Intergovernmental Co-operative Programme (ICP) on Assessment and Monitoring of Air Pollution Effects on Forests of UN/ECE in Co-operation with EC

4th Meeting of the Forest Foliar Expert Panel
(Vienna, 24-25 February 1997)

MINUTES

The Meeting was attended by experts of the following sixteen countries: Austria, Belgium-Wallonia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Norway, Slovakia, Slovenia, Spain, and the United Kingdom. The European Commission (EC) was also represented (see list of participants, Annex I).

Item 1: Opening, welcome, adoption of agenda

The Meeting was opened by the Chairman of the Foliar Expert Panel, Mr. K. Stefan (Austria). Mr. F. Ruhm, Director of the Austrian Federal Forest Research Centre in Vienna, welcomed the participants on behalf of the host country. The proposed agenda (Annex II) was adopted. Mr. Haußmann (Germany) suggested that Item 3 (Interlaboratory test) should be discussed prior to Item 2 (Proposal of the draft report); this proposal was adopted, too.

Item 3: Discussion of the results of the 2nd interlaboratory test

In the Meeting of the ICP-Forest Foliar Expert Panel held in As, Norway (8-9 March 1994) the results of the first interlaboratory ringtest were presented. The need for a second interlaboratory ringtest was presented. This was organized by Mr. Ulrich Bartels, Landesumweltamt North Rhine-Westphalia (Germany), with the participation of 39 European laboratories. In July 1994 four

unknown samples of pine needles from Slovakia, spruce needles from Slovakia and Germany, and oak leaves from Spain had been distributed to be analyzed by 31 December 1995. The detailed data were reported separately in October 1996.

An extremely compressed evaluation of the ringtest data is given in tables R1 and R2. It contains a list of the mandatory and optional elements, the concentration ranges of the 4 samples, the determined interlaboratory variances (=standard deviations between the laboratories expressed in percent) and a short review by the ringtest leader. For all 39 laboratories the test results for the elements nitrogen, phosphorus, calcium, magnesium, potassium, zinc, manganese, and copper proved to be very good, good or acceptable. The analyses of iron, aluminium and boron are acceptable under certain conditions, while those of sulphur are fairly problematic because many laboratories have had some analytical problems. The results of sodium and lead were criticised as being unacceptable.

The dry ashing methods provided systematically lower values; if possible, these methods should not be applied in the future.

Table R2 gives an extract for only those 15 anonymous laboratories which parallel to the ring test analyzed plant material from the Level-I plots of 1995 and only for this foliar report evaluated nine elements. The tendency of outlayers is given. A check of the individual results, especially for sulphur, of the laboratories who did not wish that their anonymity be detected, proved that it was not necessary to exclude one or more countries from the Level-I evaluation. Their tendency of analytical deviations is principally not in contrast to the forest foliar condition report.

Nevertheless the interlaboratory analytical test demonstrates that a further Europe-wide improvement and harmonisation of the analytical methods is necessary. A repetition of the ring test with another set of unknown samples is recommended.

Table R 1

Evaluations of Elements

Element	Range mg/g	Interlab.var. %	Criticism
Mandatory elements			
N	11.4-14.6	6.5-5.5	very good
S	1-1.4	18-13	problematic
P	0.7-1.4	12-6	good
Ca	4.5-12.5	13-5	good
Mg	0.5-1.3	13-5.5	good-acceptable
K	4-6.2	8.5-5.5	good
Optional elements	μg/g		
Na	20-80	130-30	not acceptable
Zn	23-39	17-10	acceptable
Mn	28-1560	10-7.7	very good
Fe	70-300	30-6	acceptable >120μg/g
Cu	2.9-5.8	34-22	acceptable
Pb	1-3.2	100-30	not acceptable
Al	80-420	55-10	acceptable >200μg/g
B	10-60	50-10	acceptable >25μg/g

Table R 2: ICP-Forests 2nd Needle/leaf Interlab-test 1995/96
Problematic parameters/laboratories

Lab Code	N	S	P	Ca	Mg	K	Zn	Mn	Fe
3									
7									
13								<<	
14	>>								
17		<							
18									
20				<<			>>		>
21							<		<<
23									
24		>>				<<			
25		>>							
26		>			>>				<>
27					<<	<			<
28									<>
44									

Criteria   1 value out of tolerance: no mention
              2 values out of tolerance: < or >
              3 or 4 values out of tolerance: << or >>

              > = values higher than mean
              < = values lower than mean
              <>= no tendency

Item 2: Discussion of the proposed draft report – Forest Foliar Condition – prepared by the FFCC

The FFCC proposal for a draft Forest Foliar Condition Report, which had been sent to the members of the Foliar Expert Panel (and the NFC's) in mid-January 1997, was discussed in detail. The table of contents of the draft report is enclosed (Annex III).

In order to make the document clearer and to improve its readability, large tables and the representations of the statistical evaluations were transferred to the Annex. The same was decided in respect of the description of the sampling and analytical methods used by the individual countries; according to the Expert Panel these two items should be treated in the national reports. At a later point of the discussion the deadline for communication of the national reports was fixed for March 27, 1997.

The Expert Panel further agreed that data from earlier investigations should be included in the report to a larger extent than was proposed in the documents presented in Vienna [4.9 Classification of data from earlier years].

Another modification of the FFCC proposal concerned the representation of the results: Country-specific results are not to be presented in the form of pie charts, but as plot charts.

It was also discussed inhowfar the results of the national laboratories that participated in the foliar survey at Level-1 are comparable; reference was made to the results presented in Table R2 (under Item 3): For two thirds of these laboratories, the major nutrients (N, P, K, Ca, Mg) did not pose problems and for the remaining third only one element proved to be problematic. Even in the case of sulphur, which, according to the results of the interlaboratory test, was classified as being problematic, more than half of the participating countries did not have problems.

Based on this discussion it was agreed that the results of the 2nd interlaboratory test should be integrated into the draft FFCC Report.

In addition the NFC's was invited (by FAX in February 27, 1997) to provide FFCC by March 27, 1997, national reports to be included in Annex A of the report.

The draft report on the foliar survey at Level I of EC and ICP Forests will be submitted to the Standing Forestry Committee (EU) and to the Task Force for finalization.

Item 4: Discussion and establishment of classification values on micronutrients of the main tree genera and sulphur values for oak.

At the 3rd Meeting of the Foliar Expert Panel Spain was invited to work out a proposal in respect of sulphur classification values for oak. The Foliar Expert Panel accepted Mrs. Maria Gonzales Cascon's (Spain) proposal to establish a lower classification value of 0.8 mg S/g and an upper classification value of 2.0 mg S/g for oak.

As for the micronutrients, Mr. Fürst (FFCC) in consideration of the results of the Level-1 foliar data of 1995, references from literature and national assessment values communicated to the FFCC proposed the following lower and upper classification values:

Zinc (mg/kg	low	high
Beech	20	50
Oak	15	50
Pine	20	70
Spruce	20	60

Manganese (mg/kg)	low	high
Beech	60	2500
Oak	60	2500
Pine	20	800
Spruce	20	2000

Iron (mg/kg)	low	high
Beech	60	200
Oak	60	200
Pine	20	200
Spruce	20	200

Copper (mg/kg)	low	high
Beech	5	10
Oak	5	10
Pine	2	10
Spruce	2	7

No classification values were proposed for natrium, lead, aluminium, and boron because the problems in connection with the analysis do not allow an all-European evaluation and/or not enough Level-1 data are available.
The final discussion of these values was postponed to the next meeting of the Foliar Expert Panel; the representatives of the countries were requested to check the national micronutrient results established in the future against these classification values and to present their relevant experiences at the next meeting of the Foliar Expert Panel, when the classification values of micronutrients will be discussed.

Item 5: Revision of the ICP Forests "Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests".

Mr. Thomas Haußmann briefly reported on the current state of the work in connection with the 4th (extended and revised) edition of the Manual. Mrs. S. Augustin (PCC of ICP Forests) reported on proposals for amendments of the Manual received so far. The participants of the 4th Meeting of the Foliar Expert Panel unanimously recommended to cancel the determination of the shoot mass from the Manual Dr. Raitio (Finland) promised to send Dr. Augustin the citations from specialized literature which are to be included in the Manual. The draft Manual will be submitted to the 13th Meeting of the Task Force of ICP Forests for adaption.

Item 6: Foliar data within the Level-II programme

Mr. E. Vel briefly explained the tasks of the Forest Intensive Monitoring Coordinating Institute (FIMCI) and asked the Foliar Expert Panel's opinion on:

Formats of the datasubmission forms

The Expert Panel recommends to delete the columns for the shootmass and to include an extra separation column between 16 and 17 in the form FOM.
In the form FOO the decimal point in ZN should be deleted and the decimal point in B should move to the 4th place;

Plausibility ranges

The plausibility ranges (95 - 99%) for the main elements, which are used in the FIMCI_CK programme for the detection of unexpected values are suggested to be narrowed (see Annex IV). These values will be included in the next version of the checking programme.

Data Accompanying Report-Questionnaires (DAR-Q)

At present no important changes of the DAR-Q for foliar are considered necessary by the Expert Panel.

Several participants pointed out that, in connection with the plausible ranges, tree-specific ranges should be applied (e.g. needle weight of Pinus pinaster/maritime pine).

Item 7: Future activities of the Forest Foliar Expert Panel and the FFCC

The members of the Expert Panel agreed that, before the end of 1997, another interlaboratory test should be carried out with regard to the samples from the Level-II plots. Dr. Bartels (Germany) will kindly again organize the interlaboratory test. As the test programmes are already available, evaluation will not take as long as the last time. To allow that both samples of a high and samples of a low content of the individual elements

can be included in the investigation, Dr. Bartels will be provided with sufficient amounts of samples from Finland, Slovakia and Slovenia.

Most of the delegates recommended a repetition of the foliar survey on the Level-1 plots. The recommendation – whether such survey should be repeated, for instance, in the year 2000 – is to be made after critical review of the results of the first foliar survey at the next Meeting of the Foliar Expert Panel, which is planned for autumn 1998 in Vienna.

Possibilities to carry out a study linking the Level I foliar data with other data from Level I (soil, crown condition) should be considered. At the next Expert Panel Meeting also the result of the above-mentioned interlaboratory test are foreseen to be discussed; by means of those results the list of methods given in the Manual would have to be adapted; and, following examination by the individual countries, the proposed classification values for micronutrients (see Item 4) should be finalized. An additional item for the next Expert Panel Meeting in the autumn 1998 will be the foliar survey within the Intensive Monitoring Programme at Level II in summer/autumn/winter 1997 (in time for the discussion of the survey results prior to the next repetition in 1999).

In the course of the discussion it was pointed out that the FFCC should continue the data management for investigations on Level-1 plots within the EU/ICP Forests Programms to the following extent:

* Data checking and entry of belatedly received data and/or of data from earlier years into the database;
* Data check and entry of data of repeated surveys from countries sampling their Level-1 plots at shorter intervals than provided for Europe;
* Preparing of annual intermediate reports about the development of the database, if new data have been entered.

The Expert Panel recommends that the FFCC should also take every possible effort to allow a linkage of currently available results from Level-1 plots in co-operation with the other coordinating centres.

4th MEETING OF THE FOLIAR EXPERT PANEL

24/25 February 1997

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ANNEX III

Table of Contents

Annex 3.4d Foliar analysis

Data submission form	Parameter	Unit	Plausible range[1]
XX199?.FOM	Sample number	(-)	Tree number followed by 0 or 1[2]
XX199?.FOM	Mass of 100 leaves	g	1-100
XX199?.FOM	Mass of 1000 needles	g	1-100
XX199?.FOM	Shootmass	g	1-500
XX199?.FOM	N	$mg.g^{-1}$	5 - 40[3]
XX199?.FOM	S	$mg.g^{-1}$	0.3 - 10
XX199?.FOM	P	$mg.g^{-1}$	0.3 - 10
XX199?.FOM	Ca	$mg.g^{-1}$	1- 40
XX199?.FOM	Mg	$mg.g^{-1}$	0.1 - 10
XX199?.FOM	K	$mg.g^{-1}$	1 - 35
XX199?.FOO	Na	$\mu g.g^{-1}$	50 - 7500
XX199?.FOO	Zn	$\mu g.g^{-1}$	10 - 500[4]
XX199?.FOO	Mn	$\mu g.g^{-1}$	10 - 5000
XX199?.FOO	Fe	$\mu g.g^{-1}$	10 - 1000
XX199?.FOO	Cu	$\mu g.g^{-1}$	1 - 100[4]
XX199?.FOO	Pb	$\mu g.g^{-1}$	1 - 100[4]
XX199?.FOO	Al	$\mu g.g^{-1}$	10 - 1000
XX199?.FOO	B	$\mu g.g^{-1}$	5 - 150

Handwritten annotations (right margin):
- 0.5 - 5
- 0.5 - 5
- 1 - 20
- 0.5 - 5
- 1 - 20
- 10 - 150
- ✓
- 20 - 800
- 1 - 25
- 0.5 - 30
- 20 - 500
- 5 - 50

[1] Based on foliar contents in coniferous and deciduous trees in the Netherlands over the period 1950-1991 (Van den Burg, pers. comm., Hendriks et al., 1994)

[2] Leaf types: 0 = current year, 1 = last year; e.g. a sample of the needles of last year (1) of *Picea Abies* (118) is thus 118.1

[3] For conifers trees the maximum will generally be less than 30

[4] Based on heavy metal fluxes at strongly polluted sites (Bergkvist *et al.*, 1989). For Zn even higher values up to 1500 $mg.kg^{-1}$ have been recorded near Zn melters (Van den Burg, pers. comm.), but these values were considered extreme.