

United Nations Economic Commission for Europe (UNECE)
Convention on Long-range Transboundary Air Pollution (CLRTAP)

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

MANUAL

on

methods and criteria for harmonized sampling, assessment,
monitoring and analysis of the effects of air pollution on forests

Part I

Objectives, Strategy and Implementation of ICP Forests

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1 Introduction

In response to widespread concern that air pollution could affect forest condition, the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) was established by the Convention on Long-range Transboundary Air Pollution (CLRTAP) under the United Nations Economic Commission for Europe in 1985. One year later the European Union (EU) adopted the scheme on the protection of forests against atmospheric pollution and with Regulation (EEC) No. 3528/86 the legal basis for co-financing of relevant assessments was provided. This was replaced by Regulation (EC) No 2152/2003 (Forest Focus) adopted by the European Parliament and the Council for 2003 to 2006. From 2009 to 2011 the EU supported the forest monitoring at European scale on a project basis (Further Development and Implementation of an EU-level Forest Monitoring System, FutMon) under the LIFE+ Regulation.

Besides its original purpose the monitoring system and the monitoring data can also be used for international processes of environmental policies other than CLRTAP. This applies in particular to the FAO Global Forest Resources Assessment (FRA) and the future Global Forest Survey (GFS), to the Forest Europe process (formerly: Ministerial Conference for Protection of Forests in Europe (MCPFE)), the Convention on Biological Diversity (CBD), to the Framework Convention on Climate Change (UNFCCC), and the European Commission. The monitoring pursues the objectives of Resolution S1 of the Strasbourg, Resolution H1 of the Helsinki, and Resolution L2 of the Lisbon Ministerial Conference on the protection of Forests in Europe. It also contributes to the discussion on global forest policy, such as the Intergovernmental Forum on Forests leading to the United Nations Forest Forum (UNFF). The monitoring and research infrastructure established within the last 30 years may in the future also contribute to terrestrial research infrastructures within new international consortia.

At present, 40 European countries as well as the United States of America and Canada are participating in the Programme, which includes assessments according to harmonized and standardized methods following this ICP Forests Manual, which has developed into an important platform for the exchange of expert knowledge. Results of ICP Forests provide the scientific basis for political decisions on air pollution control and thus contribute to the elaboration and review of protocols of the CLRTAP. Moreover, ICP Forests' monitoring activities can contribute to other aspects of relevance for forest policy, such as effects of climate change on forests, forests' contribution to climate change mitigation, sustainable forest management, and biodiversity in forests.

2 Structures and Objectives of ICP Forests

2.1 Background

The objectives of ICP Forests are based on both the long-term strategy of the CLRTAP (ECE/EB.AIR/133/Add.1) and the long-term strategy of the WGE (ECE/EB.AIR/2009/17/Rev.1). The long-term aims to which all Task Forces respectively ICPs under the WGE (see Fig. 2.1-1) are expected to contribute are:

Assessment of knowledge on

- The present status, long-term trends and dynamics, and the degree and geographical extent of the impact of air pollution, particularly, but not exclusively, its long-range transboundary impact,
- Exposure-response relationships for agreed air pollutants,
- Critical loads, levels and limits for agreed air pollutants, and their links to observations,
- The linkages between the effects of air pollution, biodiversity and the effects of changes in climate and land use.

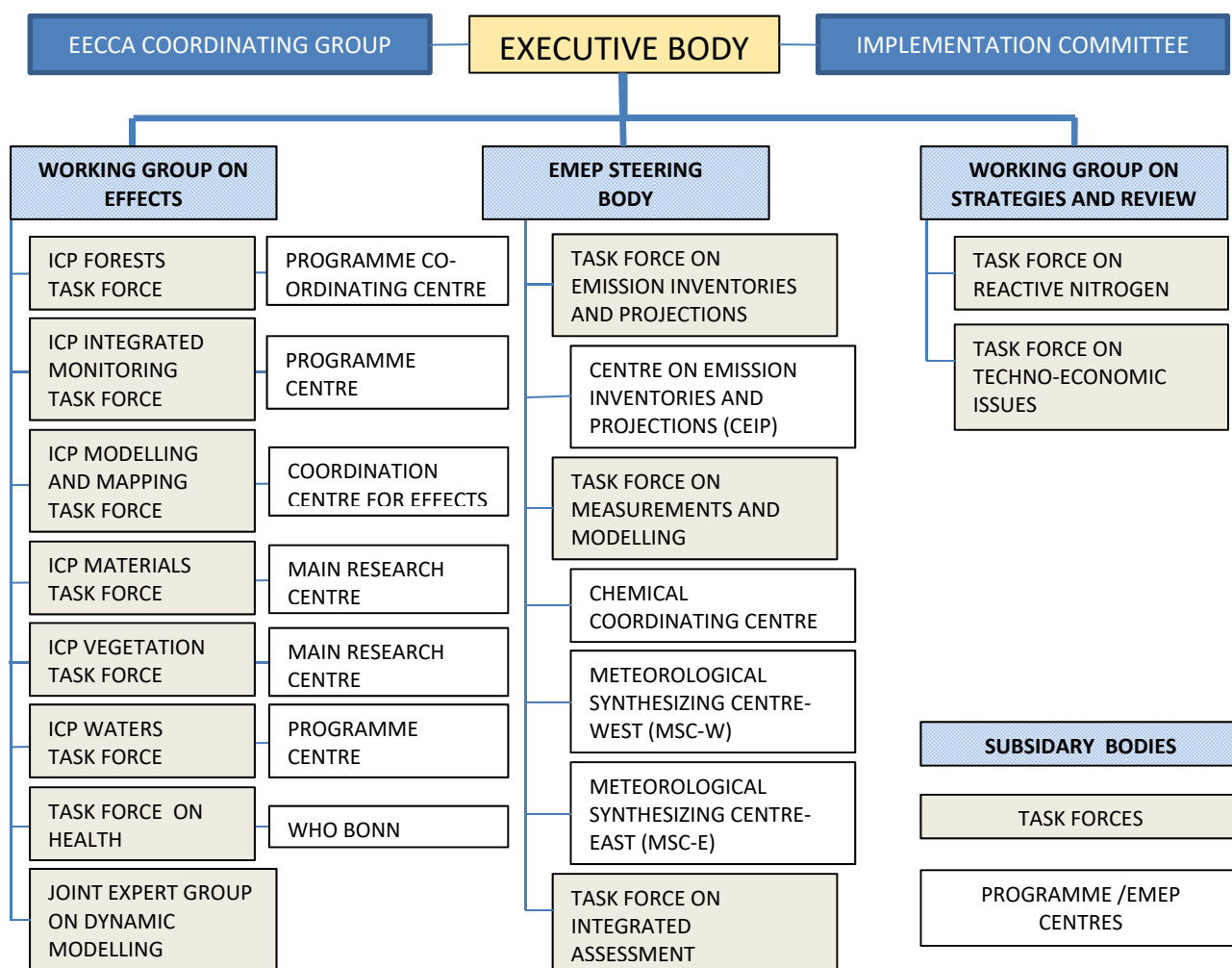


Figure I -1: Organisational chart of WGE and related intergovernmental bodies under CLRTAP

Moreover, the long-term strategy of WGE specifies the following priorities to ICP Forests:

- Derivation of exposure-response functions for chemical and biological effects of air pollutants, inter alia for effects of nutrient nitrogen, ozone and acidifying pollutants on ecosystems' functioning and biodiversity, in combination with other stresses such as land management and climate change;
- Further development of modelling and mapping procedures, particularly for effects of nitrogen and ozone on the environment and for the description of dynamic processes of

damage and recovery due to eutrophication, acidification, and heavy metal accumulation, including biological effects;

- Evaluation of environmental benefits of air pollution control policies, as well as contribution to economic assessment of damages.

Two-year's workplan items and in the future mandates laid down as Annex to the Memorandum of Understanding between the UNECE CLRTAP Secretariat and the Thünen Institute (see Chap. 3.1.5) further specify the effects-oriented activities.

In order to meet the information needs of WGE, ICP Forests pursues the following two main objectives:

- Objective 1: A periodic overview on the spatial and temporal variation of forest condition in relation to anthropogenic and natural stress factors (in particular air pollution) by means of European-wide and national large-scale representative monitoring on a systematic network.
- Objective 2: A better understanding of the cause-effect relationships between the condition of forest ecosystems and anthropogenic as well as natural stress factors (in particular air pollution) by means of intensive monitoring on a number of selected permanent observation plots spread over Europe and to study the development of important forest ecosystems in Europe.

These objectives imply in accordance with the long-term priorities of WGE contributions to calculations of critical loads and levels and the assessment of their exceedances. They imply also dynamic modelling of the response of forest ecosystems to deposition scenarios expected for the future. Additional insight is gained by compiling available studies from the National Focal Centres (NFCs) and from related programmes inside and outside CLRTAP. In this respect close cooperation is sought with the other relevant ICPs under WGE.

To better address the above objectives, strategies of ICP Forests have been periodically developed since 1998. The most recent strategy, adopted by the Task Force in Luxembourg in May 2016, covers the period from 2016 to 2023 and is included as Annex 1 to this Part I of the ICP Forests Manual.

2.2 General features of ICP Forests

2.2.1 Monitoring activities

In order to meet its data generation and reporting obligations, ICP Forests employs data collection at two levels.

- Large-scale monitoring (Level I) provides a periodic overview of the spatial and temporal variation in a range of attributes related to forest condition. Level I plots, national forest inventory (NFI) plots, and other related inventory plots may be combined when appropriate, feasible and necessary, according to defined and agreed procedures.
- Intensive monitoring (Level II) is carried out on plots installed in important forest ecosystems. These plots are dedicated to in-depth investigation of the interactive effects of anthropogenic and natural stress factors on the condition of forest ecosystems.

2.2.2 Quality assurance and control

All monitoring activities are largely harmonized and standardised within ICP Forests among the participating countries and are laid down in this Manual. This ensures a standard approach for data collection and evaluation and can be further developed towards a future common European or even global forest monitoring programme. A consistent quality assurance (QA) approach is applied within the programme covering the setup, methods, data collection, submission and investigation

as well as reporting. Quality assurance and control is supervised by the Programme Co-ordinating Group (PCG) through its Quality Assurance Committee (QAC). A set of Expert Panels (EPs) cares for data quality assurance within the specific surveys and for the further development of monitoring methods and standards. This includes field checks, intercalibration courses, laboratory ring tests, and data validation.

2.2.3 Data evaluation

A range of monitoring variables is required to meet the information requirements of CLRTAP and other international institutions. The Programme Co-ordinating Centre (PCC), the PCG and the EPs are responsible for a data evaluation and reporting approach based on the general mandate given to the PCC of ICP Forests and on current 2-years' workplans both negotiated at WGE level and agreed on by the UNECE CLRTAP Secretariat on one side and the Thünen Institute on the other side. If appropriate, international and national data from other programmes and institutions should be included in combined analyses. The main topics for data analyses are:

- Forest condition
- Effects on forest ecosystems from acidity, nitrogen, and ozone

as well as contributions in the fields of

- Climate change
- Biodiversity.

The integrative monitoring approach of ICP Forests using the Level I and Level II networks provides robust data on the condition including health aspects and stability of forests. This facilitates an understanding of the effects of deposition on the role and functioning of forest ecosystems in protecting soils and water. Furthermore the programme surveys can contribute to the understanding and forecast of climate change effects on forests and can be used to supply information on the sequestration of carbon and are going to provide information on forest biodiversity as an integral part of forest ecosystems.

Trends in deposition and effects on the adaptation and vulnerability of forest ecosystems are evaluated. This includes spatial and temporal changes and cause-effect relationships with special emphasis on critical loads and their exceedances. Dynamic models and transfer functions derived from suitably selected intensive monitoring plots are used to investigate the effects of air pollutants, climatic factors and greenhouse gases on forest ecosystems in space and time. Resulting model values are validated against measured data collected at the plots.

2.2.4 Deliverables

Results are published via reports and scientific publications available under: <http://icp-forests.net/page/publications> (see Chap. 3.4).

Relevant results from ICP Forests important for WGE and other CLRTAP bodies are summarized by PCC and the chairperson of ICP Forests. The most recent versions of such summaries are available under: <http://www.unece.org/index.php?id=43514> along with version from earlier years.

3 Programme Implementation

3.1 Organization of ICP Forests

3.1.1 Overview

The organisational structure of ICP Forests is shown in Figure 3.1-1. The programme is steered by its Task Force where all participating countries are represented by their National Focal Centres (NFCs). The Programme Co-ordinating Centre (PCC) and the Programme Co-ordinating Group (PCG) including a Quality Assurance and a Scientific Committee care for the full implementation of the programme. Programme co-ordination, database management as well as evaluations and reports are entrusted to the PCC. The Forest Soil Co-ordinating Centre (FSCC) assists in preparing and evaluating soil data while the foliar data are treated and evaluated by the Forest Foliar Co-ordinating Centre (FFCC). In response to the demand for harmonized and standardised monitoring at both Level I and Level II, EPs were established and mandated to develop and maintain suitable and up-to-date methods, and to support proper data evaluation.

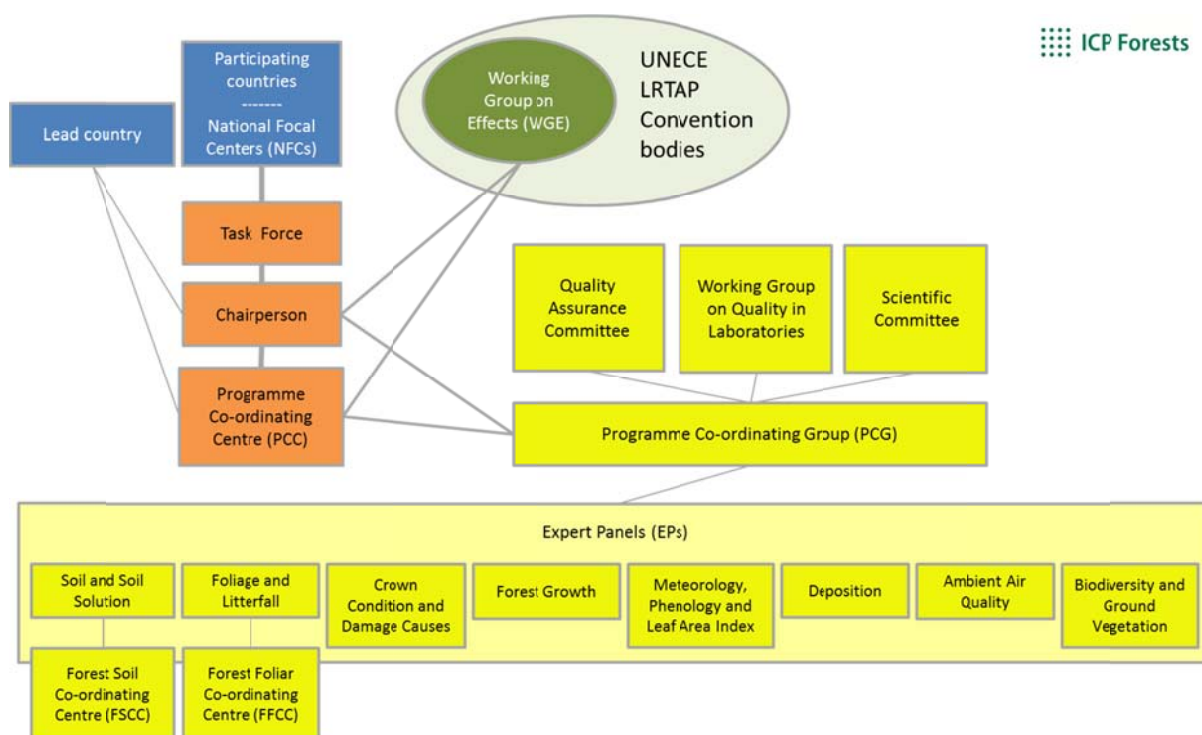


Figure 3.1-1: Structure (organogram) of ICP Forests.

3.1.2 The Task Force

The programme is steered by the Task Force, in which 42 participating countries are represented by their responsible ministries and their NFCs. The European Commission (EC) might be represented as well. The Task Force is the highest body of ICP Forests. All relevant programme issues have to be presented to the Task Force. The Chairperson - supported by the Lead Country and the PCC - prepares, convenes and chairs annual Task Force meetings.

3.1.3 The National Focal Centres (NFCs)

The NFCs are nominated and financed by the participating countries. They are responsible for the collection, validation, evaluation and storage of their monitoring data and aggregation of national data in accordance with the ICP Forests Manual. The NFCs and their responsible agencies have to ensure that the data is collected according to the methods described in the Manual and that the quality assurance programme has been applied. The NFCs evaluate and interpret their national data. In the last years an enormous potential for evaluation and advancement of knowledge of forest ecosystems has been gained at national level. Increasing attention also at national level is paid to integrative data evaluations.

The NFCs have the task to submit the Level I and Level II data and accompanying information to the PCC in accordance with the agreed deadlines and format. The NFCs are invited to participate in the evaluation and interpretation of the data at European level. In case that part of the national responsibilities is delegated to sub-national agencies, PCC needs to be informed accordingly.

Within the procedures under the Intellectual Property and Publication Policy of ICP Forests, NFCs inform PCC on contact details of experts that are interested to participate in specific evaluations.

3.1.4 The Lead Country

The Lead Country installs the Chairperson and maintains the PCC, supports the Chairperson and the PCC to prepare, convene and chair the annual meetings of the Task Force. The Lead Country also convenes and chairs meetings of the PCG, fosters co-operations with the EC, and supports the contact with other monitoring programmes within and outside CLRTAP.

3.1.5 The Chairperson

The Chairperson of ICP Forests is appointed by the Lead Country or by a Co-lead Country. This country(ies) is(are) responsible for funds to enable adequate scope for action. The chairperson represents ICP Forests externally and plays a central role internally. The chairperson connects the different entities of ICP Forests and fosters its coherency, leads the Task Force and – in accordance with the Lead Country – the PCG meetings. He or she supports the contact with other monitoring programmes within and outside CLRTAP as well as the co-operation with the EC. Together with the head of the PCC of ICP Forests the chairperson represents ICP Forests within the WGE and is part of its Extended Bureaux.

3.1.6 The Programme Co-ordinating Centre (PCC)

The PCC is hosted by the Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries and located at the Institute of Forest Ecosystems in Eberswalde, Germany. Together with the chairperson the head of the PCC of ICP Forests represents ICP Forests within the WGE and is part of its Extended Bureaux. PCC is entrusted with a broad range of tasks including:

a) Assistance to the Chairperson, the Task Force, and the PCG in the continuous review, further development, and implementation of the programme. This comprises:

- Interface functions between ICP Forests, related ICPs, and WGE;
- Maintenance of a platform for information exchange including the ICP Forests website;
- Preparation and organisation of meetings;
- Editorship of the ICP Forests Manual;
- Management of the budget of ICP Forests and fund-raising for the co-ordinating and monitoring costs
- Execution and stimulation of data analyses

- Publication of results in reports of ICP Forests and scientific journals.
- b) Database management including:
- Online data acquisition from NFCs;
 - Data validation;
 - Data dissemination to third parties, management of the procedures under the Intellectual Property and Publication Policy of ICP Forests.

3.1.7 The Programme Co-ordinating Group (PCG)

The PCG has the task to continuously review and further develop the monitoring and to support the Chairperson in all issues of relevance for the future of the programme. Recommendations of the PCG are directed to the Task Force of ICP Forests. Members of the PCG are the Chairperson, the Lead Country, the PCC, the chairpersons of the Expert Panels, the Scientific Committee, the Quality Assurance Committee, the Working Group on Quality in Laboratories and possibly a representative of the EC. In order to meet these tasks, the PCG needs to convene regularly. A participation of representatives of NFCs in PCG meetings as well as representatives of the WGE or the UNECE secretariat may be considered.

3.1.8 The Scientific Committee

The Scientific Committee promotes and fosters scientifically sound evaluations and publications within the programme and explores links between ICP Forests and international scientific communities at various levels in close cooperation with PCC, PCG and the EPs.

3.1.9 The Quality Assurance Committee

The Quality Assurance Committee further develops concepts and approaches to enhance the quality of evaluated data. This applies especially of all kinds for field methods. This work is done in close cooperation with the respective EPs and the PCC.

3.1.10 The Working Group on Quality in Laboratories

This group is mainly concerned with chemical analyses of probes from different media or forest ecosystems. This includes definition and optimisation of transport conditions from the field to the laboratories, preparation treatments of probes and evaluation of the whole range of available analytical methods in the laboratories itself.

3.1.11 The Expert Panels (EPs)

The EPs further develop the harmonized methods as laid down in this manual. This includes the development of methods and standards including data quality assurance, as well as supporting and actively working towards integrative data evaluations and scientific publications. For specific purposes and for a limited period of time, additional ad hoc working groups may be established consisting of representatives from different EPs. The EPs hold EP and joint-EP meetings.

3.2 Monitoring activities and manual updates and revisions

The methods and standards of the monitoring activities are laid down in the various parts of this manual. Part II describes the monitoring design at the two intensity levels (Level I and Level II) including plot selection and plot design. Also described are the data submission procedures, database management, as well as principles of data dissemination and acknowledgements in

publications. From Part III onwards, data quality assurance and the methods and standards of individual surveys are described in detail.

Investigation methods, variables to be measured and QA/QC procedures are under continuous screening by the EPs (see Part III). This continuous process provides the basis for manual updates and revisions. Manual updates can occur at any time as a result of the activity of individual EPs and WGs. Before entering into force, the update must be approved by the Task Force of ICP Forests. Manual revisions embrace a much broader process, when all individual parts are subject to a more in depth review and modification. Revisions are carried out on a 5-year basis. A revision must also be formally approved by the Task Force.

3.3 Data analyses

Analyses of the monitoring data pursue the objectives of ICP Forests laid down in Chapter 2.1. Both the Level I and in particular the Level II approaches call for an integration of the data from various monitoring surveys. The possibility for integrating data from different investigations into a cohesive evaluation system is the most important aspect related to the Level II plots. The integration can be achieved at different levels according to data availability in space and time. Forest over-all condition (health) in terms of growth, tree condition, plant diversity and soil condition can be impacted by biotic (pests and diseases) and abiotic (e.g. climate, air pollution) factors, the effects and importance of which depends on inherent site properties (e.g. site history and management, topography, soil condition) according to complex and often mutual relationships. These relationships can be fully investigated only if data from all investigations are available. Another option can be to consider modelled data from available and suited models, provided model outputs can be applied with confidence to the situation of the plot being considered. In this respect, the wealth of data collected on Level II sites can be used to establish deterministic relationships that can be useful for deriving estimates of unmeasured variables at given sites.

3.4 Publishing and reporting

The WGE asks in its long-term strategy to “further develop forms and methods for efficient, comprehensive and timely communication of scientific results with the Convention and to policymakers, the scientific community and the general public”. To comply with these demands ICP Forests has developed a multi-level publication and reporting system. Research, review and methodological papers regarding air pollution and other impacts on forest ecosystems published in reviewed scientific journals are targeted at the scientific community. The initiative for these publications is to be taken up by all members of ICP Forests, however initiatives are expected especially from members of the EPs, the Committees, and the PCC.

In order to provide general overviews on monitoring results and their interpretation with respect to relevant results of forest damage research as well as on special topics for a broad public, ranging from politicians across NGOs and environmentalists to forest owners and the general public currently glossy brochures (traditionally called Executive Reports) and ICP Forests briefs are issued. The scientific and technical basis of the monitoring is provided by annually published ICP Forests Technical Reports along with evaluations and reviews to be carried out by the EPs, the PCC, and the NFCs. Other suitable contributions can be included as well. The target group of the Technical Reports is mainly experts involved in the work. The responsibility for the brochures, the briefs, and the Technical Reports lies with the PCC.

3.5 Data release and acknowledgement

ICP Forests data is available for use by the wider scientific community. Experts and data providers of the monitoring programme are available to support external data users. Data is made available upon request. External users need to agree to and need to acknowledge the intellectual property policy of ICP Forests (see Annex 2).

3.6 Citation of ICP Forests reports and manuals

ICP Forests reports and publications should be cited as follows:

Author(s or editor), year: title. (In: **Editor** [e.g. UNECE ICP Forests Programme Co-ordinating Centre (ed.)]: title of omnibus volume [e.g. Executive Report...]), **publisher** [e.g. Thünen Institute of Forest Ecosystems], place, pages or n of pages. [optional: DOI], [optional: available from: IP address].

The recommended form of citation should be included in all scientific ICP Forests publications on the back cover or on a colophon page. As a contribution to the increasing importance of the WWW, the DOI and IP address of the respective ICP Forests website should additionally be given in square brackets.

The ICP Forests Manual as a whole is suggested to be cited as follows:

UNECE ICP Forests Programme Co-ordinating Centre (ed.), 2016: Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests. Thünen Institute of Forest Ecosystems, Eberswalde [available from: <http://icp-forests.net/page/icp-forests-manual>].

Individual parts of the ICP Forests Manual should be cited as follows:

Authors, 2016: [Title of relevant manual part]. In: UNECE ICP Forests Programme Co-ordinating Centre (ed.): Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests. Thünen Institute of Forest Ecosystems, Eberswalde, [n of pages], [available from: <http://icp-forests.net/page/icp-forests-manual>].

Annex I – Strategy of ICP Forests 2016–2023

I ICP FORESTS IN SHORT

The 'International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests' (ICP Forests) is a work programme within the 'Working Group on Effects' (WGE) of the 'Convention on Long-range Transboundary Air Pollution' (CLRTAP) under the United Nations Economic Commission for Europe (UNECE). ICP Forests is led by a Chairperson and administered by its Programme Co-ordinating Centre (PCC). The Programme Co-ordinating Group (PCG), its Committees (Scientific Committee (SC); Quality Assurance Committee (QAC)), the Expert Panels (EPs) and the National Focal Centres contribute to the Programme.

II MISSION STATEMENT

The mission of ICP Forests is to carry out multifunctional long-term monitoring of forests within the UNECE region and beyond and provide scientific knowledge on the effects of air pollution, climate change and other stressors on forest ecosystems.

III AIMS

ICP Forests pursues the following aims:

- *Forest Condition.* Provide a continuing overview on forest health, vitality, forest soil condition and biodiversity status in relation to anthropogenic (air pollution, atmospheric deposition) and natural stressors.
- *Cause-effect relationships.* Contribute to a better understanding of cause-effect relationships between anthropogenic as well as natural stressors and forest condition and processes.
- *High quality data.* Provide high quality and open access data managed in one central database for risk assessment for forests across Europe, large-scale and long-term trend analyses as well as model validation and calibration, serving also as a reference for global assessments.
- *Infrastructure.* Develop and maintain highly equipped forest measurement stations as central data hubs and standardized forest monitoring and research infrastructures across Europe.

IV FEATURES OF THE CURRENT PROGRAMME

ICP Forests works at two levels:

- The systematic large-scale monitoring (Level I) provides periodic overviews of the spatial and temporal variation in forest health, vitality and forest soil condition.
- The intensive monitoring (Level II) is carried out on permanent, highly equipped forest monitoring plots to foster integrative studies on cause-effect relationships based on consistent and harmonized long-term data series.

All monitoring activities are described in the "Manual on methods and criteria for harmonised sampling, assessment, monitoring and analysis of the effects of air pollution on forests". This

ensures reliable and consistent information and quality assurance by a standardised approach for data collection and evaluation.

Quality assurance and control

A consistent quality assurance is guaranteed for the set-up of methods, data collection, submission, validation, as well as reporting and publishing. This includes field checks, inter-calibration and cross-comparison courses, inter-laboratory ring tests, data validation procedures and internal reviewing.

Data and database

A large range of data is provided. All data are kept in a central database and managed according to agreed guidelines as laid down in the Manual. Data are open for internal and external use upon request.

Evaluation, reporting and publishing

ICP Forests

- publishes annual *technical reports* on main scientific topics including long-term effects from e.g. acidification, eutrophication, ozone and other relevant impacts on forest ecosystems;
- publishes syntheses, highlights, and extracts of results compiled in annual *executive reports* addressing public and political stakeholders;
- publishes *scientific papers* in peer-reviewed scientific journals addressing the scientific community;
- organizes scientific conferences and publishes *proceedings* to foster the exchange among scientists, stakeholders and policy makers;
- encourages participating countries to publish *national forest reports*, which complement and support the ICP Forests dissemination efforts.

V VISION FOR THE FUTURE

Our vision is for a European-wide forest monitoring infrastructure, integrating multiple levels and providing high quality, transparent, robust and open access data i) on the status and trends of forest health, vitality, productivity and biodiversity; ii) on risks of forests being exposed to anthropogenic and natural stressors (separately and combined), and iii) on progress in achieving relevant policy goals to diminish risks.

VI OBJECTIVES AND ACTIONS

We focus on new challenges for forest health, vitality and diversity in relation to the impact of transboundary air pollution and climate change to further develop the ICP Forests programme in the next period (2016–2023). To support work to realise the future vision ICP Forests states its commitment to:

- **intensify co-ordination** of the national monitoring activities by offering standardized infrastructure and facilities to potential users, such as forest authorities, environmental

agencies, and research institutions, for additional research activities complementing the central purpose and data, thereby deriving improvements and/or extensions such as long-term experimental monitoring sites to the programme.

- **broaden the scope of monitoring activities** for the unique long-term data series of traits and processes in forest ecosystems by considering topics such as climate change effects, ecosystem services, biodiversity, and large-scale scientific investigations.
- **follow-up on relevant international policy issues** and offer collaborations by supplying the scientific background for forest related policies and providing advice to national and European policy makers.
- **strive for long-term financing** of activities, particularly including the maintenance of existing infrastructure and required staff as well as exploring more mechanisms for sustainable funding.
- **increase the visibility** of the programme to improve the acknowledgement as well as the funding opportunities, by organizing scientific conferences and workshops (partly in co-operation with other ICPs and forestry organizations), by publishing peer-reviewed scientific articles in highly ranked journals, policy briefs, fact sheets, information bulletins, and in social media (internet blogs, ResearchGate, Facebook, etc.). The current publication strategy is renewed.
- **foster a high quality and transparent database** and work towards open access to researchers and stakeholders.
- **strive towards maintaining used field measurement methods** at the latest state of the art to guarantee for high-quality data. A review of the Manual every five years and Expert Panel meetings continuously promote the awareness and discussions on the latest methodologies and instrumentation. The concept of core plots with more in-depth investigations will be further explored.
- **explore new tools and technologies** (e.g. satellites, remote sensors, proximal sensing, new analytical instruments, modelling tools, information technology) and strive for incorporating them into the programme.
- **use monitoring data for** testing cause-effect relationships, long-term trend analyses, modelling (calibration, parameterization, and validation) and evaluating effects of forest management and environmental policy strategies.
- **enhance co-operation with other ICPs** to promote integrated and cross-sectorial evaluations and reporting as well as unified measurement protocols through e.g. mutual funding and scientific conferences.
- **stress the global importance of air pollution monitoring** and increase the motivation to common activities by closer collaboration with monitoring networks outside of Europe, such as NADP (USA) and EANET (East Asia) and by inviting members from SEE and EECCA countries into the ICP Forests network.
- **encourage and increase future collaborations** with other research activities and monitoring platforms by joint use of research infrastructures, open data access, data harmonization,

federated databases and large-scale scientific evaluations and hereby attain possibilities for an even more comprehensive terrestrial monitoring research programme.

- **feed information into other bodies and programmes** such as the FAO Forest Resources Assessment (FRA 2015 and its long-term strategy), the Ministerial Conference for Protection of Forests in Europe (*Forest Europe*), the UN Convention on Biological Diversity (CBD), the Framework Convention on Climate Change (UNFCCC), and other appropriate bodies, e.g. of the European Commission.

VII ADOPTION

This strategy of ICP Forests is fully in line with the long-term strategy of the Convention (2010–2019, ECE/EB.AIR/2008/6 and ECE/EB.AIR/106/Add.1, Annex), the revised long-term strategy of the WGE (2010–2020 and beyond, ECE/EB.AIR/2009/17/Rev.1) and the most recent work plan (ECE/EB.AIR/122/Add.2) for the effects-oriented activities of the WGE.

This document was adopted at the 32nd Meeting of the Programme Task Force of ICP Forests in Luxembourg, 13 May 2016. By the end of 2016, ICP Forests develops a plan for how and when to work towards implementation of each of the actions. In the year 2020, a mid-term review of this strategy will take place.

APPENDIX: AREA OF IMPLEMENTATION AND MEMBER STATES

The ICP Forests Strategy 2016–2023 is targeted at all 51 Parties (as of November 2013) of the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP): Albania¹, Armenia², Austria, Azerbaijan², Belarus², Belgium, Bosnia and Herzegovina¹, Bulgaria¹, Canada, Croatia¹, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia², Germany, Greece¹, Hungary, Iceland, Ireland, Italy, Kazakhstan², Kyrgyzstan², Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova¹, Romania¹, Russian Federation², Serbia¹, Slovakia, Slovenia¹, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia¹, Turkey¹, Ukraine², United Kingdom, United States of America, and the European Union.

ICP Forests has 42 members (as of January 2016): Albania, Andorra, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom, and the United States of America.

¹) South East Europe (SEE) Programme of the EU and ²) Eastern Europe, Caucasus, and Central Asia (EECCA) region of the OECD

Annex II – Intellectual Property and Publication Policy

The Intellectual Property and Publication Policy (IPPP) covers rules, rights and obligations to be applied for data supply, data request, and use from the official ICP Forests PCC Collaborative Database (ICP Forests DB).

The aims of this Intellectual Property and Publication Policy (IPPP) are to:

- stimulate cooperative scientific studies among internal and between internal and external partners of the ICP Forests network;
- protect the rights of owner- and authorship;
- ensure proper co-authorship and acknowledgement.

Rights and Obligations of the Applicant

Data Application

- 1 In order to receive access to data from the ICP Forests DB, the applicant has to submit this application form to the PCC. The applicant is declaring the intended use of the data requested specifying the scientific purpose of the study, the duration, the methodological approach and the sub-contractors foreseen to also work with the data.
- 2 The data application is first evaluated by the PCC for formal correctness. Hereafter, the PCC sends it to all relevant NFCs for evaluation.
- 3 A response by the NFCs containing the decision over the submitted proposal may be expected from the PCC within 4 weeks. [1]
- 4 Following the rules under the LRTAP Convention data access by applicants can only be denied or restricted by the contributors if appropriate reasons are provided. [2]
- 5 Information provided with the application will be made public on the ICP Forests website. [3]

Use of Data

- 1 In case of a positive evaluation the applicant is allowed to use the requested data for the scientific purpose described in the proposal and to publish the results.
- 2 It constitutes a breach of the agreement if data is submitted to other parties or used for purposes other than declared in the proposal.
- 3 The applicant is free to provide requested data to peer-reviewed journals for validation purposes on demand if the peer-reviewed journal does not request to publish this data.
- 4 The applicant is not allowed to include the explicit co-ordinates of ICP Forests monitoring plots in any publication.

Distribution of Results

- 1 Any publication based on data from the ICP Forests DB has to be provided to the PCC for publication on the ICP Forests website. [4]
- 2 The applicant informs the PCC if a publication can be shared on the ICP Forests website according to the publisher's rules.
- 3 If any rules and regulations stand against an open publication, only metadata on the article such as author, co-authors, title and journal will be published.

- 4 The applicant agrees to report on the progress of the data evaluation using a standardized report form which will be distributed by the PCC annually.

Scientific Collaboration – Co-Authorship

- 1 The applicant is obliged to offer a scientific collaboration to interested members of the ICP Forests Network to gain the requirements for a co-authorship.
- 2 According to the Vancouver Protocol [5], which is used as an international standard for ethics of publication, all following criteria have to be fulfilled to be named as a co-author:
 - a Conception and design, or analysis and interpretation of data
 - b Drafting the article or revising it critically for important intellectual content
 - c Final approval of the version to be published.

Acknowledgements

- 1 The applicant is obliged to properly acknowledge the origin of used data with the following acknowledgement text in any publication: **“The evaluation was based on data that was collected by partners of the official UNECE ICP Forests Network (<http://icp-forests.net/contributors>). Part of the data was co-financed by the European Commission (Data achieved at “download date”).”**
- 2 For any form of graphical presentation of results (e.g. maps, tables, presentations) the following short label should be used including the hyperlink to the official ICP Forests website: **“Based on ICP Forests data” (<http://icp-forests.net>)**

Rights and Obligations of the ICP Forests Network

- 1 A two-year exclusive right for data evaluation is granted to the ICP Forests Network for Internal Evaluations. Data evaluation by the ICP Forests Network is regarded as the final step of validation and is thus essential to ensure appropriate data quality.
- 2 Internal Evaluations can be initialized by the Chairperson of ICP Forests, the PCC, the Expert Panel Chairs and/or other bodies under the LRTAP Convention [6]
- 3 For any Internal Evaluation the official application form is to be submitted to the PCC by the person(s) initializing the evaluation.
- 4 The NFCs will be informed by the PCC about any Internal Evaluation using the provided application form.
- 5 Internal Evaluations do not need the permission of concerned contributors.
- 6 Any member of the ICP Forests Network has the right to be included in any Internal Evaluation.
- 7 The requirements for a co-authorship remain according to the criteria of the Vancouver Protocol.

Processed Datasets

Based on the measurement data collected during the monitoring activities several processed datasets have been created by members of the ICP Forests Network. Those datasets can only be requested for Internal Evaluations.

Precision and Quality of Data

- 1 In order to respect national property rights, plot co-ordinates of some countries will be provided only at the accuracy of geographic minutes for External Evaluations.
- 2 A list of those countries is included in the data request approval letter by the PCC.
- 3 The measurement data is not interpolated to those generalized co-ordinates. So data from listed countries cannot be used for spatially explicit pinpoint analyses.
- 4 Neither the PCC nor the contributor is fully responsible for data quality. Only the close collaboration between the applicant and the concerning members of the ICP Forests Network can guarantee for a full understanding of the data, their relevant background information (metadata), and overall quality, including accuracy and applicability. A list of (national) experts of the ICP Forests network is available under: <http://icp-forests.net/page/expertlist>

The data is requested for the following kind of usage:

non-commercial / scientific commercial

I confirm that I have read and understood the Intellectual Property and Publication Policy of ICP Forests and guarantee that I will maintain it.

Date:

Signature:

Annex to the Intellectual Property and Publication Policy

Application and Publication Process

In the following, the individual steps of the required application process are described for both, Internal and External Evaluations. Recommended response times are given in parentheses.

- 1 The applicant completes this official data application form and submits it to the PCC, hereby accepting and agreeing to the conditions of this IPPP.
- 2 The PCC informs the NFCs about the application and the proposed purpose for the provision of data (2 weeks).
- 3 The NFCs consider the application and respond within the following categories (4 weeks) In case other parties than the NFC are responsible for the data contribution the NFC might further distribute the request to concerned parties and co-ordinate the final decision delivered to the PCC:
 - **Rejection:** the contributor is not convinced that the data will be fairly used and duly acknowledged or there is a significant conflict of interest. Following the data rules under the LRTAP Convention, the contributor is obliged to provide specific reasons for rejecting the release of data.
 - **Permission:** the contributor is satisfied with the proposal and agrees that the respective data is provided to the applicant. The contributor may name contact details of relevant experts of the ICP Forests Network for scientific collaboration.

An Internal Evaluation cannot be rejected by the contributors. There is no formal reply of the contributors to the applicant. Instead, the contributors that are interested in a direct involvement of the proposed analyses may contact the applicant directly.

In case, the contributor does not participate in the application approval process within a predefined period (4 weeks), the final decision over the application is up to the PCC.

- 4 The PCC compiles the NFCs' responses and informs the applicant about the final decision on the approval of the submitted application (2 weeks), including:
 - any information needed to get access to the data;
 - the list of experts to be contacted for collaborations.
- 5 The applicant shares any publication based on ICP Forests data with the PCC as pdf-file. The applicant informs the PCC if the publication can be shared on the ICP Forests website according to the publisher's rules. If any rules and regulations stand against an open publication, only metadata will be published on the website.

Explanation of Used Terms

- **ICP Forests DB:** the official ICP Forests PCC Collaborative Database
- **Contributor:** representatives of NFCs and any other institution delivering data to the ICP Forests DB listed under <http://icp-forests.net/contributors>
- **Applicant:** a third party, individual, or institution that applies for data access
- **NFC:** National Focal Centre
- **PCC:** Programme Co-ordinating Centre of ICP Forests [7]

- **ICP Forests Network:** Contributors, Expert Panels (EPs) and the PCC
- **Internal Evaluations:** Evaluations initialized by the Chairperson of ICP Forests, the PCC, the Expert Panel Chairs and/or other bodies under the LRTAP Convention [6]
- **External Evaluations:** Evaluations initialized by Applicants other than bodies under the LRTAP Convention [6]

[1] In case that data is contributed by different contributors of one country (e.g. representative institutions of federal states) the corresponding NFC organizes the national work and information flow.

[2] Report of the Executive Body on its twenty-fourth session held in Geneva from 11 to 14 December 2007 – Addendum – Part Two: Decisions adopted by the Executive Body – Decision 2006/1

[3] <http://icp-forests.net/page/project-list>

[4] <http://icp-forests.net/page/scientific-publications>

[5] Anonymus (2008): Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication. Updated October 2008. International Committee of Medical Journal Editors. <http://www.icmje.org>

[6] Convention on Long-range Transboundary Air Pollution (CLRTAP)

[7] The PCC is responsible for the application approval process and the protection of the rights of both parties, the Contributors and the Applicants, according to this IPPP.

Please see attached document “data application form.pdf” on the following page.

DECLARATION of ICP Forests data contributor

The PCC of ICP Forests is

- authorised to forward the data as requested
- authorised to forward data as requested with the following restrictions
.....
- not authorised to forward any data for the following reason
.....
to (name and address of applicant)

for the project (name of the project)
due to following reasons:

- Experts are available for scientific input in the activities and shall be put in touch with the applicant to discuss potential collaboration.

(name and institute of experts, e-mail address)

Data provision is agreed under the condition that the intellectual property policy of ICP Forests is respected

National Focal Centre of

Date:

Signature:

Please return the signed declaration to
Programme Co-ordinating Centre of ICP Forests
Thünen Institute of Forest Ecosystems
Alfred-Möller-Strasse 1, Haus 41/42
16225 Eberswalde
Germany

Fax: 0049 3334 3820-354

Annex III – Minor changes after 2017

Date	Minor change to latest published version in 2017	Affected sections of this document