioSoil

Title of module

Assessment and prediction of effects of deposition of acidity and nitrogen on forests in Europe (EDANF)

Main objectives

The main objectives of the project-module are contributions to the scientific basis for political decisions aimed at reducing harmful effects of acidifying and eutrophying deposition in forest ecosystems in Europe. Moreover, the module aims to provide information needed by related projects on climate change, on biodiversity as well as on the protection of soil, water and infrastructure.

Description (max. 2 Pages)

Air pollution is known to affect forest condition directly via the tree's foliage and indirectly via the soil and soil water. Indirect effects, mainly caused by sulfate, nitrate and ammonium deposition, include soil and water acidification and eutrophication. These, in turn, may lead to reduced tree vitality, changes in tree growth and in the carbon sequestration potential of forests, changes in species composition of the ground vegetation, and nitrate leaching into the groundwater and surface waters. Therefore, air pollution and its effects on forests are closely related to climate change, biodiversity and the protection of soil, water and infrastructure. As a consequence, air pollution effects do not only continue to be a challenge to clean air policies in Europe. In addition, they are relevant to those processes of international environmental policies focussing on climate change, biodiversity, sustainable forest management and water quality. The scientific basis for the respective political decisions requires testing a number of scientific hypotheses such as the following:

- Deposition of acidity and nitrogen causes soil and water acidification, eutrophication and nitrate leaching in forest ecosystems;
- Deposition of acidity and nitrogen exceeds critical loads in forest ecosystems;
- Critical load exceedances of acidity and nitrogen cause defoliation, changes in the species composition of ground vegetation, and changes in tree growth;
- Clean air policies reduce the effects of deposition of acidity and nitrogen on forest ecosystems;
- Clean air policies will lead to a recovery of forest ecosystems from the effects of acidifying and eutrophying deposition.

The methods for testing such hypotheses are largely available but may partly need further development. The critical loads concept is a scientifically sound and politically accepted approach for risk assessment. Scenario analyses of future impacts of expected air pollution loads are possible by means of dynamic modelling. Such studies have been conducted successfully by some countries at the national level as well as by EMEP, by ICP Modelling and Mapping, and by ICP Forests at the international level. Whilst these studies had to rest largely on data calculated by models, the studies of the proposed project-module may rely on the unique sets of measured data provided by EU/ICP Forests monitoring at Level I and Level II. The monitoring data required for the studies result from the assessments of bulk,

throughfall and stemflow deposition, of meteorological parameters, of soil condition and soil solution chemistry, of foliage chemistry, of crown condition, of tree age and growth, of pathogen activity and of the species composition of ground vegetation. Several of these data sets are also required by those modules focussing on climate change, biodiversity, and the protection of soil, water and infrastructure. A wealth of monitoring data is already available in the databases of EU and ICP Forests, but monitoring at Levels I and II must be maintained and in some cases even extended in order to permit time series analyses, to check the response of forest ecosystems to environmental changes and to verify the effectiveness of environmental policies. The main data analyses to be conducted are:

- Assessments of spatial and temporal trends in the deposition of acidity and nitrogen, both in the open field and under the canopy;
- Comparison of measured deposition of acidity and nitrogen with respective data calculated by models, including calculation of canopy effects;
- Assessments of cause-effect relationships between acidifying and eutrophying deposition on the one hand and damage symptoms on the other hand;
- Analyses of forest growth under the influence of acidifying and eutrophying deposition under increasing temperatures and availability of carbon dioxide;
- Comparison of the current status of forest soils and vegetation with site specific effects thresholds (critical limits) used in models (e.g. the development of defoliation in relation to critical limits of pH and base saturation);
- Comparison of spatial and temporal trends in soil water acidity, sulphate and labile aluminium concentrations with spatial and temporal trends in deposition of acidity;
- Calculations of critical loads and their exceedances for acidity and nitrogen as a basis for risk assessment, using models like e.g. VSD and SAFE
- Contributions to the verification and calibration of existing models of large-scale deposition of acidity and nitrogen;
- Studies of the relationships between critical load exceedances, defoliation, tree growth and the composition of ground vegetation species;
- Prediction of the response of forest ecosystems to clean air policies.

Strict data quality assurance and data management will be applied in order to create a consistent database. Data quality assurance will range from harmonised instructions and methods for field sampling via laboratory manuals and ringtests to automated data validation and error checking with the data providers prior to final storage in the database.

Reporting will aim to serve the information needs of a broad range of target groups. Of highest priority is the contribution to the reports to be elaborated by the European Commission under LIFE+ by the year 2010. The same information will be made available to other political stakeholders such as CLRTAP and MCPFE, if necessary by means of separate technical reports or satellite papers. The scientific community will be involved by means of peer-reviewed articles in scientific journals aimed to assure the quality of the scientific analyses and the reporting. For the public, the results will be aggregated with those of the other project-modules and presented on the web, in brochures, flyers and press releases.

Expected results/European benefit

The project-module will contribute to the evaluation of the Thematic Strategy on Air Pollution and provide scientific information on the effects of acidifying and eutrophying deposition on forests. These effects will include changes in forest soil condition, changes in the nutritional status, crown condition and growth of trees as well as changes in the composition of ground vegetation. The risk of damage to forest ecosystems by current deposition will be assessed and the response of forest ecosystems to clean air policies will be estimated. This scientific information is relevant to clean air policies by EC (CAFE and various directives) and UNECE (CLRTAP). Moreover, it will partly meet the information needs of MCPFE, FCCC and CBD.

Deliverables

- Contribution to the knowledge on status and trends of critical loads exceedance
- A continued and further developed system for harmonised European-wide monitoring of air pollution effects on forests;
- A continued and further developed system for quality assurance of data on deposition, meteorology, forest soil condition, soil solution chemistry, tree nutrition, crown condition and growth;
- Measured data on the above mentioned monitoring attributes as well as aggregated data for storage in the forest monitoring database of EU and ICP Forests;
- A report to the European Commission aimed at meeting its reporting obligations under LIFE+;
- Satellite papers or technical reports to other political stakeholders, such as UNECE (CLRTAP), and MCPFE;
- Peer-reviewed articles in scientific journals;
- Information for the public on the web as well as in brochures, flyers and press releases.

Participating countries and institutions

EU 27 and European non-EU countries, UNECE (ICP Forests, EMEP)

Duration

2008 - 2010

Utilized monitoring network

☒ Level I	☐ NFI	☐ other, please specify:
☒ Level II	☒ BioSoil	

Title of module

Integrated Monitoring and Process-oriented Research for the Assessment of Ozone Effects on Forest Vegetation in Europe (OzEFV)

Main objectives

The main objective of the project-module is to provide quantitative, reliable data and estimates for levels, exposure, flux, actual and potential ozone effects on forest ecosystems in Europe. The results aim to support policies related to the Air Quality Framework Directive and related Daughter Directives of EU and related to the UNECE Convention on Long-range Transboundary Air Pollution. The project-module aims as well at understanding links between ozone and climate change (impacts of ozone on tree growth and thus on C stocks), biodiversity (impacts of ozone on species diversity) and sustainable forest management (forest health, growth, and air pollutants deposition to forests).

Description (max. 2 Pages)

Background

Tropospheric ozone is considered to be the most harmful gaseous air pollutant to forest vegetation in Europe and elsewhere. Models are consistent in predicting an increase in the near future. At the same time tropospheric ozone is considered to play a role in climate change due to its positive radiative forcing potential. On the other hand, it is recognized that a failure in considering ozone effects on net primary productivity of vegetation will result in wrong estimations of the carbon sequestration potential of the vergetation and likely increase in costs for stabilizing CO_2 concentrations.

Most data on ozone effects on forests are derived from experimental studies with seedlings. Few experiments are available with mature trees, and few observational and correlative studies with mature trees applied measured ozone concentrations at the large-scale. One of these former studies was carried out on EU/ICP Forests Level II plots in five countries of South-Western Europe over the years 2000-2002. It demonstrated that ozone critical levels were frequently exceeded and effects occurred in terms of visible symptoms and increased defoliation on Level II plots. The data collected on these and additional Level II plots since then are an ideal basis to further improve the understanding of ozone effects on forests under natural field conditions and to test the hypothesis that current ozone levels have an impact on health and growth of European forests.

Data and Methods

1. Assessment questions to be answered include:
- What are the ambient ozone concentrations to which our forest ecosystems are exposed?
- Are there directional changes in ozone concentration over the period of 1999-2010?
- Are there geographical trends? Are they consistent over time?
- Where and to what extent are ozone critical levels exceeded?
- To what extent are large-scale models reliable for ozone exposure predictions?
- To what extent can flux modelling be implemented on Level II plots?
- To what extent are large-scale models reliable predictors for ozone flux?

- Are there significant differences in growth, health and symptoms on vegetation located under different ozone exposure and/or flux?
- Which plots are more sensitive to ozone in relation to their species composition?
- Is there any relationship between critical levels exceedances, defoliation, tree growth and visible injury?

2. Plot selection and surveys: The project-module will screen the available data and plots from EU/ICP Forests Level II, ICP Integrated Monitoring and from existing long-term and experimental sites with free-air fumigation experiments. It will then consolidate, amend and possibly extend the existing surveys and plots in order to optimize the coverage of the necessary surveys and data. Building up a network of consolidated plots will include the upgrade of existing plots with additional surveys and – if needed - the installation of new plots. This may be necessary for areas where ozone hot spots are being identified.
Plot selection will follow a quasi-experimental approach. For this approach, plots with similar species, age, forest management and soil characteristics but with different ozone exposures and different climatic conditions will be selected. On these plots, response to ozone will be evaluated by means of measurement on native vegetation (crown condition, growth, stable C isotopes, visible foliar injury) as well as on standard bio-indicators (poplar clones). Additional measurements on mature forest trees at the selected Level II plots will include tree-ring width and sap-flow measurements. Ground vegetation data will be used to assess possible ozone impacts on the diversity of vascular plant species. In combination with results of EMEP models Level I/BioSoil plots will as well be taken into account.

3. Data needs: The project-module will make use of existing as well as newly collected data. Data from the following surveys will be utilized: ozone passive sampling and real-time analyzers, meteorology, soil analyses, forest growth, crown condition, foliage chemistry, deposition chemistry and composition of ground vegetation. Data will be collected routinely on a harmonized basis and for the entire time frame of the project. The project-module will concentrate on the most frequent European tree species like Norway spruce and European beech. In particular, beech is a species in the focus of model development due to its large geographical coverage, its sensitivity to ozone and due to the implications connected to climate change scenarios. In addition, typical Mediterranean species like holm oak will be considered as the exceedance of critical levels is in particular observed in the Mediterranean region and there is a clear need for validation data in that region.

4. Data evaluation and models:
a.) The improved monitoring on a consolidated network of Level II sites will offer time near information on ozone concentrations and critical level exceedances in remote areas. b.) In addition, it will be the basis for flux model validation and parameterization. Ozone flux and deposition models are based on meteorology (temp., humidity, radiation, wind speed), canopy structure (height, density, leaf area index), species (stomatal density and conductance), soil (texture, soil water potential, soil moisture deficit) and ozone concentration measured (or scaled-up) at canopy height. Together with Level II plots, soil and stand structure data of Level I/BioSoil plots in combination with EMEP model results will be used for a simplified but large scale approach.
c.) Level I/BioSoil plots will be the basis for an epidemiological study which will test whether defoliation and occurrence of biotic damages is higher on plots with high

ozone exposure and flux (e.g. EMEP model) compared to plots located in areas with low exposure and flux.

Expected results/European benefit

The project-module will offer policy relevant information on ozone risk to forest ecosystems and will contribute information on the response of forest ecosystems to clean air policies in Europe by improving the spatial and temporal coverage of ozone concentration data and of ozone exposure (AOT40) estimates and by an improved assessment of critical levels exceedances in forests in Europe.
This information is directly relevant to clean air policies under the EU (CAFE and various EU directives; Thematic Strategy on Air Pollution) and UNECE (CLRTAP).
Moreover, the project-module will offer information needed to improve the understanding of future climate change scenarios by scientific bodies as IPCC.
Results will also provide a basis for discussion on international policy fora like MCPFE, UNFCCC, CBD.

Deliverables

1. Set up of a network of consolidated plots.
2. Completing the instrumentation of the selected plots for surveying (if needed)
- ozone (passive sampling, real-time analyzers, visible injury)
- meteorology
- soil analyses
- forest growth
- crown condition
- foliage chemistry
- deposition chemistry
- composition of ground vegetation.

3. Continuous, updated and harmonised European-wide monitoring of ozone effects on forests
4. Measured data on ozone levels at remote forest sites
5. Contributions to the implementation of the flux approach
6. Implementation of a database which is compatible to the existing Forest Focus data base.
7. Scientific evaluation of the results.
8. Dissemination of results by 2010 via a comprehensive policy report, executive summaries, scientific publications and via internet.
9. Installation of a quality control programme.

Participating countries and institutions

EU 27 and European and non-EU countries, ICP Forests, EMEP, ICP Integrated Monitoring

Duration

2008-2010

Utilized monitoring network

☒ Level I	☐ NFI	☒ others: EMEP, ICP Integrated Monitoring,
☒ Level II	☒ BioSoil	Existing experimental research sites

Topic area: biological diversity

Title of module
Future forest biodiversity monitoring in Europe (FutDiv)

Main objectives
The project-module aims to set-up and test a scheme to assess key aspects of biodiversity in forests at European scale. The main objective is to contribute with essential information to ongoing policy processes such as CBD, SEBI2010, MCPFE, and FRA. The scheme aims to increase the understanding of spatial and temporal variation of key factors for biological diversity in European forests and to identify the factors causing loss of biodiversity and to understand the mechanisms promoting biodiversity. Another important aim is to investigate the relationships between ecosystem functioning and biodiversity as this will underpin effective management of vulnerable areas.

Description (max. 2 Pages)
The project-module proposal builds on activities like assessments of stand structure, ground vegetation, deadwood, epiphytic lichens and forest types that have already been conducted on different levels (i.e. EU/ICP Forests Level II and Level I plots, National Forest Inventories and remote sensing data) at European scale. Using the existing national approaches, harmonized methods for the assessment of the major key parameters wil be developed. New parameters related to genetics of forest trees, soil biological activity/soil invertebrates, naturalness, epiphytic lichens at the large scale, and birds will be tested and integrated. The most important and useful key parameters will be implemented and assessed at the different levels with specific monitoring intensities and with methods adjusted to the respective assessment intensity, allowing for the up- and downscaling of results.

Major Tasks:

1. The project-module will conduct a comprehensive analysis of available data (e.g. BioSoil, ForestBIOTA in relation to Level II, Level I and BioSoil plots, relation of Level I data to National Forest Inventories) and will based on these results contribute information for a possible restructuring of the monitoring networks. It will complete the existing assessments wherever required in order to derive a representative picture.
2. The project-module will elaborate a core set of biodiversity parameters to be assessed in European forests. These parameters are an ideal link to forested Natura 2000 sites, where they are assessed on denser grids and upon national initiative. Taking into account the existing national approaches, harmonized methods for the assessment of additional key parameters will be developed. New parameters are related to genetics of forest trees, soil biological activity/soil invertebrates, naturalness, epiphytic lichens at the large scale, and birds. A final list of new key factors will only be set up after consultation with national experts. Existing SEBI2010 criteria will be applied for the selection and development of future candidate indicators.
3. The project-module will contribute to the implementation of a consistent multi-level monitoring approach. The different existing levels have their specific strengths from which the project will benefit, but which have to be combined in a

consistent approach (EU/ICP Forests Level II, Level I/BioSoil plots, National Forest Inventories and remote sensing data).

4. The new monitoring scheme will be tested in a demonstration project and:

   a.) will be based on the well developed and standardized assessment at Level I, enabling a comparable diagnosis at eco-region level for the most important forest types using a representative grid

   b.) will be linked to the information of national inventories (NFI's) and other available information e. g. datasets of the Natura 2000 monitoring activities and existing landscape level information (e.g. forest maps) for a more intensive analysis at an regional, landscape oriented level

   c.) will be supported by intensive monitoring analysis of cause effect relationships at Level II

   d.) will be enhanced by remotely sensed information, acquired at different spatial and temporal resolution in distinct test-regions, and with different technologies, in order to provide additional information at landscape level

5. After a restructuring of the monitoring networks, the project-module foresees a full implementation of the monitoring at EU/ICP Forests Level I/BioSoil and Level II plots. National forest inventory protocols for the assessment of the new core parameters will be set up for the participating countries and assessments will be implemented at a selection of NFI points. The project-module takes into account the NFI harmonisation approaches currently developed in ongoing projects under the Forest Focus regulation as well as the developing process of Natura 2000 Monitoring
6. Activities include database management, scientific evaluations of the data, continuous quality control and quality assurance measures as well as reporting of results.

   a.) Data management will be carried out in the context of the existing Forest Focus database. This includes data submission via internet as well as automated and semi-automated validation checks and a password protected dissemination module.

   b.) Evaluations will focus on the present state of the assessed biodiversity key factors and their spatial variability. Temporal trends will be presented for those parameters for which earlier data are available. Correlative analysis between different key factors will enable the determination of cause effect relationships and thus reveal possible drivers for changes in biological diversity. Existing dynamic biodiversity models (e.g. BERN, ForSAFE-Veg) will be further developed in order to adjust them to larger regions in Europe. The development of ground vegetation will be predicted for different deposition and climate change scenarios.

   c.) Reporting of results will be targeted at different audiences like policy makers, broad public, scientific community, national experts and forest managers.

   d.) A quality control programme will include all levels and stages from method development and documentation to field assessments, data submission and

storage, evaluation and reporting.

Expected results/European benefit

The project-module will yield policy essential and relevant information on the state of forest biodiversity in Europe and on its development e.g. in view of the 2010 target. It will thus be the main information base for policy processes such as CBD, SEBI 2010, MCPFE, and FRA. It will take into account the various scales and components of biological diversity and will benefit from existing networks. Relevant biodiversity key factors and related indicators will be determined and monitoring will be implemented at different monitoring intensity levels. By the end of 2010 a comprehensive report on biodiversity in forests will be produced. Beyond this time frame the project-module sets the basis for future long-term biodiversity monitoring in European forests.

Deliverables

1. Integration, harmonisation and partly restructuring of existing monitoring and inventorying networks (Level I/BioSoil, Level II, NFI, remote sensing).
2. Development of new harmonized monitoring methods building inter alia on existing national approaches and including new key parameters.
3. Creation of a basis for future long-term biodiversity monitoring in European forests.
4. Test of the improved monitoring system in a demonstration project
5. Implementation of a database which is compatible to the existing Forest Focus data base.
6. Scientific evaluation of the results
7. Dissemination of results by 2010 via a comprehensive policy report, executive summaries, scientific publications and via internet.
8. Installation of a quality control programme.

Participating countries and institutions

EU 27 and European non-EU countries, ICP Forests, National Forest Inventories, NGOs e. g. in the field of ornithology

Duration

2008 – 2010,
(with a view for full implementation of the system in a second phase 2011-2013)

Utilized monitoring network

☒ Level I ☒ NFI ☒ other: Remote sensing information

☒ Level II ☒ BioSoil

Topic area monitoring: role of forests in protection of soil and water

Title of module

Enhancing protective functions of forests for soil and water under changing environment and forest management (Protect)

Main objectives

1. Assessment of air pollution and climate change impacts as well as forest management effects on protective functions of forests
2. Assessment of forest sites at risk for nutrient depletion and groundwater/surface water contamination with nitrogen and toxic elements
3. Evaluation of needs and effectiveness of liming and/or nutrient recirculation,
4. Derivation of recommendations for sustainable forest management aimed at preserving the protective functions for soil and water

Description (max. 2 Pages)

Deposition of pollutants, global warming and forest management alter nutrient and element cycles of forest sites: e.g. increased nitrogen saturation of forest soils will enhance N leaching from forest soils into groundwater and surface waters. Recent developments on fossil energy markets resulted in increased demand for fuel wood and the EU aims to increase the share of biomass for energy supply in the community. Forests have a considerable potential to contribute to energy supply, but intensive fuelwood harvesting (especially full-tree harvesting) may result in nutrient depletion of forest soils. In addition, climate change may alter nutrient cycles in the future. Future emission reductions will reduce inputs of air pollutants, but the release of previously deposited pollutants will alter the protective functions of forest ecosystems for decades.

The project-module will:

1. assess processes and trends of acidification, eutrophication, nutrient leaching, input of toxic substances and their allocation to the ecosystem compartments (on Level II plots, based on results of module EDANF:). Based on Level II process studies, it will elaborate transfer functions for element and water fluxes for different site types, forest types and deposition pattern to be applied on Level I plots.
2. perform large-scale assessment of status and trends of element contents and element balances in forest ecosystems based on results from the Level I network (BioSoil, national soil inventories).
3. relate the nutritional status of main tree species to site conditions, deposition, tree vitality and climate factors;
4. define indicators for a risk assessment of element depletion, eutrophication and water contamination.

5. test the feasibility of regionalisation / up-scaling approaches in some selected regions (depending on participating countries –possibly covering different climatic, edaphic and deposition situations and forest types across Europe).
6. assess the influence of forest management (e.g. tree species selection, harvesting – including different harvesting intensities, techniques and strategies, regeneration strategies) and stand properties (age, structure, tree species mixture) on element cycling and nutrient allocation.
7. identify sites sensible to nutrient depletion,
8. define the ecological constraints for sustainable forestry based on site type and deposition regime,
9. evaluate the needs of liming / nutrient recirculation and the long-term effects of liming /nutrient recirculation,
10. derive recommendations for forest and environment policy and forest management; including development of concepts for the transfer of data from forest monitoring to scales of respective activities.

Methods and data used

Nutrient and element balances (input-output budgets) will be calculated for different site types, deposition regimes, stand types and harvesting intensities.

Processes to be studied on Level II-plots:
Element input from deposition and weathering, uptake by vegetation and element allocation to different ecosystem compartments, element output with harvesting, element output with seepage water,
Data used:
Level II: Deposition, soil solution, soil, meteorology, growth and yield, foliar, ground vegetation, crown condition, phenology, litterfall

Results on processes (element fluxes) from Level II plots to be up-scaled to Level I, using transfer functions and the following data:

Level I:
soil, ground vegetation (from BioSoil or national soil inventories), crown condition

Data from other sources:
data for element contents in different tree compartments for estimation of element exports under different utilisation scenarios,
Modelled large-scale deposition data (for current and future deposition),
interpolated official meteorological data,
regional climate scenarios

data on soil, site quality, forest structure etc. for the entire forested area.

Expected results/European benefit

Identification of forest sites sensitive to nutrient depletion and water contamination. Recommendations for sustainable forest management and for forest and environment policy ensuring protective functions for soil and water including support to the aims of the EU Water Framework Directive and the EU Soil Strategy.

Demonstration of the feasibility of up-scaling / regionalisation of plot information to derive spatially explicit information on nutrient and element balances, with a view to a future broader application for risk assessments and the planning of mitigation measures.

Deliverables

1. Transfer functions allowing up-scaling of Process information gained on Level II-plots for spatial assessments at different geographical scales
2. Description of the up-scaling and regionalisation models used
3. Indicators for the risk of nutrient depletion, eutrophication and water contamination
4. Hints for the feasibility of the regionalisation / up-scaling approaches in some selected regions (depending on participating countries –possibly covering different climatic, edaphic and deposition situations and forest types across Europe).
5. Contribution to risk assessments and consequent recommendations for environment policy and forest management at different scales from the forest management unit to larger regions in Europe.
6. Dissemination of the results through written reports, maps, presentations and via EFICP

Participating countries and institutions

EU 27 and European non-EU countries, ICP-Forests, DG JRC

Duration

2008 - 2010

Utilized monitoring network

☒ Level I ☒ NFI ☒ other, please specify: national soil inventories, forest site mapping

☒ Level II ☒ BioSoil

Topic area: forest fire

(not yet available; will be integrated later)

Supporting Actions

Title of module
Further development and implementation of an EU-Level Forest Monitoring system (Futmon)

Main objectives
The activities are aimed at developing and implementing an EU-wide forest monitoring system as an open information system on the state of forests and the impact of environmental change on forest functions and productivity. The thematic scope of the surveys will be broadened to comply with novel information needs of environmental and forest policy and forest managers.
The monitoring system will combine and enhance existing tools and complement them with new elements such as remote sensing. The current set of intensive Level II plots will be screened and a list of core measurements will be developed and implemented in order to improve the effectiveness of the assessments and the potential to satisfy current and future information needs.
The new monitoring design will be tested in a demonstration project and provide measured data for the thematic reports on climate change, biodiversity, protective functions. The data will also contribute to policy information needs in the fields of the Thematic Strategy on air pollution, water policy, the soil and forest resources in Europe.

The project-module includes:
1. Enhancing representative sampling,
2. Improving the experimental design of long term intensive monitoring,
3. Develop linkages between monitoring on existing or redesigned Level I and Level II networks and NFIs,
4. Acquisition of field data and maintaining the time series of former Level I and Level II assessments

Description

The major strength of forest monitoring in the framework of the Forest Focus Regulation and ICP-Forests is the trans-national harmonisation of methods, allowing to provide comparable data at national and European scale. Furthermore, long time-series are needed as a valuable basis for the assessment of the dynamic processes of environmental change and ecosystem response.

There is however an urgent need to address new information needs of environmental and forest policy, resulting from new issues such as climate change, the loss of biodiversity and sustainability. A wealth of information relevant for these topics is available at national level from NFIs. To make full use of this information at the European scale, harmonization and the development of linkages between the different networks is needed.

Sub-module 1: Enhancing representative sampling

Current state and changes of forest condition have been observed on sample plots systematically distributed over entire Europe since roughly 20 years. The

measurements taken on those plots were coordinated by EC-Forest Focus and ICP-Forests. A harmonised system of nomenclature was implemented for assessing core attributes (e.g. crown condition, needle/ leave discoloration, fructification, biotic and abiotic damages). The European-wide forest soil monitoring is carried out on the Level I network. The ongoing BioSoil-Project – a Pilot project under the Forest Focus regulation - provides core data sets on soil condition and on structural attributes of the forest stock and ground vegetation. These attributes do not only cover structural aspects of biodiversity but are also relevant for the assessment of carbon storage in European forests.

Some of the attributes which were initially developed to assess the effect of airborne pollutants on forests prove also relevant as indicators of ecosystem response to Climate Change. However, the experiences gained show that the current monitoring schemes cover current and future information needs only to a limited extend. Especially in the fields of climate change effects on forests, the protective function of forests, or forest biodiversity the available data sources show deficits as well as in the applicability for describing cause-effect relationships related to forest ecosystem health and vitality. BioSoil was a first step to broaden the scope of forest monitoring in Europe. Additional sets of core attributes need to be developed and implemented in the representative sampling on Level I and/or NFIs.

This project-module will enhance the current Forest Focus/ ICP-Forests monitoring by simultaneously maintaining the time series of former Level I assessments. The adequacy of the current statistical sampling scheme will be assessed and modified as appropriate. The list of attributes will be enhanced in order to widen the scope of information demands and to satisfy future information needs. The further development of the Level I system will as well study the possibilities to combine the assessments with national forest inventories (cf. item 3) and remote sensing.

Sub-module 2: Improving the experimental design of long term intensive monitoring

The study of the impact of air pollution, climate change and forest management on forest ecosystems and forest sites renders the intensive, consistent, and multi-seasonal assessment of a suite of attributes describing the state of vegetation and soil and their change over time as well as driving factors of disturbances and ecosystem response necessary. Intensive monitoring allows to study different influences on forest ecosystems (including the effects of forest management) and their interaction, including effects on neighbouring ecospheres, such as the atmosphere and the hydrosphere. It provides valuable insight into underlying processes of disturbances and ecosystem response. Transfer functions and indicators can be derived that can be implemented in extensive sampling surveys in order to obtain a representative figure on air pollution and climate change effects on forest ecosystems. If combined with models (climate models, forest growth models, water budget models, nutrient and element budgets, etc.), it is a powerful tool to assess risks, to build scenarios of ecosystem response to environmental stress and to test management options for adaptation.

The intensity of assessments and related cost implications allow only for studies on sites, which are limited in number and area. The selection of study sites has to be guided by the objective to derive hypotheses on cause-effect relationships; the hypotheses have to be verified by representative sampling, or by further experiments (which are not part of this project but of complementary research

projects which should be launched e.g. in EU 7th FRP). The need to study cause-effect relationships drives the selection of study sites: only sites, where effects are found qualify for further investigations.
In the past, Forest Focus and ICP-Forests concentrated their respective efforts on intensive monitoring on Level II plots. The insight gained over time suggests to revise the current set of Level II plots and decide which plots should be maintained or excluded from further assessments and to identify factorial constellations which are currently not covered and where new sites should be allocated. A set of selection criteria needs to be developed that guides the selection of intensive monitoring plots. The current assessments on individual Level II plots show distinct differences in the number and intensity of parameters assessed. Urgently needed is a predefinition of a core set of attributes and their associated measurement that should guide the assessments on intensive monitoring plots. The "core plots" will increase the efficiency of data acquisition and provide comparable data for further causal inference.
The feasibility of the system of core plots will be studied in a demonstration project, which implements the screening of plots according to the selection criteria and the application of the core measurements on the plots which passed the screening or were newly established.

Sub-module 3: Develop linkages between monitoring on existing or redesigned Level I and Level II networks with NFIs

In national Forest inventories, core structural attributes of forests are assessed. Several countries have already extended time series which allow for evaluations of changes over long time frames covering several decades. While the main focus of NFIs is on productive functions of forests and the development of growing stock the NFIs provide also valuable information on forest biodiversity (e.g. tree species composition, stand age and structure, dead wood, forest type), carbon stocks in above-ground biomass, forest protective functions etc.

Current work undertaken by ENFIN and a study launched by under Forest Focus aim to harmonise the information gained from NFIs.
However, in most cases NFIs have been established on sampling plot networks which are different from the Level I-grid. This renders more difficult integrated evaluations of NFI-data together with findings from the Level I monitoring and the intensive monitoring network. To make full use of synergies, linkages between the different networks will be developed and tested in pilot studies. The harmonisation concepts of ENFIN have to be further developed in order to integrate NFIs in the European Forest Monitoring System.

Sub-module 4: Acquisition of field data and maintaining the time series of former Level I and Level II assessments

While further developing the monitoring networks and the set of attributes to be assessed, monitoring will continue to be implemented, maintaining the time series. While proceeding with the assessments on Level I and Level II, new attributes will be incorporated in the following years, e. g. those developed and tested in the BioSoil-demonstration project and in the modules of the present Project proposals. Furthermore, the feasibility of the system of core plots and core measurements for the revised Level II programme will be studied in a demonstration project.

Expected results/European benefit

The Level I monitoring scheme will be transformed to a system providing harmonised and most purposeful information on forests in the MS. The cost-efficiency of intensive monitoring will be increased. Linkages and synergies with NFIs will be developed and tested. The project-module will provide data for studying biotic responses and biotic adaptation to Climate Change and air pollution, causal inference, and risk assessment.

Policymakers as well as forest resource and nature/landscape managers will receive relevant information. The data collected are expected to facilitate forest sector policies and support reporting for international initiatives and processes such as FCCC, Kyoto-Protocol, CLRTAP, CBD, FRA, or MCPFE.

Deliverables

1. Revision of the manual on Level I assessments including nomenclature for additional attributes and revised sampling scheme.
2. A selection scheme for Level II plots for further assessments and identify conditions under which new intensive monitoring plots are needed.
3. A set of core attributes/parameters to be assessed on intensive monitoring plots and their respective measurement rules
4. Schemes and plans for the implementation of core attributes in the intensive monitoring and for the provision of data.
5. Concepts for the linkage of Level I, Level II and NFIs to improve the basis for integrated evaluations and increase the effectiveness and efficiency of the monitoring system.
6. Implementation of the revised assessment scheme in a demonstration project.
7. An evaluation report on the demonstration project, assessing the feasibility of the new concepts and identifying their strengths and weaknesses in satisfying novel information needs
8. Provision of data to the European Forest Data Centre and for special studies and reports on climate change and air pollution effects on forests, forest protection, protective functions, forest fires, and forest biodiversity.

Participating countries and institutions

EU 27 and European non-EU countries, ICP Forests, National Forest Inventories, DG-JRC, ENFIN

Duration

2008 - 2012

Utilized monitoring network

☒ Level I	☒ NFI	☒ other: Remote sensing information
☒ Level II	☒ BioSoil	

Title of module
Forest Information and Communication Platform (EFICP)

Main objectives
In line with key action 18 of the FAP, the development of a European Forest Information and Communication Platform will be realised to achieve the best use and dissemination of available information on the forest sector.

Description (max. 2 Pages)
The data achieved by activities funded under LIFE+ will be merged and made available for multiple uses. This requires the maintenance of data management systems, data analysis and preparation and dissemination of reports. The specific nature of forest ecosystem related information needs renders modelling approaches and causal inference necessary to guarantee the best possible use of the available data sets.
Beside data from forest monitoring programmes (Level I, Level II, NFI) additional data sets exist on the European Level, that should be utilized for cause-effect analyses and modelling. Those additional data sets are among others remote sensing, meteorological data, digital terrain models, CORINE land-cover data, geological maps and other geo-referenced data. This requires the implementation of meta-data catalogues (as initiated by the NEFIS project), the enhancement of harmonised systems of nomenclature, and the implementation of techniques for data fusion. Activities have already started under INSPIRE and need to be coordinated by the European Forest Data Centre
The investigation of the functioning of ecosystems and their response to disturbances requires causal inference. Much scientific knowledge is gained through direct observation for which forest monitoring provides ideal data sets. In general, however, challenges to understanding transcend that which can be observed directly, so that inference is an essential aspect of scientific activity. It is typically not possible to observe all aspects of a phenomenon of interest, and this situation is very much the case for relationships under causal investigation.
The results of long-term observations and causal inference need to be utilized to develop models that allow the prediction of the development of forests under different scenarios of climate change, air pollution and other disturbances. As different aspects of causal effects on forest ecosystems require different modelling techniques, specific empirical and process based models needs to be developed. The development of models and the conflation of individual models to a suite of models will be coordinated by the European Forest Data Centre.
Data collection, analyses, dissemination of results, and the preparation of reports on status and trends of forest resources in Europe will be coordinated with the existing activities and mandate of ICP-Forests.

Expected results/European benefit
The forest information and communication platform will provide an open information system on the status of forests in Europe. Aggregated and targeted information will be provided to Commission Services, policy makers, Stakeholders and the general public. The information will facilitate forest sector policies and support reporting for international initiatives and processes such as FCCC, Kyoto-Protocol, CLRTAP, CBD, FRA, or MCPFE. It will help to reduce the reporting burden for MS and provide an interface for European data collection systems and scientific research.

Deliverables

1. Regular reporting for EU and candidate countries (in complement to the reporting made by the Member States) to forest fora, notably the SFC, other EU bodies and MCPFE, as well as to global FRA and forest condition under the CLRTAP
2. Reporting as agreed and required on other forest related commitments, notably in the framework of CBD, UNFCCC and Kyoto Protocol
3. Aggregated up-to-date information on forests for stakeholders and the general public, contributing to the awareness on the value of forests and threats on them
3. Causal inference and epidemiological studies based on those data and the available long time series in order to increase our understanding of ecosystem process, with special reference to climate change and air pollution

Participating countries and institutions

EU 27 and European non-EU countries, ICP Forests, National Forest Inventories, DG JRC, DG Env, EEA

Duration

2008 - 2012

Utilized monitoring network

☒ Level I	☒ NFI	☒ other: climatic data, deposition data
☒ Level II	☒ BioSoil	

Appendix II

Literature

EC DG ENV, 2006: Adaptive capacity to climate change may be overestimated, DG Environment News Alert Issue 26, June 2006

EEA, 2005: Vulnerability and adaptation to climate change in Europe, EEA Techical report No. 7/2005, Copenhagen, 79 p.

Harris, A.H., 1993: Wisconsinan pre-pleniglacial biotic change in southeastern New Mexico. Quat. Res. 40:127-133

IPCC, 2007: http://www.ipcc.ch/press/prwg2feb07.htm

OECD, 2006: Declaration on integrating climate change adaptation into development co-operations, OECD Headquarters, Paris, 4 April 2006

R. Päivinen, M. Köhl, 2005: European Forest Information and Communication System (EFICS), Technical Report 17, 2005, European Forest Institute199 p.

Parmesan; C., G. Yohe, 2003: A globally coherent fingerprint of climate change impacts across natural systems, Nature, Vol. 421: 37-42

Rothman, K.J., 1998: Modern Epideimology, Lippincott Williams and Wilkins; 2nd edition, 752 p.

Root, T.L., J.T. Price, K.R. Hall, S.H. Schneider, C. Rosenzweig, J.A. Pounds, 2003: Fingerprints of global warming on wild animals and plants, Nature Vol. 321: 57-60

Schmidt, K., 1891: Das Kreisflächen-Aufnahmeverfahren des Herrn Oberforstrath Zetsche, Allgemeine Forst- und Jagdzeitung 11. Jg.: 73 - 76

Schröter et al., 2005: Ecosystem service supply and vulnerability to global change in Europe, Science 310: 1333-1337

UN-ECE/FAO, 2001: Temperate and Boreal Forest Resources Assessment (TBFRA) 2000, UN, New York

UN-ECE, 2006: The condition of forests in Europe; 2006 Executive Report, Hamburg, 33 p.

Wigley, T.M.L., 2005: The climate change commitment, Science 307: 1766-1769