

# IUFRO

International Union of Forestry Research Organizations  
Union Internationale des Instituts de Recherches Forestières  
Unión Internacional de Organizaciones de Investigación Forestal  
Internationaler Verband Forstlicher Forschungsanstalten

## IUFRO Task Force "Forest, Climate Change and Air Pollution"

Final Report of the Period 1991-1995

Occasional Paper

4

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"Forest, Climate Change and Air Pollution"

Final Report of the Period 1991-1995  
edited by N. Kräuchi

IUFRO Occasional Paper Nr. 4

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# Final Report for the Period 1991-1995

## 1. Introduction

The IUFRO Task Force "Forest, Climate Change and Air Pollution", which was formed following a IUFRO Executive Board Decision in 1990 and which was formally constituted in 1991, will finish its work at the end of 1995. The aim of this final report is to a) present the Task Force concept; b) to list the Task Force activities; c) to summarise existing IUFRO activities with respect to landuse change, climate change and air pollution in relation to forests; and d) to present the conclusions and recommendations of the Task Force.

## 2. Operational Plan of the Task Force

### 2.1. Legal Basis

- IUFRO Statutes Article IV, Ch. 1.7, VII, 12., XIV, 1.
- XXIV IUFRO Executive Board Meeting, April 29- May 6 1990, Vienna (Austria) and Prague (Czech Republic); Appendix 3, Ch. 4.
- XXV IUFRO Executive Board Meeting August 3-5, 1990, Auberge Far Hills, Val Morin, Québec: Recommendations, Appendix 5, Ch. 3.1, Appendix 7 (Executive Board).

### 2.2. Framework and general objectives

The subject area of the Task Force is the world-wide interaction of global climatic change, air pollution and forests, especially the effects of climate change on forests, the effects of air pollution on forests and the effects of forests on climate change.

Within this context, the Task Force was designed to:

- provide, without ideological bias, information on the state of science, through easily understandable reviews of existing research knowledge
- disseminate scientific facts, individual opinions, existing hypothesis, uncertainties, conflicting views and gaps in our knowledge
- propose to the IUFRO Executive Board ways of disseminating the information obtained in order to furnish a useful basis for decision-making in research planning, forest management and environmental policy
- encourage the exchange of information and coordinate, as far as possible, the activities within IUFRO that are required beyond the Project Group programme
- promote contacts and coordination between IUFRO and other organizations and advise the IUFRO Executive Board on appropriate contacts
- call the attention of the IUFRO Executive Board to the nature of emerging forest problems and suggested remedial action, where justified by scientific findings
- encourage a holistic approach in research and forest management.

### **2.3. Working methods**

The following working methods were approved by the Executive Board:

- The Task Force operates in close collaboration with the IUFRO Divisions
- The Task Force will not commission research itself, but will summarise information coming from research groups
- The Task Force works on the basis of voluntary contributions from the members
- The contributions from the members can take the form of scientific reports, decision-making or administration
- These contributions will be financed by the organizations for which the members are working
- Decisions will be reached through meetings, telephone conversations, or correspondence
- The administration of the Task Force will be conducted by the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmensdorf (Switzerland).

### **2.4. Members and organization**

The Task Force has a Committee and a Contributing Board. The Task Force Committee consists of the Coordinator, the Deputy Coordinator, a Scientific Secretary and two other members. Its members are nominated by the IUFRO Executive Board on the basis of proposals made by the Task Force Coordinator. The Task Force Committee comprises the following five members:

Prof. Rodolphe Schlaepfer, Task Force Coordinator; Dr. John L. Innes, Deputy Coordinator; Dr. Norbert Kräuchi, Scientific Secretary; Prof. John M. Skelly, Committee Member; Prof. Ryszard Siwecki, Committee Member. R. Siwecki and N. Kräuchi joined the Task Force Committee in 1993. F. Haemmerli and H.-P. Bucher, both former Scientific Secretaries of the Task Force, resigned from their respective posts in 1992 and in spring 1993.

The Contributing Board is composed of an unlimited number of scientific experts from different fields with which the Task Force is concerned. Its members are nominated by the Task Force Coordinator. Its role is to provide the Task Force Committee with information related to specific areas of expertise and to review documents produced by the Task Force.

## **3. Main activities 1991-1995**

### **3.1. Activities in 1991**

The Task Force Committee was constituted in 1991 and its Operational Plan was approved in April 1991 by the IUFRO Executive Board. The Task Force Contributing Board was drawn up in September 1991. By the end of 1991, about 25 experts had accepted invitations to join the Task Force.

Members of the Task Force presented papers at conferences and represented IUFRO in different groups, including the IGBP-GCTE Focus 3 Meeting in Wageningen, the International Conference "Acidification Research: Evaluation and Policy Applications" in Maastricht, and at the EC-Workshop "CO<sub>2</sub> and Terrestrial Ecosystems" in Brussels.

The Task Force Coordinator acted as an observer in the United Nations-Economic Commission for Europe Task Force on the Assessment and Monitoring of Air Pollution Effects on Forests in the ECE-region and was responsible for liaison with the International Geosphere-Biosphere Programme IGBP, especially GCTE.

### **3.2. Activities in 1992 and 1993**

The members of the Task Force presented papers at conferences and represented IUFRO in different groups, including the International Cooperative Programme "Assessment and Monitoring of Air Pollution Effects on Forests" of the UN-ECE, the International Geosphere Biosphere Programme, the IUFRO Regional Meeting of Eastern Europe, and the Ministerial Conference on the Protection of Forests in Europe (expert level preparatory meeting). At each meeting, the Task Force, on behalf of IUFRO, emphasised the need for an independent, objective position based on a sound knowledge of forest science. The objectives and the working methods of the Task Force were published in IUFRO News. The Task Force also published an item on the International Geosphere Biosphere Programme in the IUFRO News, encouraging links between IUFRO and IGBP. The Task Force submitted a proposal for a IUFRO Policy document drawing attention to the need to develop a comprehensive IUFRO policy oriented towards the requirements of forest research in the 21st century (Appendix I), as well as detailed comments on the draft Strategic Plan proposed by President.

A major effort was the publication of the progress report "Long-term Implications of Climate Change and Air Pollution on Forest Ecosystems", Vol. 4 of the IUFRO World Series in 1993. Demand for this publication was very good and the report is the best-seller in the World Series.

The first meeting of the Full Task Force Committee took place in late July 1993 in Switzerland.

### **3.3. Activities in 1994 and 1995**

The Task Force has been very active over the last 18 months. The members of the Task Force presented papers at conferences and represented IUFRO in different groups, including the GCTE Science Meeting in Woods Hole, MA, the 26th Air Pollution Workshop in Ithaca, NY, the 27th Air Pollution Workshop in Cuernavaca, Mexico, the UN-ECE Task Force on "Assessment and Monitoring of Air Pollution Effects on Forests", the Workshop on "Effects of Global Climate Change on Boreal and Temperate Forests" in Jiloviste, Czech Republic, the "Vth Symposium on the protection of Forest Ecosystems" in Poland and the International Working Group Meeting on Global Forest in Ottawa, Canada, sponsored by Canada and Malaysia. Parts of the Task Force World Series Vol. 4 was translated into Czech by the Forestry and Game Research Institute, Jiloviste (Czech Republic).

The full Task Force Committee met in University Park, PA in March 1994 and a further meeting was held in January 1995 in Birmensdorf, Switzerland where the upcoming activities of the TF were discussed (see below). A questionnaire was sent to all Divisional Coordinators and Leaders of IUFRO Subject Groups, Project Groups and Working Parties asking them about the status and research activities within IUFRO in relation to climate change and air pollution effects on forests (c.f. chapter 4).

The Task Force submitted a proposal for the future development of the Task Force (c.f. chapter 5) to President Salleh. The proposal included subjects such as the role of a future Task

Force, its composition and its external relations as well as the publication of its results (see Minutes of the 30th EB Meeting Beijing, China, 4-8 October 1994, Appendix 8, p. 66-69).

In accordance with appendix 9 of the minutes of the 28th EB meeting, the Task Force has organised a sub-pleinary session on global change at the IUFRO World Congress (Monday, 7 August, 14:00-16.00) in Tampere. This session is organised as follows:

Moderation and introduction of speakers (Rodolphe Schlaepfer)

- "What is changing in the Global Environment" (P. Kauppi) 1
- "Climate Change Effects on Forests" (N. Kräuchi and D. Xu) 2
- "Air Pollution Effects on Forests" (J. Innes and J. Skelly) 3

The goal of the papers is to give an overview of the changes occurring in atmospheric chemistry, deposition, climate and landuse(1) and to give an overview of current scientific knowledge and future perspectives on the effects of climate change and air pollution on forests. Landuse will be addressed in a separate paper outside the Sub-Plenary session (2, 3). The papers being presented were peer-reviewed by the scientific experts of the Task Force Contributing Board. Currently, 49 scientists belong to the TF Contributing Board.

## **4. IUFRO activities with respect to Climate Change, Air Pollution and Forests**

The Task Force has compiled an assessment of all research within the broad area of landuse change, climate change impacts and air pollution impacts on forests being undertaken by individual research units within IUFRO. A questionnaire was sent to all Divisional Coordinators, Subject Group Leaders, Project Group Leaders and Working Party Chairs in IUFRO. They were asked whether their unit organised or coordinated any research within the fields of landuse, climate change or air pollution impacts on forest ecosystems. We received 97 replies from about 250 questionnaires sent. 32 Project/Subject Group Leaders indicated that their group is involved in one of the issues mentioned above and 2/3 do not address air pollution, climate change or landuse issues. The answers are compiled below.

### **4.1. Issues that have been addressed**

Which, in your view as leader, are the three most important aspects of landuse change, air pollution impacts or climate change impacts that your unit has formally addressed in the period 1990-1995?

#### **4.1.1. Climate change**

- Assessment of the likelihood of global climate change.
- Stability of ecosystems in relation climatic change, including silvicultural measures to mitigate effects.
- Defining minimum levels of climate change that will affect forests.

- Impact of a short warm period in late autumn on winter dormancy and de-acclimation, and the degree of re-acclimation following such periods
- Variability in re-acclimation among families and mechanisms accounting for the ability to re-acclimat.
- Implications of acclimation for the adaptation of populations to future environments as modified by global climate change.
- Climate change impact on Sitka spruce plantations.
- Climate change impact on plantation insect and diseases.
- Mediterranean oak decline - impact of global warming on the activity of a causal fungus (*Phytophthora cinnamomi*).

#### **4.1.2. Air pollution**

- Intensive use of forest species to reduce global air pollution. Study and recommendations for wide use of the most important species in different geographic regions.
- Central European oak declines - impact of air pollution.
- Impacts from chronic accumulation of pollution impacts on soil fauna and flora worldwide.
- Pollution impacts on forest processes.
- The impact of air pollution on Latvia's principal forest tree species (pine, spruce and birch).
- Improvement of forest damage assessment survey using CIR aerial photos.
- Critical loads and critical levels work (ozone, sulphur and nitrogen compounds).

#### **4.1.3. Landuse change**

- Evaluation and understanding of landuse changes from agriculture to forest, mainly in Europe, and already occurring over large areas.
- Quantitative assessment of site degradation as a consequence of landuse practices.
- Socio-economic factors behind landuse changes especially deforestation in developing countries.
- The place of forests in landuse.
- Agroforestry in temperate zones.
- Deforestation and afforestation.
- Landuse and landscape biodiversity.
- Central European and Mediterranean oak declines - impact of hydrology and changing landuse patterns.
- Impacts of landuse change on forest resources in Russia
- Deforestation in the mountainous regions of Asia (and also South America and Africa).

#### **4.1.4. Soil**

- Assessment of forest soil condition (extent of soil acidification and nutrient supply).
- Soil and site monitoring.
- Chemical changes and degradation of forest sites, and possibilities of reclamation and amelioration. Assessment of soil degradation as a consequence of landuse practices in the past.
- Changes in physical and chemical properties and the moisture holding capacity of grassland soils put under commercial afforestation.
- Nitrogen deposition.



- Integration of protection and other uses of forests, such as recreation in mountainous regions.
- Investigations on the effects and risks of liming and application of rock meal to counteract forest soil acidification.
- Arid sand storms in desert valleys and dry winds from the western African Sahara.
- Ecological boundary conditions to soil utilisation.
- Providing access without disturbances to slope stability, water flow and landscape.

#### **4.1.5. Carbon cycle**

- The influence of afforestation and harvesting on the carbon dioxide balance.
- Fossil fuel substitution by forest biomass energy which is renewable, sulphur-free and greenhouse neutral. Utilisation of the vast wood-residue resource for energy. Utilisation of plantation wood from new reforestation projects for energy and chemicals which will help sequester atmospheric carbon.
- Stabilisation and development of production and non-wood-producing functions of forests.

#### **4.1.6. Tree physiology and tree growth**

- What is the influence of temperature on dormancy, acclimation and de-acclimation at different seedling growth stages. Do provenances differ in their response to temperature? Is there family x environment interaction for these responses?
- Responses to carbon dioxide, water and nutrients in the plant-soil-system.
- Quantification and modelling of atmospheric impacts on forest growth and productivity at all temporal and spatial scales.
- Growth trends and changes in site productivity.
- Modelling of processes in time and space which affect trees and forests.

#### **4.1.7. Various**

- The management of forests for biodiversity and stability of the ecosystems or their successful dynamics.
- Forest management impacts on biodiversity.
- Development of a large and strong interaction between society (government, local communities and citizen groups), and forest managers' associations.
- Forest and site survey / monitoring; forest mensuration; data assessment; planning of assessments.
- Non-timber inventory.
- Changes in forest ecosystems-analysis of forest state and environmental conditions.
- Interscale relationships in forest atmospheric processes.
- Biospheric aspects of the hydrological cycle.
- Mapping of landuse change and damaged forests by means of colour-infrared aerial photography, satellite imagery and use of Geographic Information Systems.
- Statistical analysis, spatial statistics, modelling.
- Mensurational definition and models designed to assess change.
- Use of breeding experiments to monitor and forecast the reaction of tree populations to environmental changes, and use of tree breeding/genetic information to specify the strategy of maintaining forest ecosystems (genetic structure of species, effective population size etc.).
- Establishing a consistent baseline against which change could be assessed.

- Traffic impacts on forests.
- Natural forest ecosystems vs. plantation forest ecosystem in tolerance to climate change and air pollution.
- Protection of genetic diversity as a component of global forest management facing uncertainties in climate change.

#### **4.2. Aspects that should be addressed in the period 1995-2005**

Which, in your view as leader, are the three most important areas that IUFRO should address in relation to landuse, climate change and air pollution issues in the period 1995-2005?

##### **4.2.1. Climate change**

- The distinction between natural variation and long term cycles and true trends.
- Boreal and coniferous forests in a changing climate.
- Forests and atmospheric carbon dioxide.
- Climatic stresses limiting the main tree species.
- Silvicultural policy (especially use of species) in areas where climate change threatens a change in forest type or deforestation.
- Management tools to counteract impacts of climate change and for the restoration of acidified and depleted forest soils.
- Changes in variation of rainfall and temperature in areas now considered as prime forestry areas and possible effects on productivity.
- Impact of climate change on forest ecosystems.
- Global warming impacts on existing forests where major shifts in forest type might occur.
- Impacts by insects and disease as a result of climate change.
- Biodiversity impacts created by climate change.
- Changes in forest health as dependent upon climatic changes.

##### **4.2.2. Air pollution**

- Consolidation of pollution measures and impact measures in relation to timber production, ecological diversity, and amenity.
- Reduction in the use of high sulphur fuels particularly in environmentally sensitive areas and areas of high health risk.
- Long-term changes of chemical status and nutrient supply of forest ecosystems due to air pollution impacts.
- Efficient use of the forest resource, targeting 100% utilisation of forestry and forest products residues.
- Toronto targets for CO<sub>2</sub> reduction by 2005-through fossil fuel substitution and atmospheric carbon sequestering by reforestation.
- Tropospheric ozone and its effects.
- Determination of forest management procedures to improve forest stands vitality in regions with high level of forest damage.
- Impact of air pollution on forest ecosystems.

##### **4.2.3. Landuse change**

- Multi-dimensional measures of utility which may be collapsed appropriately onto simple dimensions (monetary?). Inclusion of generalised concepts of ecological diversity.
- Site classification for appropriate landuse.

- Nature conservation areas.
- Driving factors behind change in landuse (social science).
- Consequences of landuse change on the environment (e.g., climate).
- Forest conservation by utilisation of all functions of the forests in a sustained-yield, multiple-use concept.
- Near-natural utilisation of all functions of forests for optimum use and with minimum disturbance.
- Development of procedures to assist land managers to make decisions on how to manage resources for the good of the whole.
- Environmental change/degradation, including humus and soil processes.
- Policy analysis- how to affect the development.
- Cost effective methods to determine landuse and changes thereof.
- Means for getting closer to nature in forest management.
- The changes in forest structure affecting the hydrological cycle.
- Forest-policy instruments for the application of ecologically sound forest management at both national and international scales.
- Agroforestry; land swapping between forestry and agriculture, and the environmental problems involved.
- Adaptation of forest ecosystems to global changes in their environment and the health condition of tree species; flexible systems of forest management.
- Landuse and agroforestry.
- How can deforested areas be effectively reforested and the process of desertification be stopped?

#### **4.2.4. Various**

- International trials with a large number of compatible plantations over a wide range of environments that are evaluated considering environmental influences on trees.
- Increased use of forest products as a source of energy and for uses such as building materials.
- Spontaneous processes in forest ecosystems and multiple stress response of trees.
- Role of forests in the global carbon cycle (carbon dioxide sequestration) - especially the quantification of current changes in the tropics, U.S. and Eastern Asia.
- Establishment of an international baseline inventory and monitoring system that is consistent country to country, especially in the tropics and in the boreal region.
- The interscale relations in forest-atmosphere interactions.
- Environmental statistics and modelling including more collaboration with researchers outside of forestry.
- Quantification and modelling of the nature of forest changes between and within forest ecosystems (we still have difficulty characterising transitional phases in forest dynamics).
- Changes in fauna of the disturbed forests with the main emphasis on the insect pathogens (imported, sanitary and compulsory parasitic species).
- Role of the *Armillaria mellea* group.
- Continuous trend evaluation and research - monitoring systems.
- Maintaining or increasing species diversity of forests.
- Follow-up of forest health with a view to outbursts of pest and diseases and their causes.

#### **4.3. Output:**

Please describe the nature of any output in this area (e.g., Workshop/Conference Proceedings, Resolutions papers in journals etc.)

Although many groups have organised several meetings and participated at conferences, each individual researcher normally uses his own publication channels. No conference has ever been organised to address all the issues covered by the Task Force. Based on the information available, several IUFRO Subject groups organise relevant meetings and conferences, sometimes in collaboration with other international and national organizations (see also appendix IV). The aim of the conferences is primarily focused on the research topics of the organizing committee. There is a chance that topics such as the long-term impact of global climate change and/or air pollution on forest ecosystems are discussed in one or more of the presentations but in most cases the overall discussion focus on specific problems in e.g., ecology, statistics, genetics, modelling, ecological engineering, harvesting, socio-economics, monitoring, silviculture and management.

#### **4.4. Other comments from IUFRO groups:**

##### **4.4.1. Landuse change**

- Afforestation/Agroforestry in temperate regions. Agroforestry management systems and intercropping with medicinal plants in plantations should be given priority.
- Deforestation, climatic change, and pollution are fields which require research outside the fields of biological sciences and ecology. An example is change in human behaviour, which needs research in fields such as psychology, motivation and economics.
- Subject group S6.12.03 has focused on the economics of landuse, biodiversity and the stability of forests.

##### **4.4.2. Mitigation**

There is a potential for the forestry and forest products industry to become as successful as the crude oil and petrochemical industry if it can put its efforts into developing its resource base, products and processing to the same degree. Its major advantage is that its resource is renewable. However, it must be developed in an ecologically and environmentally acceptable and sustainable way.

##### **4.4.3. Various**

- Forest condition depends on many factors. Climate is one of them. Forest condition can be surveyed. However, in surveys, very many factors are confounded and the evaluation of the causal influence of a single factor is extremely uncertain. Under the auspices of IUFRO, international provenance trials have been established. In these experiments, there is an efficient control of most of the possible confounding factors and the experimental series are spread over a wide range of environments. The experiments are already established, so no investment in time or money is required. In many cases, measurement data are available so the only substantial cost is the the analysis. Latitude and altitude explain 56% of differences in growth! Precipitation explained an additional part. It ought thus to be simple to construct a model explaining growth as a function of simple climatic components. This knowledge will be helpful in analysing consequences of climate changes in the boreal forest conditions. There are also more sophisticated analysis: international provenance trials can yield information by analysing how different provenances react to variable environments. Thus, if international data compiled, they can be used for many purposes.
- Biological materials are not constant, but vary and evolve. To evaluate to what degree biological changes are caused by changes in environment (climatic or chemical) it is

necessary to have biologically constant materials which are exposed in different environments. Constant materials thus must be defined and preserved over time.

- IUFRO should keep a low profile in setting research priorities where cross-border research coordination is not essential. Such activities could affect local initiatives and plurality. IUFRO should have a higher political profile on "save the world" issues, thus stating that things are going perhaps seriously wrong in the cases when the scientific community can come reasonably close to a consensus, while the political community remains inattentive.
- Databases (e.g., on climate, geographic features, and forest surveys) are essential for evaluations. The access to these bases are usually restricted because of commercial reasons. IUFRO should survey these problems and the constraints they create.
- Public algorithms and data-bases from which climate can be described with coordinates and altitude of a site as entry should be encouraged.
- The use of high speed computers, possibly parallel, in conjunction with remote sensed data will rapidly increase. The contribution that statistical methodology and mathematical modelling and optimisation techniques can make, should not be overlooked.

## Discussion

The above statements have been reproduced from the answers of the IUFRO officers with minimal editing. They reveal that there is a wide range of interests in the general themes of climate change, air pollution and landuse. However, compared to other general enquiries, the feedback resulting from our questionnaire was relatively low. We assume that most addressees who did not respond do not undertake any research within the themes being dealt with by the Task Force. A number of the groups that responded indicated that they had no activities within the scope of the Task Force. In some cases, the negative responses were rather surprising and reveal a dichotomy between the wishes of IUFRO officers as expressed in the questionnaire and the activities of others within IUFRO. A good example is provided by the strong interest in silvicultural and tree-breeding as a means of reducing the impact of climatic change on forests, which is not reflected in the programmes of some of the groups dealing with silviculture and tree breeding (see Appendix III).

The activities reported here suggest that three global issues are very poorly reflected in the overall activities of IUFRO. Naturally, there are some groups within IUFRO that have had a major impact, particularly in relation to air pollution (P2.05). However, we believe that the results of the questionnaire indicate that there is a need for the development of a research policy and structure that can address today's (and tomorrow's) key issues adequately. We have therefore proposed two options for a change to the structure of IUFRO. The first is a new Task Force, outlined in detail in the following section. The second is for a new interdisciplinary Division within IUFRO. These two options are not mutually exclusive. The major function of the Task Force would be to synthesise information coming from different research groups, where such syntheses were required. The new Division, on the other hand, would be responsible for coordinating interdisciplinary research on global issues.

## 5. Proposal

A proposal for the future development of the IUFRO Task Force: "Forests, Climate Change and Air Pollution".

## **5.1. Introduction**

The current period of the IUFRO Task Force "Forests, Climate Change and Air Pollution" has been one when increasing pressure has been placed on scientific bodies to provide answers to environmental problems. IUFRO is in a good position to answer specific questions related to particular subject areas through its existing structure. However, the questions now being asked are of an increasingly interdisciplinary nature. IUFRO should also be in an ideal position to approach interdisciplinary issues, but the structure of the Union is such that interdisciplinary coordination between groups is difficult. This is illustrated by the difficulties the present Task Force had in identifying the groups responsible for work on climate change: 32 Working, Subject and Project groups indicated that they had organised an official meeting in this area or had another type of formal interest (Appendix III). As a result, there is some confusion as to who is responsible for what, and the information flow to the EB and the President, and from IUFRO to other international organizations is not as smooth as it should be.

## **5.2. The role of a future Task Force**

Our proposal is that there should be a Task Force for global, inter-disciplinary issues that should be directly responsible to the President of IUFRO. This Task Force would not undertake or coordinate research, which is a function of the Divisions and Subject/Project Groups. Instead the Task Force would be responsible for synthesising information obtained by different groups within and outside IUFRO and presenting these as concise, state-of-the-art summaries to the President.

## **5.3. Composition of the Task Force**

Given the nature of environmental problems today, the composition of the Task Force should be flexible. Our proposal (Fig. 1) is that the Task Force should be led by a coordinator with a broad inter-disciplinary background. The members of the Task Force (maximum of 10) should consist each of leaders from a series of inter-disciplinary issues. The issues should be chosen by the President in consultation with the EB. Membership of the committees should be drawn from leaders of existing Working/Project/Subject groups, together with other experts as required. Each committee would be responsible for drafting a report on a particular issue, using both existing organizational structure of IUFRO and contributing members (in the same fashion as the present Task Force).

For example, the President might decide that the influence of climate change on forests was sufficiently important to warrant inclusion in the Task Force. A committee would be formed from existing groups within IUFRO to take into account the various interests across the different Divisions and the Chairman of this committee would automatically become a member of the Task Force. Other issues might include land use change, air pollution, forest monitoring, biodiversity or sustainable development.

## **5.4. External relations**

On a number of occasions, IUFRO has been invited to attend international meetings as a representative of the scientific community. This reflects a trend to increasingly involve non-governmental organizations in policy decisions. It is vital that IUFRO is represented at such meetings and that the representative has a good working knowledge of the issues being discussed. The Task Force would provide a pool of such expertise. This pool could either

brief delegates appointed by the EB and/or provide an opportunity for IUFRO to make a useful contribution to policy matters related to forests and forestry.

### **5.5. Presentation of results**

The Task Force would be responsible for the production of state-of-the-art reports on particular issues. These would be developed by issue committees and coordinated through the Task Force. These reports would be published by the Task Force and could be used by the President and the EB to develop official position statements.

## **6. Conclusions**

During the period 1991-1995, the Task Force provided an active forum for interdisciplinary assessments of climate change, air pollution and landuse issues. All three of these issues proved to be controversial and it would be outside the remit of the Task Force to say more than that a number of opposing views remain. In relation to climate change, there is still discussion as to whether climate change as a result of anthropogenic activities can be identified, although the Inter-governmental Panel on Climate Change is rather more confident that such changes are occurring. Within the theme of air pollution, some hold the view that large-scale (continental) declines in forest health are occurring as a result of air pollution; others deny that there is any evidence for this. With landuse change, the major controversies today surround the causes of the changes - truly interdisciplinary problems with no easy answers.

The comments received from the contributing members of the Task Force, together with the comments received from various IUFRO officers strongly suggests that the existing structure could be further improved to take into account interdisciplinary research on themes such as air pollution, climate change and landuse. There are many instances where individual groups within IUFRO are working on a theme in the belief that they are the only such group when in fact several groups are working on the same theme. This problem needs to be resolved if duplication of effort is to be avoided. To this end, we have advocated the establishment of a new interdisciplinary Division and have also proposed that the current Task Force be continued, although in a modified form. At the same time, the Task Force has made a proposal for a policy statement by IUFRO, high-lighting important issues for forest research at the present time. At a time when major developments are occurring in the international forestry policy sector, an active and pro-active role for IUFRO is important.

Even though the Task Force did not achieve all its goals for the 1990-95 period, it has been very active over the past years and has successfully accomplished many tasks. The scientific community has been very interested in our work and many joined the Contributing Board and helped to write the Task Force Progress Report. Landuse change, climate change and air pollution impacts on forests have become important issues.

## Acknowledgements

We would finally like to thank all Members of the Task Force "Forests, Climate Change and Air Pollution" who have provided stimulating support over the last years and who have helped to publish volume 4 of the IUFRO's World Series and acted as reviewers for the papers to be presented at the Global Change sub-plenary session in Tampere. We are further grateful to Erika Stotz for her assistance in many instances.

Last but not least we are grateful to the IUFRO Executive Board, its President and Secretary for their support.

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**Appendix:**

- I: Analysis and Evaluation of IUFRO Structure and Suggestions
- II. IUFRO groups that are active in Global Change issues
- III. IUFRO Groups that are not active in Global Change Research
- IV: Selected Output of IUFRO groups (based on questionnaire)
- V. Members of the TF Contributing Board

# Appendix I: Analysis and Evaluation of IUFRO Structure and Suggestions

## 1. Introduction

There appears to be a need for IUFRO to develop a comprehensive policy orientated towards the requirements of forest research in the 21st century. The following proposal for an adjustment of the existing IUFRO structure is related to the policy statement proposed by the Task Force and reproduced here.

## 2. Basis for the proposal

Any recommendation for a change in the existing structure of an international organization must be based on sound reasoning. The Task Force "Forest, climate change and air pollution" has suggested that a clear statement of policy is needed from IUFRO. Combining information from several sources, it has made the following suggestion for a policy statement:

### 2.1 IUFRO recognises that forests are ecosystems

Forests, an important natural resource of the World, are dynamic ecosystems that consist not only of trees, but which also contain other vegetation (herbs, shrubs), animals, microorganisms, soils, water and air.

### 2.2 IUFRO recognises that there are different types of forest

There are different types of forest, namely natural forests with minimal disturbance, managed forests (forests surviving primarily by natural regeneration but which are exploited by man) and plantations. All must be the object of research by IUFRO.

### 2.3 IUFRO is concerned with the holistic needs of society with regard to the forests

These roles, which vary in space and time, include:

- protection against natural dangers
- wood supply
- landscape shaping
- an environment for animals and plants
- recreation
- carbon dioxide sink

### 2.4 IUFRO is concerned with the different factors that influence forests

Different factors can influence forests or cause stress to them. Examples include: anthropogenic influences (management, industry or tourism, the economic situation, air pollution), pathogens, weather, climate etc. IUFRO should examine all influences on forests as a basis for understanding specific problems.

### 2.5 IUFRO activities are especially directed towards the most important problems of

the World's forests. These are in particular:

#### Forest ecology

- The uncontrolled destruction of tropical forests, which currently constitutes the single greatest forestry problem within the global context
- The loss of biodiversity in managed forests
- The replacement of natural and primary forests by plantations, which constitutes a major threat of biodiversity
- The difficulty of reconciling ecological and economic aspects of plantation management

#### Forest health

- The threat to forests from natural dangers
- Air pollution, which constitutes a serious threat to some forests of the World
- A possible change in climate which could potentially change the forests of the World

#### Forest economics

- The improvement of wood utilization and the incorporation of wood into new products
- The economic difficulties currently encountered by many forest enterprises
- The management of forests in view of their role as a sink for carbon dioxide
- The conflicts between different forest uses (e.g. wood production vs. recreation vs. nature conservation)
- The complexity of forest problems and their complication by many factors e.g. population growth, industrialisation, management activities, education, traditions, one-sided thinking etc.

### 2.6 Tasks of IUFRO

IUFRO as a worldwide organization should:

- a) promote the acquisition of scientific results which will serve as the basis for measures to resolve the problems in the World's forests. In particular, to improve scientific knowledge in order to restore the different forest types worldwide, that these important natural resources are then in a position to satisfy in a sustainable way the different needs of society.
- b) disseminate the results of such research in a form that is understandable by forest practitioners, national and international policy makers and the general public.
- c) encourage international research on global forest problems.
- d) promote multidisciplinary research.

IUFRO should set the following research priorities not only for managed forests and plantations but also for natural forests:

- To understand the structure, processes and dynamics of forest ecosystems
- To identify and describe the different needs of society with respect to the forest
- To investigate the biological, technological, social and economic requirements of society that forests must satisfy, such that the needs can be reconciled in a way compatible with the sustainable use of the global forest resource
- To identify, describe and investigate the problems of the World's forests

- To aim for the proposition of realistic scientific solutions to forest problems at all scales
- To set standards for the collection, analysis and interpretation of scientific data about forests.

### 3. Evaluation of current organizational structure

3.1 IUFRO has an excellent history of solving pressing forestry problems within its existing organizational structure. Within divisions, it has been able to adopt an international multidisciplinary approach to particular problems, in many cases leading to their quick resolution.

3.2 The existing divisional structure is less well geared to the solution of problems that span the competences of more than one division. No suitable structure exists for the uninhibited liaison and transfer of knowledge between divisions. Consequently, although some projects have been multidisciplinary in nature, they have not been truly interdisciplinary.

3.3 While the tremendous achievements of IUFRO are well-known within the forestry community, they are less well recognised by the international scientific community. Consequently, there is a need for more publicity of the achievements of IUFRO.

3.4 Relationships between IUFRO and other organizations are quite good, but have been conducted in an ad hoc fashion. There is a need for a general strategy promoting the interaction between IUFRO and other organizations.

3.5 While the structure of IUFRO is such that a wide range of views are possible, there seems to be a need for IUFRO as an organization to be able to make clear and concise scientific statements on key issues when required to do so. Other international organizations already have this capability with the result that contributions of IUFRO are not as widely recognised as they should be.

### 4. Suggestions for the development of the existing structure

4.1 To enable IUFRO to adopt an interdisciplinary approach to current forest problems while maintaining its excellent research record in specific areas, the Task Force suggests that the existing structure be maintained. **However, a new division should be added which has the sole responsibility of dealing with interdivisional and interdisciplinary problems.**

4.2 Each section in this new division should be oriented towards a specific problem. Consequently, some sections will be only temporary in nature. The coordinator of each section should be in a position to call on the expertise of individuals of groups from throughout the remainder of the organization.

4.3 The Task Force also wishes to suggest that the EB of IUFRO is enlarged to include a person responsible for external affairs and information. This person would have the following responsibilities:

- to propose an overall strategy for collaboration between IUFRO and other organizations
- to propose the form of this collaboration
- to propose who should be responsible for collaboration over particular issues
- to promote the exchange of information between IUFRO and other organizations.

The officer should advise the Heads of individual Divisions within IUFRO on information transfer and, in turn, should be supported by nominated individuals from within the Divisions. One possibility is that this person would be supported by a member institute; another possibility is a connection with the Secretariat.

## **Appendix II IUFRO groups that are active in Global Change issues**

D4.00.00 Division 4  
 P2.02.01 Productivity of eucalyptus  
 P2.05.00 Impacts of air pollution on forest ecosystems  
 P2.05.04 Soil organisms, rhizosphere and nutrient uptake  
 P2.05.07 Silviculture in polluted areas  
 P5.03.00 Energy and chemicals from forests  
 P5.07.00 Non-wood forest products  
 P6.11.00 Forest sector analysis  
 S1.01.00 Ecosystems  
 S1.02.00 Site  
 S1.03.00 Environmental influences (incl. S1.03.01-04)  
 S1.05.00 Stand establishment, treatment and amelioration  
 S1.05.01 Peatland forestry  
 S1.07.15 Silviculture and management in arid and semi-arid regions  
 S2.01.00 Physiology  
 S2.02.00 Provenances, breeding and genetic resources  
 S2.02.05 Douglas-fir provenances and breeding  
 S2.02.06 Contorta pine provenances and breeding  
 S2.02.12 Sitka spruce provenances and breeding  
 S2.06.06 Vascular wilt diseases  
 S2.06.14 Complex diseases  
 S2.07.00 Entomology  
 S3.06.01 Accessibility of mountainous forests  
 S4.01.00 Mensuration, growth and yield  
 S4.01.04 Growth models for tree and stand simulation  
 S4.02.00 Forest resource inventory and monitoring  
 S4.04.02 Managerial economics in forestry  
 S4.11.00 Statistical methods, mathematics and computers  
 S4.11.01 Statistical methods  
 S4.11.02 Mathematics (mathematical modelling)  
 S6.01.02 Planning and management  
 S6.12.03 Integrated landuse and forest policy

## **Appendix III IUFRO Groups that responded to the questionnaire**

(indicating that they are not active in Global Change Research)

P1.06.00 Improvement and silviculture of oaks  
 P1.10.00 Improvement and silviculture of beech  
 P1.17.03 Rehabilitation of degraded and secondary tropical forests  
 P2.05.06 Interactions with biotic stresses, impacts on wildlife and ecology  
 P2.05.08 Anatomy and ultrastructure  
 P3.03.00 Ergonomics  
 P3.07.04 Harvesting and forest energy  
 P3.08.00 Forest operations and environmental protection  
 P3.08.01 Site impact caused by forestry operations  
 P5.01.00 Properties and utilization of tropical woods  
 P5.06.00 Forest products marketing  
 P5.07.03 Maple and the environment  
 S1.01.05 Landscape ecology  
 S1.01.08 Ecology and silviculture of European silver fir  
 S1.02.08 Foliar analysis  
 S1.04.00 Natural disasters  
 S1.04.01 Torrent erosion and control  
 S1.05.04 Characterization of plant material  
 S1.05.08 Natural stand regeneration  
 S1.05.12 Innovative silviculture systems in boreal forests  
 S1.05.14 Silvicultural problems in mountain regions  
 S1.05.15 Treatment of maritime pine  
 S1.07.00 Tropical silviculture  
 S1.07.00 Tropical silviculture  
 S1.07.14 Silviculture of plantations in africa  
 S1.09.00 Forest fire research  
 S2.01.05 Reproductive processes  
 S2.01.08 World directory of tree physiologist  
 S2.01.15 Whole plant physiology  
 S2.02.07 Larch provenances and breeding  
 S2.02.09 Eucalypt provenances and breeding  
 S2.02.11 Norway spruce provenances and breeding  
 S2.02.13 Mediterranean conifer provenances and breeding  
 S2.02.14 Abies provenances and breeding  
 S2.02.18 Scots pine provenances and breeding  
 S2.02.21 Legislation of forest reproductive material  
 S2.04.02 Breeding theory and progeny testing  
 S2.04.05 Biochemical genetics  
 S2.04.06 Molecular genetics of forest trees  
 S2.06.00 Pathology  
 S2.06.01 Root and butt rot  
 S2.06.04 Foliage diseases  
 S2.06.09 Mycoplasma and virus diseases of forest trees  
 S2.06.10 Rusts of pine  
 S2.07.06 Population dynamics of forest insects  
 S2.07.10 Forest protection of northeast asia

S2.07.11 Integrated management of forest defoliating insects  
S3.02.03 Nursery operations  
S3.06.00 Forest operations under mountainous conditions  
S4.01.03 Design, performance and evaluation of experiments  
S4.01.07 Design, performance and evaluation of models for forest stand dynamics  
S4.02.02 Multipurpose inventories  
S4.02.03 Forest inventory on successive occasions  
S4.04.00 Forest management planning and managerial economics  
S4.04.06 Management planning and managerial economics in short rotation timber plantations  
S4.11.03 Information management  
S5.01.04 Biological improvement of wood properties  
S5.03.05 Biodeterioration  
S5.04.01 Building and engineering with bamboo  
S5.04.06 Wood drying  
S6.01.05 Application of recreation and landscape research  
S6.03.00 Information systems and terminology  
S6.06.00 Management of forest research  
S6.06.04 Education and research in silviculture  
S6.11.01 Economic and social aspects of forestry in developing countries



## Appendix IV Selected Output of IUFRO groups (based on questionnaire)

This list only contains a selection of Workshops, Conferences and Proceedings of relevance to the Task Force theme. The references are as cited by Subject Group Leaders, Project Group Leaders and Party Chairs. Not included are the numerous papers written by individual scientists are excluded as they are easily obtained from sources such as "Current Contents".

- Workshop "Effect of global climate change on boreal and temperate forests" October 10-14, 1994 in Jiloviste, Czech Republic.
- Conference on wind & wind-related change to trees; Edinburgh, 1993.
- Interscale relationships in forest atmosphere processes; Newfoundland, 1994.
- Forest meteorology and climatology conference; Ontario, 1994.
- Environmental influences technical sessions S1.03 centennial meeting of IUFRO (Berlin, 1992)
- S1.02.06 Tech. meeting: site monitoring, and humus workshop (changes after different management practices); Clermont Ferrand, France 1993.
- Joint IUFRO/CEC symposium on nutrient uptake and cycling in forest ecosystems (with forest management) for ecosystems under change; Halmstad, Sweden 1993.
- Workshops on a) breeding experiments and b) on genetic structure of species, are in preparation for IUFRO conference in Tampere, 1995. a) has been addressed e.g., at the Viterbo meeting 1993 and b) at the Bordeaux meeting 1992.
- Advancement in forest inventory and forest management sciences proceedings of the IUFRO Conference in Seoul, September 20-25, 1993. Recommendations: more research be focused on possible effects of global climate change upon forests and forestry as well on the role of forests as a counter-balance against unwanted anthropogenic changes.
- Workshop and Proceedings: "Investigation of the forest ecosystem and forest damage; lowland and sub-montane forest monitoring of the forest status.
- International Symposium on agroforestry and landuse change in industrialised countries; Berlin, 1994.
- Economic assessment of damages caused to forests by air pollutants/forest decline; 1988.
- Silvicultural systems for forests impacted by air pollution in the region of Trutnov.
- International Conferences (incl. proceedings) on oak decline, sponsored by S2.06.06 (at Kornik, Poland May 1990 and at Bari, Italy, Sept. 1992 and an oak ecophysiology meeting at Nancy, France, August 1994).

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