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

Further development and implementation of an EU-level Forest Monitorng System (FutMon)

Forest Condition in Europe

2011 Technical Report of ICP Forests and FutMon

Work Report of the:

Johann Heinrich von Thünen-Institute
Institute for World Forestry

Johann Heinrich von Thünen-Institute
Federal Research Institute for Rural Areas, Forestry and Fisheries
Address: Leuschnerstr. 91, D-21031 Hamburg, Germany
Postal address: P.O. Box: 80 02 09, D-21002 Hamburg, Germany

Phone: +40 / 73962-101
Fax: +40 / 73962-299
E-mail: wfw@vti.bund.de
Internet: http://www.vti.bund.de

Institute for World Forestry

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Richard Fischer, Martin Lorenz (eds.)

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Institute for World Forestry
von Thünen-Institute,
Leuschnerstr. 91
D-21031 Hamburg
Germany

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Cover photos: Dan Aamlid (landscape, top), Richard Fischer (middle) Silvia Stofer (bottom)

Table of Contents

Part III ELEMENT FLUXES

Part IV CARBON AND CLIMATE CHANGE

Part V BIODIVERSITY

Part VI NATIONAL SURVEYS

Preface

Forests provide a wealth of benefits to the society but are at the same time subject to numerous natural and anthropogenic impacts. For this reason several processes of international environmental and forest politics were established and the monitoring of forest condition is considered as indispensable by the countries of Europe. Forest condition in Europe has been monitored since 1986 by the International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) in the framework of the Convention on Long-range Transboundary Air Pollution (CLRTAP) under the United Nations Economic Commission for Europe (UNECE). The number of countries participating in ICP Forests has meanwhile grown to 41 including Canada and the United States of America, rendering ICP Forests one of the largest biomonitoring networks of the world. ICP Forests has been chaired by Germany from the beginning on. The Institute for World Forestry of the Johann Heinrich von Thünen-Institute (vTI) hosts the Programme Coordinating Centre (PCC) of ICP Forests.

Aimed mainly at the assessment of effects of air pollution on forests, ICP Forests provides scientific information to CLRTAP as a basis of legally binding protocols on air pollution abatement policies. For this purpose ICP Forests developed a harmonised monitoring approach comprising a large-scale forest monitoring (Level I) as well as a forest ecosystem forest monitoring (Level II) approach laid down in the ICP Forests Manual. The participating countries have obliged themselves to submit their monitoring data to PCC for validation, storage, and analysis. The monitoring, the data management and the reporting of results used to be conducted in close cooperation with the European Commission (EC). EC co-financed the work of PCC and of the Expert Panels of ICP Forests as well as the monitoring by the EU-Member States until 2006.

While ICP Forests - in line with its obligations under CLRTAP - focuses on air pollution effects, it delivers information also to other processes of international environmental politics. This holds true in particular for the provision of information on several indicators for sustainable forest management laid down by Forest Europe (FE). The monitoring system offers itself for being further developed towards assessments of forest information related to carbon budgets, climate change, and biodiversity. This is accomplished by means of the project “Further Development and Implementation of an EU-level Forest Monitoring System” (FutMon). FutMon is carried out from January 2009 to June 2011 by a consortium of 38 partners in 23 EU-Member States, is also coordinated by the Institute for World Forestry of vTI, and is co-financed by EC under its Regulation “LIFE+”. FutMon revises the monitoring system in close cooperation with ICP Forests. It establishes links between large-scale forest monitoring and National Forest Inventories (NFIs). It increases the efficiency of forest ecosystem monitoring by reducing the number of plots for the benefit of a higher monitoring intensity per plot. This is reached by means of a higher number of surveys per plot and newly developed monitoring parameters adopted by ICP Forests for inclusion into its Manual. Moreover, data quality assurance and the database system are greatly improved.

Given the current cooperation between ICP Forests and FutMon, the present Technical Report is published as a joint report of both of them.

9. National crown condition surveys and contacts

Richard Fischer[1] *and Georg Becher*[1]

Reports on the results of the national crown condition surveys at Level I of the year 2010 were received from 33 countries. For these countries, the present chapter presents summaries. Besides that, numerical data on crown condition in 2010 were received. These results are tabulated and presented as graphs.

It has to be noted, however, that in contrast to the transnational survey (Chapt. 3) it is not possible to directly compare the national survey results of individual countries. The sample sizes and survey designs in national surveys may differ substantially and therefore conflict with comparisons. In a number of cases the plots for the transnational survey are identical with the national survey, in other cases the national survey is carried out on condensed nets. Gaps in the Annexes, both tabulated and plotted, may indicate that data for certain years are missing. Gaps also may occur if large differences in the samples were given e.g. due to changes in the grid, or the participation of a new country.

9.1 National Survey Reports

9.1.1 Andorra

The assessment of crown condition in Andorra in 2010 was conducted on the only 3 plots of the transnational grid and included 72 trees, 42 *Pinus sylvestris* and 30 *Pinus uncinata*.

Results obtained in 2010 for both species show a majority of trees classified in defoliation and discolouration classes 0 and 1, as noticed in 2009. These results continue to show the improving tendency in forest condition after the worst results for the Andorran assessments reported in 2007. Related to defoliation, there was a slight decrease in not defoliated and slightly defoliated trees and an increase in the moderate defoliation class rate which passed from 5.5% in 2009 to 13.9% in 2010. Only 1.4% of the trees were rated as severely damaged.

Results for discolouration showed a different distribution. There was a decrease in the not discolouration class which passed from 67.1% in 2009 to 41.7% in 2010, mainly caused by an increase in slight and moderate discolouration classes. Severe discolouration was registered on only 1.4% of the trees.

In 2010, the assessment of damage causes showed, as in previous surveys, that the main causal agent was the fungus *Cronartium flaccidum* which affected 6.9% of the sample trees and which occurred on all plots. During this year, one tree was affected by the insects *Ips acuminatus* and *Phaenops cyanea*.

9.1.2 Austria

The 2010 crown condition survey was carried out on 135 plots of the transnational 16 x 16 km grid net. The assessment covered 3 087 trees, 90.4% coniferous trees and 9.6% broadleaved trees. The main coniferous tree species was *Picea abies* comprising 70.9% of all sample trees, the main broadleaved species was *Fagus sylvatica* comprising 6.9% of all sample trees.

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[1] *Johann Heinrich von Thünen-Institut (vTI), Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute for World Forestry, Leuschnerstraße 91, D-21031 Hamburg, Germany*

The mean defoliation of all tree species was estimated to 10.6%. The mean defoliation for coniferous trees was 10.7% and for broadleaves 10.6% in 2010. 14.2% of the assessed trees were classified as damaged (defoliation classes 2-4). The respective figures were 14.5% for conifers and 10.5% for broadleaved trees. 54.9% of all sample trees were classified as not defoliated (class 0) and 0.5% were found standing dead, this means having died since the last assessment in 2006.

No evaluation of the development of crown condition over the last years is possible, as the assessment of crown condition on the Level I grid net has been discontinued since 2006.

The assessment of biotic and abiotic damage types revealed that about 30% of all sample trees showed some kind of damage symptoms. The most frequent symptoms were different kinds of wounds on the stem/collar found on about 15% of the sample trees. The main causal agent responsible for this damage symptom is direct action of man.

9.1.3 Belarus

The forest condition survey in 2010 was conducted on 411 Level I plots of the transnational grid. The condition of 9 778 trees was assessed. 71.8% of all trees were conifers. *Pinus sylvestris* and *Picea abies* accounted for 61.9% of all sample trees. 28.2% were deciduous trees (*Betula* spp., *Populus tremula*, *Alnus* spp., etc.).

In comparison to 2009, the share of trees without defoliation increased by 1.7 percentage points and was 29.5%, the share of trees in defoliation classes 2-4 decreased by 1.0 percentage points and was 7.4%. Mean defoliation of all species decreased by 0.5 percentage points and was 17.2%.

As in previous years, *Alnus glutinosa* had the lowest defoliation (13.9%), and *Fraxinus excelsior* and *Quercus robur* showed the highest mean defoliation, 43.1% and 19.3%, respectively. These species had the highest share of trees in defoliation classes 2-4 (52.3% and 10.4%), and the smallest share of trees without defoliation (11.4% and 20.9%, respectively).

In comparison to 2009, *Fraxinus excelsior* revealed a clear increase in the share of dead trees and in mean defoliation. A continuous deterioration of crown condition of *Fraxinus excelsior* has been observed during the last years. In contrast, for *Quercus robur*, since 2006 an obvious improvement has been observed.

Damage signs by various factors were observed on 14.1% of the sample trees. Damage was most frequently recorded for *Fraxinus excelsior* (55.5% of all trees), *Populus tremula* (34.3%) and *Quercus robur* (29.9%), and more rarely for *Pinus sylvestris* (9.9%). The most frequent damage types were fungi (4.8%), direct action of man (3.3%), and insects (1.7%). The highest share of trees with signs of damage by fungi was recorded for *Fraxinus excelsior* (40.0%, *Armillaria* sp.), *Populus tremula* (23.8%, mainly *Phellinus tremulae*) and *Quercus robur* (10.8%, mainly *Phellinus robustus*). 5.0% *Betula pendula* and 4.6% *Picea abies* were damaged mechanically. Insect infestation was most frequently recorded for *Alnus glutinosa* (21.7%) and *Quercus robur* (6.2%).

Over the last three years significant wind damage has occurred in Belarus forests. On 28 July and on 8 August 2010 storms caused 2.5 million m^3 storm felled timber mainly in the central part of the republic. This volume corresponds to more than 15% of the annually harvested wood.

9.1.4 Belgium

Belgium/Flanders

In the northern part of Belgium large scale assessments were carried out on 72 plots on a 4 x 4 km grid, with a total of 1 733 trees. The main tree species in the survey were *Quercus* *robur*, *Pinus sylvestris*, *Fagus sylvatica*, *Quercus rubra*, *Pinus nigra* subsp. *laricio* and *Populus* spp.

16.1% of the trees were rated damaged and the mean defoliation in the plots was 20.4%. 16.4% of the trees were considered as healthy. Dead trees were found on 4 plots (0.3% mortality rate). The share of damaged trees was 9.7% in conifers and 19.1% in broadleaves, with a mean defoliation of 18.4% and 21.3%, respectively. Defoliation was higher than the mean in *Quercus robur, Populus* spp., *Pinus nigra* and 'other broadleaves'.

Crown condition deteriorated compared to the year before. The share of damaged trees increased by 1.2 percentage points and the mean defoliation by 0.6 percentage points. There was only a slight change for conifers, with a small increase in defoliation in *Pinus sylvestris* and a decrease in *Pinus nigra.* With 20.8% of the trees in defoliation classes 2-4, *Pinus nigra* revealed higher defoliation compared to *Pinus sylvestris*, with 6.7% of the sample trees in the same classes. The main changes were detected in broadleaved species. With 22.4% moderately to severely damaged trees, *Populus* spp. showed an improvement of the crown condition. Compared to 2008 and 2009, defoliation caused by rust infection (*Melampsora* spp.) started later. Both oak species showed a significant increase in defoliation. *Quercus robur* was the most affected oak species, with 23.2% of the trees in defoliation classes 2-4. Serious insect damage was recorded in several *Quercus robur* plots. In *Quercus rubra*, 11.0% of the sample trees showed moderate to severe defoliation. There was no significant increase in defoliation of *Fagus sylvatica* and the group of 'other broadleaves'. 9.2% *Fagus sylvatica* and 22.5% the 'other broadleaves' showed more than 25% defoliation. In the category 'other species', serious damage by *Phytophthora alni* occurred on *Alnus glutinosa*. *Chalara fraxinea* infection was observed in two *Fraxinus excelsior* stands outside the Level I grid.

Within the framework of the FutMon C1-NFI action, the plot design of the Flemish forest inventory was introduced and the volume of coarse woody debris was compared using regional and reference definitions. The downed deadwood volume in the Level I plots ranged from 0 to 68m³, with a mean volume of 8 m³.

A storm on 14 July 2010 caused damage in a few plots. 0.8% of the sample trees were removed because of thinning or mechanical damage.

Belgium-Wallonia

The survey in 2010 concerned 1 017 trees on 47 plots, on the regional 8 x 8 km systematic grid, a subdivision of the 16 x 16 km transnational European grid. The percentage of trees with a defoliation >=25% shows different long term trends for conifers and broad-leaved trees: The conifers, which were two time more defoliated in the beginning of the nineties, show this year a rate of 29.3%, which is much higher than last year with 15.5% of the trees. The broad-leaved trees showed an increase from 10% in 1990 to about 20% in 2005. This damage increase was mainly due to the degradation of beech (*Scolytidae* in 2000-2002, drought in 2003 followed by fruiting in 2004) and of *Quercus robur* (drought in 2003).

Concerning the mean defoliation observed for the four main species, after an improvement since 2006 for *Fagus sylvatica* and *Quercus robur*, mean defoliation increased to about 22% for *Fagus sylvatica* and to 26.7% for *Quercus robur* in 2010. *Quercus petraea* as well was in a bad condition in 2010 with 16.7%, and also *Picea abies* showed a distinct increase in mean defoliation, with 19.6%.

Damage causes, which were identified for only about 10% of the trees, were mainly defoliators for beech and oak, abiotic causes (storm) and big herbivors (*Cervus elaphus*) for spruce, and sometimes human induced damages (forest operation). Sunburn for *Fagus sylvatica* bark was sometimes mentioned. In 2010, June and July were two months with low rain; in July, sunshine duration and temperatures were very high (about 4°C higher than the average), with dry conditions, which may explain the increase in defoliation.

9.1.5 Bulgaria

A revision and restructuring of the existing 22 years old forest monitoring network was carried out in the period 2009-2010. When building the new network the following items were taken into consideration:

1. The sampling plots of the new network should include existing ICP Forests sampling plots as many as possible.
2. The sampling plots should include the most typical biotopes of the Bulgarian forests.
3. Part of the sampling plots should be located in protected zones of the Bulgarian ecological network and should characterize priority habitats, subject to protection.
4. The sampling plots should be representative for the tree species of the country.
5. Plots disturbed or destroyed by various reasons like felling or wind throws should be replaced.

In 2010, large-scale monitoring of forests in Bulgaria was carried out on 159 sample plots. 69 sampling plots were located in coniferous stands and 90 plots in deciduous forest types. 62% of the sampling plots were previous ICP Forests plots. The monitoring activities were carried out in conformity with the requirements of ICP Forests Manual.

The assessment included 2 396 coniferous trees and 3 173 deciduous trees. The results regarding the indicator "defoliation" for *Pinus nigra* showed that up to 59 years of age 11.6% of the assessed trees were in defoliation class 0, and 49.9% were in defoliation class 1. The overall condition remained unchanged compared to 2009. *Pinus sylvestris* also retained its condition up to 59 years of age, and in older age a small decrease in the healthy and slightly defoliated trees was observed. *Picea abies* was the species that showed lowest defoliation with a slight increase in the trees in defoliation classes 0 and 1. For *Pinus nigra* there was some increase in defoliation classes 1 and 2. Most of the damage for conifers was caused by *Lophoderminium pinastri*.

Among the deciduous tree species, *Fagus sylvatica* showed the lowest defoliation, followed by *Quercus petraea*. The condition of *Quercus cerris* was also very good. A tendency towards deterioration was not determined. The results for the observed deciduous trees showed that in general most trees were healthy or slightly defoliated. The results for *Fagus sylvatica* showed that up to 59 years of age, 55.1% of the observed trees were in defoliation class 0. For older trees the share of healthy and slightly defoliated trees slightly decreased. In comparison with 2009, a small decrease in the healthy and slightly defoliated trees was determined for *Quercus frainetto* and *Quercus petraea.*

Damage on *Fagus sylvatica* was due to *Rhynchaenus fagi, Ectoedemia libwerdella,* and *Nectria* spp., and damage on *Quercus* spp. was mainly caused by *Tortix viridana*. Most frequent abiotic agents for both, coniferous and deciduous species, were drought, snow, and ice.

9.1.6 Cyprus

The annual assessment of crown condition was conducted on 15 Level I plots, during the period September - October 2010. The assessment covered the main forest ecosystems of Cyprus and a total of 360 trees of *Pinus brutia*, *Pinus nigra* and *Cedrus brevifolia* were assessed. Defoliation, discoloration and damaging agents were recorded.

A comparison of the results of the conducted survey with those of the previous year (2009) shows significant improvement among the four categories on all species. From the total number of trees assessed (360 trees), 12.2% were not defoliated, 68.6% were slightly defoliated, 17.8% were moderately defoliated, and 1.4% were severely defoliated.

Compared to the previous year, the 2010 results show an increase in the first two classes, by 9.2 percentage points in class 0 (not defoliated) and 7.9 percentage points in class

1 (slightly defoliated). A decrease by 16.5 percentage points was observed in class 2 (moderately defoliated). In class 3 (severely defoliated) no changes were observed, and no dead trees were recorded (class 4). The observed improvement of crown in 2010 is mainly due to the sufficient rainfall in 2008-2009 compared to the rainless period 2007-2008.

In *Pinus brutia*, 12.7% of the sample trees showed no defoliation, 67.3% were slightly defoliated, 18.3% were moderately defoliated and 1.7% were severely defoliated. In *Pinus nigra*, 8.3% of the sample trees showed no defoliation, 72.2% of the sample trees showed slight defoliation while the remaining 19.5% were moderately defoliated. In *Cedrus brevifolia*, 12.5% of the sample trees showed no defoliation, 79.2% of them were slightly defoliated, 8.3% were moderately defoliated. No dead trees were observed. In contrast to the assessment of the year 2009, no discoloration was assessed at any of the trees.

From the total number of sample trees surveyed, 70.6% showed signs of insect attack and 8.6% showed signs of "*other agents*" (lichens, dead branches and rat attacks). 6.9% showed signs of both factors (insect attack and other agent). The major abiotic factors causing defoliation in Cyprus during the year 2010 were climatic factors in combination with the edaphic conditions. As a result of these factors, half of the trees were attacked by *Leucaspis* spp., which contributed to the defoliation during the year 2010 as a secondary factor. *Leucaspis* spp. was one of the two important insects causing damage; the other one was *Thaumetopoea wilkinsoni*. No damage was attributed to any of the known air pollutants.

9.1.7 Czech Republic

In 2010, there was a very slight decrease in the total defoliation of conifers in the older age category (stands 60 years old and older) when compared with the preceding year. Defoliation in the classes 0 and 1 slightly increased and decreased in classes 2 and 3. The change was mostly due to the development in *Picea abies* and partly *Abies alba.* Defoliation of *Picea abies* in class 2 dropped from 68.7% in 2009 to 64.0% in 2010 with a related increase in defoliation in classes 0 and 1. *Abies alba* defoliation decreased in class 1 from 38.2% to 34.3% and increased in class 0 from 2.9% to 5.7%. No important changes occurred in the development of total defoliation in the younger age category of conifers (stands up to 59 years of age).

Younger conifers (up to the age of 59 years) showed lower defoliation in the long-term period compared to stands of younger broadleaves. For the older stands (stands 60 years old and older) this comparison was reverse, the older conifers were of markedly higher defoliation than the stands of older broadleaves.

Development of total defoliation of broadleaves in the older age category slightly decreased, based on an increasing defoliation in classes 0 and 1 and a fall in classes 2 and 3. This insignificant change was caused by two main deciduous species *Fagus sylvatica* and *Quercus* spp.. Defoliation of *Fagus sylvatica* in class 2 fell from 12.5% to 8.2% and at the same time defoliation in class 0 increased from 19.8% to 24.2%. Defoliation of *Quercus* spp. increased in class 1 from 26.3% to 30.3% and at the same time defoliation in classes 2 and 3 dropped. A slight worsening occurred in the younger broadleaves (stands up to 59 years of age). Defoliation in class 2 increased from 14.6% in 2009 to 20.0% in 2010 with a related decrease in class 0. This change was mainly due to the group of other broadleaves where defoliation in class 2 increased from 8.1% to 29.2% and decreased in class 0 from 31.1% to 11.5%.

At the beginning of the vegetation period, during May, some forest stands, mainly in north-eastern Bohemia, were mechanically damaged by strong wind and hailstorm. Compared with long term mean temperatures, the average monthly temperatures in the vegetation period were mostly above average. In July with the deviation of mean temperature was +3.1 °C. In contrast, below-average temperatures were measured in September and October 2010.

Average monthly precipitation was mostly above average. The only exceptions were June with 88% and October with only 31% of the long-term means.

Over the last ten years, no important change has been recorded for the main pollutants (particulate matters, SO_2, NO_x, CO, VOC, NH_3). Total emissions of most of these substances, despite a certain fluctuation, have been slightly dropping since many years. Emissions of particulate matters and NH_3 were constant.

9.1.8 Denmark

The Danish forest condition monitoring in 2010 was carried out in the National Forest Inventory (NFI) and on the remaining Level I and II plots. Monitoring showed that most tree species had a satisfactory health status. Exceptions were *Fraxinus excelsior* where the problem with extensive dieback of shoots had continued. Average defoliation was 40% for all monitored ash trees and 31% of the trees had more than 50% defoliation. However, this result was mainly due to one long-term ash monitoring plot where all the trees were dying, but even discounting this plot average defoliation was 25%. The situation for ash in Denmark has thus not improved since 2009.

Picea sitchensis still had higher than normal mean defoliation (13%), and *Pinus sylvestris* also showed some signs of stress (14% mean defoliation). *Picea abies* and other conifers had low defoliation, and the health situation for *Picea abies* in Denmark was very satisfactory. With 8% mean defoliation *Fagus sylvatica* stays at a low level of leaf loss, and no health problems had been noted for this important species for some years. *Quercus robur* and *petraea* had a slightly increased defoliation, but even with 15% mean defoliation the health condition of oak can be considered satisfactory.

Based on both NFI plots and Level I and II plots, the results of the crown condition survey in 2010 showed that 73% of all coniferous trees and 65% of all deciduous trees were undamaged. 19% of all conifers and 24% of all deciduous trees showed warning signs of damage. The mean defoliation of all conifers was 8% in 2010, and the share of damaged trees was 7%, which was the same as in 2009. Mean defoliation of all broadleaves was 13%, and 11% were damaged, also similar to last year’s result.

9.1.9 Estonia

Forest condition in Estonia has been systematically monitored since 1988. In 2010, altogether 2 348 trees were examined on 97 permanent Level I sample plots. Assessment covered 582 *Picea abies*, 1 489 *Pinus sylvestris*, 209 *Betula pendula* and 28 *Betula pubescens*, 13 *Populus tremula*, 16 *Alnus glutinosa*, 6 *Alnus incana* and 4 *Fraxinus excelisior*, also 1 *Quercus robur*.

The total share of not defoliated trees was 52.8%. The percentage of trees in classes 2 to 4 (moderately defoliated to dead) was 8.2%. In Estonia the most defoliated tree species has traditionally been Scots pine (*Pinus sylvestris*). The percentage of pine trees in defoliation classes 2-4 was 9.4% in 2010. Essential improvement in crown condition of Scots pine was observed in the period 1991–2000. Subsequently a certain decline was registered up to 2003 and since 2004 defoliation has remained on the same level. In 2008-2009, 37% of Scots pines were not defoliated, but in 2010 a new improvement occurred and already 45.3% of pines were not defoliated (defoliation class 0). The increase in defoliation of *Picea abies* started in 1996, stopped in 2003 and remained on the same level up to 2005. In 2006, some worsening in crown condition occurred. In 2007-2010 the share of *Picea abies*, which were not defoliated, remained almost at the same level. In 2010, 63.7% of *Picea abies* were not defoliated. The condition of deciduous tree species was estimated to be better than that of the conifers. In 2010, 68.4% of *Betula pendula* were not defoliated.

Numerous factors determine the condition of forests. Climatic factors, disease and insect damage as well as other natural factors have an impact on tree vitality. In 2010, 5.5% of the trees assessed showed some kind of insect damage and 36% identificable damage symptoms of diseases. Needle cast and shoot blight were the most significant reasons for biotic damage on trees.

9.1.10 Finland

In Finland the integration of the ICP Level I and national forest inventory (NFI) networks was accomplished in 2009. The sampling design of the current NFI (NFI 11) is a systematic cluster sampling. The distance between clusters, the shape of a cluster, the number of field plots in a cluster and the distance between plots within a cluster vary in different parts of the country according to spatial variation of forests and density of the road network.

Principally, every fourth cluster is marked as a permanent cluster. Annually a new set of permanent plots, established during the 9^{th} NFI in 1996-2003, is to be assessed. The same permanent plots will be assessed in five- year intervals. All dominant and co-dominant *Picea abies, Pinus sylvestris* and *Betula pendula* trees are assessed, and results from 6 pre-selected permanent plots from each cluster are reported to the ICP Forests and to the EU.

The results of the 2010 forest condition survey are reported from 932 permanent sample plots. Of the 7 876 trees assessed in 2010, 51.5% of the conifers and 56.8% of the broadleaves were not suffering from defoliation (leaf or needle loss 0-10%). The proportion of slightly defoliated conifers (11- 25%) was 37.9%, and that of moderately defoliated (over 26%) 10.6%. For broadleaves the corresponding proportions were 34.0% and 9.2%, respectively.

The average tree-specific degree of defoliation was 13.3% in *Pinus sylvestris*, 18.5% in *Picea abies*, and 14.2% in broadleaves (*Betula pendula* and *B. pubescens*). 70 trees (50 of which conifers), which were broken or felled by storms, are not included in the defoliation scores. Compared to the previous year, the mean defoliation had increased in both *Pinus sylvestris* (by 1.4 percentage points) and in broadleaves (by 3.1% percentage points). As the plots assessed during 2009 and 2010 are completely different samples, the results from 2009 and 2010 are not directly comparable.

Abiotic and biotic damage was also assessed in connection with the large-scale monitoring of forest condition. 31% of *Pinus sylvestris*, 24% of *Picea abies* and 30% of the broadleaves were reported to have visible/ symptoms attributed to abiotic or biotic damaging agents. Apart from physical contact, *Neodiprion sertifer* (5.5%) and *Gremmeniella abietina* (5.0%) were the most abundant identified damaging agents in *Pinus sylvestris*. *Neodiprion sertifer* was having a massive outbreak in the mid-western parts of the country, but the amount of damaged pines was about the same as in the previous year in the whole data. The most notable change in the incidence of biotic causes was the much lesser occurrence of *Chrysomyxa ledi* on *Picea abies* in the 2010 sample. In broadleaves, undetermined defoliating insects (4.5%) were the most common group of biotic/abiotic causes. However, the number of broken, fallen or tilted conifers was much higher than in the previous year's sample.

9.1.11 France

In 2010, the forest damage monitoring in the French part of the systematic European network comprised 10 584 trees on 532 plots. The increase in plot number is due to a correction in the network taking into account the increasing forest area in France since several years.

The climatic conditions of the year were not really favourable to the forest vegetation due to a hot and dry summer which particularly affected broadleaved stands.

Defoliation slightly increased for most of the broadleaved species. *Quercus pubescens* and evergreen oak, species which are frequent in the South East of France, still had the worst crown condition of all monitored species in 2010, and did not show any sign of improvement. Death of sampled trees stayed at a relatively low level. The number of discoloured trees was still low except for *Populus* spp., *Fagus sylvatica*, *Prunus avium* and *Pinus haleppensis*.

Damage was reported on about a quarter of the sampled trees, mainly on broad-leaved species. The most important causes of damage were mistletoe (*Viscum album*) on *Pinus sylvestris*, chestnut canker (*Cryphonectria parasitica*) and the oak buprestid (*Coroebus florentinus*) on *Quercus* spp. Abnormally small leaves were observed on different species, specially on *Quercus* spp. (mainly on evergreen oaks and Q. *pubescens*).

9.1.12 Germany

The national results of 2010 were calculated based on the crown condition data of 10 159 sample trees which were assessed on 415 sampling plots of the national 16 x 16 km grid. The assessment covered 38 different tree species. However, about 85% of all trees included in the samples belonged to the four main tree species: *Picea abies*, *Pinus sylvestris*, *Fagus sylvatica* and *Quercus* spp.(*Quercus robur* and *Quercus petraea* are assessed together). The remaining tree species were grouped as “other conifers” and “other broadleaves”.

Forest condition has slightly improved in comparison to 2009. The improvement is mainly due to the significant recovery of *Fagus sylvatica*. Defoliation of *Picea abies* and *Pinus sylvestris* remained nearly unchanged on the national average; this is, however, the result of contrasting trends at the regional scale. *Quercus* spp. still shows severe defoliation. The recovery that seemed to start in 2009 did not continue in 2010; on the contrary: the percentage of trees showing more than 25% defoliation as well as mean defoliation increased in 2010.

Over all tree species, 23% of the forest area was assessed as damaged, i. e. showed more than 25% of defoliation (damage classes 2 to 4). This is a decrease by 2 percentage points as compared to 2009. 39% of the forest area was in the warning stage and 38% of the area was assessed as undamaged (2009: 36%). Mean crown defoliation continued to decrease from 19.7% to 19.1%.

The main tree species show the following development:

- *Picea abies*: the area percentage of damaged trees was 26%, the same as in 2009, while the percentage of trees in damage class 0 has increased. Mean crown defoliation decreased from 19.4% in 2009 to 18.7%.
- *Pinus sylvestris*: the area percentage of damaged trees was 13% and remained unchanged. Mean crown defoliation slightly increased from 15.8% to 16.0%.
- *Fagus sylvatica* showed a significant recovery of crown condition. The area percentage of damaged trees decreased by 17 percentage points from 50% in 2009 to 33% in 2010. Mean crown defoliation decreased from 27.0% to 23.3%.
- *Quercus petraea and Q. robur* showed increasing defoliation compared to the previous year. The area percentage of damaged trees amounted to 51% (2009: 48%). Mean crown defoliation was 29.6%, the highest score ever since the beginning of the surveys in 1984 (2009: 26.5%). According to the reports from the *laender*, damage caused by defoliators has intensified and was further aggravated by mildew infections of the secondary shoots.

9.1.13 Greece

In the 2010 survey, a total of 90 plots was assessed in the high forests (89 in 2009). 8 plots were assessed in maquis vegetation types. The installed plots are representative for the Greek forest ecosystems. No other forest health observation network exists in Greece.

In total, 2 135 forest trees in the high forests and 176 trees in the 8 maquis plots were assessed, on average corresponding to roughly 24 trees per plot. From the forest trees, 1 150 were conifers and 985 trees were deciduous broadleaves (mainly *Quercus* spp.). The survey was carried out from the beginning of July to the end of October 2010. During the assessments, 12 trees dead since previous assessments were replaced (3 conifers and 9 broadleaves), 13 new dead trees were found (1 conifer and 12 broadleaves).

Compared to 2009, a slight deterioration of tree crown condition is obvious but generally forest trees in Greece are in a good condition. The period 2008-2010 was characterized by low precipitation with frequent summer droughts and extreme temperatures.

44.5% of all sample trees in the high forest were not defoliated, 31.7% were slightly defoliated, 20.2% were moderately, 3.0% were severely defoliated and 0.6% were dead. In the maquis 39.8% were not defoliated, 38.6% were slightly defoliated, 18.8% were moderately, 2.3% were severely defoliated and 0.5% of the trees were dead. A comparison of defoliation results between 2009 and 2010 shows that the share of trees in the classes 0, 1 and 3 increased by 0.5 percentage points. The share of trees in class 2 decreased by 0.9 percentage points and the share of dead trees decreased by 0.1 percentage points.

42.3% of all conifers (1 150 trees), showed no defoliation, 34.0% were slightly, 21.4% were moderately and 2.2% and 0.1% were severely defoliated and dead, respectively. A comparison of defoliation results between 2009 and 2010 shows an increase by 4.4 percentage points in the share of not defoliated trees with a corresponding decrease in all the other classes. Conifers clearly appear in better condition as compared to 2009.

In broadleaves (985 trees), 47.1% showed no defoliation, 29.0% were slightly, 18.8% were moderately and 3.9% and 1.2% were severely defoliated and dead, respectively. Compared to 2009, a decrease by 1.9 percentage points in the slightly defoliated class was observed with a corresponding increase in all the other classes. This points to a slight worsening of tree crown condition.

Main damaging factor for *Abies* spp. was the insect *Choristoneura murinana*. In a number of plots also *Viscum album* was registered. *Pinus* spp. was affected by the insects *Thaumetopoea pityocampa* and *Marchalina hellenica.* In the various species of deciduous *Quercus* spp. *Lymantria dispar,* as well as *Tortrix viridana, Archips xylesteana,* and *Altica quercetorum* were registered. Necroses were caused by abiotic (frost, drought) or biotic (insects) factors. In *Fagus* species *Rhynchaenus fagi* was registered. *Platanus orientalis* was affected by the fungus *Nectria dittisima. Castanea sativa* suffered from the fungus *Cryphonectria parasitica.* In *Acer* spp. infestation by the fungus *Uncinula aceris* played a certain role. In maquis plots there were signs of intense grazing (ovines) during the regeneration period and damage from the insect *Lymantria dispar*.

9.1.14 Hungary

In 2010, the forest condition survey was based on the 16 x 16 km grid including 1 848 sample trees on 77 permanent plots in Hungary. The assessment was carried out during the period of July – August. 88.7% of all assessed trees were broadleaves, 11.3% were conifers.

The share of trees without visible damage decreased from 54.8% to 49.3%. The mean defoliation of all species was 22.0%, which is worse than in 2009 but still means a slight damage. Based on the defoliation of all trees, 49.3% showed no defoliation, 28.9% were slightly defoliated, 14.7% were moderately defoliated, and 4.4% were severely defoliated. 2.7% of all trees assessed were dead.

The percentage of all tree species in defoliation classes 2-4 was in 2010 higher than in 2009 (21.8% and 18.4%, respectively). The ICP Forests defoliation class 4 was divided into two classes. Whereas in class 4 trees were included that died in the current year, trees were included in class 5 which died in previous years. 2.7% of the trees were dead, but only one tenth of these trees died this year (0.5% and 2.5%, respectively). In the classes 2-4 the most damaged species was *Pinus nigra*, with 55.7% of the trees in these defoliation classes, followed by *Pinus sylvestris* (28.8%) and *Robinia pseudoaccacia* (14.0%). *Fagus sylvatica* had the lowest defoliation (9.7%) in classes 2-4.

Discolouration rarely occurred in Hungarian forests, 94.8% of the trees showed no discolouration.

In 2010, the dominant weather factor was rainfall. From March to August the monthly rainfall exceeded the average of many years. In middle Hungary the average rainfall exceeded twice or even three times the average rate for several months. The daily average temperatures, with few exceptions, in June and July were nearly 5 degrees warmer than average for many years. Due to the high precipitation no drought did occur. The humid and warm weather favoured the formation of fungus damage.

Two thirds of visible damage, 65% were caused by biotic pests (37% by insects, 26% by fungi and 2% by game). Abiotic accounted for 13% of the damage assessed while 12% were caused by direct human impact. Fire was responsible for 1%, 8% of the damages were caused by other factors and 1% was defined as unknown.

Following the classification defined in the ICP manual on crown condition assessment, it can be ascertained that damage caused by insects was still the main damage factor, 57.4% of the trees were damaged in total. Defoliators were responsible for damage on 80.1% of other conifers, 76.9% of other oaks and 62.6% of *Quercus robur* trees. Mean defoliation of the assessed trees caused by insects was 8.0%. The stem and branch damage assessed on coniferous trees was mainly caused by pine shoot moth (*Rhyacionia buoliana*). On *Pinus sylvestris* 60.2% of the stems and 37.7% of the branches were damaged by this species. Fungal damage on leaves was assessed on 11.7%, on branch and on stem together on 27.2% of all assessed trees. The mean damage attributed to fungi was 19.1%.

Abiotic damage was recorded on 19.4% of the sample trees. Among abiotic damages 35% were caused by drought and 29.2% by frost.

Based on the surveys it can be concluded that the health of Hungarian forests is in a good state, the extent of damage is low, negative trends have not been observed in recent years.

9.1.15 Ireland

The annual assessment of crown condition was conducted on the Level I plots in Ireland between August 15th and November 24th 2010. Overall mean percent defoliation and discolouration recorded for 2010 was 6.7% and 5.4% respectively. These results indicate that overall mean percent defoliation and mean percent discolouration levels have improved since the 2009 survey by 2.9 percentage points and 2.0 percentage points respectively. Defoliation and discolouration levels recorded in 2010 were significantly below the respective long term 22 year averages of 14.0% and 7.6%.

In terms of species, defoliation decreased in the order of *Picea abies* (13.8%)> Pinus *contorta* (13.6%)> *Picea sitchensis* (4.5%), while the trend in discolouration was in the order of *Pinus contorta* (12.8%)> *Picea abies* (2.5%)> *Picea sitchensis* (2.4%).

Twelve of the plots assessed in the 2010 survey are newly established plots which are fully integrated with the National Forest Inventory. Since the 2009 assessment two plots from the long established Level I plot network were felled as part of normal forest management planned operations.

As observed through long-term trend analysis, exposure continued to be the greatest single cause of damage to the sample trees in 2010. Other damage types (aphid, shoot die-back, top dying and nutritional problems) accounted for damage in a smaller percentage of trees. No instances of damage attributable to atmospheric deposition were recorded in the 2010 survey.

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9.1.16 Italy

The 2010 Level I survey on crown condition was carried out on 8 338 selected trees on 253 plots belonging to the 16 x 16 km EU network. The number of sample plots was reduced by 4 plots compared to 2009 because the plots did not meet the requirements (threshold diameters, dominance, etc.). The number of trees has increased considerably as a result of integrating the second adjustment inventory model.

Defoliation data were reported in different classes: for all species, 72.0% were in defoliation classes 1 to 4, of which 29.8% were in defoliation classes 2 to 4. Regarding the groups of conifers and broadleaves, it was noted that conifers with 31.8% in defoliation class 0 (not defoliated) were in a better condition than broadleaves with 21.3% not defoliated trees. 29.1% conifers and 30.1% broadleaves were assessed in defoliation classes 2-4. Among the young conifers (<60 years), the rates in defoliation classes 2-4 were for *Pinus sylvestris* 37.4%, followed by *Pinus nigra* (24.0%), *Larix decidua* (19.9%), and *Picea abies* (15.2%), whereas the best condition was observed for *Pinus halepensis* with 0.0%. Among the old conifers (>60 years), the highest percentage of trees in defoliation classes 2-4 was assessed for *Pinus nigra* (75.5%), followed by *Picea abies* (41.7%), *Pinus cembra* (24.1%), and *Larix decidua* (24.0%), while *Abies alba* had the lowest rate of defoliation among the conifers (22.5%). Among the young broadleaves (<60 years), 56.3% *Castanea sativa* and 46.3% *Quercus pubescens* were in defoliation classes 2 to 4, while the rates for other young broadleaves were distinctly lower: 15.4% *Quercus cerris*, 21.7% *Fagus sylvatica*, and 25.1% *Ostrya carpinifolia*. Among the old broadleaves (>60 years), 56.2% *Castanea sativa*, 42.6% *Quercus pubescens* were in defoliation classes 2-4, while very low defoliation levels were assessed for *Fagus sylvatica* (15.6%), *Quercus ilex* (14.0%), and *Ostrya carpinifolia* (13.7%)

93.1% of conifers and 95.8% of broadleaves did not show discolouration, only in young *Pinus sylvestris* stands 7.6% of the trees were in classes 2 to 4. For uneven aged coniferous stands, *Picea abies* showed 10.0% of the trees in discolouration classes 2 to 4.

Starting from 2005, a new methodology for a more detailed assessment of damage factors (biotic and abiotic) was introduced. The main results are as follows: Most of the observed symptoms were attributed to insects (25.5%), subdivided into defoliators (19,1%), wood borers (1.9%) aphids (0.9%), needle miners (0.8%), among fungi (5.9%) the most significant damages were attributable to “dieback and canker fungi” (3.4%). Among abiotic agents, “hail” (1.6%) was the most significant one.

9.1.17 Latvia

The forest condition survey 2010 in Latvia was carried out in parallel on two plot sets – on the old Level I plots on the 8 x 8 km grid, in total 325, including 92 plots on the transnational 16 x 16 km grid, and on recently established NFI plots, in total 115. Whilst the comparison of both data sets and the integration between ICP Level I and NFI is ongoing, the national report of 2010 is still based on the old Level I plot data.

In total, on 325 Level I plots 7 606 trees were assessed, of which 72% were conifers and 28% broadleaves. Of all tree species, 15.0% were not defoliated, 71.6% were slightly defoliated and 13.4% moderately defoliated to dead. Compared to 2009 no considerable changes were observed in the distribution in these classes. The proportion of trees in defoliation classes 2-4 remained to be about 5% higher for conifers than for broadleaves.

Mean defoliation of *Pinus sylvestris* was 21.8% (21.5% in 2009). Insignificant fluctuations of the mean defoliation, not exceeding 0.3 percentage points, were observed for *Pinus sylvestris* during the recent years. The share of moderately damaged to dead trees constituted 15.4% (15.1% in 2009). Mean defoliation of *Picea abies* was 20.4% - that is only 0.1 percent point higher than in 2009. Changes in the distribution of trees in defoliation classes are insignificant for *Picea abies* as well. The mean defoliation level of *Betula* spp. was 18.3% in 2010, staying practically at the same level as in previous years (18.5% in 2009). The share of trees in defoliation classes 2-4 decreased to 9%. The worst crown condition of all assessed tree species remained for *Fraxinus excelsior* with mean defoliation of 26.8% and 36.0% in defoliation classes 2 to 4 – however, based on data of a comparatively low number of trees in the survey.

Visible damage symptoms were observed to a lesser extent than in previous years, namely on 11.3% of the assessed trees (16.1% in 2009). No serious and extensive attacks of biotic agents were recorded in 2010. The outbreaks of spruce bark beetle (*Ips typographus*) and European pine sawfly (*Neodiprion sertifer*) observed in previous years have gradually decreased. Most frequently recorded damage was caused by direct action of man (19.3% of all cases), followed by fungi (16.1%) and abiotic factors (mostly wind, winter frost) (13.9%). The proportion of insect damage has decreased considerably compared to the previous years. The greatest share of trees with damage symptoms was recorded for *Populus* spp..

Alarming dieback of *Picea abies* stands was observed in several regions of Latvia in 2010, the causes of which are currently examined. In August 2010 windstorm damaged large forest areas in eastern Latvia, increasing the risk of new local attacks of bark beetles.

9.1.18 Lithuania

The national forest inventory and the regional forest health monitoring grids (4 x 4 km) in Lithuania are combined since 2008. The transnational grid of Level I (16 x 16 km) plots was kept unchanged and the monitoring activities were continued. In 2010 the forest condition survey was carried out on 1 065 sample plots from which 75 plots were on the transnational Level I grid and 990 plots on the national forest inventory grid. In total, 6 349 sample trees representing 19 tree species were assessed. The main tree species assessed were *Pinus sylvestris*, *Picea abies*, *Betula pendula*, *Betula pubescens*, *Populus tremula*, *Alnus glutinosa*, *Alnus incana*, *Fraxinus excelsior*, and *Quercus robur*.

The mean defoliation of all tree species slightly increased up to 22.6% (21.3% in 2009). 14.7% of all sample trees were not defoliated (class 0), 64.0% were slightly defoliated and 21.3% were assessed as moderately defoliated, severely defoliated and dead (defoliation classes 2-4). Mean defoliation of conifers was 22.0% (20.8% in 2009) and for broadleaves 23.4% (22.1% in 2009).

Mean defoliation of *Pinus sylvestris* was 21.5% (20.8% in 2009). Starting from 1998, mean defoliation of *Pinus sylvestris* has not exceeded 22.0%. The number of trees in defoliation classes 2-4 increased to 16.0% (14.9% in 2009). Mean defoliation of *Picea abies* increased to 22.9% (20.6% in 2009) and the share of trees in defoliation classes 2-4 increased to 25.8% (20.9% in 2009).

Populus tremula had the lowest mean defoliation and the lowest share of trees in defoliation classes 2-4. Mean defoliation of *Populus tremula* was 19.3% (17.8% in 2009) and the proportion of trees in defoliation classes 2-4 was 14.5% (9.3% in 2009). Mean defoliation of *Alnus glutinosa* decreased to 23.4% (25.1% in 2009) and the share of trees in defoliation classes 2-4 to 25.0% (27.9% in 2009). In 2009 – 2010 the condition of *Alnus glutinosa* was the worst in the whole observation period (1989 – 2010). Mean defoliation of *Alnus incana* increased up to 25.1% (23.2% in 2008). The share of trees in defoliation classes 2-4 distinctly increased up to 28.3% (19.6% in 2009). Mean defoliation of *Betula* spp. increased to 21.5% (19.8% in 2009) and the share of trees in defoliation classes 2-4 increased up to 19.6% (13.8% in 2009).

The condition of *Fraxinus excelsior* remained the worst between all observed tree species. This tree species had the highest defoliation since 2000. In 2007 – 2008 mean defoliation of *Fraxinus excelsior* has been gradually decreasing, but increased again in 2009 - 2010. The assessed mean defoliation was 41.2% (39.8% in 2009). The share of trees in defoliation classes 2-4 increased up to 55.6% (48.4% in 2009). Mean defoliation of *Quercus robur* was 3.2% percentage points higher than in 2009 (22.2%) and the number of trees in defoliation classes 2-4 increased up to 24.8% (16.8% in 2009).

21.1% of all sample trees had some kind of identifiable damage symptoms. The most frequent damage was caused by fungi (5.0%), abiotic agents (4.9%) and direct action of man (4.1%). The highest share of damage symptoms was assessed for *Fraxinus excelsior* (48.4%), *Alnus incana* (35.7%) and for *Populus tremula* (34.0%), the least for *Pinus sylvestris* (15.1%) and for *Alnus glutinosa* (16.8%).

In general, the mean defoliation of all tree species has slightly increased since 2007. However, mean defoliation of all tree species has varied inconsiderably from 1997 to 2010 and the condition of Lithuanian forests can be defined as relatively stable.

9.1.19 Republic of Moldova

In 2010, the forest condition survey was carried out on 622 plots on a 2 x 2 km grid. A total of 14 347 sample trees was assessed, 135 of them were conifers and 14 212 broadleaves.

The weather conditions of the reference year were favourable for the growth of arboreal and shrubby vegetation, which had a positive impact on stand conditions. Thus, for broadleaves, trees in defoliation classes 1-4 constituted 57.2% against 56.9% in the previous year. Trees without visible signs of damage constituted 42.8% against 43.1% in 2009.

In 2010 trees in discolouration classes 2-4 remained with 7.9% at the same level.

A decreasing number of trees in defoliation classes 2-4 was observed for *Robinia pseudoacacia* with 38.4% in comparison with 2009 (41.5%). In *Quercus robur* stands 27.3% of the trees were in these defoliation classes, and a distinct decrease could also be observed for *Fraxinus* with 20.4% in defoliation classes 2-4 (28.2% in 2009). The slight improvement of health condition of trees in 2010 reflects a stabilization of forest condition.

For conifers, a decrease in the percentage of trees in defoliation classes 2-4 was recorded, from 46.7% in 2009 to 33.3% in 2010. For *Pinus* spp. this index in 2009 was 54.6%, and in 2010 43.5%. For 2010 a decrease of trees in discolouration classes 2-4 was recorded: 4.6% in 2009 in comparison with 4.4% in 2010. All this indicates the stabilization of degradation processes of coniferous stands. Under favorable environmental conditions, it is likely that the degradation processes in the future will be stabilized at this level.

The number of trees with identified types of damage constituted 1 969 or 13.7%. The most common type of injury was damage caused by insects, which affected 73.1% of all trees with recorded damage.

9.1.20 The Netherlands

The 2010 crown condition survey was carried out on 11 Level I plots of the transnational 16 x 16 km grid net. Tree species on these plots are representative for the Dutch forest on sandy soils. The assessment covered 227 trees, 65.2% coniferous trees and 34.8% broadleaved trees. The main coniferous tree species was *Pinus sylvestris* comprising 83.1% of all sample trees, *Pseudotsuga menziesii* had a share of 11.0%. The broadleaved species was

Quercus robur comprising 34.8% of all sample trees. The mean defoliation of all tree species was estimated to 16.0%. The mean defoliation for coniferous trees was 12.1% (*Pinus sylvestris* 4.5% and *Pseudotsuga menziesii* 49.4%) and for broadleaves 23.4% in 2010. 40% of the trees assessed showed no defoliation.

29.5% of the assessed trees were classified as damaged. The respective figures were 2.6% for conifers and 26.9% for broadleaved trees. 0.4% of the assessed trees were found standing dead, this means having died since the last assessment in 2009. The main damage cause was drought.

Between 2006 and 2009 no tree assessments were performed on the Level I plots. Compared to 2006 and 2009 tree vitality of oak has slightly increased. Although during the spring of 2009 and 2010 oak was severely attacked by mainly *Operophthera brumata*. Tree vitality for *Pinus sylvestris* and *Pseudotsuga menziesii* have more or less stabilised in the same period.

9.1.21 Norway

The results for 2010 show a small decrease in crown defoliation for all tree species compared to the year before. The mean defoliation for *Picea abies* was 14.8%, for *Pinus sylvestris* it was 14.6%, and for *Betula* spp. 20.9%. After a peak with high defoliation for all 3 tree species in 2007, the last three years 2008-2010 represent a decrease in defoliation. During the last ten years *Betula* spp. had the lowest defoliation in 2001, while *Picea abies* and *Pinus sylvestris* had the same low defoliation in 2010 as in 2004.

Of all the coniferous trees, 50.1% were rated not defoliated in 2010, which is a small increase by about 1.4 percentage points compared to the year before. Only 40.8% of the *Pinus sylvestris* trees were rated as not defoliated, while 56.4% of all *Picea abies* trees were not defoliated, also an increase by 1.9 percentage points compared to the year before. For *Betula* spp. 28.4% of the trees were observed in the class not defoliated, also representing an increase by 2.1 percentage points compared to the year before. For *Betula* spp. and *Pinus sylvestris* especially the class 'moderately defoliated' decreased, to 26% and 11%, respectively in 2010. For other classes of defoliated trees, only small changes were observed.

In crown discolouration 9.3% discoloured trees were observed for *Picea abies*, the same as in 2009. For *Pinus sylvestris*, only 2.8% of the assessed trees were discoloured, also about the same as the year before. For *Betula* spp., the discolouration increased from 4.7% in 2009 to 7.7% in 2010. For *Betula* spp, the observed trees in the most serious classes 'moderate discolouration' and 'severe discolouration' was doubled: 3.0% and 1% respectively were observed in these classes in 2010.

The mean mortality rate for all species was 0.3% in 2010. The mortality rate was 0.4%, 0.3% and 0.3%, for *Picea abies*, *Pinus sylvestris* and *Betula* ssp., respectively. The mortality rate of *Betula* ssp. has been more normal over the last two years and has been clearly reduced from the high level of 1-1.8% which occurred in the tree year period 2006-2008 probably due to serious attacks of insects and fungi.

In general, the observed crown condition values result from interactions between climate, pests, pathogens and general stress. According to the Norwegian Meteorological Institute the summer (June, July and August) of 2010 was regarded as normal warm but with much more precipitation as normal. The mean temperature for the whole country was 0.4°C above normal, while the precipitation was 125% of the normal for these months which is the 4th wettest summer since 1900. There are of course large climatic variations between regions in Norway.

9.1.22 Poland

The 2010 survey was carried out on 1 957 plots. Forest condition was slightly worse than in the previous year. 21.0% of all sample trees were without any symptoms of defoliation, indicating a decrease by 3.1 percentage points compared to 2009. The proportion of defoliated trees (classes 2-4) increased by 3.0 percentage points to 20.7% in 2010. The share of trees defoliated more than 25% increased by 3.1 percentage points for conifers and by 2.9 percentage points for broadleaves.

18.8% of conifers were not suffering from defoliation. For 20.3% of the conifers, defoliation of more than 25% (classes 2-4) was observed. With regard to the three main coniferous species, *Picea abies* remained the species with the highest defoliation, indicating a slight worsening in younger stands and quite a great improvement in older stands. A share of 23.6% (22.6% in 2009) of *Picea abies* trees up to 59 years old and 24.4% (33.0% in 2009) of *Picea abies* trees 60 years old and older was in defoliation classes 2-4.

25.2% of the assessed broad-leaved trees were not defoliated. The proportion of trees with more than 25% defoliation (classes 2-4) amounted to 21.5%. As in the previous survey the highest defoliation amongst broad-leaved trees was observed in stands of *Quercus* spp and indicated a distinct worsening in younger stands. In 2010 a share of 29.3% (17.4% in 2009) of *Quercus* spp. trees up to 59 years old and 37.5% (37.1% in 2009) of *Quercus* spp. trees 60 years old and older was in defoliation classes 2-4.

9.1.23 Romania

In 2010, the assessment of crown condition on Level I plots in Romania was carried out on the 16 x 16 km transnational grid net, from 10th of July to 16th of September. The total number of sample trees was 5 736, which were assessed on 239 permanent plots. From the total number of trees, 1 082 were conifers and 4 654 broadleaves. Trees on 13 plots were harvested during the last year and several other plots were not accessible due to natural hazards.

For all species, 45.5% of the trees were rated as healthy, 36.8% as slightly defoliated, 16.6% as moderately defoliated, 0.9% as severely defoliated and 0.3% were dead. The percentage of damaged trees (defoliation classes 2-4) was 17.7%.

For conifers 16.1% of the trees were classified as damaged (classes 2-4). *Picea abies* was the least affected coniferous species with only 12.6% of the trees damaged (defoliation classes 2-4). For broadleaves 18.1% of the trees were assessed as damaged or dead (classes 2-4). From all broadleaved species, *Tillia* spp. had the lowest share of damaged trees (6.8%), followed by *Fagus sylvatica* with 13.7%. The most affected species was *Robinia pseudoaccacia* with a share of 27.3% damaged or dead trees (classes 2-4). For *Quercus* spp. a share of 25.2% trees was rated as damaged or dead. Compared to 2009, the overall share of damaged trees (classes 2-4) decreased by 1.2 percentage points. Forest health status was slightly influenced, mainly for conifers, by the relatively favourable weather conditions during the vegetation season.

Concerning the assessment of biotic and abiotic damage factors, most of the observed symptoms were attributed to insects (15.6%), and especially defoliators (14.8%), abiotic factors (8.7%), fungi (3.3%), and anthropogenic factors (2.5%).

In the framework of the FutMon project crown condition was assessed on plots of the National Forest Inventory as well on a 16 x 16 km grid, the share of the damaged trees differed by 1-3 percentage points compared to the results obtained in the Level I network. These findings are currently still analysed and interpreted statistically.

9.1.24 Russian Federation

In 2010, forest condition was assessed in 6 regions on the monitoring network of Russia. About 40% of the trees were considered ‘damaged’. Fire, men and insect pests were among the most frequent causes of direct damage of trees; they were observed on 6.5%, 7.8%, and 15.8% of the trees respectively. In the Murmansk region where the most severe sources of air pollution in Northern Europe are located, namely Cu-Ni smelters, no trees damaged by air pollution were noticed. The reason for that is an insufficient density of the network, the monitoring grid is 32 x 32 km. A denser network is in plan with a monitoring grid of 16 x 16 km and 8 x 8 km.

Compared to 2009, no significant increase in defoliation was found in 2010. The highest defoliation of *Pinus sylvestris* was observed in the Leningrad and Kaliningrad regions (11% and 12%), and relatively high defoliation of *Picea abies* in the Murmansk region (12%). As for the broad-leaved trees, *Alnus incana* showed highest defoliation in the Novgorod and Leningrad regions, and in Karelia (up to 16%), and *Fraxinus* spp. in the Kaliningrad region (12%).

Compared to 2009, the discolouration of trees was higher in the Kaliningrad region affecting 16%, 12%, 9%, and 9% for *Pinus sylvestris*, *Fraxinus* spp, *Quercus* spp. and *Betula* spp., respectively. Discolouration of *Picea abies* reached maximum values in the Murmansk region (12%). The level of discoloration of *Alnus incana* was highest in the Novgorod region (20%).

9.1.25 Serbia

A total of 2 786 trees was assessed on all sample plots, with 328 coniferous trees and a considerably higher number i.e. 2 458 broad-leaved trees. The coniferous tree species were: *Abies alba, Picea abies, Pinus nigra* and *Pinus silvestris,* and the most frequently occurring broadleaved tree species were: *Carpinus betulus, Fagus moesiaca, Quercus cerris, Quercus frainetto* and *Quercus petraea.*

For conifers, the share of trees with no defoliation was 70.1%, with slight defoliation 18.0%, with moderate defoliation 9.2% and with severe defoliation 2.7%. For broadleaves the percentages were as follows: no defoliation 66.8%, slight defoliation 22.5%, moderate defoliation 8.8%, severe defoliation 1.0% and dead trees 0.9%.

Discolouration was not detected on 89.3% of coniferous trees, slight discolouration on 9.8% and moderate on 0.9%. The degree of discolouration calculated for all broadleaved species was: no discolouration 95.5%, slight 2.8%, moderate 0.6%, severe discolouration 1.1% and dead 0.0%.

No visible damage types were observed on 85.1% of the conifers, 7.9% trees were with slight damage, 4.9% trees were moderately damaged and 2.1% trees were severely damaged. As for broadleaved tree species, the proportions were: no damage on 87.9% trees, 8.9% trees with slight damage, 1.6% moderately damaged trees, 0.8% trees with severe damage and 0.8% trees were dead.

Moderate and severe defoliation does not always imply a reduction of vitality caused by the effect of adverse agents (climate stress, insect pests, pathogenic fungi). Moderate and severe defoliation can as well be related to a temporary phase of natural variability of crown density.

9.1.26 Slovak Republic

The 2010 national crown condition survey was carried out on 108 Level I plots on the 16 x16 km grid net. The assessments covered 4 837 trees, 3 901 of which were being assessed as dominant or co-dominant trees. Of the 3 901 assessed trees, 38.6% were damaged (defoliation classes 2-4). The respective figures were 46.8% for conifers and 32.9% for broadleaves. Compared to 2009, the share of trees defoliated more than 25% increased by 6.5 percentage points. Mean defoliation for all tree species together was 26.0%, with 28.6% for conifers and 24.2% for broadleaves. Results show that crown condition in Slovak Republic is worse than on the European average. This is mainly due to the bad condition of coniferous species.

Compared to 2009 survey, worsening of mean defoliation was observed in all species except for *Robinia pseudoacacia* and *Abies alba*. Since 1987, the lowest damage was observed for *Fagus sylvatica* and *Carpinus betulus*, with an exception of fructification years. The most severely damaged species were *Abies alba*, *Picea abies* and *Robinia pseudacacia*.

From the beginning of the forest condition monitoring in 1987 on until 1996 results show a significant decrease in defoliation and visible forest damage. Since 1996, the share of damaged trees (25-32%) and mean defoliation (22-25%) has been relatively stable. The recorded fluctuation of defoliation mostly depends on meteorological conditions.

As a part of the crown condition survey, damage types were assessed. 27.3% of all sample trees (4 837) had some kind of damage symptoms. The most frequent damage was caused by logging activities (14.0%) and fungi (11.0%) at tree stems. Additional damage causes were abiotic agents (6.4%), and insects (3.6%). Epiphytes had the most important influence on defoliation. 68% of trees damaged by epiphytes revealed defoliation above 25%.

9.1.27 Slovenia

In 2010, the Slovenian national forest health inventory was carried out on 44 systematically arranged sample plots on a 16 x 16 km grid net. The assessment encompassed 1 052 trees, 397 coniferous and 655 broadleaved trees. The sampling scheme and the assessment method were the same as in the previous years.

The mean defoliation of all tree species was estimated to 24.7%. In comparison to the results of 2009 when the mean defoliation was 26.1%, there was a change by 1.4 percentage points. In 2010, mean defoliation for coniferous trees was 24.1% and for broadleaves 24.5%.

The share of trees with more than 25% of unexplained defoliation (damaged trees) reached 31.8%. In comparison to the results of 2009, when the share of trees with more than 25% of unexplained defoliation was 35.4%, the value decreased by 4.1 percentage points. The change was specifically related to broadleaves where the share of damaged trees decreased from 33.3% in 2009 to 28.1% in 2010, while the share of damaged conifers decreased from 38.8% in 2009 to 37.8% in 2010.

As in the previous years conifers were still more damaged than broadleaves. While their mean defoliation and the share of damaged trees were assessed to 25.1% and 42.8% respectively (in 2009 26.4% and 39.1%), the values of the both indicators for broadleaves were assessed to 24.5% and 23.2% (in 2009 25.9% and 32.8%). The health condition of coniferous sample trees was worse than in 2009.

9.1.28 Spain

Results obtained in the 2010 inventory show a clear improvement in the general health condition of trees when compared to previous years. 85.4% of the surveyed trees were healthy (compared to 82.3% in the previous year). 12.2% of the trees were in defoliation classes 2 and 3, indicating defoliation levels higher than 25%. This is a clear improvement compared to 2009 when this percentage was 15.7%. The number of damaged trees decreased noticeably and the number of dead ones remained stable, with about a 2.3% of the trees surveyed. This general improvement was slightly lower for conifers, with 86.9% healthy trees (85.1% in the previous year), than for broadleaves (83.3% in 2010 and 79.3% in 2009).

The mortality of trees (2.0% dead trees of the total sample, the same percentage as in 2009) was due to strong water shortages which affected trees in previous years as well as to felling operations (frequent sanitary cuts).

Regarding the possible damaging agents, a general decrease is detected. This is especially remarkable in the case of damage due to drought, and in a lower degree to damage by insects. Damage caused by the pine processionary caterpillar (*Thaumetopoea pityiocampa*) and spring defoliators on broadleaves, decreased specifically. Records related to forest fires and to action of man increased slightly as did records of borers (*Cerambicidae* and *Buprestidae*), cochineal insects and some punctual attacks by insects which were, however, not very relevant on national scale.

The decline processes in *Pinus radiata* and *Pinus nigra* stands near the Cantabrian coasts continued as did the general presence of chestnut blight and chestnut ink disease in chestnut stands.

Mistletoe infestations have increased which is now a worrying trend and the decline process affecting *Populus* spp. stands near the Cantabrian coasts has again been confirmed. There are punctual decline processes in some juniper stands and a certain increase of damage related to the *Seca* syndrome.

The importance of atmospheric pollution for the evolution of forest condition is a factor which can not be quantified directly, as it is frequently disguised by other kind of processes which are more apparent. However, in combination with other agents it can contribute to the degradation processes of forests.

9.1.29 Sweden

The national results are based on the assessment of the main tree species *Picea abies* and *Pinus sylvestris* in the National Forest Inventory (NFI), and concern as previously only forest in thinning age or older. In total, 6 917 trees on 3 149 sample plots were assessed. The Swedish NFI is carried out on permanent as well as on temporary sample plots. The permanent sample plots, which are two thirds of the total sample, are remeasured every 5^{th} year.

The proportion of trees with more than 25% defoliation was 25.5% for *Picea abies* (25.0% in 2009) and 10.5% for *Pinus sylvestris* (7.1% in 2009). Deterioration in both species compared to previous years was noticed in central Sweden. Increasing defoliation was also seen on *Pinus sylvestris* in southern Sweden.

An outbreak of the European spruce bark beetle (*Ips typographus*) has been noticed incentral Sweden. The outbreak in southern Sweden has declined, and the timber volume of *Picea abies* killed by the European bark beetle in 2010 in this region was estimated to 300 000 m3. In southeastern Sweden needle loss caused by the European pine sawfly (*Neodiprion sertifer*) has been observed on *Pinus sylvestris* .A new pest, Hungarian spruce scale (*Physokermes inopinatus*), caused damage on *Picea abies* in the southernmost Sweden. In northeastern Sweden the outbreak of chrysomyxa rust on *Picea abies* (*Chrysomyxa ledi*) was registered but less pronounced compared to 2009. In the same area resin top disease (*Cronartium flaccidum*) still is a problem in young *Pinus sylvestris* stands. Birch rust (*Melampsoridium betulinum*) had an outbreak in southern Sweden. The decline in Fraxinus excelsior has been continuing in southern Sweden. The decline is caused by a fungus (*Chalara fraxinea*). Although *Fraxinus excelsior* covers less than 1% of the total standing volume in Sweden, the trees are significant in the landscape of the agricultural areas.

9.1.30 Switzerland

In 2010 the Swiss national forest health inventory was carried out on 48 plots of the 16 x 16 km grid using the same sampling and assessment methods as in the previous years.

Crown condition in 2010 increased as compared to 2009. In 2010, 22.2% of the trees had more than 25% unexplained defoliation (i.e. subtracting the known causes such as insect damage, or frost damage; 2009: 18.3%) and 32.0% of the trees had more than 25% total defoliation (2009: 24.6%). There was no obvious explanation for the increase in transparency, in particular in deciduous tress.

The relatively high defoliation was somehow surprising as 2010 was characterized by extremely low fructification which followed a mast year. Low seed production was found for almost all tree species. For *Betula* spp. on Level I plots only 4% of all trees in 2010 had seeds, while in 2009 around 64% of all trees were recorded with seeds, for *Picea abies* in 2010 only 26% of all trees had fresh cones as compared to 63% in 2009.

On the other hand, low rates of insect defoliation or pathogens had been observed for most tree species in 2009. In 2010 the proportion of recorded insect increased, particularly for *Quercus* spp.. Annual mortality rates, however, remained very low (2 out of 1 000 trees died). For *Fraxinus excelsior*, so far no increased transparency or die-back could be detected neither on Level I nor on Level II plots. However, foliage discolouration and leaf fall in 2010 was extremely early in the areas where ash branch die-back occurred.

9.1.31 Turkey

In 2010, 13 009 trees were assessed for crown condition on 555 Level I plots. 28.4% of the assessed trees showed no defoliation (class 0). Mean defoliation rate was 19.2% for coniferous species and 22.1% for broadleaved species. There has been no significant change in tree vitality in comparison to results of 2009.

16.9% of the observed trees had defoliation scores greater than 25% (classes 2, 3 and 4). The proportions were 14.5% for coniferous species and 21.2% for broadleaved species. Among the most common coniferous species, defoliation of more than 25% was registered on 22.9% of the trees for *Pinus brutia*, 20.7% for *Juniperus excelsa*, 18.5% for *Pinus sylvestris*, 16.1% for *Pinus nigra* and 12.7% for *Abies nordmanniana*.

Among the most common broadleaved species, defoliation of more than 25% was registered on 29.5% of the trees for *Quercus pubescens*, 26.6% for *Quercus petraea*, 21.9% for *Quercus cerris*, 18.2% for *Fagus orientalis*, and 17.3% for *Quercus robur*. The most defoliated species were *Juglans regia* with 52.5% trees in defoliation classes 2-4 and *Ulmus glabra* with 46.3%.

There was no damage on 69% of all assessed trees. At the damaged trees, most of the observed symptoms were attributed to insects constituting a share of 31% of all damages, and abiotic factors with 10%. *Thaumetopoea pityocampa, Lymantria dispar, Tomicus destruens* were the major insects encountered. Damaging agents such as parasitism and competition constituted 20% of the registered damages.

The central and eastern Black Sea regions of Turkey were the regions with highest defoliation in 2010, as it was already the case in previous years. Furthermore, defoliation rates have increased in Southwestern regions in comparison to earlier years. 2010 results showed some recovery in terms of defoliation in Western Blacksea and Marmara regions in comparison to 2008. High levels of defoliation were observed in Kırklareli, İstanbul, Zonguldak, Amasya, Sinop, Artvin, İzmir ve Hatay provinces.

Crown condition, tree growth, deposition, ground vegetation, tree phenology, plant ozone injury and plant litterfall studies were conducted on 12 Level II plots. A laboratory which will be used for sample analysis in Forest Ecosystems Monitoring Program will soon be ready. As soon as the laboratory is ready for operation, other surveys requiring laboratory analysis will also be included in the future works.

9.1.32 United Kingdom

The scope of the Level I survey undertaken in the UK during 2010 encompassed the following species: *Fagus sylvatica*, *Quercus robur*, *Picea sitchensis*, *Picea abies* and *Pinus sylvestris*. A number of sites/trees were lost due to felling, windthrow and the loss of paint upon the trees over time and so a large number of replacements have been necessary making direct comparisons difficult to previous years. The National Forest Inventory (NFI) of Great Britain is locating 1-ha sample squares at all Level I and Level II sites to allow for comparison between data sets in future years where possible should these assessments continue.

Following a winter which was much colder than average, weather conditions in spring 2010 were slightly warmer than average but also drier than average. The amount of sunshine received during this time was also higher than average leading into a warmer and wetter summer than usual generally providing good growing conditions over most of the UK.

Mean defoliation rates from the 2010 assessments are Fagus sylvatica – 9.6%, Quercus robur – 44%, Picea sitchensis – 23%, Picea abies – 39% and Pinus sylvestris – 30%.

Insect damage was the greatest contributor to defoliation: 86% of recorded causes of attack in *Fagus sylvatica*, 70% of *Quercus robur*, 41% of *Picea sitchensis* and 30% of *Pinus sylvestris*. Fungal attacks were only recorded in high proportions in *Pinus sylvestris* (29%) and *Picea abies* (27%).

9.1.33 Ukraine

In 2010, 36 263 sample trees were assessed on 1 505 forest monitoring plots in 25 administrative regions of Ukraine. Mean defoliation of conifers was 10.5% and of broad-leaved trees 11.3%.

For the total sample only slight changes were observed compared to the previous year. In 2010, the percentage of healthy trees slightly increased (67.7% against 66.4%). At the same time, the share of slightly to moderately defoliated trees decreased from 33% to 32%.

For the sample of common sample trees (CSTs) (33 173 trees) inessential changes with tendency to improvement were observed. Mean defoliation slightly decreased in 2010 (10.9%), compared to 2009 (11.2%). Some improvement of tree condition was registered for CSTs of *Quercus robur*, *Fagus sylvatica*, and *Picea abies*. Changes are characterised by an increasing share of trees in defoliation class 0 (for *Picea abies* 4.1% and for *Fagus sylvarica* – 3.7%) and decreasing in all other classes. Acomparatively big amount of healthy trees was registered in *Pinus sylvestris* (72.9% in 0 class), and a relatively small amount of *Picea abies* (58.8% in 0 class). Among CSTs of *Pinus sylvestris* an increase in class 1 was observed with an insignificant decrease in all other classes. Some improvement of tree condition can be explained by a decreasing number of defoliating insects in 2010 compared to 2009.

9.1.34 United States of America

USDA Forest Service (USDA FS) continues its efforts into development of the Critical Loads (CL) approaches for the U.S. forests and other ecosystems. This is done in collaboration with other US agencies, such as the US EPA, National Park Service, US Geological Survey and the Bureau of Land Management as well as with various universities. Critical Loads is a scientifically accepted approach to link ecosystem effects to deposition loading, atmospheric concentrations and emissions of N and S pollutants. A successful implementation of this approach at the national scale requires a fully integrated monitoring and research approach — collocating deposition and ecosystem response data, processing and mapping the data, and documenting methods to develop CLs for a variety of purposes and scales. In order to accomplish this goal, scientists and managers conducting CL research in the U.S. have coordinated their activities through the NADP-CLAD (National Atmospheric

Deposition Program's Critical Loads for Atmospheric Deposition Science Subcommittee) with funding provided by US EPA, National Park Service, and the Forest Service. CLAD is currently spearheading an effort to consolidate the CL data and protocols developed under various agencies/universities into regional/national scale CL data layers or maps for aquatic and terrestrial acidification, and nutrient nitrogen excess. This effort which is named "FOCUS" has three goals: (1) Use the UNECE "call for CL data" to develop consistent regional/ national-scale critical loads & identify gaps and issues with consolidating data from multiple agencies and organizations; (2) identify geographic and ecosystem type gaps in CL development (including differences in methods, approaches, and assumptions); and 3) develop CL maps at scales the data permits preliminary use within the U.S. To fulfill these goals, a Project Manager has already been hired, and data processing has started with full participation of the USDA FS scientists and Air Quality Specialists. Phase II will entail a "data gap" analysis to identify overlap in monitoring efforts and infrastructure needs for monitoring and data collection and processing, including selected sites in the USDA FS Experimental Forest and Ranges.

An example of the experimental work related to forest health that addresses potential effects of ambient ozone and N deposition is a new study in the Lake Tahoe Basin in California & Nevada. This is a joint effort between the USDA FS Pacific Southwest Research Station, USDA FS managers representing Region 5 (California), the Desert Research Institute in Reno, Nevada, and several universities. In this study distribution of ozone, precursors of O_3 formation and gaseous pollutants that are important contributors to atmospheric nitrogen (N) deposition in the Lake Tahoe Basin are being characterized. In summer 2010, passive samplers were used for monitoring O_3, nitric oxide (NO), nitrogen dioxide (NO_2), ammonia (NH_3), nitric acid (HNO_3) and volatile organic compounds (VOCs) on a network of 32 sites inside and outside of the Basin. On a subset of 10 monitoring sites, real-time O_3 concentrations were measured with portable active UV absorption monitors to evaluate diurnal changes of the pollutant, calibrate passive O_3 samplers, and use that data for evaluation of the exceedances of O_3 air pollution standards in the Basin. At the same sites N deposition was measured with ion exchange resin (IER) collectors placed in forest clearings (bulk precipitation) and under tree canopies (throughfall). In these bulk and throughfall samples from the IER collectors the stable isotope composition (^{15}N and ^{18}O) of NO_3 and of NH_3 (^{15}N) will be measured from passive sampler extracts to evaluate the origin of N deposition in the Basin. Results of this study will help to evaluate the present and future potential of O_3 formation as well as the biological/ecological effects of N air pollutants and the resulting N deposition in the Lake Tahoe Basin. These results will also help to develop science-based management strategies aimed at improving air quality and ecological sustainability of the Basin.

9.2 Annex: National results

9.2.1 Forests and surveys in European countries (2010).

Participating countries	Total area (1000 ha)	Forest area (1000 ha)	Coniferous forest (1000 ha)	Broadleav. forest (1000 ha)	Area surveyed (1000 ha)	Grid size (km x km)	No. of sample plots	No. of sample trees
Albania	2875	1063	171	600	no survey in 2010			
Andorra	47	18	15	2	18	16 x 16	3	72
Austria	8385	3878	2683	798	3481	16 x 16	135	3087
Belarus	20760	7963	4764	3199	7963	16 x 16	410	9615
Belgium	3035	700	281	324	700	4^2 / 8^2	119	2750
Bulgaria	11100	4064	1289	2775	4064	$4^2/8^2/16^2$	159	5569
Croatia	5654	2061	321	1740	2061	16 x 16	84	2016
Cyprus	925	298	172	0	138	16x16	15	362
Czech Republic	7886	2647	2014	633	2647	$8^2/16^2$	132	5330
Denmark	4310	580	294	266	580	$7^2/16^2$	25	615
Estonia	4510	2209	1108	1101	2209	16 x 16	97	2348
Finland	30415	20150	17974	1897	19871	16^2 / 24x32	932	7876
France	54883	15840	4041	9884	13100	16 x 16	532	10584
Germany	35702	11076	6490	3857	10347	16^2 / 4^2	415	10159
Greece	12890	2034	954	1080	2034		90	2135
Hungary	9300	1913	216	1697	1913	16 x 16	77	1848
Ireland	7028	680	399	37	436	16 x 16	36	539
Italy	30128	8675	1735	6940		16 x 16	253	8338
Latvia	6459	3162	1452	1710	3162	8 x 8	325	7606
Liechtenstein	16	8	6	2	no survey in 2010			
Lithuania	6530	2160	1155	896		4x4/16x16	1065	6349
Luxembourg	259	89	30	54	no survey in 2010			
FYR of Macedonia					no survey in 2010			
Rep. of Moldova	3384	401	8	367	375	2 x 2	622	14347
The Netherlands	3482	360	140	136	360	16 x 16	11	227
Norway	32376	12000	6800	5200	12000	$3^2/9^2$	1651	9417
Poland	31268	9200	6955	2245	9200	16 x 16	1957	39154
Portugal	8893	3234	1081	2153	no survey in 2010			
Romania	23839	6233	1873	4360	6233	16 x 16	239	5736
Russian Fed.	1700075	809090	405809	195769	36173	32 x 32	288	8992
Serbia	8836	2360	179	2181	1868	16 x 16/4 x 4	130	2786
Slovak Republic	4901	1961	815	1069	1961	16 x 16	108	3901
Slovenia	2027	1099	410	688	1099	16 x 16	44	1052
Spain	50471	18173	6600	9626		16 x 16	620	14880
Sweden	41000	28300	19600	900	20600	varying	3149	6917
Switzerland	4129	1186	818	368	1186	16 x 16	48	1040
Turkey	77846	21189	12773	8416	8884	16 x 16	555	13009
Ukraine	60350	9400	2756	3285	6033	16 x 16	1505	36263
United Kingdom	20933	2665	1306	854		16 x 16	80	1912
TOTAL	2340295	1011868	514955	271591	180696	varying	15911	246831

9.2.2 Percent of trees of all species by defoliation classes and class aggregates (2010).

Participating countries	Area surveyed (1000 ha)	No. of sample trees	0 none	1 slight	2 moderate	3+4 severe and dead	2+3+4
Albania			no survey in 2010				
Andorra	18	72	58.3	26.4	13.9	1.4	15.3
Austria	3481	3087	54.9	30.9	11.9	2.3	14.2
Belarus	7963	9615	29.5	63.1	6.0	1.4	7.4
Belgium	700	2750	26.9	51.0	20.3	1.8	22.1
Bulgaria	4064	5569	29.6	46.6	21.9	1.9	23.8
Croatia		2016	35.1	37.0	22.9	5.0	27.9
Cyprus	138	362	12.2	68.6	17.8	1.4	19.2
Czech Republic	2647	5330	13.1	32.7	52.7	1.5	54.2
Denmark	580	615	70.6	20.2	4.6	4.7	9.3
Estonia	2209	2348	52.8	39.1	5.9	2.2	8.1
Finland	19871	7876	52.4	37.2	8.9	1.6	10.5
France	13100	10584	28.1	37.2	31.0	3.6	34.6
Germany	10347	10159	37.8	39.0	21.5	1.7	23.2
Greece	2034	2135	44.5	31.7	20.2	3.6	23.8
Hungary	1913	1848	49.3	28.9	14.7	7.1	21.8
Ireland	399	539	70.9	11.6	7.4	10.1	17.5
Italy		8338	28.0	42.2	25.8	4.0	29.8
Latvia	3162	7606	15.0	71.6	11.7	1.7	13.4
Liechtenstein			no survey in 2010				
Lithuania		6349	14.7	64.0	19.0	2.3	21.3
Luxembourg			no survey in 2010				
FYR of Macedonia			no survey in 2010				
Rep. of Moldova	375	14347	42.8	34.7	20.5	2.0	22.5
The Netherlands	360	227	56.4	22.0	18.9	2.2	21.6
Norway	12000	9417	44.8	36.3	15.7	3.2	18.9
Poland	9200	39154	21.0	58.3	19.6	1.1	20.7
Portugal			no survey in 2010				
Romania		5736	45.5	36.8	16.6	1.2	17.8
Russian Fed.	36173	8992	82.6	13.0	3.8	0.6	4.4
Serbia	1868	2786	67.2	22.0	8.8	2.0	10.8
Slovak Republic	1961	3901	9.5	51.9	37.2	1.4	38.6
Slovenia	1099	1052	18.3	50.0	27.7	4.1	31.8
Spain		14880	24.3	61.1	11.1	3.5	14.6
Sweden	20600	7052	56.3	26.6	14.5	2.6	17.1
Switzerland	1186	1040	25.3	52.5	12.8	9.4	22.2
Turkey	8884	13009	28.4	54.8	14.7	2.1	16.8
Ukraine	6033	36263	67.7	26.5	5.5	0.3	5.8
United Kingdom		1912	20.8	30.7	46.0	2.5	48.5

Andorra, Cyprus, Ireland, Sweden: Only conifers assessed.

Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used. This restriction, however, does not affect the reliability of the trends over time.

9.2.3 Percent of conifers by defoliation classes and class aggregates (2010)

Participating countries	Coniferous forest (1000 ha)	No. of sample trees	0 none	1 slight	2 moderate	3+4 severe and dead	2+3+4
Albania			no survey in 2010				
Andorra	18	72	58.3	26.4	13.9	1.4	15.3
Austria	2683	2791	55.0	30.5	12.4	2.1	14.5
Belarus	4764	6937	26.7	65.6	6.4	1.3	7.7
Belgium	281	840	25.0	58.8	15.5	0.7	16.2
Bulgaria	1289	2936	23.2	45.7	27.9	3.2	31.1
Croatia	321	272	12.9	20.2	52.9	14.0	66.9
Cyprus	172	360	12.2	68.6	17.8	1.4	19.2
Czech Republic	2014	4194	12.1	27.8	58.3	1.8	60.1
Denmark	294	260	78.8	15.8	4.2	1.2	5.4
Estonia	1108	2071	50.5	40.5	6.5	2.5	9.0
Finland	17974	6543	51.5	37.9	9.2	1.4	10.6
France	4041	3680	42.8	29.8	25.1	2.3	27.4
Germany	6490	6150	42.4	38.4	18.0	1.2	19.2
Greece	954	1150	42.3	34.0	21.4	2.3	23.7
Hungary	216	254	35.8	29.1	21.3	13.8	35.1
Ireland	399	539	70.9	11.6	7.4	10.1	17.5
Italy	1735	2269	32.0	38.9	25.4	3.7	29.1
Latvia	1452	5478	9.8	75.2	13.3	1.7	15.0
Liechtenstein			no survey in 2010				
Lithuania	1155	3801	12.6	67.6	18.3	1.5	19.8
Luxembourg			no survey in 2010				
FYR of Macedonia			no survey in 2010				
Rep. of Moldova	8	135	27.4	39.3	33.3	0.0	33.3
The Netherlands	140	148	75.0	6.1	15.5	3.4	18.9
Norway	6800	7143	50.1	33.5	13.6	2.8	16.4
Poland	6955	25753	18.8	60.9	19.3	1.0	20.3
Portugal			no survey in 2010				
Romania	1873	1082	49.1	34.8	14.6	1.5	16.1
Russian Fed.	405809	5584	80.4	14.5	4.4	0.7	5.1
Serbia	179	328	70.1	18.0	9.2	2.8	12.0
Slovak Republic	815	1595	5.7	47.5	44.5	2.3	46.8
Slovenia	410	397	21.9	40.3	33.0	4.8	37.8
Spain	5910	7469	27.2	59.7	9.5	3.6	13.1
Sweden	19600	7052	56.3	26.6	14.5	2.6	17.1
Switzerland	818	725	22.0	57.1	13.2	7.7	20.9
Turkey	12773	8329	29.9	55.7	13.0	1.5	14.5
Ukraine	2756	15209	69.3	25.1	5.4	0.2	5.6
United Kingdom	1306	824	28.0	33.4	36.9	1.7	38.6

Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used. This restriction, however, does not affect the reliability of the trends over time.

9.2.4 Percent of broadleaves by defoliation classes and class aggregates (2010).

Participating Countries	Broadleav. forest (1000 ha)	No. of sample trees	0 none	1 slight	2 moderate	3+4 severe and dead	2+3+4
Albania			no survey in 2010				
Andorra	2		only conifers assessed				
Austria	798	296	54.7	34.8	7.1	3.4	10.5
Belarus	3199	2678	36.7	56.4	5.1	1.8	6.9
Belgium	783	1910	27.7	47.7	22.3	2.3	24.6
Bulgaria	2775	3173	34.5	47.3	17.3	0.9	18.2
Croatia	1740	1744	38.5	39.6	18.2	3.7	21.9
Cyprus			only conifers assessed				
Czech Republic	633	1136	17.0	50.8	31.7	0.5	32.2
Denmark	266	355	64.5	23.4	4.8	7.3	12.1
Estonia	1101	277	70.1	27.4	1.8	0.7	2.5
Finland	1897	1333	56.8	34.0	7.5	1.7	9.2
France	9884	6864	20.2	41.1	34.3	4.4	38.7
Germany	3857	4009	30.4	40.1	27.3	2.1	29.4
Greece	1080	985	47.1	29.0	18.8	5.1	23.9
Hungary	1697	1594	51.5	28.8	13.7	6.0	19.7
Ireland	37		only conifers assessed				
Italy		6069	26.6	43.3	25.9	4.2	30.1
Latvia	1710	2128	28.3	62.3	7.3	2.1	9.4
Liechtenstein	2		no survey in 2010				
Lithuania	896	2548	17.7	58.6	20.1	3.6	23.7
Luxembourg	54		no survey in 2010				
FYR of Macedonia			no survey in 2010				
Rep. of Moldova	367	14212	42.9	34.7	20.4	2.0	22.4
			no survey in 2010				
The Netherlands	136	79	21.5	51.9	25.3	1.3	26.6
Norway	5200	2276	28.3	44.9	22.1	4.7	26.8
Poland	2245	13426	25.2	53.3	20.1	1.4	21.5
Portugal	2153		no survey in 2010				
Romania	4360	4654	44.8	37.2	17.0	1.0	18.0
Russian Fed.	195769	3408	86.1	10.7	2.9	0.3	3.2
Serbia	2181	2458	66.8	22.5	8.8	1.9	10.7
Slovak Republic	1069	2306	12.1	55.0	32.2	0.7	32.9
Slovenia	688	655	16.0	55.9	24.4	3.7	28.1
Spain	4056	7411	21.4	62.5	12.8	3.3	16.1
Sweden	900		only conifers assessed				
Switzerland	368	289	32.5	42.3	12.0	13.2	25.2
Turkey	8416	4680	25.6	53.2	17.8	3.4	21.2
Ukraine	3285	20364	64.7	28.9	6.0	0.4	6.4
United Kingdom	854	1088	15.3	28.6	52.9	3.2	56.1

Norway: Special study on birch.
Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used. This restriction, however, does not affect the reliability of the trends over time.

9.2.5 Percent of damaged trees of all species (1999-2010)

Participating countries	All species Defoliation classes 2-4												change % points
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2009/ 2010
Albania	9.9	10.1	10.2	13.1		12.2		11.1					
Andorra						36.1		23.0	47.2	15.3	6.8	15.3	8.5
Austria	6.8	8.9	9.7	10.2	11.1	13.1	14.8	15.0				14.2	
Belarus	26.0	24.0	20.7	9.5	11.3	10.0	9.0	7.9	8.1	8.0	8.4	7.4	-1.0
Belgium	17.7	19.0	17.9	17.8	17.3	19.4	19.9	17.9	16.4	14.5	20.2	22.1	1.9
Bulgaria	44.2	46.3	33.8	37.1	33.7	39.7	35.0	37.4	29.7	31.9	21.1	23.8	2.7
Croatia	23.1	23.4	25.0	20.6	22.0	25.2	27.1	24.9	25.1	23.9	26.3	27.9	1.6
Cyprus			8.9	2.8	18.4	12.2	10.8	20.8	16.7	47.0	36.2	19.2	-17.0
Czech Rep.	50.4	51.7	52.1	53.4	54.4	57.3	57.1	56.2	57.1	56.7	56.8	54.2	-2.6
Denmark	13.2	11.0	7.4	8.7	10.2	11.8	9.4	7.6	6.1	9.1	5.5	9.3	3.8
Estonia	8.7	7.4	8.5	7.6	7.6	5.3	5.4	6.2	6.8	9.0	7.2	8.1	0.9
Finland	11.4	11.6	11.0	11.5	10.7	9.8	8.8	9.7	10.5	10.2	9.1	10.5	1.4
France	19.7	18.3	20.3	21.9	28.4	31.7	34.2	35.6	35.4	32.4	33.5	34.6	1.1
Germany	21.7	23.0	21.9	21.4	22.5	31.4	28.5	27.9	24.8	25.7	26.5	23.2	-3.3
Greece	16.6	18.2	21.7	20.9			16.3				24.3	23.8	-0.5
Hungary	18.2	20.8	21.2	21.2	22.5	21.5	21.0	19.2	20.7		18.4	21.8	3.4
Ireland	13.0	14.6	17.4	20.7	13.9	17.4	16.2	7.4	6.0	10.0	12.5	17.5	5.0
Italy	35.3	34.4	38.4	37.3	37.6	35.9	32.9	30.5	35.7	32.8	35.8	29.8	-6.0
Latvia	18.9	20.7	15.6	13.8	12.5	12.5	13.1	13.4	15.0	15.3	13.8	13.4	-0.4
Liechtenstein													
Lithuania	11.6	13.9	11.7	12.8	14.7	13.9	11.0	12.0	12.3	19.6	17.7	21.3	3.6
Luxembourg	19.2	23.4											
FYR of Macedonia													
Rep. of Moldova		29.1	36.9	42.5	42.4	34.0	26.5	27.6	32.5	33.6	25.2	22.5	-2.7
The Netherlands	12.9	21.8	19.9	21.7	18.0	27.5	30.2	19.5			18.2	21.6	3.4
Norway	28.6	24.3	27.2	25.5	22.9	20.7	21.6	23.3	26.2	22.7	21.0	18.9	-2.1
Poland	30.6	32.0	30.6	32.7	34.7	34.6	30.7	20.1	20.2	18.0	17.7	20.7	3.0
Portugal	11.1	10.3	10.1	9.6	13.0	16.6	24.3						
Romania	12.7	14.3	13.3	13.5	12.6	11.7	8.1	8.6	23.2		18.9	17.8	-1.1
Russian Fed.			9.8	10.9							6.2	4.4	-1.8
Serbia	11.2	8.4	14.0	3.9	22.8	14.3	16.4	11.3	15.4	11.5	10.3	10.8	0.5
Slovak Rep.	27.8	23.5	31.7	24.8	31.4	26.7	22.9	28.1	25.6	29.3	32.1	38.6	6.5
Slovenia	29.1	24.8	28.9	28.1	27.5	29.3	30.6	29.4	35.8	36.9	35.5	31.8	-3.7
Spain	12.9	13.8	13.0	16.4	16.6	15.0	21.3	21.5	17.6	15.6	17.7	14.6	-3.1
Sweden	13.2	13.7	17.5	16.8	19.2	16.5	18.4	19.4	17.9	17.3	15.1	17.1	2.0
Switzerland	19.0	29.4	18.2	18.6	14.9	29.1	28.1	22.6	22.4	19.0	18.3	22.2	3.9
Turkey									8.1	24.6	18.7	16.8	-1.9
Ukraine	56.2	60.7	39.6	27.7	27.0	29.9	8.7	6.6	7.1	8.2	6.8	5.8	-1.0
United Kingdom	21.4	21.6	21.1	27.3	24.7	26.5	24.8	25.9	26.0			48.5	

Andorra, Cyprus, Ireland, Sweden: Only conifers assessed. *Andorra:* observe the small sample size. *Austria*: From 2003 on. results are based on the 16x16 km transnational grid net and must not be compared with previous years. *Poland*: Change of grid net since 2006. *Russian Federation:* North-western and Central European parts only. *Ukraine*: Change of gridnet in 2005. *Hungary, Romania*: comparisons not possible due to changing survey designs. *Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used. This restriction, however, does not affect the reliability of the trends over time.*

9.2.6 Percent of damaged conifers (1999-2010).

Paticipating countries	Conifers Defoliation classes 2-4												change % points
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2009/ 2010
Albania	12.1	12.3	12.4	15.5		14.0		13.6					
Andorra						36.1		23.0	47.2	15.3	6.8	15.3	8.5
Austria	6.4	9.1	9.6	10.1	11.2	13.1	15.1	14.5				14.5	
Belarus	28.9	26.1	23.4	9.7	9.5	8.9	8.4	7.5	8.1	8.1	8.3	7.7	-0.6
Belgium	15.5	19.5	17.5	19.7	18.6	15.6	16.8	15.8	13.9	13.2	13.6	16.2	2.6
Bulgaria	48.9	46.4	39.1	44.0	38.4	47.1	45.4	47.6	37.4	45.6	33.0	31.1	-1.9
Croatia	53.2	53.3	65.1	63.5	77.4	70.6	79.5	71.7	61.1	59.1	66.5	56.9	-9.6
Cyprus			8.9	2.8	18.4	12.2	10.8	20.8	16.7	46.9	36.2	19.2	-17.0
Czech Rep.	57.4	58.3	58.1	60.1	60.7	62.6	62.7	62.3	62.9	62.8	63.1	60.1	-3.0
Denmark	9.9	8.8	6.7	4.5	6.1	5.8	5.5	1.7	3.1	9.9	1.0	5.4	4.4
Estonia	9.1	7.5	8.8	7.9	7.7	5.3	5.6	6.0	6.7	9.3	7.5	9.0	1.5
Finland	11.9	12.0	11.4	11.9	11.1	10.1	9.2	9.6	10.4	10.1	9.9	10.6	0.7
France	14.1	12.0	14.0	15.2	18.9	18.6	20.8	23.6	24.1	25.1	26.8	27.4	0.6
Germany	19.2	19.6	20.0	19.8	20.1	26.3	24.9	22.7	20.2	24.1	20.3	19.2	-1.1
Greece	13.5	16.5	17.2	16.1			15.0				26.3	23.7	-2.6
Hungary	17.6	21.5	19.5	22.8	27.6	24.2	22.0	20.8	22.3		27.1	35.1	8.0
Ireland	13.0	14.6	17.4	20.7	13.9	17.4	16.2	7.4	6.2	10.0	12.5	17.5	5.0
Italy	23.1	19.2	19.1	20.5	20.4	21.7	22.8	19.5	22.7	24.0	31.6	29.1	-2.5
Latvia	20.6	20.1	15.8	14.3	12.2	11.9	13.2	15.2	16.2	16.7	14.8	15.0	0.2
Liechtenstein													
Lithuania	11.5	12.0	9.8	9.3	10.7	10.2	9.3	9.5	10.2	19.1	17.4	19.8	2.4
Luxembourg	8.7	7.0											
FYR. of Macedonia													
Rep. of Moldova					55.4	35.5	38.0	38.6	34.3			33.3	
The Netherlands	14.5	23.5	20.7	17.5	9.4	17.2	17.9	15.3			14.1	18.9	4.8
Norway	24.3	21.8	25.1	24.1	21.2	16.7	19.7	20.2	23.0	19.2	17.9	16.4	-1.5
Poland	30.6	32.1	30.3	32.5	33.2	33.4	29.6	21.1	20.9	17.5	17.2	20.3	3.1
Portugal	6.0	4.3	4.3	3.6	5.3	10.8	17.1						
Romania	9.1	9.8	9.6	9.9	9.8	7.6	4.7	5.2	21.8		21.7	16.1	-5.6
Russian Fed.			9.8	10.0							7.3	5.1	-2.2
Serbia	9.2	10.0	21.3	7.3	39.6	19.8	21.3	12.6	13.3	13.0	12.6	12.0	-0.6
Slovak Rep.	40.2	37.9	38.7	40.4	39.7	36.2	35.3	42.4	37.5	41.1	42.7	46.8	4.1
Slovenia	38.0	34.5	32.2	31.4	35.3	37.4	33.8	32.1	36.0	40.7	38.8	37.8	-1.0
Spain	9.8	12.0	11.6	15.6	14.1	14.0	19.4	18.7	15.8	12.9	14.9	13.1	-1.8
Sweden	13.6	13.5	18.4	17.7	20.4	16.0	19.6	20.1	17.9	17.3	15.1	17.1	2.0
Switzerland	18.3	33.0	19.1	19.9	13.3	27.4	28.2	22.5	20.7	18.7	18.8	20.9	2.1
Turkey									8.1	16.2	16.0	14.5	-1.5
Ukraine	50.0	47.3	16.8	14.6	15.4	11.4	8.1	6.9	7.1	7.1	6.3	5.6	-0.7
United Kingdom	20.1	20.2	20.6	25.1	25.8	23.2	22.2	23.3	16.1			38.6	

Andorra: observe the small sample size. *Austria*: From 2003 on. results are based on the 16 x 16 km transnational grid net and must not be compared with previous years. *Poland*: Change of grid net since 2006. *Russian Federation:* North-western and Central European parts only. *Ukraine*: Change of gridnet in 2005. *Hungary, Romania*: Comparisons not possible due to changing survey designs.

Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used. This restriction, however, does not affect the reliability of the trends over time.

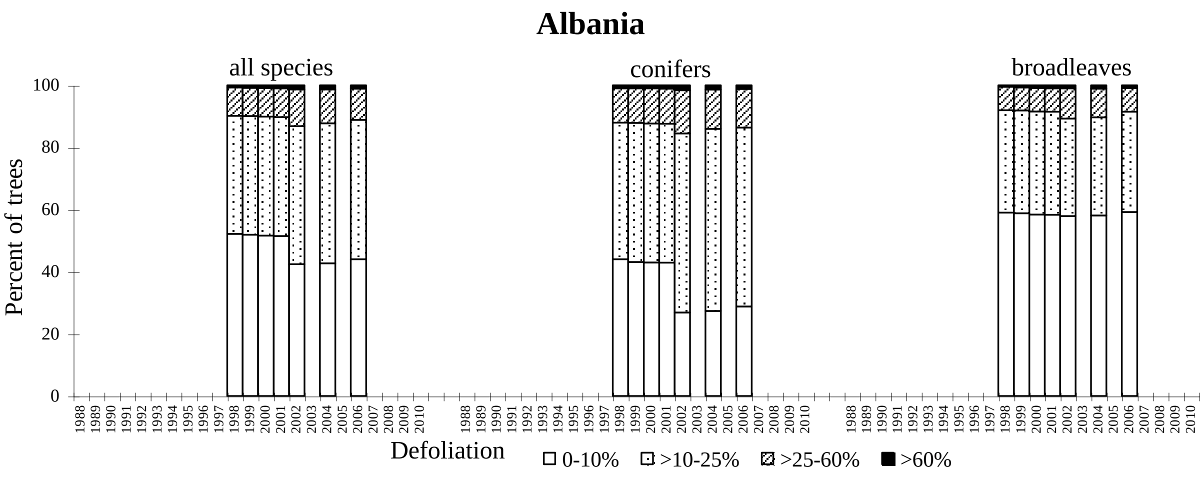
9.2.7 Percent of damaged broadleaves (1999-2010).

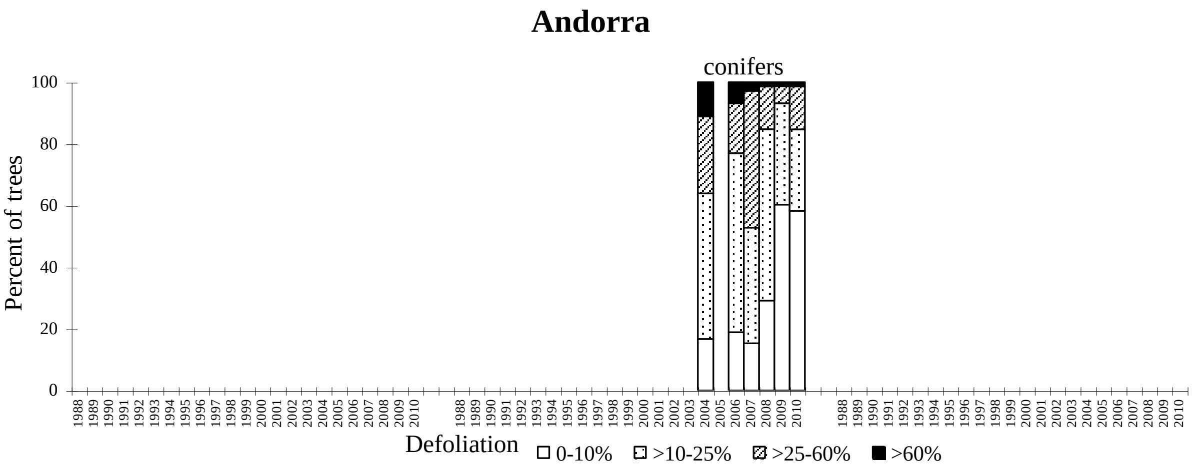
Paticipating countries	Broadleaves Defoliation classes 2-4												change % points
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2009/ 2010
Albania	8.1	8.4	8.4	10.7		10.3		8.5					
Andorra							only conifers assessed						
Austria	9.4	7.6	10.4	11.3	10.2	13.6	12.9	20.1				10.5	
Belarus	17.0	16.9	13.3	9.0	15.8	12.9	10.6	8.9	8.2	7.6	8.7	6.9	-1.8
Belgium	19.1	18.8	18.3	17.0	16.6	21.3	21.4	18.8	17.5	15.3	23.4	24.6	1.2
Bulgaria	35.9	45.8	26.0	29.0	27.2	30.1	23.1	36.4	21.1	17.8	12.2	18.2	6.0
Croatia	16.8	18.3	18.7	14.4	14.3	17.2	19.2	18.2	20.0	19.1	20.7	21.9	1.2
Cyprus							only conifers assessed						
Czech Rep.	17.1	21.4	21.7	19.9	24.4	31.8	32.0	31.2	33.5	32.2	32.9	32.2	-0.7
Denmark	18.8	13.9	8.5	15.4	16.6	19.1	14.4	14.8	10.3	8.0	10.0	12.1	2.1
Estonia	1.1	9.5	2.1	2.7	6.7	5.3	3.4	8.6	7.6	3.4	3.5	2.5	-1.0
Finland	8.6	9.9	8.8	8.8	8.3	8.4	7.2	10.3	10.9	10.6	4.7	9.2	4.5
France	22.9	21.6	23.6	25.5	33.5	38.7	41.3	42.0	41.6	36.5	37.1	38.7	1.6
Germany	26.9	29.9	25.4	24.7	27.3	41.5	35.8	37.2	32.8	28.4	36.1	29.4	-6.7
Greece	20.2	20.2	26.6	26.5			17.9				5.2	23.9	18.7
Hungary	18.2	20.8	21.5	20.8	22.0	21.0	20.9	19.0	20.6		17.1	19.7	2.6
Ireland							only conifers assessed						
Italy	39.3	40.5	46.3	44.6	45.0	42.0	36.5	35.2	40.4	35.8	36.8	30.1	-6.7
Latvia	14.2	22.2	14.8	12.8	13.5	14.3	12.9	8.5	11.8	11.5	11.6	9.4	-2.2
Liechtenstein													
Lithuania	11.8	17.7	16.3	19.0	24.6	21.8	15.4	16.6	17.7	20.3	18.4	23.7	5.3
Luxembourg	25.8	33.5											
FYR. of Macedonia													
Rep. of Moldova	41.4	29.2	36.9	42.5	42.3	33.9	26.4	27.6	7.4	33.6	25.2	22.4	-2.8
The Netherlands	10.0	18.8	18.5	29.6	33.7	46.9	53.1	26.2			25.6	26.6	1.0
Norway	44.8	34.0	33.7	30.4	29.0	33.2	27.6	33.2	36.3	33.8	31.0	26.8	-4.2
Poland	31.1	32.0	31.4	33.1	39.6	38.7	34.1	18.0	18.9	19.1	18.5	21.5	3.0
Portugal	13.7	13.2	12.8	12.6	16.2	19.0	27.0						
Romania	14.0	15.8	14.7	14.8	13.3	13.0	9.3	9.9	23.5		18.3	18.0	-0.3
Russian Fed.				16.0							4.4	3.2	-1.2
Serbia	13.0	6.7	6.7	0.6	21.5	13.5	15.7	11.0	15.7	11.3	9.9	10.7	0.8
Slovak Rep.	19.3	13.9	26.9	14.5	25.6	19.9	13.6	17.0	16.6	20.8	24.5	32.9	8.4
Slovenia	23.2	18.4	26.7	25.9	22.6	24.2	28.5	27.6	35.7	34.6	33.3	28.1	-5.2
Spain	16.1	15.7	14.4	17.3	19.1	16.1	23.3	24.4	19.5	18.4	20.7	16.1	-4.6
Sweden	8.7	7.5	14.1	9.6	11.1	8.3	9.2	10.8		only conifers assessed			
Switzerland	20.4	22.1	16.3	16.0	18.1	32.8	27.9	22.6	26.1	19.6	17.4	25.2	7.8
Turkey										38.3	23.4	21.2	-2.2
Ukraine	59.7	69.6	53.3	36.7	35.3	43.2	9.2	6.2	7.1	9.1	7.2	6.4	-0.8
United Kingdom	23.2	23.8	21.9	30.3	23.2	30.6	28.2	29.2	35.3			56.1	

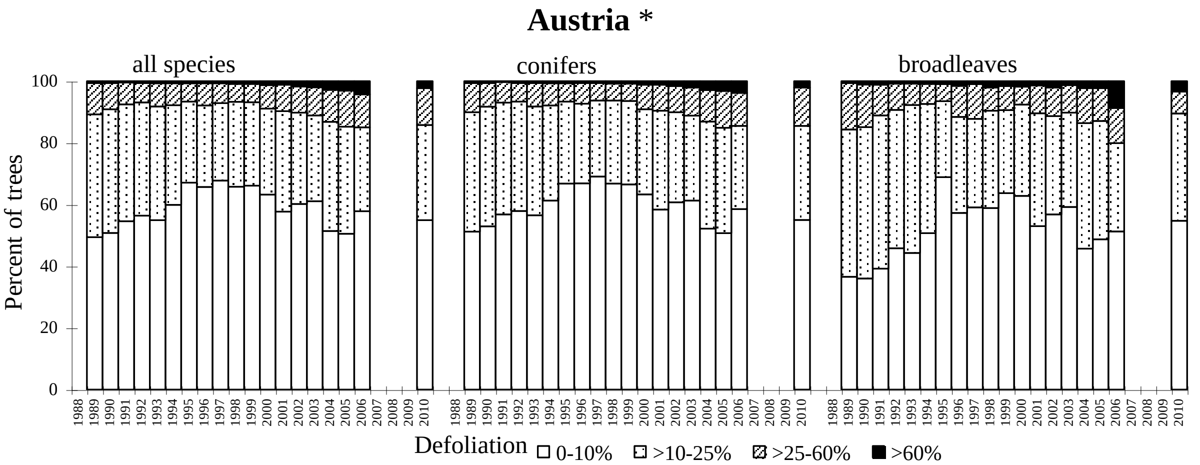
Andorra: observe the small sample size. *Austria*: From 2003 on. results are based on the 16 x 16 km transnational grid net and must not be compared with previous years. *Poland*: Change of grid net since 2006.*Russian Federation:* North-western and Central European parts only. *Ukraine*: Change of gridnet in 2005. *Hungary, Romania*: Comparisons not possible due to changing survey designs.

Note that some differences in the level of damage across national borders may be at least partly due to differences in standards used.

9.2.8 Changes in defoliation (1988-2010)

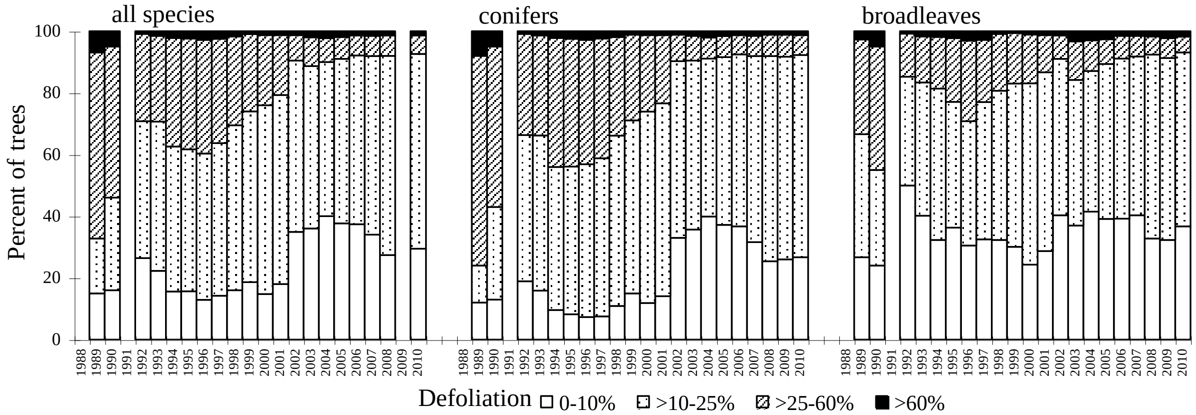




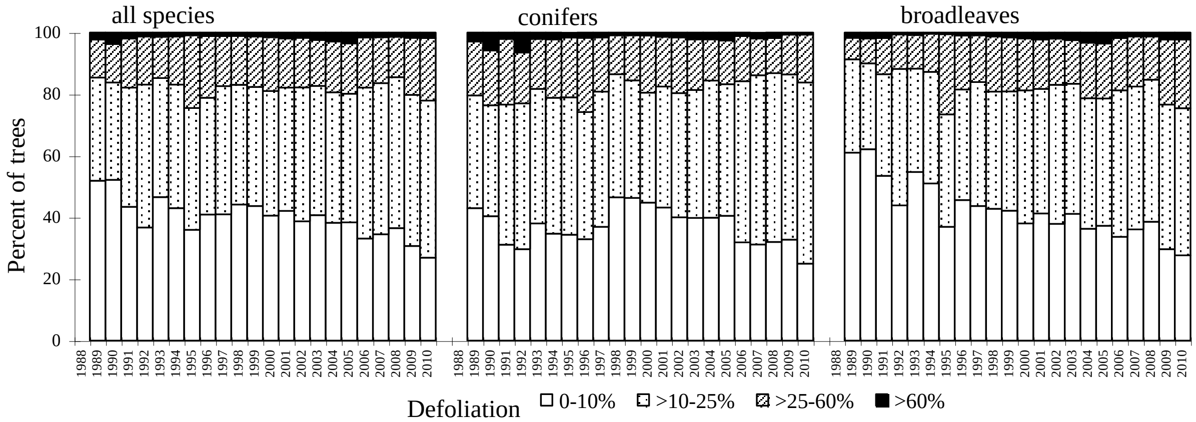


* from 2003 on, results are based on the 16 x 16 km transnational gridnet and must not be compared with previous years.

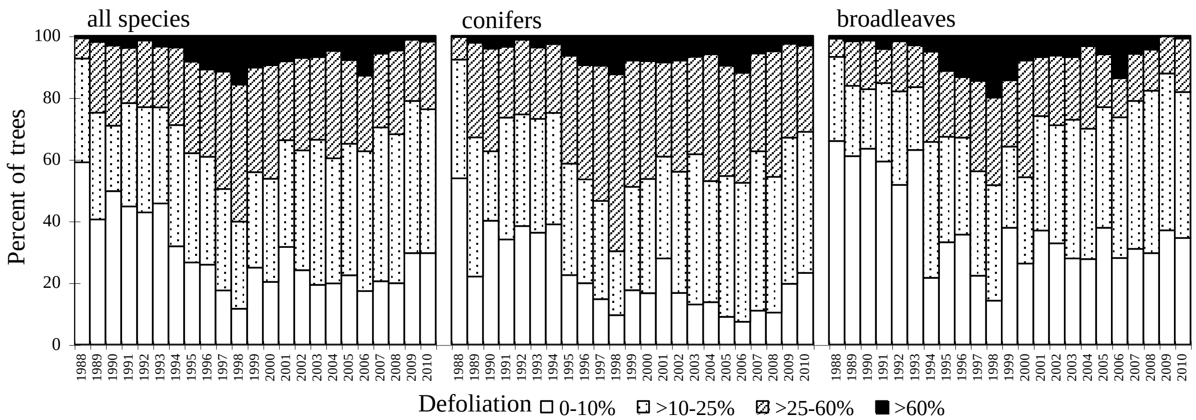
Belarus



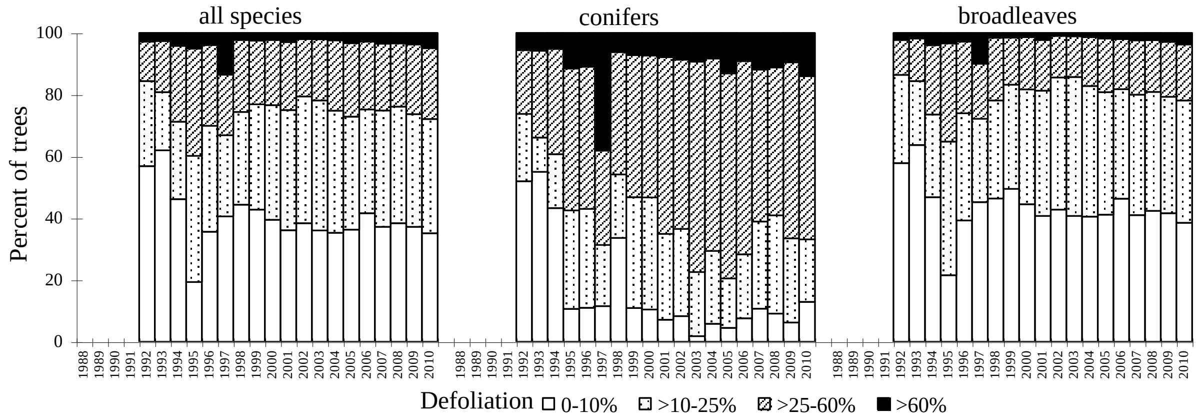
Belgium



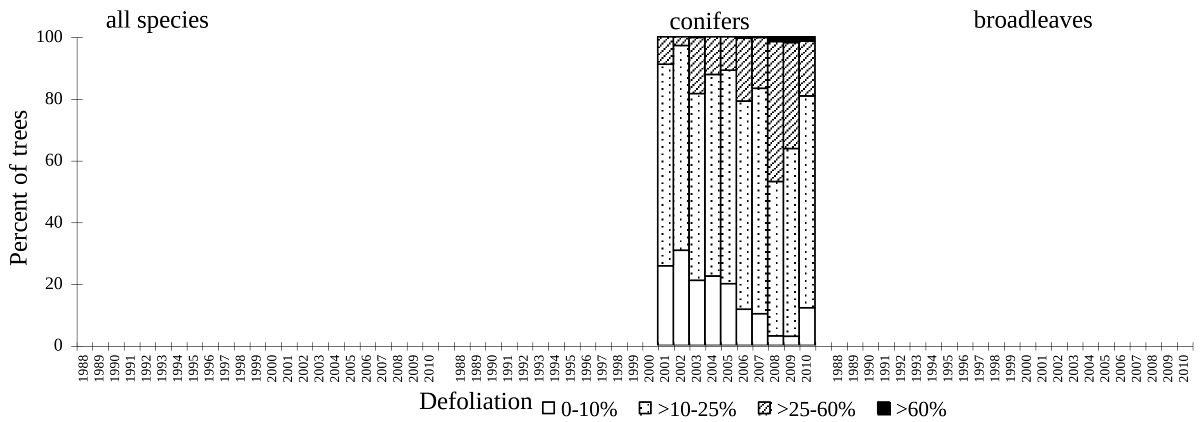
Bulgaria



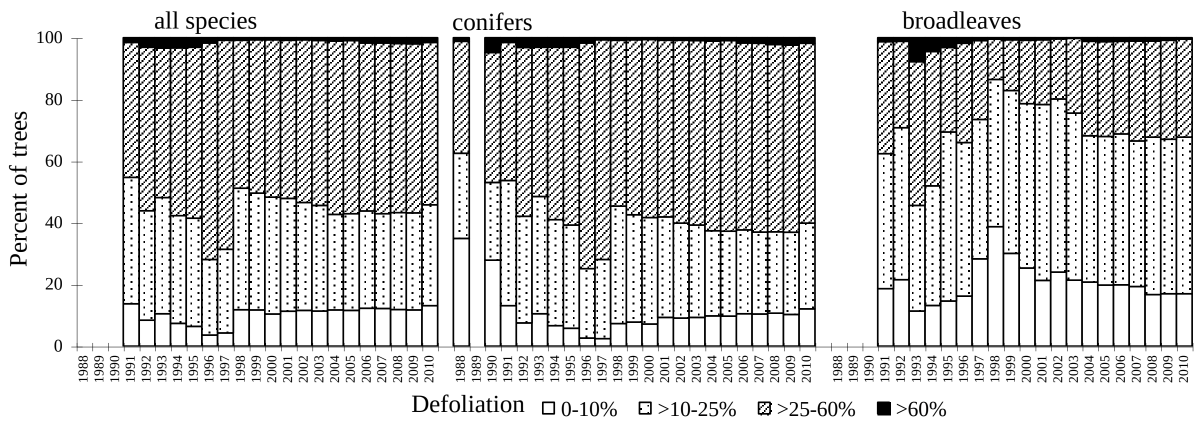
Croatia



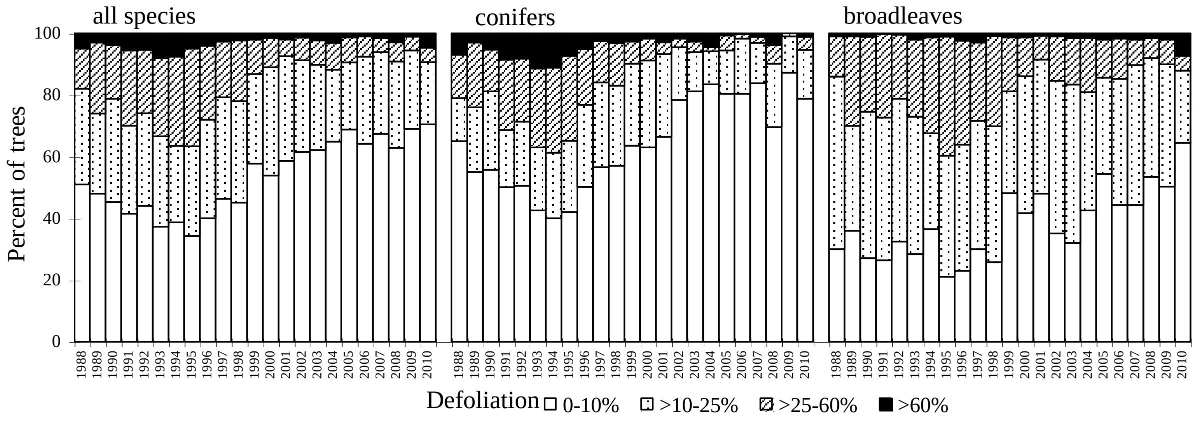
Cyprus



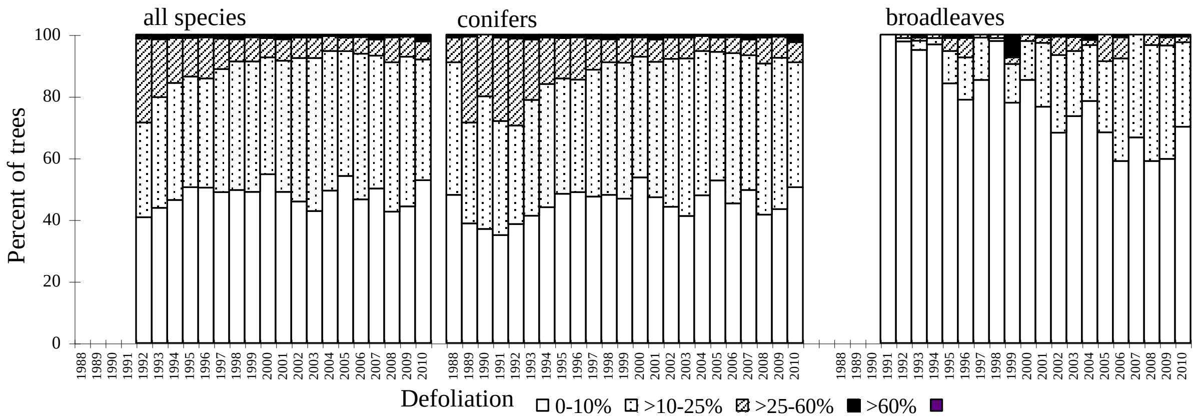
Czech Republic



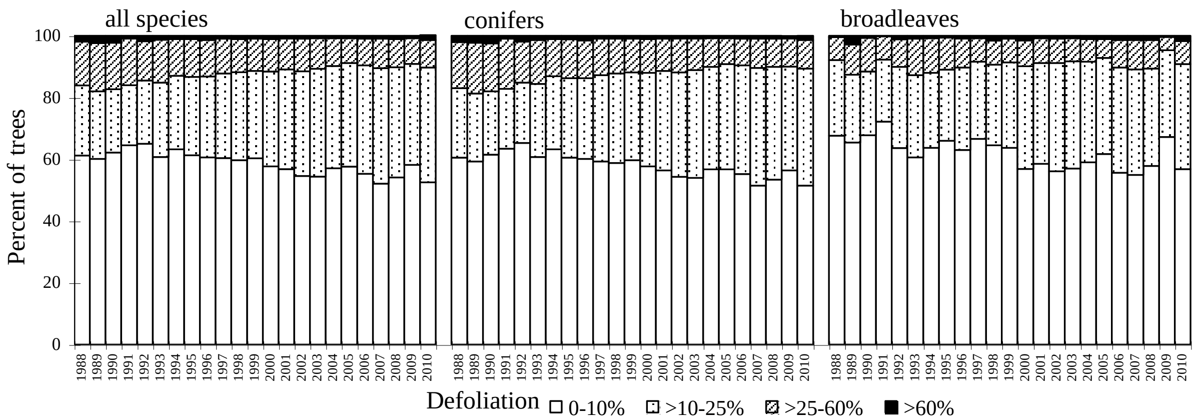
Denmark



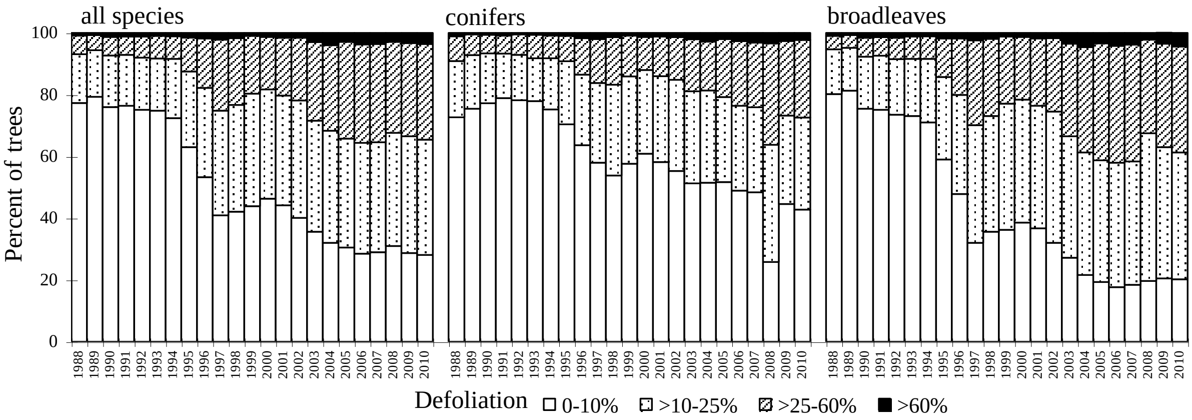
Estonia



Finland

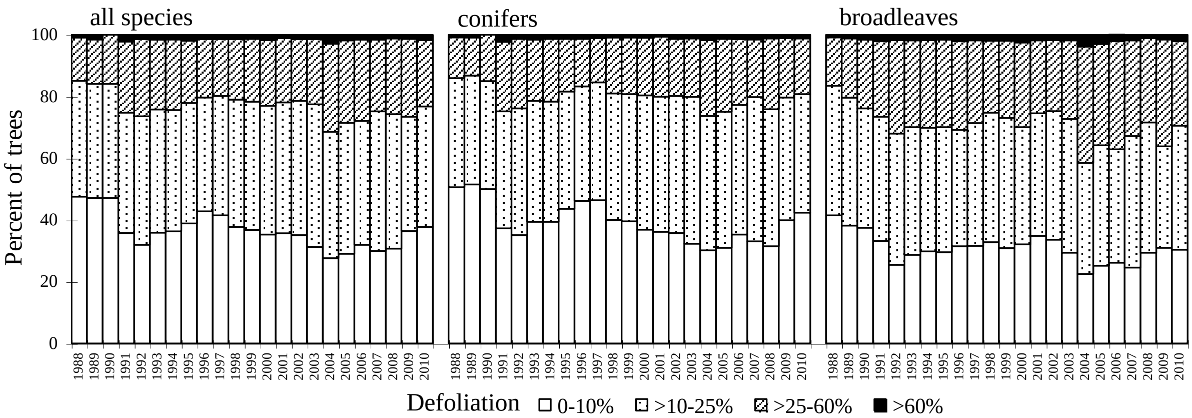


France *



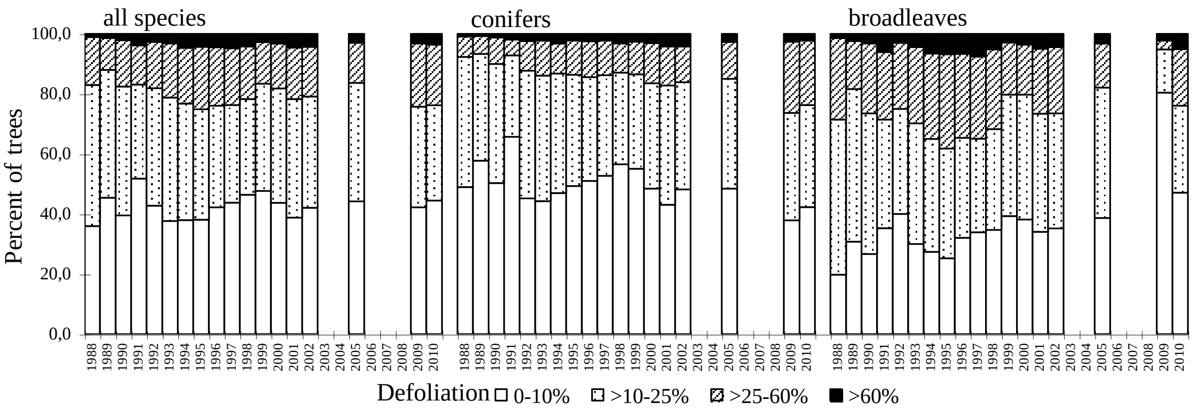
* due to methodological changes, only the time series 1988-94 and 1997-2010 are consistent, but not comparable to each other.

Germany

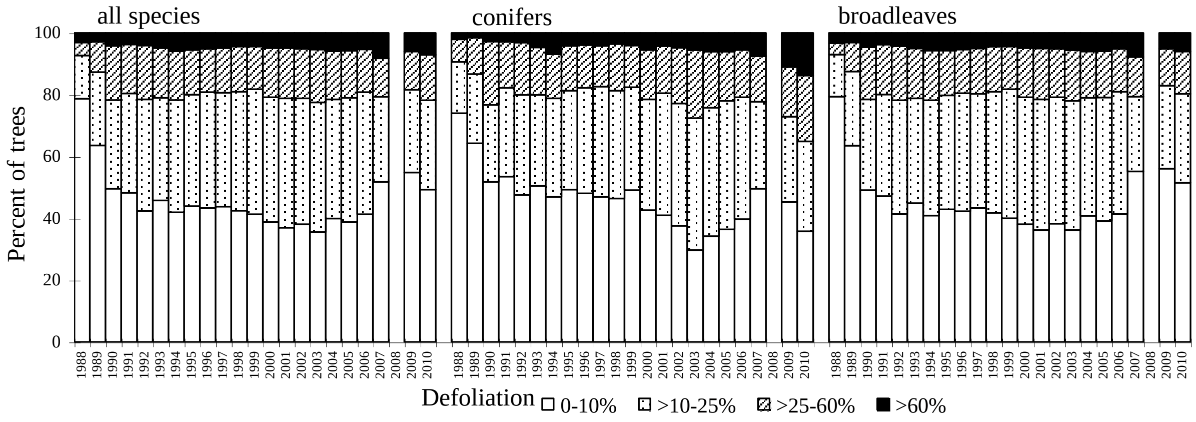


* before 1991 without former GDR

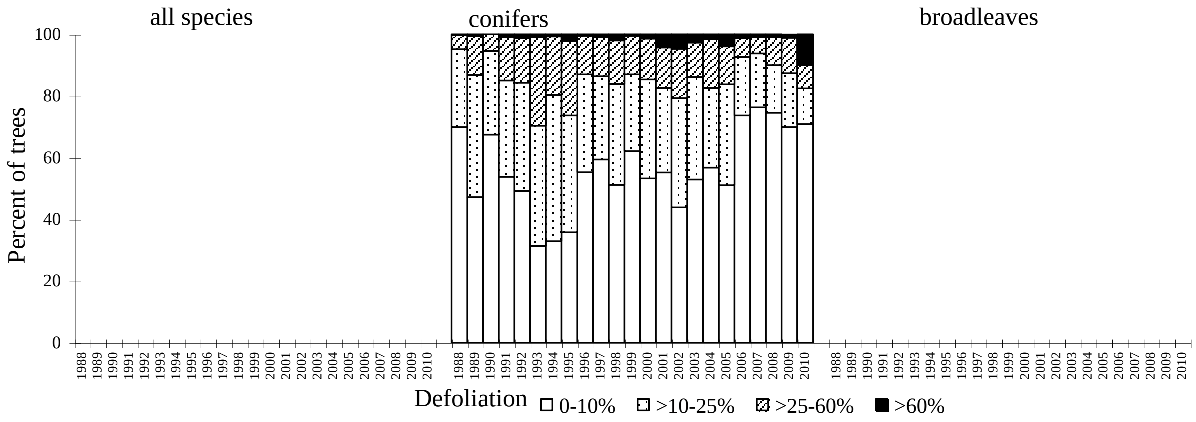
Greece



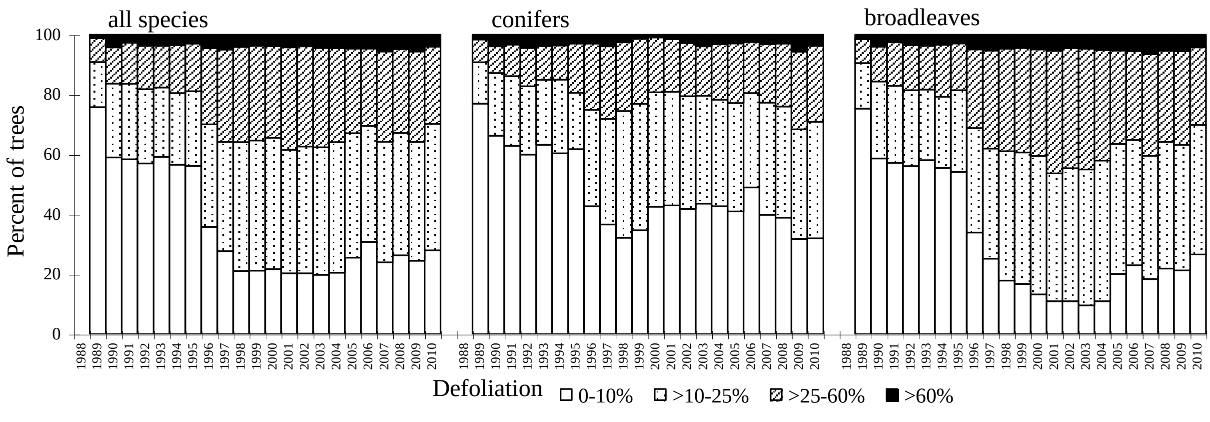
Hungary



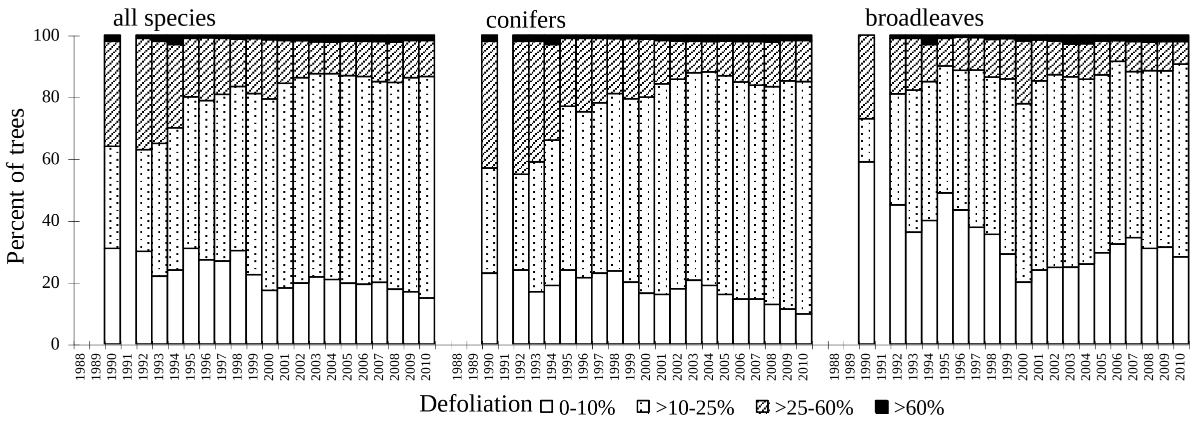
Ireland



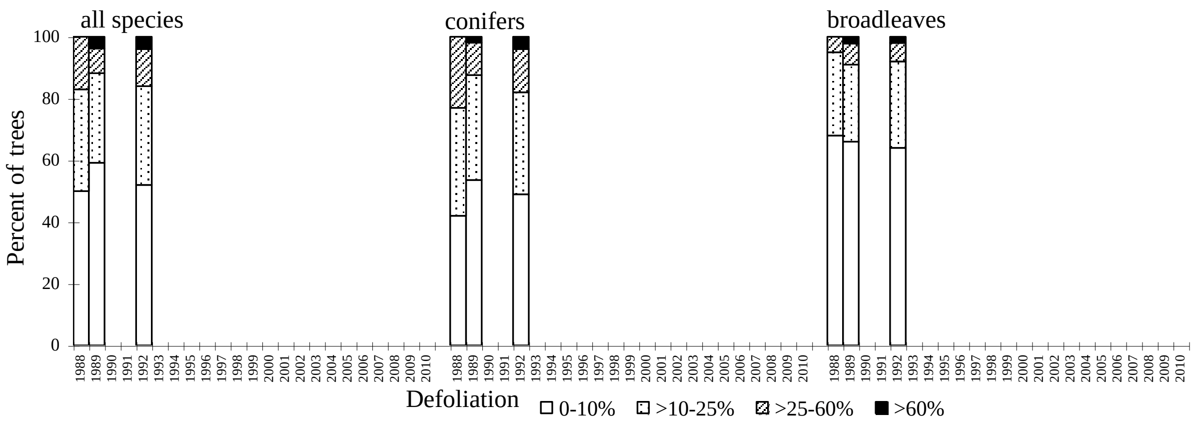
Italy



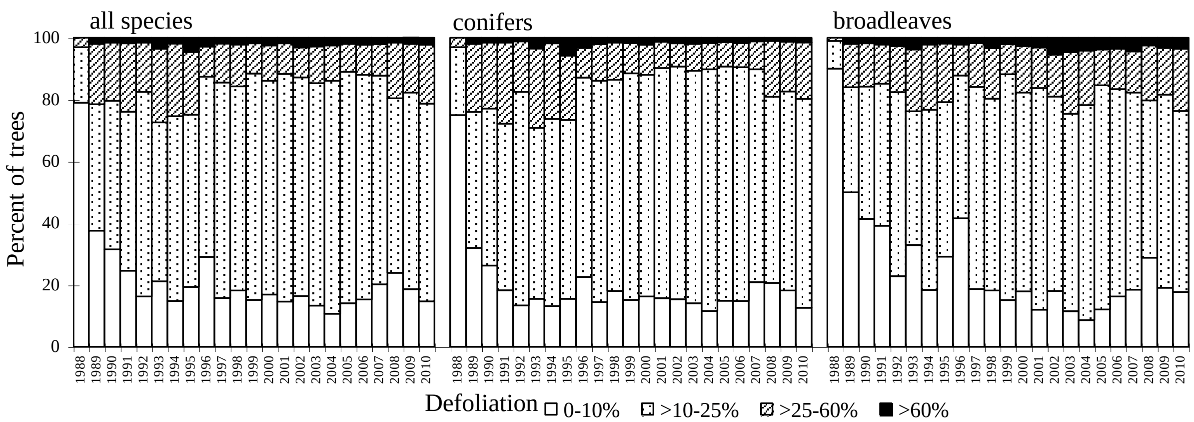
Latvia



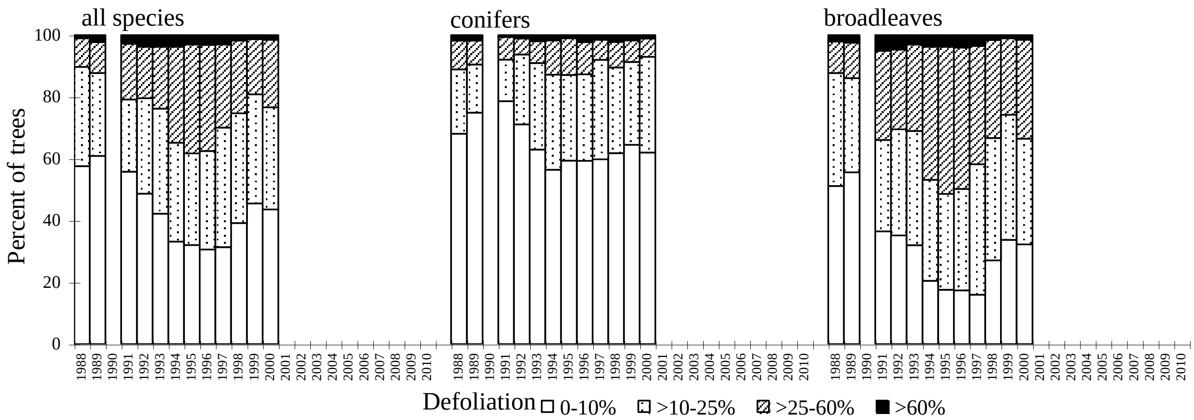
Liechtenstein



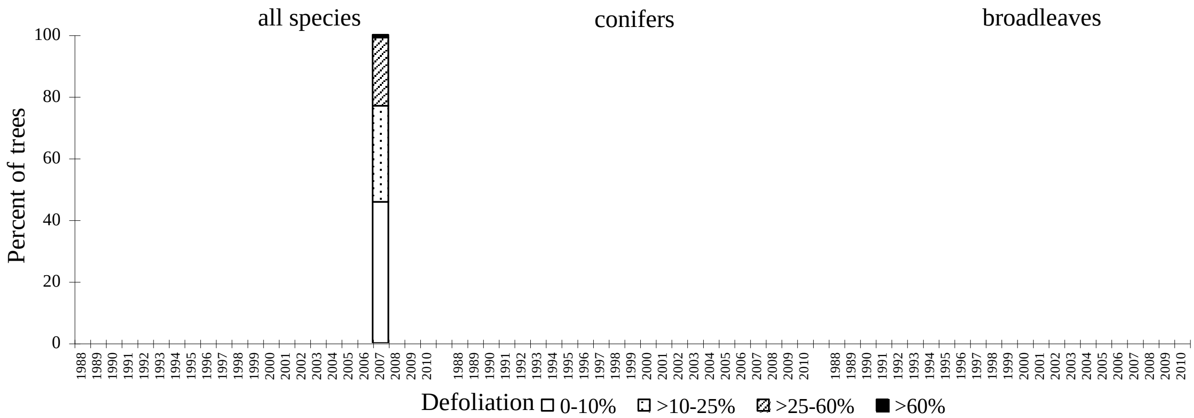
Lithuania



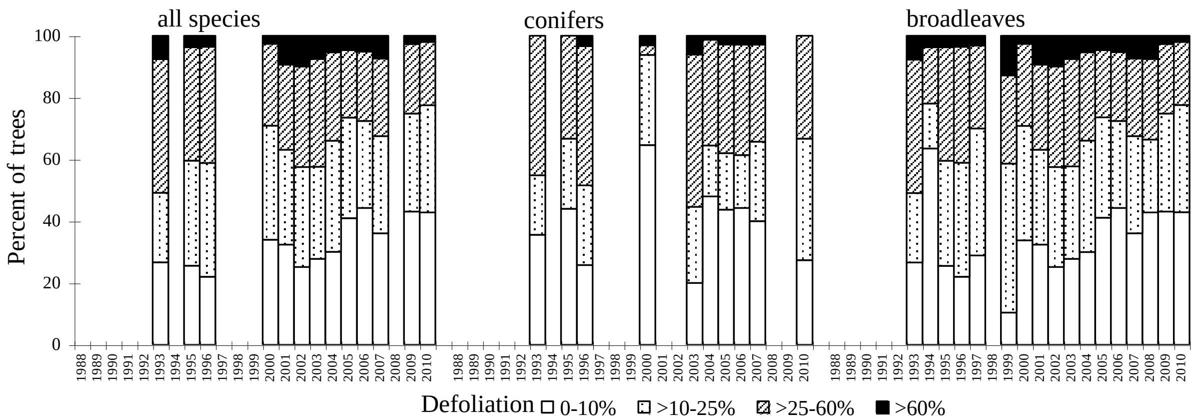
Luxembourg



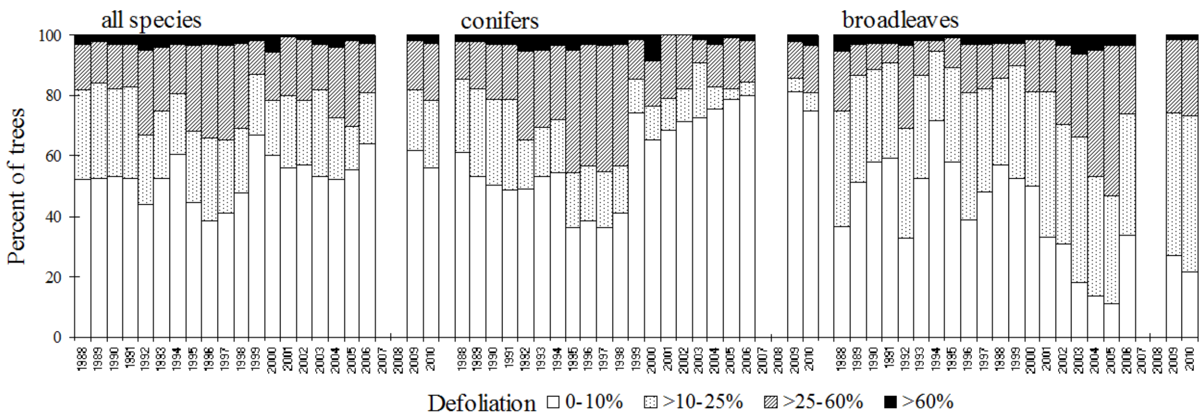
FYR of Macedonia



Republic of Moldova

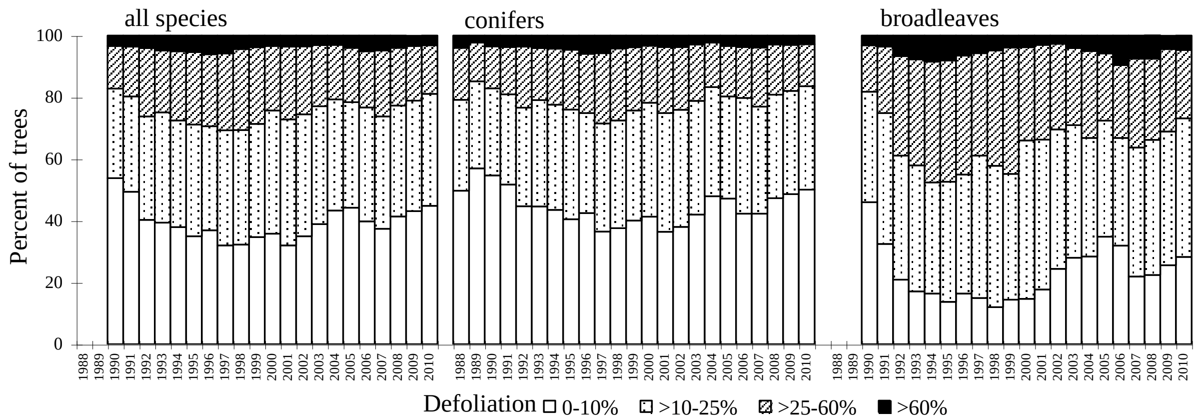


The Netherlands

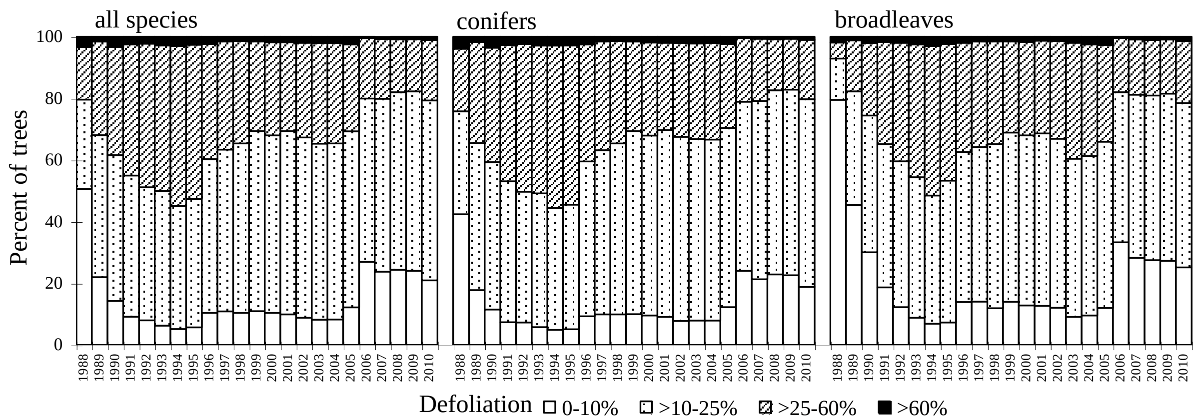


1989-1994: 1500 plots, 1995-1998: 200 plots, since 1999: 11 plots

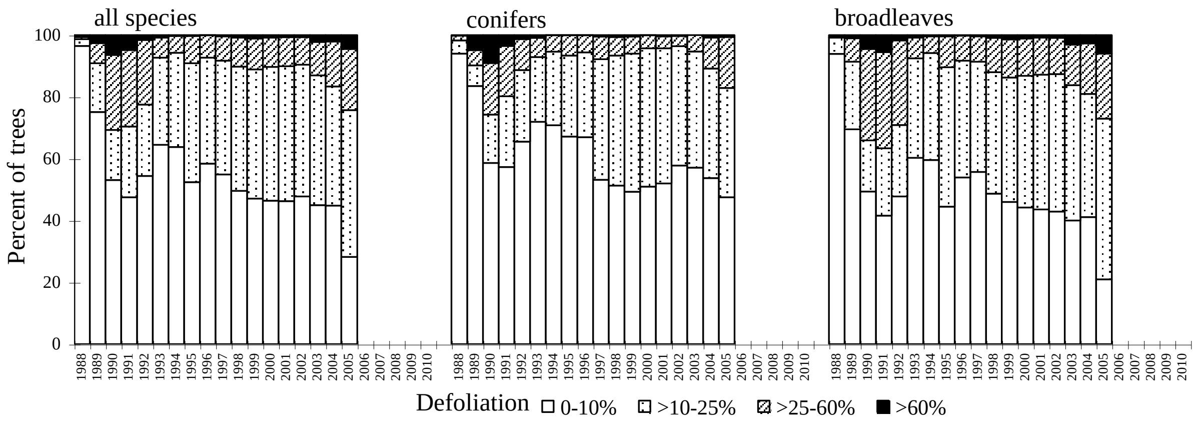
Norway



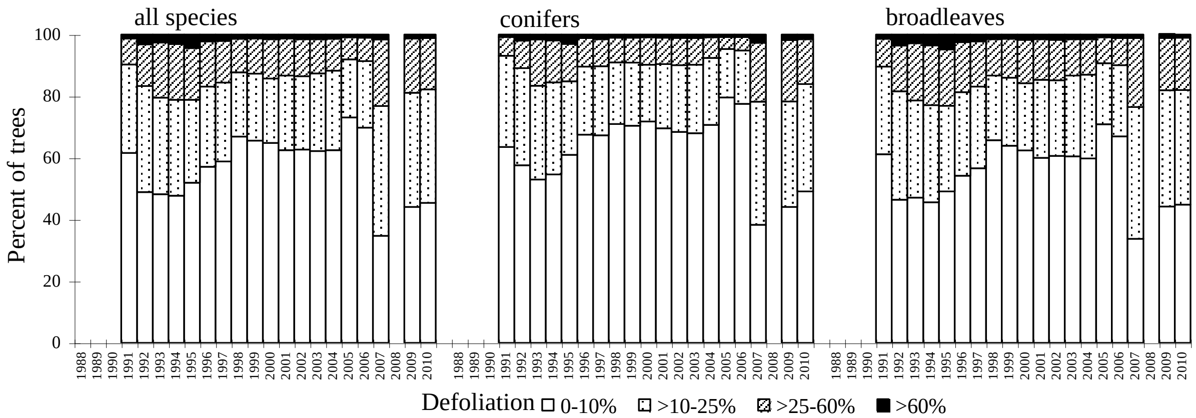
Poland



Portugal

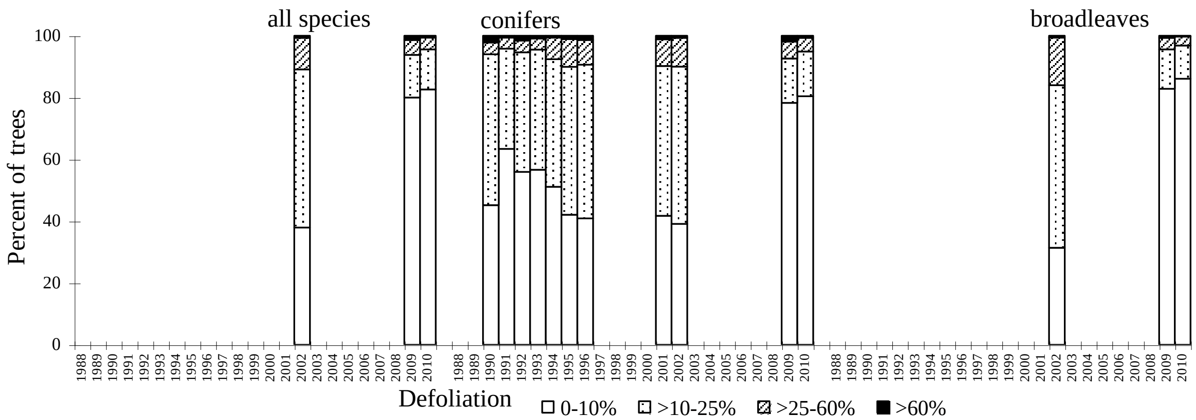


Romania *



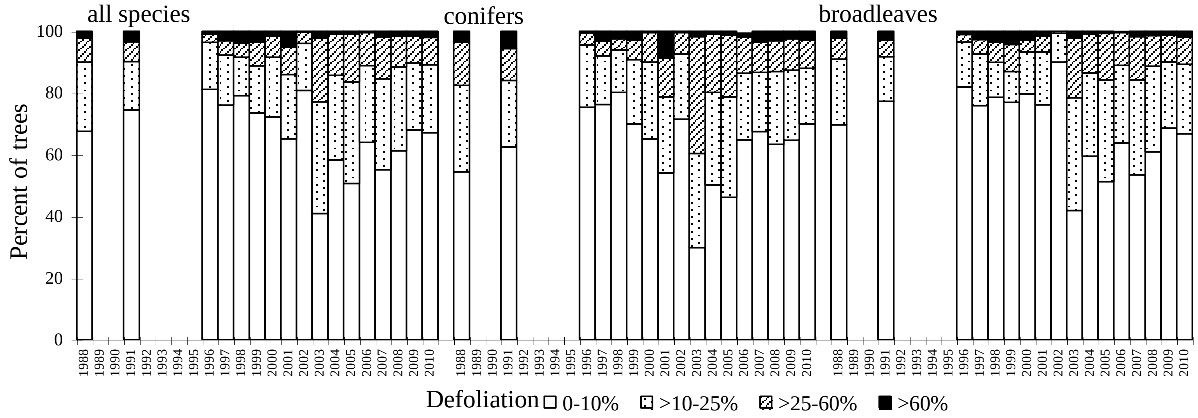
* from 2007 on, results are based on the 16 x 16 km transnational gridnet and must not be compared with previous years.

Russian Federation *

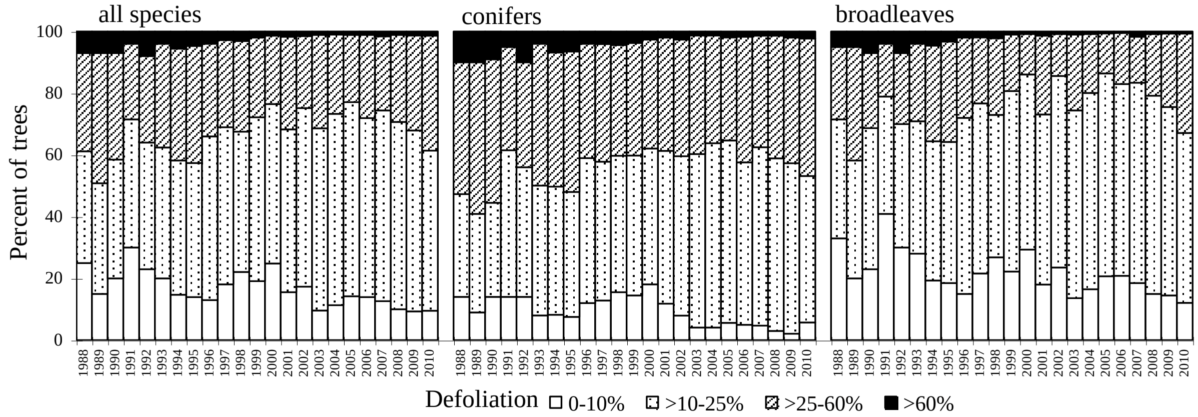


* Only regional surveys in north-western and Central European parts of Russia.

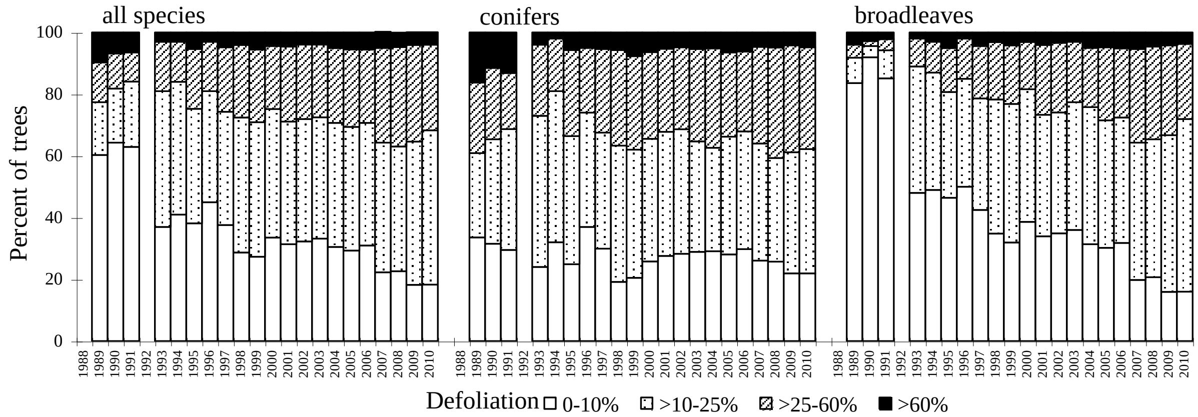
Serbia



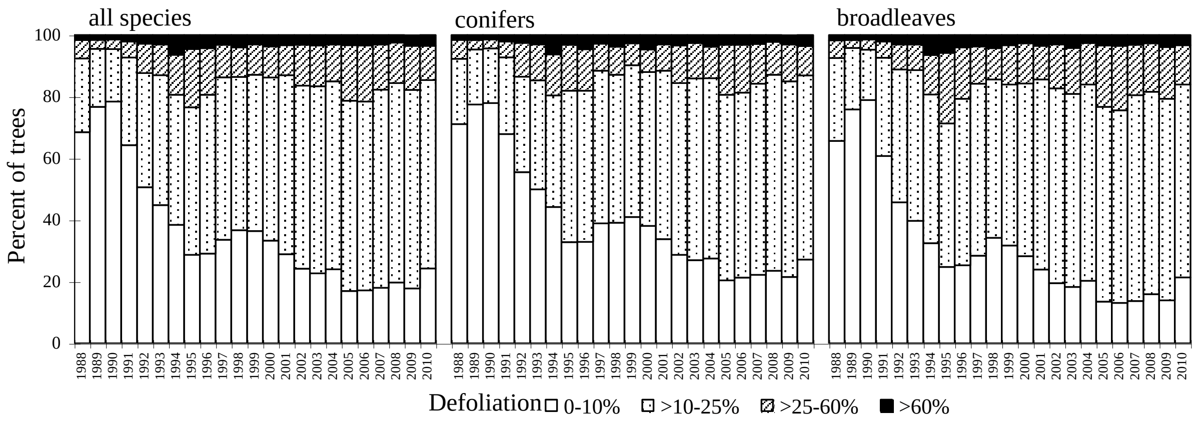
Slovak Republic



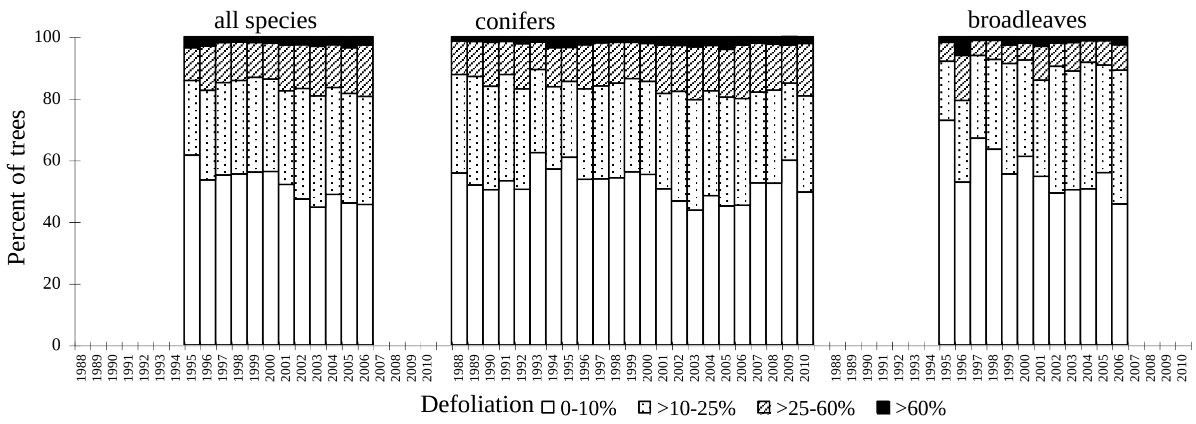
Slovenia



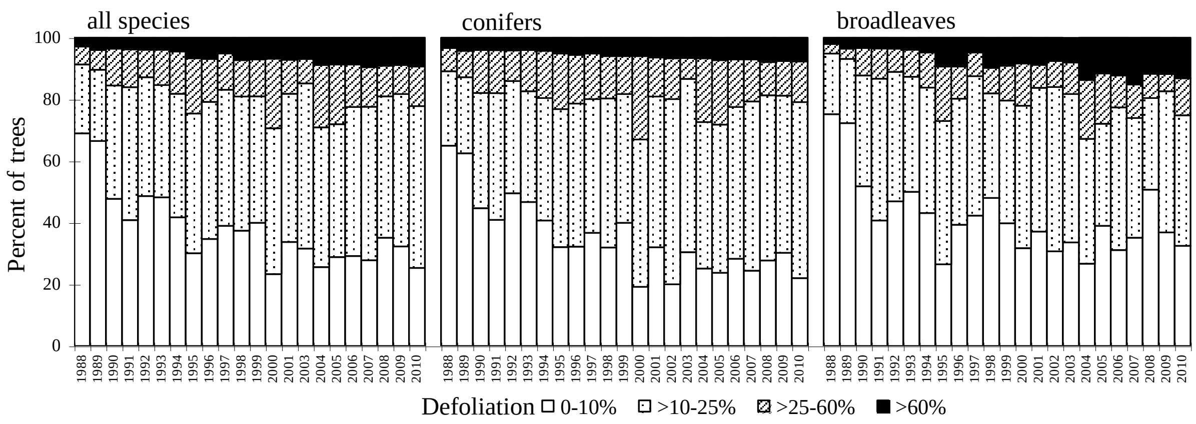
Spain



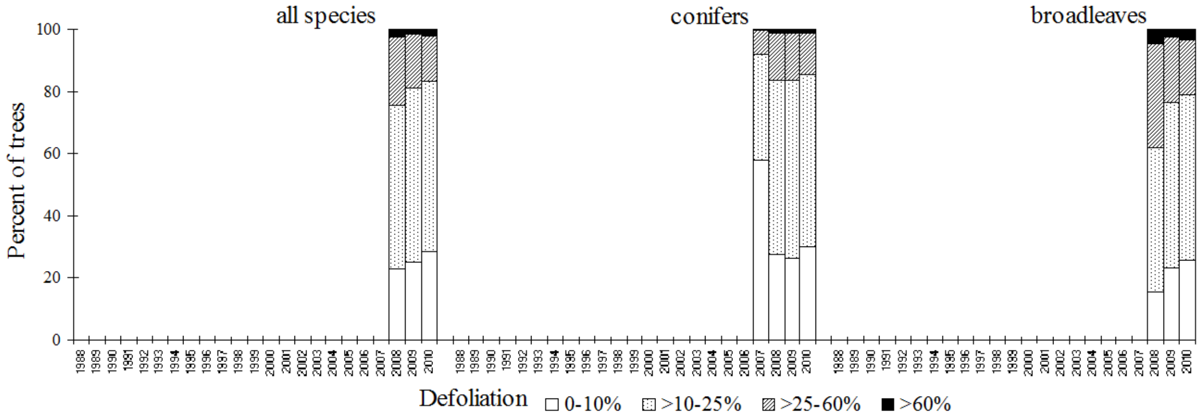
Sweden



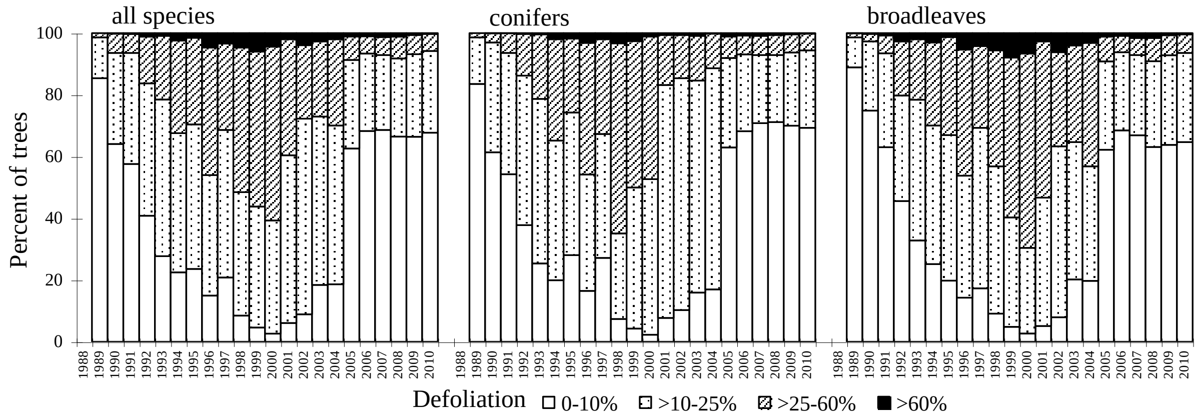
Switzerland



Turkey

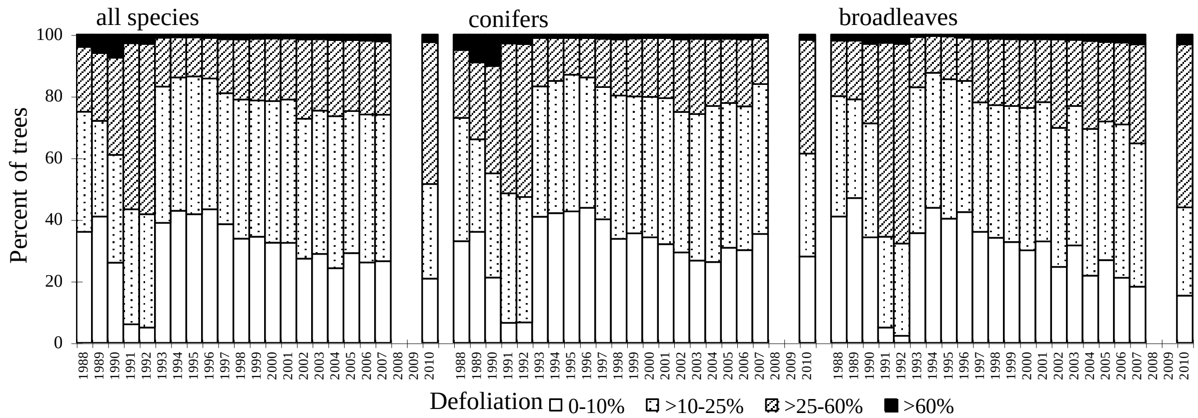


Ukraine



since 2005 change of assessment grid

United Kingdom



after 1992 change of assessment method in line with that used in other countries

9.3 Annex: Addresses

9.3.1. UNECE and ICP Forests

UNECE	United Nations Economic Commission for Europe Environment and Human Settlements Division Air Pollution Unit Palais des Nations 1211 GENEVA 10 SWITZERLAND Phone: +41 22 91 71 234/-91 72 358 Fax: +41-22-917 06 21 e-mail: Matti.Johansson@unece.org Mr Matti Johansson
ICP Forests	International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests Johann Heinrich von Thünen-Institut Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei Leuschnerstr. 91 21031 Hamburg GERMANY Phone: +49 40 739 62 100/Fax: +49 40 739 62 199 e-mail: michael.koehl@vti.bund.de Mr Michael Köhl, Chairman of ICP Forests
ICP Forests Lead Country	International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz – Ref. 535 Postfach 14 02 70 53107 BONN GERMANY Phone: +49 228 99 529-41 30/Fax: +49 228-99 529 42 62 e-mail: sigrid.strich@bmelv.bund.de Ms Sigrid Strich
PCC of ICP Forests	Programme Coordinating Centre of ICP Forests Johann Heinrich von Thünen-Institut Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei Leuschnerstr. 91 21031 Hamburg GERMANY Phone: +49 40 739 62 140/Fax: +49 40 739 62 199 e-mail: martin.lorenz@vti.bund.de Internet: http://www.icp-forests.org Mr Martin Lorenz

9.3.2 Expert Panels, WG and other Coordinating Institutions

Expert Panel on Soil and Soil Solution	Research Institute for Nature and Forest Environment & Climate Unit Gaverstraat 4 9500 GERAARDSBERGEN BELGIUM Phone: +32 54 43 71 20/Fax: +32 54 43 61 60 e-mail: bruno.devos@inbo.be Mr Bruno De Vos, Chair
	Finnish Forest Research Institute Metla PL 18 01301 VANTAA FINLAND Phone: +358 10 211 5457 / Fax: +358 10 211 2103 e-mail: tiina.nieminen@metla.fi Ms Tiina Nieminen, Co-chair
Expert Panel on Foliar Analysis and Litterfall	Finnish Forest Research Institute Northern Unit Eteläranta 55 96300, ROVANIEMI FINLAND Phone: +358 50 391 40 45 / Fax: +358 10 211 44 01 e-mail: pasi.rautio@metla.fi Mr Pasi Rautio, Chair
	Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW) Seckendorff-Gudent-Weg 8 1131 WIEN AUSTRIA Phone: +43-1-878 38-11 14/ Fax:+43-1-878 38-12 50 e-mail: alfred.fuerst@bfw.gv.at Mr Alfred Fürst, Co-chair Foliage
	Finnish Forest Research Institute Metla PL 18 01301 VANTAA FINLAND Phone: +358 10 211 5115 / Fax: +358 10 211 2103 e-mail: liisa.Ukonmaanaho@metla.fi Ms Liisa Ukonmaanaho, Co-chair Litterfall
Expert Panel on Forest Growth	Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft WSL Zürcherstr. 111 8903 BIRMENSDORF SWITZERLAND

Phone: +41 44 739 25 94/Fax: +41 44 739 22 15
e-mail: matthias.dobbertin@wsl.ch
Mr Matthias Dobbertin, Chair

Bundesforschungs- und Ausbildungszentrum für
Wald, Naturgefahren und Landschaft (BFW)
Seckendorff-Gudent-Weg 8
1131 WIEN
AUSTRIA
Phone: +43 1 878 38 13 27 / Fax: +43 1 878 38 12 50
e-mail: markus.neumann@bfw.gv.at
Mr Markus Neumann, Co-chair

Expert Panel on Deposition Measurements	Forest & Landscape Frederiksberg, University of Copenhagen Rolighedsvej 23 1958 Frederiksberg C DENMARK Phone: +45 3533 1682 / Fax: +45 3533 1508 e-mail: kiha@life.ku.dk Ms Karin Hansen, Chair
	Slovenian Forestry Institute Gozdarski Inštitut Slovenije Večna pot 2 1000 LJUBLJANA SLOVENIA Phone: +38 6 12 00 78 00 / Fax: +38 6 12 57 35 89 e-mail: daniel.zlindra@gozdis.si Mr Daniel Zlindra, Co-chair
Expert Panel on Ambient Air Quality	Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL) Zürcherstr. 111 8903 BIRMENSDORF SWITZERLAND Phone: +41 44 73 92 564 / Fax: +41 44 73 92 215 e-mail: marcus.schaub@wsl.ch Mr Marcus Schaub, Chair
	Fundación Centro de Estudios Ambientales del Mediterráneo - CEAM Parque Tecnológico C/ Charles R. Darwin, 14 46980 PATERNA - VALENCIA SPAIN Phone: +34-961 318 227 / Fax: +34-961 318 190 e-mail: vicent@ceam.es Mr Vicent Calatayud, Co-chair

Expert Panel on Crown Condition Assessment and Damage Types	Research Institute for Nature and Forest Gaverstraat 4 9500 GERAARDSBERGEN BELGIUM Tel. +32 54 43 71 15 / Fax: +32 54 43 61 60 e-mail: peter.roskams@inbo.be Mr Peter Roskams, Chair
	Servicio de Sanidad Forestal y Equilibrios Biológicos (SSF), Dirección General de Medio Natural y Política Forestal (Ministerio de medio Ambiente y Medio Rural y Marino) Forest Health Unit (DG Nature and Forest Policy) Rios Rosas, 24, 6a pl. 28003 MADRID SPAIN Phone: +34 91-749 38 12 / Fax: +34 91-749 38 77 e-mail: gsanchez@mma.es, Mr Gerardo Sánchez, Co-chair
Expert Panel on Biodiversity and Ground Vegetation Assessment	Coillte Teoranta Research and Development Dublin Road Newtown Mt. Kennedy CO. WICKLOW IRELAND Phone: +353 120 11 162 / Fax: +353 120 111 99 e-mail: Pat.Neville@coillte.ie Mr Pat Neville, Chair
	Camerino University Dept. of Environmental Sciences Via Pontoni, 5 I - 62032 Camerino (MC) ITALY Phone: +39 0737404503/5/ Fax: +39 0737404508 e-mail: roberto.canullo@unicam.it Mr Roberto Canullo
Committee on Quality Assurance	TerraData Environmetrics srl Via L. Bardelloni 19 58025 Monterotondo Marittimo (GR) ITALY Phone: +39 056 691 66 81 e-mail: ferretti@terradata.it Mr Marco Ferretti, Chair
	Nordwestdeutsche Forstliche Versuchsanstalt Grätzelstraße 2 37079 Göttingen GERMANY

	Phone: +49-551-69 401 141 / Fax. +49-551-69 401 160 e-mail: Nils.Koenig@NW-FVA.de Mr Nils König, Co-chair
WG on Quality Assurance and Quality Control in Laboratories	Nordwestdeutsche Forstliche Versuchsanstalt Grätzelstraße 2 37079 Göttingen GERMANY Phone: +49-551-69 401 141 / Fax. +49-551-69 401 160 e-mail: Nils.Koenig@NW-FVA.de Mr Nils König, Chair
	Forest Research Institute Sękocin Stary, 3 Braci Leśnej Street 05-090 RASZYN POLAND Phone: +48 22 7150 300 / Fax: +48 22 7200 397 e-mail: a.kowalska@ibles.waw.pl Ms Anna Kowalska, Co-chair
Expert Panel on Meteorology and Phenology	Bayerische Landesanstalt für Wald und Forstwirtschaft (LWF) Hans-Carl-von-Carlowitz-Platz 1 85354 Freising GERMANY Phone: +49 (81 61) 71 49 21 / Fax: +49 (81 61) 71 49 71 e-mail: Stephan.Raspe@lwf.bayern.de Mr Stephan Raspe, Chair
	Slovenian Forestry Institute Večna pot 2 SI-1000 LJUBLJANA SLOVENIA Phone: +386 (1) 200 78 46 149 / Fax: +386 (1) 257 35 89 e-mail: ursa.vilhar@gozdis.si Ms Urša Vilhar, Co-chair Phenology
Forest Foliar Coordinating Center (FFCC)	Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW) Seckendorff-Gudent-Weg 8 1131 WIEN AUSTRIA Phone: +43-1-878 38-11 14/ Fax:+43-1-878 38-12 50 e-mail: alfred.fuerst@bfw.gv.at Mr Alfred Fürst
Forest Soil Coordinating Centre	Research Institute for Nature and Forest (INBO) Gaverstraat 4 9500 GERAARDSBERGEN BELGIUM Phone: +32 54 43 61 75 / Fax: +32 54 43 61 89

e-mail: nathalie.cools@inbo.be
Ms Nathalie Cools

9.3.3 Ministries (Min) and National Focal Centres (NFC)

Albania (Min)	Ministry of the Environment, Forests and Water Administration Dep. of Biodiversity and Natural Resources Management Durresi Str., Nr. 27 TIRANA ALBANIA Phone: +355 4 2224537 / Fax: +355 422 70 627 e-mail: info@moe.gov.al
(NFC)	Forest and Pasture Research Institute "Halil Bego" Str, L. 23 TIRANA ALBANIA Phone/Fax: +355 437 12 42 +355 437 12 37 ikpk@albaniaonline.net
Andorra (Min) (NFC)	Ministeri de Medi Ambient, Agricultura i Patrimoni Natural Govern d'Andorra, Departament de Medi Ambient Tècnica de l'Àrea d'Impacte Ambiental C. Prat de la Creu, 62-64 500 ANDORRA LA VELLA PRINCIPAT D'ANDORRA Phone: +376 875 707 / Fax: +376 869 833 e-mail: Silvia_Ferrer_Lopez@govern.ad, Anna_Moles@govern.ad Ms Silvia Ferrer, Ms Anna Moles
Austria (NFC)	Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW) Seckendorff-Gudent-Weg 8 1131 WIEN AUSTRIA Phone: +43 1 878 38 13 30 / Fax: +43 1 -878 38 12 50 e-mail: ferdinand.kristoefel@bfw.gv.at Mr Ferdinand Kristöfel
(Min)	Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Abt. IV/2 Stubenring 1 1010 WIEN AUSTRIA Phone: +43 1 71 100 72 14 / Fax: +43 1 711 00 0 e-mail: vladimir.camba@lebensministerium.at Mr Vladimir Camba

Belarus
(NFC)

Forest inventory republican unitary company
"Belgosles"
Zheleznodorozhnaja st. 27
220089 MINSK
BELARUS
Phone: +375 17 22 63 053 / Fax: +375 17 226 30 92
e-mail: belgosles@open.minsk.by, olkm@tut.by
Mr Valentin Krasouski

(Min)

Committee of Forestry
Myasnikova st. 39
220048 MINSK
BELARUS
Phone/Fax: +375 172 00 45 82
e-mail: mlh@mlh.by
Mr Petr Semashko

Belgium
Wallonia
(Min)
(NFC)

Service public de Wallonie (SPW)
Direction générale opérationnelle Agriculture,
Ressources naturelles et Environnement (DGARNE)
Département de la Nature et des Forêts - Direction des Ressources Forestières
Avenue Prince de Liège 15
5100 JAMBES
BELGIUM
Phone: +32 (81) 33 58 42 +32 (81) 33 58 34
Fax: +32 (81) 33 58 11
e-mail: Christian.Laurent@spw.wallonie.be,
etienne.gerard@spw.wallonie.be
Mr Christian Laurent, Mr Etienne Gérard, Mr. Mathieu Jonard

(NFC)

Earth and Life Institute, Environmental Sciences
Université catholique de Louvain
Croix du Sud, 2 - L7.05.09
1348 LOUVAIN-LA-NEUVE
BEGLIUM
Phone: +32 10 47 37 02 +32 10 47 25 48 /
Fax: +32 10 47 36 97
e-mail: isabelle.caignet@uclouvain.be,
mathieu.jonard@uclouvain.be
Ms Isabelle Caignet, Mr Mathieu Jonard

Flanders
(Min)

Ministry of the Flemish Region (AMINAL)
Flemish Forest Service
Koning Albert II-laan 20 bus 22
1000 BRUSSELS
BELGIUM
Phone: +32 2 553 81 02 / Fax: +32 2 553 81 05
e-mail: carl.deschepper@lne.vlaanderen.be
Mr Carl De Schepper

Flanders (NFC)	Research Institute for Nature and Forest Gaverstraat 4 9500 GERAARDSBERGEN BELGIUM Tel. +32 54 43 71 15 / Fax: +32 54 43 61 60 e-mail: peter.roskams@inbo.be Mr Peter Roskams
Bulgaria (NFC)	Executive Environment Agency Monitoring of Lands, Biodiversity and Protected Areas Department 136 "Tzar Boris III" Blvd., P.O. Box 251 1618 SOFIA BULGARIA Phone: +359 2 940 64 86 / Fax:+359 2 955 90 15 e-mail: forest@eea.government.bg Ms. Genoveva Popova
(Min)	Ministry of Environment and Water National Nature Protection Service 22, Maria Luiza Blvd. 1000 SOFIA BULGARIA Phone: + 359 2 940 6112 / Fax: +359 2 940 6127 e-mail: p.stoichknova@moew.government.bg Ms. Penka Stoichkova
Canada (Min) (NFC)	Natural Resources Canada 580 Booth Str., 12th Floor OTTAWA, ONTARIO K1A 0E4 CANADA Phone: +1 (613) 947-90 60 / Fax: +1 (613) 947-90 35 e-mail: Pal.Bhogal@nrcan.gc.ca Mr Pal Bhogal
Québec (Min) (NFC)	Ministère des Ressources naturelles Direction de la recherche forestière 2700, rue Einstein, bureau RC. 102 STE. FOY (QUEBEC) G1P 3W8 CANADA Phone: +1 418 643-79 94 Ext. 65 33 / Fax: +1 418 643-21 65 e-mail: rock.ouimet@mrnf.gouv.qc.ca Mr Rock Ouimet
Croatia (Min) (NFC)	Hrvatski šumarski institut Croatian Forest Research Institute Cvjetno naselje 41 10450 JASTREBARSKO CROATIA Phone: +385 1 62 73 027 / Fax: + 385 1 62 73 035 e-mail: nenadp@sumins.hr

	Mr Nenad Potocic
Cyprus (Min) (NFC)	Ministry of Agriculture, Natural Resources and Environment Research Section - Department of Forests Louki Akrita 26 1414-NICOSIA CYPRUS Phone: +357- 22- 819 490 / Fax: +357 22 303 935 e-mail: achristou@fd.moa.gov.cy Mr Andreas Christou
Czech Republic (NFC)	Forestry and Game Management Research Institute (VULHM) Jíloviště-Strnady 136 PRAGUE 5 – Zbraslav PSČ 156 04 CZECH REPUBLIC Phone: +420 257 892 221 / Fax: +420 257 921 444 e-mail: lomsky@vulhm.cz Mr Bohumír Lomský
(Min)	Ministry of Agriculture of the Czech Republic Forest Management Tešnov 17 117 05 PRAGUE 1 CZECH REPUBLIC Phone: +420 221 811 111 / Fax: +420 221 812 988 e-mail: info@mze.cz, posta@mze.cz Mr Tomáš Krejzar
Denmark (NFC)	Forest & Landscape Frederiksberg University of Copenhagen Rolighedsvej 23 1958 Frederiksberg C DENMARK Phone: +45 35 33 1897 / Fax: +45 35 33 15 08 e-mail: ab@life.ku.dk Mrs Annemarie Bastrup-Birk
(Min)	Danish Ministry of the Environment, Nature Agency Haraldsgade 53 2100 Copenhagen DENMARK Phone: +45 72 54 30 00 e-mail: nst@nst.dk Ms Agnete Thomsen
Estonia (NFC)	Estonian Environment Information Centre Rõõmu tee 2 51013 TARTU

ESTONIA
Phone:+37 27 339 713 / Fax: +37 27 339 464
e-mail: kalle.karoles@metsad.ee
Mr Kalle Karoles

(Min) Ministry of the Environment
Forest and Nature Conservation Department
Narva mnt 7a
15172 TALLINN
ESTONIA
Phone: +27 2 626 29 13 / Fax: +27 2 626 28 01
e-mail: andres.talijarv@envir.ee
Mr Andres Talijärv

Finland (NFC) Finnish Forest Research Institute
(METLA)
Parkano Research Unit
Kaironiementie 15
39700 PARKANO
FINLAND
Phone: +358 10 211 40 61 / Fax: +358 10 211 40 01
e-mail: paivi.merila@metla.fi
Ms Päivi Merilä

(Min) Ministry of Agriculture and Forestry
Forest Department
Hallituskatu 3 A
00023 GOVERNMENT
FINLAND
Phone: +358 (9) 160 523 19 / Fax +358 9 160 52400
e-mail: teemu.seppa@mmm.fi
Mr Teemu Seppä

France (NFC) Office National des Forêts
Direction technique et commerciale bois
Département recherche - Bâtiment B
Boulevard de Constance
77300 Fontainebleau
FRANCE
Phone: +33 1 60 74 92-28 / Fax: +33 1 64 22 49 73
e-mail: manuel.nicolas@onf.fr, erwin.ulrich@onf.fr
Mr Manuel Nicolas, Mr Erwin Ulrich

(Min) Ministère de l'alimentation, de l'agriculture et de la pêche
Direction générale de l'alimentation
Sous-Direction de la qualité et de la protection des végétaux
Département de la santé des forêts
251 rue de Vaugirard
75732 Paris cedex 15
FRANCE
Phone: +33 1 49 55 51 95 / Fax: +33 1 49 55 59 49

	e-mail: jean-luc.flot@agriculture.gouv.fr, fabien.caroulle@agriculture.gouv.fr Mr Jean-Luc Flot, Mr Fabien Caroulle
Germany (Min) (NFC)	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz – Ref. 535 Rochusstr. 1 53123 BONN GERMANY Phone: +49 228 99 529-41 30 / Fax: +49 228 99 529-42 62 e-mail: sigrid.strich@bmelv.bund.de Ms Sigrid Strich
Greece (NFC)	Forest Research Institute of Athens National Agricultural Research Foundation Terma Alkmanos str. 11528 ILISSIA, ATHENS GREECE Phone: +30 210-77 84 850, +30 210 77 84 240 Fax: +30 210 77 84 602 e-mail: oika@fria.gr, mipa@fria.gr Mr George Baloutsos, Mr. Anastasios Economou, Mr Panagiotis Michopoulos
(Min)	Ministry of Rural Development and Foods Gen. Secretariat for Forests and the Natural Environment Dir. of Forest Resources Development Halkokondili 31 101 64 ATHENS GREECE Phone: +30 210 52 42 349 / Fax: +30 210 52 44 135 e-mail: pbalatsos@yahoo.com, skollarou@yahoo.gr Mr Panagiotis Balatsos, Mrs Sofia Kollarou
Hungary (NFC)	State Forest Service Central Agricultural Office (CAO), Forestry Directorates Széchenyi u. 14 1054 BUDAPEST HUNGARY Phone: +36 1 37 43 216 / Fax: +36 1 37 43 206 e-mail: kolozs.laszlo@aesz.hu Mr László Kolozs
(Min)	Ministry of Agriculture and Rural Development Department of Natural Resources Kossuth Lajos tér 11 1055 BUDAPEST HUNGARY Phone: +36-1-301 40 25 / Fax: +36 1 301 46 78 e-mail: andras.szepesi@fvm.gov.hu Mr András Szepesi

Ireland (NFC)	Coillte Teoranta Research & Environment Dublin Road Newtown Mt. Kennedy CO. WICKLOW IRELAND Phone: + 353 1 20 111 56 / Fax: +353 1 20 111 99 e-mail: Fiona.Harrington@coillte.ie Ms Fiona Harrington
(Min)	Forest Service Department of Agriculture, Fisheries and Food Mayo West Michael Davitt House CASTLEBAR, CO. MAYO IRELAND Phone: +353 94 904 29 25 / Fax: +353 94 902 36 33 e-mail: Orla.Fahy@agriculture.gov.ie Ms Orla Fahy
Italy (Min) (NFC)	Ministry for Agriculture and Forestry Policies Corpo Forestale dello Stato National Forest Service, Headquarter, Division 6^ (NFI, CONECOFOR Service and forest monitoring) via G. Carducci 5 00187 ROMA ITALY Phone: +39 06 466 570 43 / Fax: +39 06 481 89 72 e-mail: e.pompei@corpoforestale.it Mr Enrico Pompei
Latvia (Min)	Ministry of Agriculture Forest Department Republikas laukums 2 RIGA LV-1981 LATVIA Phone: +371 670 27 285 / Fax: +371 670 27 094 e-mail: lasma.abolina@zm.gov.lv Ms Lasma Abolina
(NFC)	State Forest Service of Latvia Department of Environment Protection 13. Janvara iela 15 1932 RIGA LATVIA Phone: +371 72 22 820 / Fax: +371 72 11 176 e-mail: ieva.zadeika@vmd.gov.lv Ms Ieva Zadeika

Liechtenstein (Min) (NFC)	Amt für Wald, Natur und Landschaft Dr. Grass-Strasse 10 9490 VADUZ FÜRSTENTUM LIECHTENSTEIN Phone: +423 236 64 01 / Fax: +423 236 64 11 e-mail: felix.naescher@awnl.llv.li Mr Felix Näscher
Lithuania (NFC)	State Forest Survey Service Pramones ave. 11a 51327 KAUNAS LITHUANIA Phone: +370 37 490 290 / Fax: +370 37 490 251 e-mail: a.kasparavicius@amvmt.lt Mr Albertas Kasperavicius
(Min)	Ministry of Environment Dep. of Forests and Protected Areas A. Juozapaviciaus g. 9 2600 VILNIUS LITHUANIA Phone: +370 2 723 648 / Fax: +370 2 72 20 29 e-mail: v.vaiciunas@am.lt Mr Valdas Vaiciunas
Luxembourg (Min) (NFC)	Administration de la nature et des forêts Service des forêts 16, rue Eugène Ruppert 2453 LUXEMBOURG LUXEMBOURG Phone: +352-402.201-211 / Fax: +352-402.201-250 e-mail: marc.wagner@anf.etat.lu Mr Marc Wagner
Former Yugoslav Republic of Macedonia (FYROM) (NFC)	Ss. Cyril and Methodius University in Skopje Faculty of Forestry in Skopje Department of Forest and Wood Protection bul. Aleksandar Makedonski bb 1000 SKOPJE FORMER YUGOSLAV REP. OF MACEDONIA Phone: +389 2 31 35 003 150 / Fax: +389 2 31 64 560 e-mail: nnikolov@sf.ukim.edu.mk Mr Nikola Nikolov
(Min)	Ministry of Agriculture, Forestry and Water Economy Dep. for Forestry and Hunting 2 Leninova Str. 1000 SKOPJE FORMER YUGOSLAV REP. OF MACEDONIA Phone/Fax: +398 2 31 24 298 e-mail: vojo.gogovski@mzsv.gov.mk

Mr Vojo Gogovski

Republic of Moldova State Forest Agency
(Min) 124 bd. Stefan Cel Mare
(NFC) 2001 CHISINAU
REPUBLIC OF MOLDOVA
Phone: +373 22 27 23 06 / Fax: +373 22 27 73 45
e-mail: icaspiu@starnet.md
Mr Anatolie Popusoi

The Netherlands Ministry of Agriculture, Nature and Food Quality
(NFC) Department of Nature and Rural Development
(Min) P.O. Box 20401
2500 EK DEN HAAG
THE NETHERLANDS
Phone: +31 70 378 50 49
e-mail: r.post2@minlnv.nl
Mr Ruben Post

Norway Norwegian Forest and Landscape Institute
(NFC) Høgskoleveien 8
1432 ÅS
NORWAY
Phone: +47 64 94 89 92 / Fax: +47 64 94 80 01
e-mail: dan.aamlid@skogoglandskap.no
Mr Dan Aamlid

(Min) Norwegian Pollution Control Authority (SFT)
Dep. for Environmental Strategy
Section for Environmental Monitoring
P.O. Box 8100 Dep
Strømsveien 96
0032 OSLO
NORWAY
Phone: +47 22 57 34 87 / Fax: +47 22 67 67 06
e-mail: tor.johannessen@sft.no
Mr Tor Johannessen

Poland Forest Research Institute
(NFC) Instytut Badawczy Lesnictwa
Sękocin Stary
ul. Braci Leśnej nr 3
05-090 RASZYN
POLAND
Phone: +48 22 71 50 657 / Fax: +48 22 72 00 397
e-mail: j.wawrzoniak@ibles.waw.pl
Mr Jerzy Wawrzoniak

(Min) Ministry of the Environment
Department of Forestry
Wawelska Str. 52/54

00 922 WARSAW
POLAND
Phone: +48 (22) 57 92 550 / Fax: +48 (22) 57 92 290
e-mail: Department.Lesnictwa@mos.gov.pl
Mr Edward Lenart

Portugal (Min) (NFC)	Autoridade Florestal Nacional / National Forest Authority Ministério da Agricultura, do Desenvolvimento Rural e das Pescas Divisão de Protecção e Conservação Florestal Av. João Crisóstomo, 26-28 1069-040 LISBOA PORTUGAL Phone: +351 (21) 312 49 58 / Fax: +351 21 312 49 87 e-mail: mbarros@afn.min-agricultura.pt Ms Maria Barros
Romania (Min) (NFC)	Forest Research and Management Institute (ICAS) Bd. Eroilor 128 077190 Voluntari, Judetul Ilfov ROMANIA Phone: +40 21 350 32 38 / Fax: +40 21 350 32 45 e-mail: biometrie@icas.ro, obadea@icas.ro Mr Ovidiu Badea, Mr Romica Tomescu
Russian Fed. (Min)	Ministry of Natural Resources of the Russian Federation 4/6, B. Gruzinskaya Str. MOSCOW D-242, GSP-5, 123995 RUSSIAN FEDERATION Phone: +7 495 254 48 00 / Fax: +7 495 254-43 10, +7 495 254-66-10 e-mail: korolev@mnr.gov.ru Mr Igor A. Korolev
(NFC)	Centre for Forest Ecology and Productivity of the Russian Academy of Sciences Profsouznaya str., 84/32 117 997 MOSCOW RUSSIAN FEDERATION Phone: +7 495 332 29 17 / Fax: +7 495 332 26 17 e-mail: lukina@cepl.rssi.ru Ms Natalia Lukina
Serbia (Min)	Ministry of Agriculture, Forestry and Water Management Directorate of Forests Omladinskih brigada 1 11070 BELGRADE REPUBLIC OF SERBIA Phone: +381 (11) 311 75 66 / Fax: +381 11 313 15 69 e-mail: sasao@uns.ac.rs Mr Sasa Orlovic

(NFC)	Institute of Forestry str. Kneza Viseslava 3 11000 BELGRADE SERBIA Phone: +381 11 3 553 454 / Fax: + 381 11 2 545 969 e-mail: nevenic@Eunet.rs Mr Radovan Nevenic
Slovakia (NFC)	National Forest Centre - Forest Research Institute Národné lesnícke centrum ul. T.G. Masaryka 22 962 92 ZVOLEN SLOVAKIA Phone: +421 (45) 531 42 02 / Fax: +421 (45) 531 41 92 e-mail: pavlenda@nlcsk.org Mr Pavel Pavlenda
(Min)	Ministry of Agriculture of the Slovak Republic Dobrovičova 12 812 66 BRATISLAVA SLOVAK REPUBLIC Phone: +421 2 59 266 308 / Fax: +421 2 59 266 311 e-mail: carny@mpsr.sanet.sk Mr Juraj Balkovic
Slovenia (NFC)	Slovenian Forestry Institute Gozdarski Inštitut Slovenije Večna pot 2 1000 LJUBLJANA SLOVENIA Phone: +386-1-200 78 00 / Fax: +386-1-257 35 89 e-mail: marko.kovac@gozdis.si Mr Marko Kovač
(Min)	Ministry of Agriculture, Forestry and Food (MKGP) Dunajska 56-58 1000 LJUBLJANA SLOVENIA Phone: +386 1 478 90 38 / Fax: +386 1 478 90 89 e-mail: Janez.Zafran@gov.si, robert.rezonja@gov.si Mr Janez Zafran, Mr Robert Režonja
Spain (NFC)	Servicio de Sanidad Forestal y Equilibrios Biológicos (SSF), Dirección General de Medio Natural y Política Forestal, (Ministerio de medio Ambiente y Medio Rural y Marino) Rios Rosas, 24, 6a pl. 28003 Madrid SPAIN

	Phone: +34 91-749 38 12; +34 91-749 37 20 Fax: +34 91-749 38 77 e-mail: gsanchez@mma.es, at_pgarciaf@mma.es Mr Gerardo Sánchez, Ms Paloma García Fernández
(Min)	Dirección General de Medio Natural y política Forestal Ministerio de Medio Ambiente y Medio Rural y Marino Ríos Rosas, 24 28003 MADRID SPAIN e-mail: jjimenezgh@mma.es Mr José Jimenez García-Herrera
Sweden (Min) (NFC)	Swedish Forest Agency Vallgatan 6 551 83 JÖNKÖPING SWEDEN Phone: +46 36 35 93 85 / Fax: +46 36 16 61 70 e-mail: sture.wijk@skogsstyrelsen.se Mr Sture Wijk
Switzerland (NFC)	Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft (WSL) Zürcherstr. 111 8903 BIRMENSDORF SWITZERLAND Phone: +41 44 739 25 02 / Fax: +41 44 739 22 15 e-mail: peter.waldner@wsl.ch Mr Peter Waldner
(Min)	Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation (UVEK) Bundesamt für Umwelt (BAFU) Abteilung Wald 3003 BERN SWITZERLAND Phone: +41 31 322 05 18 / Fax: +41 31 322 99 81 e-mail: sabine.augustin@bafu.admin.ch Ms Sabine Augustin
Turkey (NFC)	General Directorate of Forestry (NFC) Orman Genel Müdürlüğü Orman İdaresi ve Planlama Dairesi Başkanlığı 7 Nolu Bina 3. Kat 06560 GAZİ, ANKARA TURKEY Phone: +90 312 296 41 94/95, Fax: +90 312 296 41 96 e-mail: uomturkiye@ogm.gov.tr, Ms Banu Karabıyık, Mr Ali Temerit

(Min)
Ministry of Environment and Forestry
Çevre ve Orman Bakanlığı
Dumlupınar Bulvarı (Eskişehir Yolu 9. Km.) No:252
TOBB İkiz Kuleleri D Kule Kat: 21
Balgat /ANKARA
TURKEY
Phone: +90 312 248 17 93 Fax: +90 312 248 17 94
Email: mkocyigit@cevreorman.gov.tr
Mr Mehmet KOCYIGIT

Ukraine
(NFC)
Ukrainian Research Institute
of Forestry and Forest Melioration (URIFFM)
Laboratory of Forest Monitoring and Certification
Pushkinska Str. 86
61024 KHARKIV
UKRAINE
Phone: +380-57-707-80-49 / Fax: +380 577 041 002, +380 577 078 057
e-mail: buksha@uriffm.org.ua
Mr Igor F. Buksha

(Min)
State Committee of Forestry of the Ukrainian Republic
9a Shota Rustaveli
01601, KIEV
UKRAINE
Phone: +380-44-235 55 63 / Fax: +380-44-234 26 35
e-mail: viktor_kornienko@dklg.gov.ua
Mr Viktor P. Kornienko

United Kingdom
(NFC)
Forest Research Station Alice Holt Lodge
Gravehill Road, Wrecclesham
FARNHAM SURREY GU10 4LH
UNITED KINGDOM
Phone: +44 1-420 526 202 / Fax: +44 1-420 23 653
e-mail: andy.moffat@forestry.gsi.gov.uk
Mr Andrew J Moffat

(Min)
Corporate and Forestry Support
Forestry Commission
231 Corstorphine Road
EDINBURGH EH12 7AT
UNITED KINGDOM
Phone: +44 (0)131 314 63 54 / Fax: +44 (0)131 314 43 44
Richard.Howe@forestry.gsi.gov.uk
Mr Richard Howe

United States of America
(NFC)
USDA Forest Service
Pacific Southwest Research Station
4955 Canyon Crest Drive
RIVERSIDE, CA 92507
UNITED STATES OF AMERICA

Phone: +1 951 680 15 62 / Fax: +1 951 680 15 01
e-mail: abytnerowicz@fs.fed.us
Mr Andrzej Bytnerowicz

(Min)

US Forest Service
Environmental Science Research Staff
Rosslyn Plaza, Building C
1601 North Kent Street, 4th Fl.
ARLINGTON, VA 22209
UNITED STATES OF AMERICA
Phone: +1 703-605-5286 / Fax: +1 703-605-0279
e-mail: rpouyat@fs.fed.us
Mr Richard V. Pouyat