II. CROWN CONDITION ASSESSMENTS

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE
CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

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

MANUAL

on

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

Part II

Visual Assessment of Crown Condition

updated: 06/2006
new forms to be applied from 2007 onwards

updated 06/2006
Contents

1. INTRODUCTION .................................................................................................................................................. 7
2. FREQUENCY OF ASSESSMENT ............................................................................................................................ 7
3. SELECTION OF SAMPLE PLOTS AND TREES ......................................................................................................... 8
4. CROWN TO BE ASSESSED .................................................................................................................................... 9
5. DIRECTION OF ASSESSMENT .............................................................................................................................. 11
6. REFERENCE TREE .............................................................................................................................................. 11

6.1 DOCUMENTATION AND PHOTOGRAPHS ..................................................................................................... 12
7. PARAMETERS TO BE ASSESSED .......................................................................................................................... 12
8. GUIDELINES FOR FIELDWORK ........................................................................................................................... 12
9. QUALITY CONTROL AND QUALITY ASSURANCE ............................................................................................. 13

9.1 SELECTION OF SURVEY TEAMS (LEVEL I AND LEVEL II) ........................................................................ 13
9.2 TRAINING ...................................................................................................................................................... 13
9.3 DATA PLAUSIBILITY ....................................................................................................................................... 14
9.4 INTERNATIONAL QUALITY CONTROL ........................................................................................................... 14
10. DATA REPORTING AND SUBMISSION ............................................................................................................. 15

ANNEX 1: ASSESSMENT OF GENERAL PLOT AND TREE PARAMETERS, FOLIAGE, REPRODUCTIVE STRUCTURES AND EPICORMICS ........................................................................................................... 17

A1.1 COUNTRY (MANDATORY LEVEL I AND LEVEL II) ........................................................................................... 17
A1.2 OBSERVATION PLOT NUMBER (MANDATORY LEVEL I AND LEVEL II) ............................................................ 17
A1.3 DATE OF OBSERVATION, DATE OF ASSESSMENT, DATE OF ANALYSIS (MANDATORY LEVEL I AND LEVEL II) .................................................................................................................. 17
A1.4 LATITUDE/ LONGITUDE COORDINATES (MANDATORY LEVEL I AND LEVEL II) ........................................ 17
A1.5 AVAILABILITY OF WATER TO PRINCIPAL SPECIES (ESTIMATE) (MANDATORY LEVEL I) .................................. 17
A1.6 HUMUS TYPE (MANDATORY LEVEL I) ........................................................................................................... 18
A1.7 ALTITUDE (MANDATORY LEVEL I AND LEVEL II) ........................................................................................... 18
A1.8 ORIENTATION (MANDATORY LEVEL I) ........................................................................................................... 18
A1.9 MEAN AGE OF DOMINANT STOREY (YEARS) (MANDATORY LEVEL I) ............................................................ 18
A1.10 SOIL UNIT (MANDATORY LEVEL I) ................................................................................................................ 18
A1.11 SAMPLE TREE NUMBER (MANDATORY LEVEL I AND LEVEL II) .................................................................. 18
A1.12 SPECIES (REFERENCE FLORA EUROPAEA) (MANDATORY LEVEL I AND LEVEL II) .................................... 19
A1.13 REMOVALS AND MORTALITY (MANDATORY LEVEL II) ............................................................................. 20
A1.14 SOCIAL CLASS (MANDATORY LEVEL II) ...................................................................................................... 21
A1.15 CROWN SHADING (MANDATORY LEVEL II) .................................................................................................. 21
A1.16 VISIBILITY (MANDATORY LEVEL II) ............................................................................................................ 22
A1.17 DEFOILIATION (MANDATORY LEVEL I AND LEVEL II) .............................................................................. 22
A1.18 DISCOLOURATION (OPTIONAL LEVEL I AND LEVEL II) ........................................................................... 23
A1.19 FOLIAGE TRANSPARENCY (OPTIONAL LEVEL II) ...................................................................................... 23
A1.20 FLOWERING (OPTIONAL LEVEL II) ............................................................................................................. 25
A1.21 FRUITING (OPTIONAL LEVEL I AND LEVEL II) ............................................................................................ 26
A1.22 SECONDARY SHOOTS AND EPICORMICS (OPTIONAL LEVEL II) ................................................................. 26
A1.23 CROWN FORM/MORPHOLOGY (INCL. ROLOFF) (OPTIONAL LEVEL II) ......................................................... 27

ANNEX 2: ASSESSMENT OF DAMAGE CAUSES ....................................................................................................... 29

A2.1 INTRODUCTION .............................................................................................................................................. 30
A2.2 DEFINITIONS ................................................................................................................................................ 30
A2.3 SELECTION OF SAMPLE TREES .................................................................................................................... 30
A2.4 FREQUENCY AND TIMING ............................................................................................................................. 30
A2.5 PARAMETERS TO BE ASSESSED ..................................................................................................................... 30

A2.5.1 Symptom description ................................................................................................................................... 31
A2.5.1.1 Affected part of the tree and location in crown ...................................................................................... 31
A2.5.1.2 Symptoms and their specification ......................................................................................................... 32

updated 06/2006
A2.5.1.3 Age of the damage

The age of the damage shall be reported using the following classes:

A2.5.2 Causal agents / factors

A2.5.2.1 Scientific name of cause (mandatory Level I and Level II)

A2.5.3 Quantification

A2.5.3.1 Extent

A2.5.3.2 Extent classes (mandatory Level I and Level II)

A2.6 QUALITY ASSURANCE AND QUALITY CONTROL

A2.7 REPORTING

A2.8 REFERENCES

ANNEX 3: FORMS

ANNEX 4: DESIGN OF INTERNATIONAL CROSS-CALIBRATION COURSES

Elaborated by:
Expert Panel on Crown Condition
Johannes EICHHORN, Andras SZEPESI, Marco FERRETTI, Dave DURRANT, Peter ROSKAMS

updated 06/2006
0. Amendment history
(amendments in comparison with version of 2004)

ANNEX 1:

2. Annex 1, A1.6: The humus type is no longer defined in this section but a link is set to the respective section in part IIIa of the ICP Forests Manual on Sampling and Analyses of Soil.
3. Annex 1, A1.9: The mean age of dominant storey: definition of class 7 is defined correctly (> 120 years instead of > 121 years).
4. Annex 1, A1.10: The soil unit is no longer defined in this section but a link is set to the respective section in part IIIa of the ICP Forests Manual on Sampling and Analyses of Soil.
5. Annex 1, A1.12: The species list is amended by tree species (codes 91, 92, 93).
6. Annex 1, A1.18: Discolouration (“old definition”) is no longer mandatory but optional on Level I and Level II. The text is re-phrased with a link to ANNEX 2 (“new definition”). The table for coding discolouration is completed by code 4 (dead trees).
7. Annex 1, A1.21: Fruiting now is optional also on Level I (not assessed on Level I before). In the text the importance of this information especially for beech is underlined.

ANNEX 2: ASSESSMENT of damage causes

8. Introduction: re-phrased in order to improve the description which damage symptom to assess in which way.
9. A2.5 Parameters to be assessed: Adaptations according to the revised submission forms.
10. A2.5.1 Symptom description: re-phrased in order to improve the description which damage symptom to assess in which way.
11. A2.5.1.2 Symptoms and their specifications: in point a. the usage of “National lists” is specified.
12. A2.5.1.2: under Specifications “b. Avoiding duplication of crown condition assessment is” is revised
13. A2.5.1.3 Age of the damage is a new parameter (optional on Level I and Level II)
14. A2.5.2 Causal agents / factors: 3rd paragraph: A procedure is described how to amend the list of causal agents for species which are not already included but were investigated.
15. Table A2-6: Eriophyes ilicis was moved to code 800 (other) with code 87001 in the newly introduced class 870 “mites”
16. Table A2-7: added “Lophodermella sulcigena” under 301 under other Lophodermium (genus affected: Pinus sp.;) included Armillaria spec. in code for scientific name of cause (Annex 3 in internet presentation; see below).
17. Table A2-8: included under physical factors “rock fall” with code 434.
18. Table A2-9: added code 581 and 582; old “systematically wrong code number” remain in action
19. Table A2-11: added “Clematis sp” as 81005 and “Mites” as 870.
20. A2.5.2.1: The list of codes for scientific name of cause (table A2-12) is skipped from the manual; a link now is set to “http://www.icp-forests.org/WGbiotic.htm” >> click on annex 3”

FORMS for submitting data from the NFCs to the data centres

21. The forms were revised in a way that there are 3 forms for Level I and 3 forms for Level II, respectively:
   The first form for a reduced plot file (PLO and PLT, respectively),
   the second from for the submission of crown/tree related parameters (in general 1 observation for each tree, TRE and TRC, respectively) and
   the third form for submission of damage assessment data (0 to n observations for each tree, TRF and TRD, respectively).

updated 06/2006
22. The parameters which have to be submitted with the particular forms may change over time. Therefore, with the update from June 2006 the NFCs are asked to start each data file with a comment line. This line is starting with an exclamation mark followed by the names of the parameters, each separated by a comma. For each data file a proposal is given at the top of the respective form.

23. Forms A1, A2, A3, B1, B2, B3, and C remain unchanged!
1. Introduction

The assessment of crown condition is central to the ICP Forests operated under the UNECE since 1985. The assessment methods developed in the mid-1980s for Level I formed the basis of the assessments in the Level II plots. These were described in the earlier manual on the ‘Visual Assessment of Crown Condition’ and the ‘Submanual on Visual Assessment of Crown Condition on Intensive Monitoring Plots’. Within Europe, the combination of almost 6000 plots on a systematic 16x16 km grid (Level I) and almost 900 intensive monitoring plots (Level II) provides a unique and unrivalled data set. Scientific analyses of these data increasingly point to the need for a harmonised approach to data gathering, reporting and analysis. This re-design of the manual allows a harmonised, yet more flexible approach to crown condition monitoring, while retaining continuity and allowing better, more transparent quality assurance. All of the parameters described here have been tested in one or more countries in Europe or North America during the last 15 years. However, the value of the parameters will continue be monitored by an Expert Panel and any necessary adjustments will be recommended to the Task Force of the ICP Forests in future years.

A number of new measures, additional to the existing Level I set of parameters, are proposed in this manual, mainly aiming at a more precise description of observed damages. An important addition is the requirement for the submission of quality control data. Such information is essential for the determination of confidence limits for the data, an important step is the identification of changes through time and in cause-effect studies. Without such confidence limits, the reliable identification of temporal or spatial variation in crown condition will be extremely difficult.

This manual is a synthesis of earlier Expert Panel meetings, manuals, assessment recommendations, pilot studies and the recommendation of the 17th Task Force where the Expert Panel was asked to ‘organise the planned workshop on data evaluation’ and ‘to present a revised submanual to the Task Force in 2003’.

**Objectives**

*The major aim of Level I is to provide a periodic overview on the spatial and temporal variation in forest condition in relation to anthropogenic and natural stress factors in a European and national large-scale systematic network;*  
*whereas the Level II Intensive Monitoring Programme attempts to contribute to a better understanding of the relationships between the condition of forest ecosystems and stress factors, in particular air pollution, through intensive monitoring in a number of selected permanent observation plots spread across Europe;*

2. Frequency of assessment

Crown condition assessments are mandatory for both levels at least once a year. The time of the assessment should be between the end of the first flush of foliage (when the leaves and needles are fully developed) and the beginning of autumnal senescence. For most species, the most suitable time for the assessment is mid- to late summer. The assessments should be done during the same period each year (2 to 3 weeks) and within this time window if possible under similar weather conditions.

In regions with regular damage caused by summer drought, monitoring may be shifted to early summer. However, care should be taken to ensure that any effects are not under-estimated.
3. Selection of sample plots and trees

Level I

Within the transnational survey (Level I) sample plots and trees Kraft classes 1-3 (1 = dominant; 2 = codominant, 3 = subdominant; see Fig. A1-1 in Annex 1) should be selected according to a statistically sound procedure which includes the random principle. An example is the 4-point cross cluster, with 4 subplots oriented along the main compass directions at a distance of 25 m from the grid point. On each subplot the 6 trees nearest to the subplot centre are selected as sample trees, resulting into 24 sample trees per plot (see Fig. 1). Other procedures are possible; however, regarding Level I a minimum of 10 sample trees shall be assessed at each sample plot.

Figure 1: Illustration of 4-point cluster with 6-tree sample and sample tree replacement

Level II

The different aims of Level I and Level II programme may influence plot and tree selection as trees will be observed in more detail over a longer period of time. For intensive monitoring plots – (Level II) – a significantly larger number of sample trees may be selected in order to describe the health status of the stand more completely.

Preferably all trees Kraft classes 1-3 in the plot area should be sampled. The minimum requirement is 10 trees selected according to the method described for Level I. However a higher number of sample trees is highly advisable in order to keep a minimum of 10 identical trees over a long assessment period. If, during plot installation, a subplot was defined, then the assessments described in this chapter refer to all trees in the subplot. When the selection of sample trees follows different procedures (e.g. in very dense stands where crown assessment is impossible
II. CROWN CONDITION ASSESSMENTS

within the plot or subplot boundaries), the procedure should be described and reported to the Programme Coordinating Centre.

Selected trees on both levels should be identifiable (preferably permanently numbered) for re-assessment during the subsequent inventories.

Trees used for other surveys (e.g. foliage analysis, tree-ring analysis) located outside the (sub-) plot should also be assessed in order to correlate their crown condition with corresponding data. In principle, these trees are also permanently and uniquely numbered. These trees should be assessed annually together with the trees at the (sub-) plot.

Trees with >50% mechanical damage in the crown should be excluded when setting up a plot.

The foliage of suppressed trees in high forest stands is mainly influenced by the overstorey. The inclusion of these trees in assessments is therefore optional and will depend on the aims of the national programme and the nature of the forest ecosystem.

In coppice stands, macchia and other forest types where individual stools have many stems, the tree may be considered as a single unit consisting of multiple stems.

It is strongly advisable to map the layout of the plot. If possible, coordinates of the plot centre (Level I) or corners (Level II) should be tied into the national coordinate system for the country or GPS coordinate, facilitating the use of GIS in the analytical stage.

The tree sample on both Levels includes all tree species, provided the trees have a minimum height of 60 cm.

Trees removed within management operations or thrown by wind must be replaced by newly selected trees at Level I and Level II in order to ensure the minimum number of trees to assess. These newly selected trees must be labelled by new numbers which have never before been assigned to any tree at the respective plot. If the stand is clear-cut, the sample point ceases to exist until a new stand has been established.

A periodic revision of the grid for adaptation to changes of forest area should be conducted.

In younger, dense stands, where individual crowns are not assessable, sample trees are selected according to a defined process. This process is repeated until sufficient trees with assessable crowns have been found. Regeneration should be assessed as part of the ground vegetation assessments in the plots. Details are specified in part VIII of this manual.

4. Crown to be assessed

The estimation of crown condition strongly depends on the definition of the assessable crown.

The crown present at the moment of the assessment is to be considered, regardless of the potential or theoretical crown which may have existed in previous years. The influence of any present or absent (removed) trees on the crown of the sample tree must be taken into account when determining its condition. In cases where the sample tree crown is influenced by competition, the assessable crown includes only those parts that are not influenced by other crowns i.e. shading. Parts of the crown directly influenced by interactions between crowns or competition are excluded (see Fig. 2, classification see Annex 1).
The assessable crown of a freely developed tree is defined as the whole living crown from the lowest substantial living branch upwards. The following parts of such a crown must be excluded from the assessment:

- Epicormic shoots below the crown
- Gaps in the crown where it is assumed that no branches ever existed

For the classification of epicormics see Annex 1.

The assessable crown includes recently died branches, but excludes snags that have been dead for many years (i.e. which have already lost their side-shoots), as shown in Fig. 3. Snags represent the historic mortality of parts of the crown and have no influence on the current condition of the tree. They are therefore excluded from the assessment. Dieback of shoots and branches represents an active process in the crown and is therefore included.

The determination of the assessable crown varies between countries, it is therefore essential that it is documented in the photoguides and manuals used.

In coppice (and macchia) stands it may be necessary to consider the assessable crown as a single unit consisting of crown parts from different stems.
II. CROWN CONDITION ASSESSMENTS

Figure 3: Outlines of the assessable crown (freely grown trees) showing which areas of dieback to include and exclude. Dead branches that exist only as snags (e.g. on the left-hand side of C) are excluded from the assessable crown. Recent dieback, as indicated by the presence of lower order branches, is included (e.g. left-hand side of D). (Based on original diagrams by D’Eon et al. 1994).

5. Direction of assessment

Trees should be assessed from as many directions as possible, at least from two sides, and normally from a distance of about one tree length. In dense stands this may become difficult, but at least parts of the crown can be observed from several directions. The visibility of each crown should be noted on Level II plots using four classes as defined in Annex 1.

- On slopes, monitoring from a position upslope or to the sides is preferable, as defoliation will be underestimated if crowns are monitored from downslope only.
- If trees are observed from fixed points, then the point of observation in relation to the sample tree should be recorded in the national database. With such a system, it is particularly important to document any changes in the observation point.
- The observers should always try to avoid looking into the sun.

6. Reference tree

The concept of the reference tree is one of the most controversial issues in the monitoring programme, yet it is critical to the assessments. Two different types of reference trees are recognised: local reference trees and absolute reference trees. Use of absolute reference trees leads to higher defoliation estimates than the application of local reference trees, but the results are more amenable to temporal and spatial analyses. Most countries have adopted local reference trees as standards.

This local reference takes into account the build-up and the development stage of the tree.
A **local reference tree** or a conceptual (imaginary) tree is defined here as the best tree with full foliage that could grow at a particular site, taking into account factors such as altitude, latitude, tree age, site conditions and social status. It has 0% defoliation. This tree should represent the typical crown morphology and age of trees in the plot. **Absolute reference trees** are the best possible trees of a genotype or species, regardless of site conditions, tree age, etc. A number of photo guides exist which provide guidelines on absolute reference trees in different parts of Europe.

6.1 Documentation and photographs

It is necessary to document details of both absolute reference trees (if not available in a manual) and the local reference tree with photographs backed up with information on the tree (see form PHOT for minimum requirements).

It is advisable to photograph a selection of the trees in different defoliation classes in each area in each year. These should be accompanied by complete assessments of the trees using the relevant forms (PHOT) and should be permanently stored at the appropriate National Focal Centres.

7. Parameters to be assessed

To enable comparison between and within assessments made at Level I and Level II plots, methods for the estimation of defoliation and discoloration remain unchanged. A number of additional assessments were specified in the previous edition of the Manual (1996) for Level II and amended in this edition (2004), so that the actual status of individual trees can be better described. A large number of different parameters are currently being used throughout Europe and North America.

Detailed descriptions of the parameters to be assessed within ICP Forests can be found in Annexes 1 and 2.

The parameters described in this submanual are assessed by ground survey. For the assessment of parameters on tree parts 5 or more meters above ground, the use of binoculars is mandatory. The use of photo guides with typical photos of trees with different defoliation is strongly recommended. Some parameters may require closer observation (e.g. some forms of needle discoloration and foliage deformation). Closer (in-hand) examination is also usually required for full diagnostic assessments. Usually, a closer investigation becomes possible only every two years when the leaves for foliar analysis are picked. While every attempt should be made to provide as detailed and accurate information as possible, observers should always bear in mind that it is better to have no data than to have incorrect data.

8. Guidelines for fieldwork

Defoliation is generally estimated in 5% classes relative to a tree with full foliage (classification see Annex 1). The reference tree can be either a healthy tree in the vicinity (of the same crown type), a photograph locally applicable, representing a tree with full foliage or a conceptual (imaginary) tree. If different classification schemes are used, the class intervals, i.e. the respective defoliation percentages, must be specified.

Observers should have a satisfactory view of the tree from several observation points. On level ground, the optimal view is given at a distance of one tree length. On slopes, trees should be observed at a distance of about one tree length above the tree or at least on the same level.

It is recommended that assessments should be done by two trained observers. When the estimates produced of the two observers differ, both should change their observation position. Assessments should be done in full daylight, but it has to be recognised that the assessment, particularly of crown discoloration, may be affected by the quality of the light and the time of day.
The spatial and temporal comparison and as a norm for the valuator, the knowledge of optimal / ideal foliated trees of a species, independent of the location/stand is very useful. In this respect, photo guides are a very helpful tool. It is strongly recommended to support all teams of an inventory with such photo guides.

Observers should be provided with locally applicable, standard photographs of trees of each species and of different crown types with which to compare the trees to be assessed. Examples of various defoliation classes can also be provided if this is considered desirable.

9. Quality control and quality assurance

Experience from Level I and Level II has indicated the importance of adequate quality assurance. This is especially so for Level II given the complexity of the data. Four main areas are important

1. selection of field teams
2. training of field teams
3. plausibility of data
4. international quality control

9.1 Selection of survey teams (Level I and Level II)

Ideally field crews should consist of two professionals, at least one a diploma-level/graduate forester as the responsible crew leader.

The number of field crews per country should be optimized in order to facilitate training and harmonization. The number must take into account work loads and inaccurate assessments due to too long survey periods. Frequent changes of staff should be avoided.

Each team or team member has his own ID coordinated by the NFC. All training and field assessment data must contain the surveyors' IDs and date of assessment.

9.2 Training

National Level

Prior to the beginning of the annual field season, survey crews should undergo a period of concentrated theoretical and practical training in measurement and assessment procedures and in filling out the various forms. As far as possible, the field crews should be experienced in phytopathology.

All countries should have a designated person who is considered as a national expert on tree condition assessments and who is responsible either for undertaking the assessments or for training teams to make the assessments. It is recommended that the person is familiar with assessments at an international level and should if possible be a member of the National Reference Team.

Training should be given in the use of the ICP Forests or national manuals. The latter should be updated (at least for those parameters that are used at an international level) in line with recommendations in the ICP Forests manual.

Whenever local reference trees are used it is strongly suggested that photographs of them are also available.

Photographs should be used as a part of the training exercise both to determine variation between surveyors and field scores and variation over time by using the same (or a sub set) every year.

Results of national training courses should be available for audit/analysis. At least one person from a National Reference Team should be available to take part in International Cross-Comparison Courses (see Annex 4).
9.3 Data plausibility

It is strongly recommended that plausibility checks are included in hand-held data gathering devices (if used) and/or in the early stages of data evaluation. Plausibility checks should also be integrated into any national data analysis system and NFC’s are responsible for the quality of national data reported.

Field checks

Aims:

1. improve data completeness
2. improve consistency between teams
3. improve data consistency regarding Level II combined indices
4. document variability
5. provide information to improve training

An independent check survey should re-measure a proportion (e.g. 5-10%) of the sample plots assessed by each survey crew and this should be done very close to the actual survey date to avoid differences due to crown development. In case of significant discrepancies, adjustments or clarification of instructions and their application must be arranged immediately to avoid serious systematic errors.

National Focal Centres should compare the control data with the original observations and take action as appropriate. A summary of the data comparisons, together with details of any action taken, should be documented for potential evaluations.

9.4 International Quality Control

ICCs are field exercises aimed to

(i) document the relative position of individual National Reference Teams (NRTs) within the international context,
(ii) monitor the consistency of NRTs’ position through time,
(iii) improve the traceability of the data by establishing a direct connection with the data collected at national level. This will also help to explain anomalous year-by-year fluctuations, and
(iv) explore the relationships between the performance of the various NRTs and the major site and stand characteristics

by using field estimates and photo methods.

Detailed methodology see Annex 4.
II. CROWN CONDITION ASSESSMENTS

10. Data reporting and submission

Each National Focal Centre must submit an information describing deviations from UNECE recommended procedures or changes of assessment methods. Periodical quality control evaluations may be requested by the Programme Coordinating Centre to be part of integrated evaluations. References to any publications arising from the work on the Level I/II plots should be notified so that they can be listed on the ICP Forests web site.

Assessment data in electronic format (including mandatory and all optional parameters assessed by the relevant country) must be submitted to the responsible centre by the cut-off date requested. For the format see Annex 3.

Data submission deadlines for the different Levels and data types have to be observed.
Annex 1: Assessment of general plot and tree parameters, foliage, reproductive structures and epicormics

A1.1 Country (mandatory Level I and Level II)

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 France</td>
<td>11 Spain</td>
<td>55 Norway</td>
<td>65 Belarus</td>
<td>75 Iceland</td>
<td></td>
</tr>
<tr>
<td>2 Belgium</td>
<td>12 Luxembourg</td>
<td>56 Lithuania</td>
<td>66 Cyprus</td>
<td>76 Holy See (Vatican City State)</td>
<td></td>
</tr>
<tr>
<td>3 Netherlands</td>
<td>13 Sweden</td>
<td>57 Croatia</td>
<td>67 Serbia and Montenegro</td>
<td>77 San Marino</td>
<td></td>
</tr>
<tr>
<td>4 Germany</td>
<td>14 Austria</td>
<td>58 Czech Republic</td>
<td>68 Andorra</td>
<td>78 Former Yugoslavian Republic of Macedonia</td>
<td></td>
</tr>
<tr>
<td>5 Italy</td>
<td>15 Finland</td>
<td>59 Estonia</td>
<td>69 Malta</td>
<td>79 Bosnia and Herzegovina</td>
<td></td>
</tr>
<tr>
<td>6 United Kingdom</td>
<td>50 Switzerland</td>
<td>60 Slovenia</td>
<td>70 Monaco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Ireland</td>
<td>51 Hungary</td>
<td>61 Republic of Moldova</td>
<td>71 Albania</td>
<td>95 Canaries</td>
<td></td>
</tr>
<tr>
<td>8 Denmark</td>
<td>52 Romania</td>
<td>62 Russian Federation</td>
<td>72 Turkey</td>
<td>96 Azores</td>
<td></td>
</tr>
<tr>
<td>9 Greece</td>
<td>53 Poland</td>
<td>63 Bulgaria</td>
<td>73 Liechtenstein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Portugal</td>
<td>54 Slovak Republic</td>
<td>64 Latvia</td>
<td>74 Ukraine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A1.2 Observation plot number (mandatory Level I and Level II)
The observation plot number corresponds to a unique number given to the permanent plot during the selection or installation.

A1.3 Date of observation, date of assessment, date of analysis (mandatory Level I and Level II)
Dates shall be completed in the following order (day, month and year):

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>09</td>
<td>94</td>
</tr>
</tbody>
</table>

A1.4 Latitude/longitude coordinates (mandatory Level I and Level II)
Fill in the full six figure latitude and longitude coordinates of the centre of the observation plot, e.g:

<table>
<thead>
<tr>
<th>+/-</th>
<th>Degrees</th>
<th>Minutes</th>
<th>Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

the first box is used to indicate a + or - coordinate

A1.5 Availability of water to principal species (estimate) (mandatory Level I)
1: Insufficient
2: Sufficient
3: Excessive

updated 06/2006
A1.6 Humus type (mandatory Level I)
The classification of the humus type is described in Annex 3, Explanatory item (6) of part IIIa (Sampling and Analyses of Soil) of the ICP Forests manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests.

A1.7 Altitude (mandatory Level I and Level II)

<table>
<thead>
<tr>
<th></th>
<th>≤ 50 m</th>
<th>51—100 m</th>
<th>101—150 m</th>
<th>151—200 m</th>
<th>201—250 m</th>
<th>251—300 m</th>
<th>301—350 m</th>
<th>351—400 m</th>
<th>401—450 m</th>
<th>451—500 m</th>
<th>501—550 m</th>
<th>551—600 m</th>
<th>601—650 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>651—700 m</td>
<td>701—750 m</td>
<td>751—800 m</td>
<td>801—850 m</td>
<td>851—900 m</td>
<td>901—950 m</td>
<td>951—1000 m</td>
<td>1001—1050 m</td>
<td>1051—1100 m</td>
<td>1101—1150 m</td>
<td>1151—1200 m</td>
<td>1201—1250 m</td>
<td>1251—1300 m</td>
</tr>
<tr>
<td>2</td>
<td>1301—1350 m</td>
<td>1351—1400 m</td>
<td>1401—1450 m</td>
<td>1451—1500 m</td>
<td>1501—1550 m</td>
<td>1551—1600 m</td>
<td>1601—1650 m</td>
<td>1651—1700 m</td>
<td>1701—1750 m</td>
<td>1751—1800 m</td>
<td>1801—1850 m</td>
<td>1851—1900 m</td>
<td>1901—1950 m</td>
</tr>
<tr>
<td>3</td>
<td>1951—2000 m</td>
<td>2001—2050 m</td>
<td>2051—2100 m</td>
<td>2101—2150 m</td>
<td>2151—2200 m</td>
<td>2201—2250 m</td>
<td>2251—2300 m</td>
<td>2301—2350 m</td>
<td>2351—2400 m</td>
<td>2401—2450 m</td>
<td>2451—2500 m</td>
<td>&gt;2500 m</td>
<td></td>
</tr>
</tbody>
</table>

A1.8 Orientation (mandatory Level I)

1: N 4: SE 7: W
2: NE 5: S 8: NW
3: E 6: SW 9: flat

A1.9 Mean age of dominant storey (years) (mandatory Level I)

<table>
<thead>
<tr>
<th></th>
<th>≤ 20</th>
<th>21—40</th>
<th>41—60</th>
<th>4: 61-80</th>
<th>5: 81-100</th>
<th>6: 101-120</th>
<th>7: &gt; 120</th>
<th>8: Irregular stands</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A1.10 Soil unit (mandatory Level I)
The classification of the soil unit is described in Annex 3, Explanatory item (10) of part IIIa (Sampling and Analyses of Soil) of the ICP Forests manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests.

A1.11 Sample tree number (mandatory Level I and Level II)
The tree number is the number which has been assigned to the tree during the installation of the plot. Note: a copy of the numbers of sample trees that were assessed the year before and which must be included in the assessment in the current year should be provided to the surveyors each year. Further information should not be supplied as repeated assessments of, for example, species, will act as a control on the quality of the observations.
A1.12 Species (Reference Flora Europaea) (mandatory Level I and Level II)

**Broaddleaves** (* = species to be used for the foliage inventory)

<table>
<thead>
<tr>
<th>Number</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Acer campestre*</td>
</tr>
<tr>
<td>002</td>
<td>Acer monspessulanum*</td>
</tr>
<tr>
<td>003</td>
<td>Acer opalus</td>
</tr>
<tr>
<td>004</td>
<td>Acer platanoides</td>
</tr>
<tr>
<td>005</td>
<td>Acer pseudoplatanus*</td>
</tr>
<tr>
<td>006</td>
<td>Alnus cordata*</td>
</tr>
<tr>
<td>007</td>
<td>Alnus glutinosa*</td>
</tr>
<tr>
<td>008</td>
<td>Alnus incana</td>
</tr>
<tr>
<td>009</td>
<td>Alnus viridis</td>
</tr>
<tr>
<td>010</td>
<td>Betula pendula*</td>
</tr>
<tr>
<td>011</td>
<td>Betula pubescens*</td>
</tr>
<tr>
<td>012</td>
<td>Buxus sempervirens</td>
</tr>
<tr>
<td>013</td>
<td>Carpinus betulus*</td>
</tr>
<tr>
<td>014</td>
<td>Carpinus orientalis</td>
</tr>
<tr>
<td>015</td>
<td>Castanea sativa (C. vesca)*</td>
</tr>
<tr>
<td>016</td>
<td>Corylus avellana*</td>
</tr>
<tr>
<td>017</td>
<td>Eucalyptus sp.*</td>
</tr>
<tr>
<td>018</td>
<td>Fagus moesiaca*</td>
</tr>
<tr>
<td>019</td>
<td>Fagus orientalis</td>
</tr>
<tr>
<td>020</td>
<td>Fagus sylvatica*</td>
</tr>
<tr>
<td>021</td>
<td>Fraxinus angustifolia spp. oxycarpa (F. oxyphylla)*</td>
</tr>
<tr>
<td>022</td>
<td>Fraxinus excelsior*</td>
</tr>
<tr>
<td>023</td>
<td>Fraxinus ormai</td>
</tr>
<tr>
<td>024</td>
<td>Ilex aquifolium</td>
</tr>
<tr>
<td>025</td>
<td>Juglans nigra</td>
</tr>
<tr>
<td>026</td>
<td>Juglans regia</td>
</tr>
<tr>
<td>027</td>
<td>Malus domestica</td>
</tr>
<tr>
<td>028</td>
<td>Olea europea*</td>
</tr>
<tr>
<td>029</td>
<td>Ostrya carpinifolia*</td>
</tr>
<tr>
<td>030</td>
<td>Platanus orientalis</td>
</tr>
<tr>
<td>031</td>
<td>Populus alba</td>
</tr>
<tr>
<td>032</td>
<td>Populus canescens</td>
</tr>
<tr>
<td>033</td>
<td>Populus hybrides*</td>
</tr>
<tr>
<td>034</td>
<td>Populus nigra*</td>
</tr>
<tr>
<td>035</td>
<td>Populus tremula*</td>
</tr>
<tr>
<td>036</td>
<td>Prunus avium*</td>
</tr>
<tr>
<td>037</td>
<td>Prunus dulcis (Amygdalus communis)</td>
</tr>
<tr>
<td>038</td>
<td>Prunus padus</td>
</tr>
<tr>
<td>039</td>
<td>Prunus serotina</td>
</tr>
<tr>
<td>040</td>
<td>Pyrus coomunis</td>
</tr>
<tr>
<td>041</td>
<td>Quercus cerasifera (Q. calliprinos)*</td>
</tr>
<tr>
<td>042</td>
<td>Quercus cerris*</td>
</tr>
<tr>
<td>043</td>
<td>Quercus fabriana</td>
</tr>
<tr>
<td>044</td>
<td>Quercus frainetto (Q. conferta)*</td>
</tr>
<tr>
<td>045</td>
<td>Quercus ilex*</td>
</tr>
<tr>
<td>046</td>
<td>Quercus macrolepis (Q. aegilops)</td>
</tr>
<tr>
<td>047</td>
<td>Quercus rubra*</td>
</tr>
<tr>
<td>048</td>
<td>Quercus robur (Q. pedunculata)*</td>
</tr>
<tr>
<td>049</td>
<td>Quercus suber*</td>
</tr>
<tr>
<td>050</td>
<td>Quercus trojana</td>
</tr>
<tr>
<td>051</td>
<td>Quercus vulgaris</td>
</tr>
<tr>
<td>052</td>
<td>Quercus rotundifolia*</td>
</tr>
<tr>
<td>053</td>
<td>Quercus rubra*</td>
</tr>
<tr>
<td>054</td>
<td>Quercus suber*</td>
</tr>
<tr>
<td>055</td>
<td>Robinia pseudoacacia*</td>
</tr>
<tr>
<td>056</td>
<td>Salix alba</td>
</tr>
<tr>
<td>057</td>
<td>Salix caprea</td>
</tr>
<tr>
<td>058</td>
<td>Salix cinerea</td>
</tr>
<tr>
<td>059</td>
<td>Salix elegans</td>
</tr>
<tr>
<td>060</td>
<td>Salix fragilis</td>
</tr>
<tr>
<td>061</td>
<td>Salix sp.</td>
</tr>
<tr>
<td>062</td>
<td>Salix sp.</td>
</tr>
<tr>
<td>063</td>
<td>Sorbus aria</td>
</tr>
<tr>
<td>064</td>
<td>Sorbus aucuparia</td>
</tr>
<tr>
<td>065</td>
<td>Sorbus domestica</td>
</tr>
<tr>
<td>066</td>
<td>Sorbus torminalis</td>
</tr>
<tr>
<td>067</td>
<td>Tamarix africana</td>
</tr>
<tr>
<td>068</td>
<td>Tilia cordata</td>
</tr>
<tr>
<td>069</td>
<td>Tilia platyphyllos</td>
</tr>
<tr>
<td>070</td>
<td>Ulmus glabra (U. scabra, U. scaba, U. montana)</td>
</tr>
<tr>
<td>071</td>
<td>Ulmus laevis (U. effusus)</td>
</tr>
<tr>
<td>072</td>
<td>Ulmus minor (U. campestris, U. carpinifolia)</td>
</tr>
<tr>
<td>073</td>
<td>Arbutus unedo</td>
</tr>
<tr>
<td>074</td>
<td>Arbutus andrachne</td>
</tr>
<tr>
<td>075</td>
<td>Ceratonia siliqua</td>
</tr>
<tr>
<td>076</td>
<td>Cercis siliquastrum</td>
</tr>
<tr>
<td>077</td>
<td>Erica arborea</td>
</tr>
<tr>
<td>078</td>
<td>Erica scoparia</td>
</tr>
<tr>
<td>079</td>
<td>Erica manipuliflora</td>
</tr>
<tr>
<td>080</td>
<td>Laurus nobilis</td>
</tr>
<tr>
<td>081</td>
<td>Myrtus communis</td>
</tr>
<tr>
<td>082</td>
<td>Phillyrea latifolia</td>
</tr>
<tr>
<td>083</td>
<td>Phillyrea angustifolia</td>
</tr>
<tr>
<td>084</td>
<td>Pistacia lentiscus</td>
</tr>
<tr>
<td>085</td>
<td>Pistacia terebinthus</td>
</tr>
<tr>
<td>086</td>
<td>Rhamnus oleoides</td>
</tr>
<tr>
<td>087</td>
<td>Rhamnus alaternus</td>
</tr>
<tr>
<td>088</td>
<td>Betula tortuosa</td>
</tr>
<tr>
<td>089</td>
<td>Crataegus monogyna</td>
</tr>
<tr>
<td>090</td>
<td>Quercus pyrenaica (Q. toza)*</td>
</tr>
<tr>
<td>091</td>
<td>Ilex canariensis</td>
</tr>
<tr>
<td>092</td>
<td>Laurus azorica</td>
</tr>
<tr>
<td>093</td>
<td>Myrica faya</td>
</tr>
<tr>
<td>094</td>
<td>Other broadleaves</td>
</tr>
</tbody>
</table>

**Conifers** (* = species to be used for the foliage inventory)

<table>
<thead>
<tr>
<th>Number</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Abies alba*</td>
</tr>
<tr>
<td>101</td>
<td>Abies borsii-regis*</td>
</tr>
<tr>
<td>102</td>
<td>Abies cephalonica*</td>
</tr>
<tr>
<td>103</td>
<td>Abies grandis</td>
</tr>
<tr>
<td>104</td>
<td>Abies nordmanniana</td>
</tr>
<tr>
<td>105</td>
<td>Abies pinsapo</td>
</tr>
<tr>
<td>106</td>
<td>Abies procera</td>
</tr>
<tr>
<td>107</td>
<td>Cedrus atlantica</td>
</tr>
<tr>
<td>108</td>
<td>Cedrus deodara</td>
</tr>
<tr>
<td>109</td>
<td>Cupressus lusitanica</td>
</tr>
<tr>
<td>110</td>
<td>Cupressus sempervirens</td>
</tr>
<tr>
<td>111</td>
<td>Juniperus communis</td>
</tr>
<tr>
<td>112</td>
<td>Juniperus oxycedrus*</td>
</tr>
<tr>
<td>113</td>
<td>Juniperus phoenicica</td>
</tr>
<tr>
<td>114</td>
<td>Juniperus sabina</td>
</tr>
<tr>
<td>115</td>
<td>Juniperus thurifera*</td>
</tr>
<tr>
<td>116</td>
<td>Larix decidua*</td>
</tr>
<tr>
<td>117</td>
<td>Larix kaempferi (L.leptolepis)</td>
</tr>
<tr>
<td>118</td>
<td>Picea abies (P. excelsa)*</td>
</tr>
<tr>
<td>119</td>
<td>Picea omorika</td>
</tr>
<tr>
<td>120</td>
<td>Picea sitchensis*</td>
</tr>
<tr>
<td>121</td>
<td>Pinus brutia*</td>
</tr>
<tr>
<td>122</td>
<td>Pinus canariensis</td>
</tr>
<tr>
<td>123</td>
<td>Pinus cembra</td>
</tr>
<tr>
<td>124</td>
<td>Pinus contorta*</td>
</tr>
<tr>
<td>125</td>
<td>Pinus halipens*</td>
</tr>
<tr>
<td>126</td>
<td>Pinus heldreichii</td>
</tr>
<tr>
<td>127</td>
<td>Pinus leucodermis</td>
</tr>
<tr>
<td>128</td>
<td>Pinus mugo (P. montana)</td>
</tr>
<tr>
<td>129</td>
<td>Pinus nigra*</td>
</tr>
<tr>
<td>130</td>
<td>Pinus pinaster*</td>
</tr>
<tr>
<td>131</td>
<td>Pinus pinea*</td>
</tr>
<tr>
<td>132</td>
<td>Pinus radiata (P. insignis)*</td>
</tr>
<tr>
<td>133</td>
<td>Pinus strobus</td>
</tr>
<tr>
<td>134</td>
<td>Pinus sylvestris*</td>
</tr>
<tr>
<td>135</td>
<td>Pinus uncinata*</td>
</tr>
<tr>
<td>136</td>
<td>Pseudotsuga menziesii*</td>
</tr>
<tr>
<td>137</td>
<td>Taxus baccata</td>
</tr>
<tr>
<td>138</td>
<td>Thyua sp.</td>
</tr>
<tr>
<td>139</td>
<td>Tsuga sp.</td>
</tr>
<tr>
<td>140</td>
<td>Chamaecyparis lawsoniana</td>
</tr>
</tbody>
</table>

updated 06/2006
A1.13 Removals and mortality (mandatory Level II)

Definition
Removals are trees which for some reason are not included in the sample of assessment trees. Mortality refers to assessment trees which have died. A tree is defined as dead if all conductive tissues in the stem(s) have died.

Trees may have to be withdrawn or eliminated from sampling for several reasons. It is important to record this information so that the causes of changes in the numbers of assessment trees in each plot can be assessed. In particular, such information is critical if overestimation of mortality rates is to be avoided.

If a tree has died the cause must be determined (if possible). Standing dead trees (classes 30–32) of Kraft classes 1–3 should remain in the sample and should be assessed as dead trees as long as they are standing (until they are removed or have fallen down).

Note: This practice differs between countries, with some countries removing standing dead trees from the inventory after the initial report of mortality. It is strongly recommended that any standing dead trees in the plots are included in the assessments, regardless of the year of death.

Methods
The following classification must be used:
- Code 0: tree alive and measurable (new, note this is different than a missing value)
  - 01 tree alive, in current and previous inventory (formerly blanc)
  - 02 new alive tree (ingrowth)
  - 03 alive tree (present but not assessed in previous inventory)
- Tree has been cut and removed, only its stump has been left
  - 11 planned utilization, e.g. thinning
  - 12 utilization for biotic reasons, e.g. insect damage
  - 13 utilization for abiotic reasons, e.g. windthrow
  - 14 cut, reason unknown
  - 18 reason for disappearance unknown
- Tree is still standing and alive, but crown condition parameters are no longer assessed
  - 21 lop-sided or hanging tree
  - 22 heavy crown break (over 50% of the crown) or broken stem
  - 23 tree is no longer in Kraft classes 1, 2 or 3 (not applicable to the first inventory in a plot)
  - 29 other reasons (specify)
- Standing dead tree
  - 31 biotic reasons, e.g. bark beetle attack
  - 32 abiotic reasons, e.g. drought, lightning
  - 38 unknown cause of death
- Trees that have fallen (living or dead)
  - 41 abiotic reasons (e.g. storm)
  - 42 biotic reasons (e.g. beavers)
  - 48 unknown cause

Note: Class 22 is only applicable in those countries that do not record trees with more than 50% crown damage.

Note: Class 23 is only applicable to those countries that restrict sampling to Kraft classes 1, 2 and 3.

Note: Mortality and the number of dead trees present in a plot are two different issues. Annual mortality can be calculated from the number of living trees that are dead the following year. The total number of dead trees in a plot at any one time provides no information on mortality rates, but provides information on the condition of a stand in the year of assessment.

updated 06/2006
II. CROWN CONDITION ASSESSMENTS

Note: If trees in the plot have not been mapped, there may be some difficulty in identifying the fate of individual trees that have disappeared between surveys.

A1.14 Social class (mandatory Level II)

Definition
Social status is a measure of the height of a tree relative to the surrounding trees. Information on social status is useful as an aid to interpreting crown condition and increment data for the individual trees. For example, dominant trees may be more susceptible to stress than codominant trees.

Methods
Four classes are recognized:

1. dominant (including free-standing): Trees with upper crown standing above the general level of the canopy;
2. codominant: Trees with crowns forming the general level of the canopy;
3. subdominant: Trees extending into the canopy and receiving some light from above, but shorter than 1 or 2;
4. suppressed: Trees with crowns below the general level of the canopy, receiving no direct light from above.

Note: The assessment of the social class of a tree is in some cases difficult. Suppressed trees should not be equated with dying trees as, in a mixed-age stand, they represent future generations of trees. Classification on steep slopes presents a problem as even relatively short trees may receive direct light from above. In such cases, classification should be based on the relative heights of the trees.

Figure A1-1: Illustration of social status classes (crown canopy classes) after Kraft
(1 = dominant, 2 = codominant, 3 = subdominant, 4 = suppressed, 5 = dying)

A1.15 Crown shading (mandatory Level II)

Definition
Crown shading is an estimate of the openness of the tree’s situation. Open-grown trees usually have much larger crowns than ones in closed canopies. In addition, the absence of any competition may change the susceptibility of a tree to particular stresses. A change in the degree of shading may have significant effects on crown condition. Consequently, this assessment should refer to the degree of shading at the time of assessment. This may change

updated 06/2006
Crown shading is assessed on a six-point scale as follows:
1  crown significantly affected (shading or physical interactions) on one side
2  crown significantly affected (shading or physical interactions) on two sides
3  crown significantly affected (shading or physical interactions) on three sides
4  crown significantly affected (shading or physical interactions) on four sides
5  crown open-grown or with no evidence of shading effects
6  suppressed trees

A1.16 Visibility (mandatory Level II)

Definition
The visibility of a crown is the degree to which different parts of the assessable crown can be viewed from the ground.
Crowns with poor visibility are not removed from the sample, but information about the visibility of individual tree crowns is useful to help with the interpretation of the data from those trees. Such trees remain in the sample as the use of an objective sampling design means that their exclusion could lead to bias in the results. Some parameters, e.g. stem and branch damage may be assessable on such trees.

Method
The following codes should be used for the assessable crown:
1  Whole crown is visible
2  Crown only partially visible
3  Crown only visible with backlighting (i.e. in outline)
4  Crown not visible

Note: Class 3 is distinguished from Class 4, as some parameters can still be assessed when only back-lighting is present.

A1.17 Defoliation (mandatory Level I and Level II)

Definition
Defoliation is defined as needle/leaf loss in the assessable crown as compared to a reference tree.
Defoliation is assessed regardless of the cause of foliage loss (i.e. for example it includes damage by insects). Defoliation may also include thin crowns caused by a lack of foliage, as this may be indistinguishable from true defoliation.
This is one of the standard assessments made in Level I. Considerable problems exist with its definition, such that complete harmonization of its definition and method of assessment between countries is impossible. For example, the role of flowering is handled differently between countries.

Methods
Defoliation is assessed in 5% steps. These classes are 0, 5 (>0-5%), 10 (>5-10%) and so on. A tree with between >95% and 100% defoliation, which is still alive, is scored as 99. The score 100 is reserved for dead trees (EC Regulation). Trees should be reported in these 5% classes and not in aggregated groupings.

Hint: If the above-ground parts of a tree die (e.g. after a forest fire), the tree is classified as dead. The above-ground parts of the tree are considered dead if the phloem and xylem is dead. Note that dormant buds may continue to flush for one or more seasons on cut logs, indicating that the tissues may remain alive for some time after some people might consider them as dead. Regrowth from the roots is excluded until the shoots attain the requirements for inclusion in the assessments. Although biologically inappropriate, for practical reasons regrowth from the base of the trees should be classified as new stems with new crowns.

updated 06/2006
A1.18 Discolouration (optional Level I and Level II)

Definition

Originally the assessment of discolouration was defined on national level only. A European wide adopted assessment of discolouration is now described in the section on damage assessment (ANNEX 2). Countries which are willing to continue the assessment of discolouration according to the classes given below are invited to report the results on an optional basis.

<table>
<thead>
<tr>
<th>Class</th>
<th>Discolouration</th>
<th>Percentage of needles/leaves discoloured</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>none</td>
<td>0 - 10%</td>
</tr>
<tr>
<td>1</td>
<td>slight</td>
<td>&gt;10 - 25%</td>
</tr>
<tr>
<td>2</td>
<td>moderate</td>
<td>&gt;25 - 60%</td>
</tr>
<tr>
<td>3</td>
<td>severe</td>
<td>&gt;60%</td>
</tr>
<tr>
<td>4</td>
<td>dead</td>
<td>dead</td>
</tr>
</tbody>
</table>

A1.19 Foliage transparency (optional Level II)

Definition

Foliage transparency is defined as the amount of skylight visible through the live, normally foliated portion of the crown or branch. Each tree species has a normal range of foliage transparency. Changes in foliage transparency occur as a result of current damage, frequently referred to as defoliation, or from reduced foliage resulting from stresses during preceding years.

Methods

Estimate foliage transparency in 5% classes based on the live, normally foliated portion of the crown and branches using the transparency diagram in Fig. A1-2. Dead branches, crown dieback and missing branches where foliage is expected to be missing are deleted from the estimate (Fig. A1-3). Large uniform crowns are scored as if the whole crown should be foliated. When defoliation is severe, branches alone will screen the light, but the surveyors should exclude the branches from the foliage and rate the area as if light was penetrating. For example, an almost completely defoliated dense spruce may have less than 20% light coming through the crown, but it will be scored as highly transparent because of the missing foliage. Old trees, and some broad-leaved species, have crown characteristics with densely foliated branches which are spaced far apart in the crown. These spaces between branches should not be included in the foliage transparency score. When foliage transparency in one part of the crown differs from another part, the average foliage transparency is estimated and recorded. Foliage transparency should be assessed in the same way as defoliation, i.e. by two observers and from different positions.

Hint: The easiest way to assess foliage transparency is first to mentally draw a two-dimensional crown outline. Then block the foliated area into the crown outline. Lastly, estimate the transparency of this foliated area.
Figure A1-2: Guide to estimating transparency (derived from Tallent-Halsell 1994).
II. CROWN CONDITION ASSESSMENTS

Figure A1-3: Crown outline to be taken into account when estimating foliage transparency. Note the areas to be excluded from the estimates. This is a free standing tree, therefore the assessable crown covers a rather large area (derived from Tallent-Hassel 1994).

A1.20 Flowering (optional Level II)

Definition
This score is defined as the estimation of (current) flowering in the crown.
Flowering is important for two reasons. Firstly, it can affect the defoliation score in the assessable part of the crown, both in the year of flowering and subsequently. Secondly, flowering in the whole crown is of interest because of the effects that it has on the carbon balance of the tree – energy used for flowering cannot be used for increment.

Methods
Two assessments are made: of the assessable part of the crown and of the whole crown. Scoring is:

1. Absent or scarce. The flowers are not seen in a cursory examination.
2. Common. Flowering effect is clearly visible.
3. Abundant. Flowering dominates the appearance of the tree.

Hint: in some species, such as Pinus and Larix, the flowers will probably have been dropped by the time of assessment. Scoring is based on the gaps along the shoots where the flowers formerly were.

updated 06/2006
Hint: Some species produce large amounts of green tissues associated with the flowers (e.g. *Carpinus betulus* and *Fraxinus excelsior*). These tissues contain chlorophyll and contribute to the carbon budget of the tree. It is recommended that such tissues are included with the foliage mass when assessing defoliation. As fruiting in such species remains relatively constant from year to year, annual changes in fruiting will not significantly affect the defoliation estimates.

**A1.21 Fruiting** *(optional Level I and Level II)*

**Definition**

This score is defined as the estimation of fruiting in the crown. Only fruits produced in the year of assessment are included.

Information on fruiting is useful to have because of its effect on the carbon economy of the tree. As with flowering, fruiting diverts energy away from other parts of the tree. As with flowering, it may also have an effect on the future branch structure of the tree.

Especially on beech this parameter may provide very valuable information and its submission is very much encouraged.

**Methods**

As with flowering, two assessments are made: of the assessable part of the crown and of the whole crown. Scoring is:

1. Absent or scarce. The fruits are not seen in a cursory examination.
2. Common. Fruiting is clearly visible.
3. Abundant. Fruiting dominates the appearance of the tree.

**Note**

Quantitative estimates of both flowering and fruiting can be obtained by the use of litter traps. However, such data cannot be readily related to individual trees.

**A1.22 Secondary shoots and epicormics** *(optional Level II)*

**Definition**

Secondary shoots and epicormics are used synonymously and are defined as shoots that have developed from dormant buds on the stem or on branches.

In some species, the development of secondary shoots is the normal part of crown formation. For example, in *Picea abies*, secondary shoots develop along the main branches to replace older shoots that have lost their needles. In other species, particularly broadleaves, the development of epicormic shoots in the crown and on the stem may reflect increased levels of light penetration through the foliage of the outer crown.

Scoring of the presence of shoots reveals whether the tree is responding to loss of foliage and thus the regenerative capacity of the tree. For example, a heavily defoliated *Picea abies* that has no secondary shoots is indicative of a tree under extreme stress.
Methods
Separate assessments are made of the frequency (3 classes) of epicormics in the assessable crown and on the stem. The assessment must include all epicormics, not only the ones of the current year. Scoring is in three classes:
1. None or rare
2. Medium: light development or only present in parts of the crown or stem
3. Abundant: present throughout the majority of the crown or all over the stem

A1.23 Crown form/morphology (incl. Roloff) (optional Level II)
Definition
Crown form is defined as the appearance of the crown. It may be influenced by crown shape and/or by branch habit.

Crown form provides supplementary information about the condition of a tree. In many cases, crown form changes through time. The premature development of such changes often indicates the action of one or more types of stress. However, the separation of stress- and genetically-induced changes is often difficult.

Crown form classifications have been so far been developed for *Picea* spp., *Fagus sylvatica* and *Pinus sylvestris*. Note: the use of the Roloff classification system for species other than *Fagus sylvatica* must be undertaken with special care and is not recommended.

Methods
*Picea* (Fig. A1-4)
11. comb
12. brush
13. plate
14. mix

*Fagus sylvatica* (Fig. A1-5)
21. trees with vigorous growth both of apical and side shoots
22. reduced apical shoot growth, side shoots are still formed but at lower frequency (mainly consisting of short shoots)
23. strongly reduced apical shoot growth, no new lateral branches are formed. Shoot appearance is “claw-like”
24. development of 23, with loss of side shoots
29. other

*Pinus*
31. pine, vigorous apical dominance with tree growing strongly upwards
32. pine, reduced or no apical dominance with crown showing signs of widening
33. pine, as 32, but lower branches being lost through suppression
34. platform developing, with dominant growth direction no longer upwards, but crown still with some depth
35. platform fully developed, no vertical growth
39. other (specify)
Figure A1-4: Crown form in *Picea* spp. 11: Comb; 12: Brush; 13: Plate.


updated 06/2006
Annex 2: Assessment of damage causes

Elaborated by:
ad hoc Working Group Biotic Damage
Peter ROSKAMS

updated 06/2006
A2.1 Introduction

The causes of damage to a tree and their influence on crown condition are central to the study of cause-effect mechanisms. Without this information, data on defoliation and other crown parameters are extremely difficult to interpret. Data on leafloss and discoloration caused by the actions of defoliating insects or other factors will also provide valuable information for interpreting e.g. litterfall measurements and phenological observations. The main objective of assessing damage causes in the framework of this programme is to provide information about their impact on crown condition. Therefore this assessment should focus on the main damage factors influencing crown condition. Any part of a tree may show symptoms caused by the actions of insects, fungi, weather conditions or other factors. They may consist of defoliation, discoloration, deformations, wounds etc. and their impact may vary from completely harmless to lethal to the tree. Long-term monitoring may also provide baseline data on the distribution, occurrence and harmfulness of biotic agents / damage factors in Europe. These data may also contribute to other aspects relevant for forest policy like sustainable forest management.

A2.2 Definitions

Damage is defined as an alteration or a disturbance to a part of the tree which may have an adverse effect on the ability to fulfill its functions. Symptom: Any condition of a tree resulting from the action of a damaging agent that indicates its occurrence (e.g. defoliation, discoloration, necrosis) Sign: Evidence of a damaging factor other than that expressed by the tree (e.g. fungal fruiting bodies, nests of caterpillars) Discolouration: any deviation from the usual colour of the living foliage for the assessed tree species. Dieback: branch mortality which begins at the terminal portion of a branch and proceeds towards the trunk and/or the base of the live crown.

A2.3 Selection of sample trees

Level I + Level II: assessment of damage causes is mandatory for all trees of the crown condition sample.

A2.4 Frequency and timing

Level I + Level II: assessment of damage causes should be carried out during normal crown condition assessment in summer. At Level II plots where the complete programme is carried out, the so-called ‘key-plots’, an additional visit for damage assessment is strongly recommended if important damage is observed outside the period of crown condition assessment. The observations of the staff responsible for deposition sampling or phenological observations may act as an early warning system. This additional visit should be made at the time when the main damage cause is supposed to be at its maximum (e.g. spring for defoliators).

A2.5 Parameters to be assessed

The assessment of damage causes consists of 3 major parts:
- symptom description
- determination of the cause
- quantification of symptoms (extent)
The following table gives an overview of mandatory (M) and optional (O) parameters at Level I and Level II plots.

<table>
<thead>
<tr>
<th>Symptom description</th>
<th>Specification of affected part</th>
<th>Level I</th>
<th>Level II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom</td>
<td>Specification of symptom</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Location in crown</td>
<td></td>
<td>O</td>
<td>M</td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Extent</td>
<td></td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

In case that **more than one damaging agents/factors** are found on the same tree they should be reported using additional lines in the submission forms (more than one line per tree).

In the event of **several symptoms** on a tree caused by the **same, identified agent/factor**, only the main symptom shall be reported in the submission forms.

If a damage of a tree is observed and **the cause is unknown**, the symptoms and the extent should be reported nevertheless (regarding defoliation see “specifications”, point b, page 34). However in the field “cause” the code 999 should be entered (see Chapt. A2.5.2).

**A2.5.1 Symptom description**

“Describe what you see” could be a summary of the aims of the symptom description: it indicates which **part of the tree** is affected and the **type of symptom** it shows. It is an essential step for diagnosis of the causal agent and for the study of cause-effect mechanisms. However this does not mean that every symptom observed has to be reported. The symptom description should focus on important factors for which an actual or future impact on may influence crown condition. See also National lists (page 34).

The symptom description does not deal with quantification: it indicates only the presence of symptoms. For quantification see A2.5.3.

In principle the symptom description is restricted to causal agents or factors which may influence crown condition (defoliation, discoloration). However this does not mean that the symptom description is restricted to symptoms observed on the foliage: damage to the branches or the stem (e.g. bark beetle attack) often results in defoliation but its contribution in the defoliation score may be very difficult to assess. Therefore the symptom description should cover all affected parts of the tree.

As regards the crown the **total crown** (which may be different from the assessable crown) should be taken into account. This is important because symptoms that may be recognized outside the assessable crown may indicate the start of a process which may affect the assessable crown at a later stage (e.g. *Peridermium pini* infection in *Pinus*).

**A2.5.1.1 Affected part of the tree and location in crown**

Three main categories are distinguished for indicating the affected part of the tree: (a) leaves/needles; (b) branches, shoots & buds; (c) stem & collar. For each affected part further specification is required, which is important for diagnostic purposes. For this more detailed description, the categories used in other parts of the crown manual are applied. A separate code allows for reporting also the location in the crown. This may provide further valuable information for the diagnosis.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves/needles</td>
<td>Current needle year</td>
<td>11</td>
<td>Upper crown</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Older needles</td>
<td>12</td>
<td>Lower crown</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Needles of all ages</td>
<td>13</td>
<td>Patches</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Broadleaves (incl. evergreen spec.)</td>
<td>14</td>
<td>Total crown</td>
<td>4</td>
</tr>
</tbody>
</table>
### Table A2-1: Affected parts of a tree and location in the crown.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Branches, shoots &amp; buds</td>
<td>Current year shoots</td>
<td>21</td>
<td>Upper crown</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Twigs (diameter &lt; 2 cm)</td>
<td>22</td>
<td>Lower crown</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Branches diameter 2 – &lt; 10 cm</td>
<td>23</td>
<td>Patches</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Branches diameter ≥ 10 cm</td>
<td>24</td>
<td>Total crown</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Varying size</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top leader shoot</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buds</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stem &amp; collar</td>
<td>Crown stem: main trunk or bole within the crown</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bole: trunk between the collar and the crown</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roots (exposed) and collar (≤ 25 cm height)</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whole trunk</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead tree</td>
<td>see below</td>
<td>04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No symptoms on any part of tree</td>
<td>see below</td>
<td>00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No assessment</td>
<td>see below</td>
<td>09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Special cases:

The following codes for special cases shall be reported in the column for ‘specification of affected part’ of the tree:

**a.** Dead trees:
Dead trees should be reported using code 04. The cause of death should be reported in the column for the causal agent / factor.

**b.** No symptoms at all are observed on any part of the tree:
In order to avoid that the observers have to report that there are no symptoms on the foliage, nor at the branches and the stem, this case should be reported using code 00.

**c.** No assessment of damage causes was made
Report code 09 in the column for specification of affected part.

### A2.5.1.2 Symptoms and their specification

Symptoms are grouped into broad categories like wounds, deformations, necrosis etc. A separate code (specification of symptom) allows for a more detailed description. Nests of caterpillars, fungal fruit bodies etc. are not considered as symptoms but are defined as ‘signs’ of insects, fungi, ... Their presence provides valuable information for diagnostic purposes and should be reported. If signs of insects or fungi are observed it is important to report also the observed damage symptoms.

An overview of symptoms, specifications and codes is given in Table A2-2. For the field teams this table provides a complete overview of the section on symptom description, including the codes for reporting.

---

Updated 06/2006
<table>
<thead>
<tr>
<th>Affected part</th>
<th>Symptom / sign</th>
<th>Code</th>
<th>Symptom/sign specification</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves/needles</td>
<td>Partly or totally devoured/missing</td>
<td>01</td>
<td>holes or partly devoured/missing</td>
<td>31</td>
</tr>
<tr>
<td>Light green to yellow discolouration</td>
<td>Light green to yellow discolouration (incl. necrosis)</td>
<td>02</td>
<td>overall</td>
<td>37</td>
</tr>
<tr>
<td>Red to brown discolouration</td>
<td>Red to brown discolouration (incl. necrosis)</td>
<td>03</td>
<td>flecking, spots</td>
<td>38</td>
</tr>
<tr>
<td>Bronzing</td>
<td>Bronzing</td>
<td>04</td>
<td>marginal</td>
<td>39</td>
</tr>
<tr>
<td>Other colour</td>
<td>Other colour (incl. necrosis)</td>
<td>05</td>
<td>banding</td>
<td>40</td>
</tr>
<tr>
<td>Microfilia (small leaves)</td>
<td>Microfilia (small leaves)</td>
<td>06</td>
<td>curling</td>
<td>45</td>
</tr>
<tr>
<td>Other symptom</td>
<td>Other symptom</td>
<td>09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signs of insects</td>
<td>Signs of insects</td>
<td>10</td>
<td>black coverage on leaves</td>
<td>53</td>
</tr>
<tr>
<td>Signs of fungi</td>
<td>Signs of fungi</td>
<td>11</td>
<td>white coverage on leaves</td>
<td>56</td>
</tr>
<tr>
<td>Other signs</td>
<td>Other signs</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branches shoots&amp; buds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depewed / missing</td>
<td></td>
<td>01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broken</td>
<td></td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead / dying</td>
<td></td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abortion / abscission</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wounds (debarking, cracks etc.)</td>
<td></td>
<td>17</td>
<td>debarking</td>
<td>58</td>
</tr>
<tr>
<td>Resin flow (conifers)</td>
<td></td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slime flux (broadleaves)</td>
<td></td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decay/rot</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deformations</td>
<td></td>
<td>08</td>
<td>curling</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>bending</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>rolling</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>stalk twisting</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>folding</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Galls</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>wilting</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>other deformations</td>
<td>52</td>
</tr>
</tbody>
</table>

Table A2-2: Symptoms/signs and specification of symptoms/signs; part I / II
### Table A2-2: Symptoms/signs and specification of symptoms/signs; part II / II

#### Important remarks:

**a. National lists**

Table A2-2 aims at giving an overview of the more important symptoms that may occur in trees. The symptom description is mandatory for foliage, branches and stem, but countries are free to select for each affected part the more important symptoms at national level. If a selection is made this should be reported to the international data centre. In order to reduce the time needed for the symptom description countries may wish to compose a national standard list with a complete symptom description for well-known and frequently occurring damage factors for their field teams. This way the surveyor will only have to fill in the name of the causal agent and the quantification of the damage. In the event of damage by a factor which is not on the standard list, the complete symptom description should be made. Reporting to the international data centre however should always include the complete symptom description. The categories ‘other’ (symptom, sign, colour etc.) should be specified in the remarks column.

**b. In the event of symptoms of ozone damage** the guidelines of the ‘Submanual on Ozone injury on European Forest Ecosystems’ (Part X of this manual) shall be applied.

#### Specifications

**a. If damage symptoms on a tree are observed and the cause is unknown,** the symptoms and the extent should be reported nevertheless. However in the field “cause” the code 999 should be entered (see Chapt. A2.5.2).

**b. Avoiding duplication of crown condition assessment:**

Crown condition assessment in the ICP Forests monitoring programme mainly deals with defoliation. This symptom is also very important for the assessment of damage causes. In this respect the following rules apply:

- if defoliation of a tree is observed and the cause is unknown, defoliation should only be reported in the crown condition assessment, and should not be reported as a symptom in the damage causes section. However, other relevant symptoms observed on the same tree (e.g. dead branches) should be reported.

---

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem / collar</td>
<td>Wounds (debarking, cracks etc.)</td>
<td>17</td>
<td>Debarking cracks (frost cracks, ...)</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>other wounds</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Resin flow (conifers)</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slime flux (broadleaves)</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decavirrot</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deformations</td>
<td>08</td>
<td>Cankers</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>tumors</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Longitudinal ridges (frost ribs, ...)</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>other deformations</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>tilted</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fallen (with roots)</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>broken</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>other symptom</td>
<td>09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Signs of insects</td>
<td>10</td>
<td>Boring holes, boring dust</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White dots or covers</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Adults, larvae, nymph, pupae, egg masses</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Signs of fungi</td>
<td>11</td>
<td>Fungal fruiting bodies</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yellow to orange blisters</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Other signs</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

updated 06/2006
II. CROWN CONDITION ASSESSMENTS

• If defoliation can partly or totally be attributed to a certain, identified cause(s) (e.g. defoliators), defoliation should be reported in the damage causes section in addition (see 2.5.2 and 2.5.3).

c. Necrosis of leaves/needles and its pattern is an important symptom for diagnostic purposes. For the assessment of damage causes necrotic leaves or parts of leaves should be reported as ‘red to brown discoloration, incl. necrosis’ (code 03) and should not be considered as defoliation.

d. In the event of several symptoms on a tree caused by the same, identified agent/factor, only the main symptom shall be reported.

e. Dead branches: Snags (dead branches which are dead for several years and without side shoots) and dead branches due to competition are excluded from the assessment of dead branches. In some tree species (e.g. spruce), small dead branches may be a ‘normal’ phenomenon. This should not be reported except when an abnormal percentage of dead branches is observed.

A2.5.1.3 Age of the damage
(optional Level I and Level II)
Recording this parameter helps in detecting new epidemics. Moreover, some injuries, like harvesting scars remain visible for many years.
The age of the damage shall be reported using the following classes:

<table>
<thead>
<tr>
<th>Code</th>
<th>class damage age</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fresh</td>
<td>damage that has begun after the last year’s inventory</td>
</tr>
<tr>
<td>2</td>
<td>old</td>
<td>damage that has begun earlier</td>
</tr>
<tr>
<td>3</td>
<td>fresh and old</td>
<td>both, fresh and old damage is visible</td>
</tr>
</tbody>
</table>

A2.5.2 Causal agents / factors
(mandatory Level I and Level II)

Determination of the causal agent that is responsible for the observed damage symptoms is crucial for the study of cause-effect mechanisms. The description of symptoms is an important step in the diagnostic process, but damage symptoms on their own do not always provide the explanation for the observed damage. In many cases further examination will be necessary to determine the causal agent. However there should be no destructive sampling within plot boundaries.

Determination of causal agents should be carried out by trained observers and should be confirmed by an expert phytopathologist whenever possible.

In case that more than one damaging agents are found on the same tree they should be reported using additional lines in the submission forms (more than one line per tree possible).

In case that damage has to be reported caused by a damage factor for which no code is foreseen this should be reported to the PCC of ICP Forests. PCC will take care that a respective code will be defined by the EP and be provided to the NFCs.

Causal agents are grouped into the following categories:
### Table A2-3: Main categories of causal agents / factors

In each category a more detailed determination is possible according to a hierarchical coding system (see Tables A2-3 – A2-11). Report the damage cause as detailed as possible, if possible up to species level. E.g. a code 210 for insects is more helpful than a score 200, as in the first case it is specified that the causal agent is a defoliator.

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game and grazing</td>
<td>100</td>
</tr>
<tr>
<td>Insects</td>
<td>200</td>
</tr>
<tr>
<td>Fungi</td>
<td>300</td>
</tr>
<tr>
<td>Abiotic agents</td>
<td>400</td>
</tr>
<tr>
<td>Direct action of men</td>
<td>500</td>
</tr>
<tr>
<td>Fire</td>
<td>600</td>
</tr>
<tr>
<td>Atmospheric pollutants</td>
<td>700</td>
</tr>
<tr>
<td>Other factors</td>
<td>800</td>
</tr>
<tr>
<td>(Investigated but)</td>
<td>999</td>
</tr>
</tbody>
</table>

**unidentified**

### Table A2-4: Codes for agent group 100 (game and grazing)

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game and grazing</td>
<td>100</td>
<td>Cervidae</td>
<td>110</td>
<td>Roe deer</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Red deer</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reindeer</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Elk/Moose (<em>Alces alces</em>)</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other Cervidae</td>
<td>119</td>
</tr>
<tr>
<td>Suidae</td>
<td>120</td>
<td></td>
<td></td>
<td>Wild boar</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other Suidae</td>
<td>129</td>
</tr>
<tr>
<td>Rodentia</td>
<td>130</td>
<td>Rabbit</td>
<td>131</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hare</td>
<td>132</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Squirrel etc.</td>
<td>133</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vole</td>
<td>134</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beaver</td>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Rodentia</td>
<td>139</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aves</td>
<td>140</td>
<td>Tetraonidae</td>
<td>141</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corvida</td>
<td>142</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Picidae</td>
<td>143</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fringillidae</td>
<td>144</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Aves</td>
<td>149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic animals</td>
<td>150</td>
<td>Cattle</td>
<td>151</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goats</td>
<td>152</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sheeps</td>
<td>153</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other domestic</td>
<td>159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other vertebrates</td>
<td>190</td>
<td>Bear</td>
<td>191</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other vertebrate</td>
<td>199</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table A2-5: Codes for agent group 200 (insects): Conifers

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Main species</th>
<th>Affected genus Code</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defoliators</td>
<td>200</td>
<td></td>
<td>210</td>
<td>Acantholyda sp.</td>
<td>Pinus</td>
<td>Shelter made of silky threads and frass, on the needles,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Brachonyx pineti</td>
<td>Pinus</td>
<td>Fine spots with a central hole in the needles and presence of small holes in the sheaths</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Brachyderes suturalis</td>
<td>Pinus</td>
<td>Devoured needles forming a thick saw edge</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diptri pini</td>
<td>Pinus</td>
<td>Summer defoliations. False caterpillars, greenish with brown - orange head. Eggs in the needle margins and pupas in the soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Glyptotera senticetella</td>
<td>Juniperus, Cupressus</td>
<td>Silky threads in dry twigs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lymantria dispar</td>
<td>Larix, Picea, Pinus</td>
<td>Devoured needles; caterpillars with long hairs, variable yellow to black coloured with characteristic double row of blue and red spots on the back</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lymantria monacha</td>
<td>Pinus</td>
<td>Eggs disposed in cracks of the bark. Recently born caterpillars disposed in lines in the trunk. Summer defoliations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bupalus piniarius</td>
<td>Pinus</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Choristoneura</td>
<td>Murina</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cephalcia abietis</td>
<td>Picea</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cephalcia lariciphila</td>
<td>Larix</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dendrolimus pini</td>
<td>Pinus</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dioryctria sylvestrella</td>
<td>Pinus</td>
<td>Boring hole with resin crumb on the trunk along with sawdust and reddish excrement rests</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hylobius abietis</td>
<td>Pinus</td>
<td>Shallow bites in thin twigs and young pines</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ips acuminatus</td>
<td>Pinus</td>
<td>Star - shaped system of galleries under the bark. Trees damaged situated in sparse close groups. Death of trees in summer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ips sexdentatus</td>
<td>Pinus</td>
<td>Star - shaped system of galleries under the bark. Trees damaged situated in close groups. Death of trees in summer. Adult is bigger than the adult Ips sexdentatus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ips typographus</td>
<td>Picea</td>
<td>Bark beetle, borer, killing red spruce, dangerous for whole forest</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Magdalis sp.</td>
<td>Pinus</td>
<td>Fractures in buds and young twigs. Dry and hollow young shoots</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Orthotomicus sp.</td>
<td>Pinus</td>
<td>Long star - shaped system of galleries under the bark. Adults of very small size.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Phaenops cyanura</td>
<td>Pinus</td>
<td>Damage of larvae in part of stem with thick bark. Galleries of older larvae with <code>cloudy</code> boring dust; beetle dark blue with green glow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pissodes castaneus</td>
<td>Pinus</td>
<td>Very small holes with resin drop resina in buds and shoots. Galleries under the bark and pupation chambers with thick wood chips.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pityogenes chalcographus</td>
<td>Picea, Larix, Abies, Pseudotsuga</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pityokephalus curvidens</td>
<td>Abies</td>
<td>Thick and big resin crumb, hollow inside, along with excretments, in small branches and/or buds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Retinia resinella</td>
<td>Pinus</td>
<td>Galleries and pupation chambers in branches and twigs. Reddish small areas dispense in the crown.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Semonotus laurasi</td>
<td>Juniperus</td>
<td></td>
</tr>
<tr>
<td>Bud boring insects</td>
<td>230</td>
<td></td>
<td></td>
<td>Rhyaciaea busiana</td>
<td>Pinus</td>
<td>Hollow buds and young shoots (bayonet shaped shoots)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rhyaciaea dupiana</td>
<td>Pinus</td>
<td>Hollow buds and young shoots (bayonet shaped shoots), along without resin crumbs.</td>
</tr>
<tr>
<td>Fruit boring insects</td>
<td>240</td>
<td></td>
<td></td>
<td>Dicoryctria mendacella</td>
<td>Pinus</td>
<td>Regular shaped boring holes filled with resin in the fruit (pine cones). Presence of galleries with excretments and silky threads.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pissodes validirostris</td>
<td>Pinus</td>
<td>Round and clean boring holes in the pine cones. Egg - layings are covered with a dark stopper and disposed in the pine cone scales.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Leucaspis pini</td>
<td>Pinus</td>
<td>Adults with eliptic white bodies (like white scales stucked to the needles).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Matsucoccus sp.</td>
<td>Pinus</td>
<td>Breakage and formation of scales in stems. Adults with eliptic sessile bodies under the bark.</td>
</tr>
<tr>
<td>Mining insects</td>
<td>260</td>
<td></td>
<td></td>
<td>Epitoma subsequana</td>
<td>Abies</td>
<td>Brown and curved needle in part of its length, with a boring hole.</td>
</tr>
<tr>
<td>Gallmakers</td>
<td>270</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other insects</td>
<td>290</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

updated 06/2006
### Crown Condition Assessments

#### 200: Agent group

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Defoliators (incl. skeletonizers, leaf rollers etc.)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Abraxas pantaria</td>
<td>Fraxinus</td>
<td></td>
<td></td>
<td>It attacks leaves during the summer. Caterpillars let themselves down from the crown by means of silky threads.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Agelasica alni</td>
<td>Alnus</td>
<td></td>
<td></td>
<td>Leaves are skeletonized and defoliated irregularly. Egg cases are yellow and the egg - laying is over the leaf.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Aceria quercetorum</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Leaves look brown due to the skeletonizing.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Epirrita autumnata</td>
<td>Betula</td>
<td></td>
<td></td>
<td>Leaves devoured</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Galerucela linneola</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td>Leaves skeletonized with the veins intact and damages in buds. Egg cases are laying in the back side of the leaf.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Gonipterus scutellatus</td>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td>Leaves devoured, with margins looking as narrow and deep saw teeth</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Leucosia salicis</td>
<td>Populus, Salix, Betula</td>
<td></td>
<td></td>
<td>White egg - laying in trunks and branches</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Lymantria dispar</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Attaches the current year leaves and in extreme cases also the older ones. Egg cases are laying yellow mass and are difficult to recognize</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Archips xylosteana</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Attacks the tip of the current year shoots. Shelter is made with young leaves tied together by means of silk threads.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Lymantria monacha</td>
<td>Quercus, Fagus, Betula u.a.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Melanophila picta</td>
<td>Populus</td>
<td></td>
<td></td>
<td>Death of trees due to the sap flow is obstructed.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Paranthrene tabaniformis</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td>Many small holes in the leaf. It mines the leaf starting from the central vein to the margins.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Phoracantha semipunctata</td>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Platypoecilus incisus</td>
<td>Quercus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Platypleura flakesiana</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Rhynchaenus fagi</td>
<td>Fagus</td>
<td></td>
<td></td>
<td>Many small holes in the leaf. It mines the leaf starting from the central vein to the margins.</td>
</tr>
<tr>
<td>210</td>
<td></td>
<td></td>
<td>Sesia apiformis</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bud boring insects**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Agrilus grandioseps</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Death of thin twigs as it is a twig girdler - galleries.</td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Cerambyx sp.</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Eggs are laying at the base of the trunk and thick branches through which sawdust flows.</td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Conotrachelus florentinus</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Death of small and medium sized branches.</td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Agrilus juglandis</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Death of thin twigs due to twig girdling (galleries). The damage looks like red flashes distributed all along the crown.</td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Agrilus viridis</td>
<td>Fagus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Cerambyx sp.</td>
<td>Quercus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Cryptonympha taphetis</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Melanophila picta</td>
<td>Populus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Phoracantha semipunctata</td>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Platypoecilus incisus</td>
<td>Quercus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Platypoecilus flakesiana</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Rhynchaenus fagi</td>
<td>Fagus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td></td>
<td></td>
<td>Sesia apiformis</td>
<td>Populus, Salix</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sucking insects**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td></td>
<td></td>
<td>Ctenaritaina eucalypti</td>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td>Small aphids over young shoots. Bent shoots and sap fluxes</td>
</tr>
<tr>
<td>250</td>
<td></td>
<td></td>
<td>Kermes sp.</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Spherical bodies covered by a brilliant black reddish wax cover, situated in the stumps insertion areas of leaves, buds</td>
</tr>
<tr>
<td>250</td>
<td></td>
<td></td>
<td>Rhylla spinosa</td>
<td>Fagus</td>
<td></td>
<td></td>
<td>Many small holes in the leaf. It mines the leaf starting from the central vein to the margins.</td>
</tr>
<tr>
<td>250</td>
<td></td>
<td></td>
<td>Cynips tozae</td>
<td>Quercus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mining insects**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>260</td>
<td></td>
<td></td>
<td>Ctenaritaina eucalypti</td>
<td>Eucalyptus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>260</td>
<td></td>
<td></td>
<td>Kermes sp.</td>
<td>Quercus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>260</td>
<td></td>
<td></td>
<td>Rhylla spinosa</td>
<td>Fagus</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gallmakers**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>270</td>
<td></td>
<td></td>
<td>Cynips tozae</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Big spherical greyish - brown galls with a crown of teeth on the top, in small branches or twigs.</td>
</tr>
<tr>
<td>270</td>
<td></td>
<td></td>
<td>Lymantria monacha</td>
<td>Quercus</td>
<td></td>
<td></td>
<td>Hemispheric or irregular shaped swellings at the back side.</td>
</tr>
<tr>
<td>270</td>
<td></td>
<td></td>
<td>Mikelia fagi</td>
<td>Fagus</td>
<td></td>
<td></td>
<td>Small pink galls with a shape like waters drops, on the leaf.</td>
</tr>
</tbody>
</table>

**Other insects**

<table>
<thead>
<tr>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Agent group</th>
<th>Main species</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>290</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table A2-6: Codes for agent group 200 (insects): Broadleaves**

**Updated 06/2006**
<table>
<thead>
<tr>
<th>Agent Code</th>
<th>Class Code</th>
<th>Main species</th>
<th>Code Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>301</td>
<td>Lophodermium pini = Lophodermium sphaerospermum</td>
<td>Pinus</td>
<td>Long brilliant black carpophores located on the upper needle surface</td>
</tr>
<tr>
<td></td>
<td>302</td>
<td>Cyclaneusminicola plumula = Neoscyphus minor</td>
<td>Pinus (Sylvestris, nelini), forma subrotundus</td>
<td>Formation of traverse reddish brown stripes (banding) and presence of elliptic carpopores (light brown or the same colour than the needles)</td>
</tr>
<tr>
<td></td>
<td>303</td>
<td>Phaeocreospora austroamericana</td>
<td>Pseudotricha</td>
<td></td>
</tr>
<tr>
<td></td>
<td>304</td>
<td>Rhodococcus pittii</td>
<td>Pseudolobesia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>305</td>
<td>Mycophytochrus lacticola</td>
<td>Larix</td>
<td>Lighly coloured carpopores. When they come off, they leave holes in the needles.</td>
</tr>
<tr>
<td>Stereum and shoot rusts</td>
<td>306</td>
<td>Phoma betulae, Phoma helianthi</td>
<td>Pinus (Sylvestris, nigra, helianthi)</td>
<td>It is the so-called &quot;red browning&quot; in needles</td>
</tr>
<tr>
<td></td>
<td>307</td>
<td>Chrysosporium albidum</td>
<td>Pinus</td>
<td>Yellow-orange-brown spots on needles which fall prematurely</td>
</tr>
<tr>
<td></td>
<td>308</td>
<td>Melampsora pinitorqua = Mycosphaerella pini</td>
<td>Pinus</td>
<td>Shoots are curved in shape of &quot;C&quot; or &quot;S&quot;. To complete its biotical cycle needs host trees pertaining to Populus and/or Pinus genus</td>
</tr>
<tr>
<td></td>
<td>309</td>
<td>Cronartium albidum</td>
<td>Pinus abruptus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>310</td>
<td>Coleosporium tulasnaghi = Coleosporium tulasnaghi ssp. texanum</td>
<td>Pinus</td>
<td>&quot;Blistar rust&quot; of the needles. Blisters are orange when full and white when empty.</td>
</tr>
<tr>
<td></td>
<td>311</td>
<td>Cronartium flaccidum = Peridium pinum</td>
<td>Pinus</td>
<td>Death of branches and buds. Black carpophores over the bark. When it ripens pink pendants with conidia go out</td>
</tr>
<tr>
<td></td>
<td>312</td>
<td>Gremmeniella abietina</td>
<td>Pinus</td>
<td>Death of branches and buds with black carpophores over the bark. When it ripens pink pendants with conidia go out</td>
</tr>
<tr>
<td></td>
<td>313</td>
<td>Canisporium sphaerospermum</td>
<td>Pinus</td>
<td>&quot;Blister rust&quot; of the needles. Blisters are orange when full and white when empty.</td>
</tr>
<tr>
<td></td>
<td>314</td>
<td>Septoria pinitorqua = Diploctonion pinitorqua</td>
<td>Pinus</td>
<td>Sede shoots are curved, presenting deformations, resin flows and black carpopores.</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>Microsphaeria conigena = Microsphaeria conigena</td>
<td>Pinus (helianthi)</td>
<td>Death of shoots and reddish brown hanging needles.</td>
</tr>
<tr>
<td></td>
<td>316</td>
<td>Foema pinitorqua = Trametes pinitorqua</td>
<td>Pinus</td>
<td>Flat woody carpopores with &quot;horse hoof&quot; shape, greyish brown</td>
</tr>
<tr>
<td></td>
<td>317</td>
<td>Astilbefulica phaeocygni</td>
<td>Pinus</td>
<td>White leaf cover visible when debarking roots and root collar. Goes up.</td>
</tr>
<tr>
<td></td>
<td>318</td>
<td>Helicobasion annosum</td>
<td>Pinus, Pinus, Picea</td>
<td>White leaf cover but less dense than the one from Astilbefulica visible when debarking the root or root collar. Mushrooms are greyish brown with white margins and they are stuck to the root collar surface</td>
</tr>
</tbody>
</table>

**BROADLEAVES**

<table>
<thead>
<tr>
<th>Agent Code</th>
<th>Class Code</th>
<th>Main species</th>
<th>Code Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>301</td>
<td>Dracunculus paucitentosum = Dracunculus marssonina brunnea</td>
<td>Populus, Salix</td>
<td>Small round spots, with brown margins and greyish white centre.</td>
</tr>
<tr>
<td></td>
<td>302</td>
<td>Mycophytochrus app</td>
<td>Salix, Acer</td>
<td>Big black irregularly-shaped scabby spots</td>
</tr>
<tr>
<td></td>
<td>303</td>
<td>Taphrina aurea = Taphrina fulva</td>
<td>Populus</td>
<td>Yellowish swellings or lumps.</td>
</tr>
<tr>
<td></td>
<td>304</td>
<td>Mycosphaeria sacchari = Mycosphaeria sacchari</td>
<td>Castanea</td>
<td>Rusty rust with reddish brown dots distributed all along the leaf</td>
</tr>
<tr>
<td></td>
<td>305</td>
<td>Septoria pinitorqua</td>
<td>Populus</td>
<td>Grey spots limited by a necrotic margin</td>
</tr>
<tr>
<td></td>
<td>306</td>
<td>Helicobasion aduncum</td>
<td>Epicarpus</td>
<td>Reddish brown irregular spots</td>
</tr>
<tr>
<td></td>
<td>307</td>
<td>Microsphaeria conigena = Microsphaeria conigena</td>
<td>Epicarpus</td>
<td>Reddish brown irregular spots</td>
</tr>
<tr>
<td></td>
<td>308</td>
<td>Allegomyonia cupulina</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>309</td>
<td>Phyllodytus sylvestris</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>310</td>
<td>Ophioceros latifera</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>311</td>
<td>Ophiella simulta</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>312</td>
<td>Ophiella simulta</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>313</td>
<td>Ophiella simulta</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>314</td>
<td>Ophiella simulta</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>Ophiella simulta</td>
<td>Acer, Juglans</td>
<td>Affects to the veins</td>
</tr>
</tbody>
</table>

---

Table A2-7: Codes for agent group 300 (fungi)
### Table A2-8: Codes for the agent group 400 (abiotic factors).

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Type</th>
<th>Code</th>
<th>Specific factor</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical factors</td>
<td>400</td>
<td>410</td>
<td>411</td>
<td>Nutritional disorders, nutrient deficiencies</td>
<td>41101</td>
<td>Cu - deficiency</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fe - deficiency</td>
<td>41102</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mn - deficiency</td>
<td>41103</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>K - deficiency</td>
<td>41104</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N - deficiency</td>
<td>41106</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B-deficiency</td>
<td>41107</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mn - toxicity</td>
<td>41108</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td>41109</td>
</tr>
<tr>
<td>Physical factors</td>
<td>420</td>
<td>421</td>
<td>424</td>
<td>Winter frost</td>
<td>42401</td>
<td>Late frost</td>
<td>42402</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other abiotic factor</td>
<td>490</td>
<td></td>
<td>426</td>
<td>Heat / Sun scald</td>
<td>425</td>
<td>Math / Sun scald</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lightning</td>
<td>427</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mud / landslide</td>
<td>428</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Snow / Ice</td>
<td>430</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hail</td>
<td>431</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other</td>
<td>432</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shallow / poor soil</td>
<td>433</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rock fall</td>
<td>434</td>
</tr>
</tbody>
</table>

### Table A2-9: Codes for the agent group 500 (direct action of man).

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Type</th>
<th>Code</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct action of men</td>
<td>500</td>
<td>510</td>
<td>520</td>
<td>Improper planting technique</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>530</td>
<td>540</td>
<td>Silvicultural operations or forest harvesting</td>
<td>541</td>
<td>Cuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pruning</td>
<td>542</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Resin tapping</td>
<td>543</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cork stripping</td>
<td>544</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silvicultural operations in close trees and other silvicultural operations</td>
<td>545</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mechanical vehicle damage</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Road construction</td>
<td>560</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soil compaction</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Improper use of chemicals</td>
<td>580</td>
<td>Pesticides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Deicing salt</td>
<td>582</td>
<td></td>
</tr>
</tbody>
</table>

updated 06/2006
<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric pollutants</td>
<td>700</td>
<td>SO₂</td>
<td>701</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H₂S</td>
<td>702</td>
</tr>
<tr>
<td></td>
<td></td>
<td>O₃</td>
<td>703</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PAN</td>
<td>704</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>705</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HF</td>
<td>706</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>790</td>
</tr>
</tbody>
</table>

Table A2-10: Codes for the agent group 700 (atmospheric pollutants).

<table>
<thead>
<tr>
<th>Agent group</th>
<th>Code</th>
<th>Class</th>
<th>Code</th>
<th>Species/Type</th>
<th>Code</th>
<th>Affected genus</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>800</td>
<td>Parasite/Epiphyto/Climbing plants</td>
<td>810</td>
<td>Viscum album</td>
<td>81001</td>
<td>Pinus</td>
<td>Swellings of different sizes in branches and branchlets</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Arceuthobium pygmaeum</td>
<td>81002</td>
<td>Juniperus</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hedera helix</td>
<td>81003</td>
<td>All sps</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lonicera sp</td>
<td>81004</td>
<td>All sps</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clematis sp</td>
<td>81005</td>
<td>All sps</td>
<td></td>
</tr>
<tr>
<td>Bacteria</td>
<td>820</td>
<td>Bacillus vulnificus</td>
<td>82001</td>
<td>Pinus palustris</td>
<td></td>
<td>Swellings of different sizes in branches and branchlets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Streptomyces quercina</td>
<td>82002</td>
<td>Ustilago</td>
<td>White rust on fruits</td>
</tr>
<tr>
<td>Virus</td>
<td>830</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nematodes</td>
<td>840</td>
<td>Bursaphelenchus xylophilus</td>
<td>84001</td>
<td>Pinus</td>
<td></td>
<td>Fast reddening of the crown and sudden death of the tree</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>850</td>
<td>Lack of light</td>
<td>85001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical interactions</td>
<td>85002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Competition in general (density)</td>
<td>85003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>85004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somatic mutations</td>
<td>860</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mites</td>
<td>870</td>
<td>Eriophyes acies</td>
<td>87001</td>
<td>Quercus</td>
<td></td>
<td>Areas with abundant reddish brown hair at the back side of the leaf</td>
<td></td>
</tr>
<tr>
<td>Other (known cause but not included in the list)</td>
<td>890</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A2-11: Codes for the agent group 800 (other)

A2.5.2.1 Scientific name of cause (mandatory Level I and Level II)
If the organism involved can be identified the scientific name must be reported, using the codes of 7 letters. As a general rule the codes consist of the first 4 letters of the Genus name, followed by the first 3 letters of the species name (e.g. Lophodermium seditiosum = LOPHSED). If the Genus name has only 3 letters, these are followed by the first 4 letters of the species name (e.g. Ips typographus = IPSTYPO). Codes for the most common damaging species are listed in the internet file http://www.icp-forests.org/WGbiotic.htm >> click on annex 3. This table also provides information on synonyms and tree species on which the damaging agents occur most frequently.
The following sources of information provide information for the field observers to facilitate the diagnosis:

- Tables A2-3 – A2-11 contain the coding system for damaging agents. Especially the sheets on insects and fungi provide information about specific symptoms caused by a selection of relevant organisms.
- [http://www.icp-forests.org/WGbiotic.htm](http://www.icp-forests.org/WGbiotic.htm) >> click on Annex 3, provides codes for the scientific names of causal agents.
- [http://www.icp-forests.org/WGbiotic.htm](http://www.icp-forests.org/WGbiotic.htm) >> click on Annex 4, provides examples, descriptions and photographs of damage caused by important categories of insects and fungi.
- [http://www.icp-forests.org/WGbiotic.htm](http://www.icp-forests.org/WGbiotic.htm) >> click on Annex 5, provides a key with symptoms linked to frequently occurring damage causes. However keep in mind that these are possible damage causes, other factors may cause similar symptoms. Diagnosis should always be confirmed by an expert phytopathologist whenever possible.

**Important remark**

Tables A2-3 – A2-11 give an overview of some important damaging factors in Europe. At national level however, important factors may be missing, while others may be less important. Therefore countries may wish to compose their own national list of damaging agents/factors and classify these according to the groups and classes of the manual. Reporting to the international data centre should always be done according to the categories and codes of the manual.

**A2.5.3 Quantification**

For foliage and branches quantification of symptoms is referring to the **assessable crown**.

**A2.5.3.1 Extent**

The **extent** of the damage indicates the quantity (%) of the affected part of the tree due to the action of the causal agent or factor. Damage to the branches is expressed as a % of affected branches, damage to the stem as a % of the stem circumference.

The extent of symptoms reflecting defoliation (e.g. leaf damage by defoliators) indicates the % of the **leaf area** which is lost due to the action of the agent/factor concerned. This means that the extent should take into account not only the % of affected leaves, but also the ‘intensity’ of the damage on leaf level: physiologically it makes a difference for a tree if 30 % of its leaves show only some small holes or if 30 % of its leaves are totally devoured.

The affected leaf area is expressed as a percentage of the actual foliage at the time of observation.

**Examples:**

- Crown condition assessment results in a total defoliation score of 40 % (including defoliation by identified causes like defoliators). 20 % of the leaves in the assessable crown are totally devoured by defoliators → extent of defoliator damage = 20 % (class 2 – see A2.5.3.2);
- Crown condition assessment results in a total defoliation score of 40 % (including defoliation by identified causes like defoliators). 20 % of the leaves in the assessable crown are partly devoured by defoliators → extent of defoliator damage is e.g. 10 % (in any case < 20 % since the affected leaves are only partially devoured).
A2.5.3.2 Extent classes *(mandatory Level I and Level II)*
The damage extent will be reported in the following classes:

<table>
<thead>
<tr>
<th>Class</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 %</td>
<td>0</td>
</tr>
<tr>
<td>1 – 10 %</td>
<td>1</td>
</tr>
<tr>
<td>11 – 20 %</td>
<td>2</td>
</tr>
<tr>
<td>21– 40 %</td>
<td>3</td>
</tr>
<tr>
<td>41 – 60 %</td>
<td>4</td>
</tr>
<tr>
<td>61 – 80 %</td>
<td>5</td>
</tr>
<tr>
<td>81 – 99 %</td>
<td>6</td>
</tr>
<tr>
<td>100 %</td>
<td>7</td>
</tr>
</tbody>
</table>

Table A2-13: Damage extent classes.

Countries using different classes (e.g. 5%) should report their results according to the classes as above.

**Specifications:**

a.) Damage to the stem is expressed as a percentage of the stem circumference according to the classes as above.

b.) Signs of insects and fungi and the symptoms ‘tilted tree’ and ‘fallen tree’ should not be quantified.

c.) When two or more similar symptoms caused by different agents/factors occur on the same part of the tree, it may be extremely difficult to assess the respective contributions of the agents/factors in the damage extent. In this case only the overall extent and the different factors involved should be reported.

d.) Assessments in coppice (and macchia) stands:

- **Quantification of stem damage present on different shoots:** the damage is expressed as a percentage of the total stem circumference of coppice i.e. the sum of circumference of each shoot;

- **Stem damage present on different parts of different shoots** (for example cankers present on crown stem in one shoot and on roots & collar in other shoots): for ‘specification of affected part’ use code 34 (whole trunk); for quantification see above;

- **Assessment of a dead shoot(s) with the contemporary presence of other living shoots:** by convention the dead shoot(s) shall be recorded as illustrated in the table below. Quantification of the symptom (dead branches of varying size) follows the general rule, thus is expressed as % of affected branches.
Coppice shall only be recorded as a dead tree (code 4) when all the shoots are dead. 

*Note: The symptom description is related to the total crown and quantification is related to the assessable crown. Therefore it is possible that the presence of damage symptoms is indicated in the symptom description, but that the extent is 0% if symptoms occurred outside the assessable crown.*

### A2.6 Quality assurance and quality control

- Field crews should undergo a theoretical and practical training in diagnosing and quantifying the more important damage symptoms prior to the start of the annual field season;
- Diagnosis should always be confirmed by an expert phytopathologist whenever possible.
- If a field check by an expert phytopathologist is not possible photographs of the affected tree and/or samples of affected foliage, branches, fungal fruitbodies etc. may be of help for diagnosis. However damaging trees in the plots by destructive sampling is not allowed. Sampling of nearby trees outside the plot showing the same damage symptoms may be considered. However one should remember that similar damage symptoms may result from different causes.
- Surveyors should be provided with forest pathology field guides to facilitate diagnosis (see 9. References)

See also Crown Condition manual main text chapt. 9 for QA/QC guidelines.

### A2.7 Reporting

Validated data are sent every year to the European database accompanied by a “Data accompanying report – questionnaire (DAR-Q), including details on the applied method and any deviation from the manual. It is recommended to include a chapter on damage causes in the yearly national report on forest condition.

### A2.8 References


*updated 06/2006*
Parkbäume. Eugen Ulmer, Stuttgart.
Scientific Publishing Company, Amsterdam.
Institut für Waldökologie der Slowakischen Akademie der Wissenschaften, Zvolen.
Università degli studi di Sassari, Regione Autonoma della Sardegna.
Ediciones Mundi-Prensa. Sociedad Española de Ciencias Forestales, Madrid.
Berlin.
Stergulc, F., Frigimelica, G., 1996. Insetti e Funghi Dannosi ai Boschi nel Friuli Venezia
Giulia. Servizio Selvicoltura. Direzione Regionale delle Foreste e dei Parchi, Regione
Autonoma Friuli – Venezia Giulia.
pp.
Eigenverlag C. Tomiczek, Wien.
Annex 3: Forms
The parameters which have to be submitted with the particular forms may change over time. Therefore, with the update from June 2006 the NFCs are asked to start each data file (A3.2) with a header line. This line is starting with an exclamation mark followed by the names of the parameters, each separated by a comma. For each data file a proposal is given at the top of the form.
### II. CROWN CONDITION ASSESSMENTS

**Convention on Long-Range Transboundary Air Pollution**  
**International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests and European Union Scheme on the Protection of Forests against Atmospheric Pollution**  
**Annual report on health status of main tree species on the basis of defoliation:**

<table>
<thead>
<tr>
<th>Country (region):</th>
<th>total area of country (1000 ha):</th>
<th>total forest area (1000 ha):</th>
<th>forest area surveyed (1000 ha):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution (National Focal Centre):</td>
<td>total coniferous area (1000 ha):</td>
<td>total broadleaved area (1000 ha):</td>
<td></td>
</tr>
<tr>
<td>Survey period:</td>
<td>day/month - day/month/year</td>
<td>(from - to)</td>
<td></td>
</tr>
</tbody>
</table>

#### SURVEY 2006

**CONIFERS**  
**form A1**

<table>
<thead>
<tr>
<th>Classification</th>
<th>trees up to 59 years old</th>
<th>trees 60 years and older</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Species:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of species:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of sample trees:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defoliation class</td>
<td>percentage of needle loss</td>
<td>%</td>
</tr>
<tr>
<td>0 not defoliated</td>
<td>0 - 10%</td>
<td></td>
</tr>
<tr>
<td>1 slightly defoliated</td>
<td>&gt;10 - 25%</td>
<td></td>
</tr>
<tr>
<td>2 moderately defoliated</td>
<td>&gt;25 - 60%</td>
<td></td>
</tr>
<tr>
<td>3 severely defoliated</td>
<td>&gt;60% - &lt;100%</td>
<td></td>
</tr>
<tr>
<td>4 dead</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Return to: PCC of ICP Forests, Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, D-21031 Hamburg, Federal Republic of Germany, e-mail: luebker@holz.uni-hamburg.de*
<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage of trees discoloured (yellowed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trees up to 59 years old</td>
</tr>
<tr>
<td></td>
<td>1  2  3  4  5  6  7(1-6)  8  9  10  11  12  13  14(8-13)  15(7+14)</td>
</tr>
<tr>
<td><strong>species:</strong></td>
<td>others total</td>
</tr>
<tr>
<td><strong>area of species:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>no. of sample trees:</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **discolouration class**| percentage of needles disc. | %   %   %   %   %   %   %   %   %   %   %   %   |%
| 0 not discoloured       | 0 - 10%                                   | 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 |
| 1 slightly discoloured  | >10 - 25%                                 |                                                       |
| 2 moderately discoloured| >25 - 60%                                 |                                                       |
| 3 severely discoloured  | >60%                                      |                                                       |
| 4 dead                  |                                           |                                                       |
### Convention on Long-Range Transboundary Air Pollution
### International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests and European Union Scheme on the Protection of Forests against Atmospheric Pollution

Annual report on health status of main tree species on the basis of defoliation and discolouration (combined assessment):

<table>
<thead>
<tr>
<th>Country (region):</th>
<th>total area of country (1000 ha):</th>
<th>total forest area (1000 ha):</th>
<th>forest area surveyed (1000 ha):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Institution (National Focal Centre):</th>
<th>total coniferous area (1000 ha):</th>
<th>total broadleaved area (1000 ha):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Survey period:</th>
<th>day/month - day/month/year (from - to)</th>
</tr>
</thead>
</table>

**SURVEY 2006 CONIFERS form A3**

#### Classification

<table>
<thead>
<tr>
<th>Species</th>
<th>trees up to 59 years old</th>
<th>trees 60 years and older</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>others</td>
<td>total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combined damage class</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 not damaged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 slightly damaged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 moderately damaged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 severely damaged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 dead</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total                  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Return to: PCC of ICP Forests, Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, D-21031 Hamburg, Federal Republic of Germany, e-mail: laecker@holz.uni-hamburg.de*
### Identification

**Convention on Long-Range Transboundary Air Pollution**

**International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests and European Union Scheme on the Protection of Forests against Atmospheric Pollution**

**Annual report on health status of main tree species on the basis of defoliation:**

#### Survey Data

- **Institution (National Focal Centre):**
- **Survey period:** day/month - day/month/year

#### Species and Area

<table>
<thead>
<tr>
<th>Country (region):</th>
<th>total area of country (1000 ha):</th>
<th>total forest area (1000 ha):</th>
<th>forest area surveyed (1000 ha):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Broadleaves

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage of trees defoliated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trees up to 59 years old</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6 7(1-6) 8 9 10   11 12 13 14(8-13)</td>
</tr>
<tr>
<td>species:</td>
<td></td>
</tr>
<tr>
<td>area of species:</td>
<td></td>
</tr>
<tr>
<td>no. of sample trees:</td>
<td></td>
</tr>
<tr>
<td>defoliation class</td>
<td>percentage of leaf loss (%)</td>
</tr>
<tr>
<td>0 not defoliated</td>
<td>0 - 10%</td>
</tr>
<tr>
<td>1 slightly defoliated</td>
<td>&gt;10 - 25%</td>
</tr>
<tr>
<td>2 moderately defoliated</td>
<td>&gt;25 - 60%</td>
</tr>
<tr>
<td>3 severely defoliated</td>
<td>&gt;60% - &lt;100%</td>
</tr>
<tr>
<td>4 dead</td>
<td>100%</td>
</tr>
<tr>
<td>total</td>
<td>100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0</td>
</tr>
</tbody>
</table>
## Convention on Long-Range Transboundary Air Pollution

### International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests and European Union Scheme on the Protection of Forests against Atmospheric Pollution

Annual report on health status of main tree species on the basis of discoloration:

**S U R V E Y  2 0 0 6**

**B R O A D L E A V E S**

*form B2*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage of trees discoloured (yellowed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trees up to 59 years old</td>
</tr>
<tr>
<td></td>
<td>1  2  3  4  5  6  7(1-6)</td>
</tr>
<tr>
<td>species:</td>
<td>others</td>
</tr>
<tr>
<td>area of species:</td>
<td></td>
</tr>
<tr>
<td>no. of sample trees:</td>
<td></td>
</tr>
<tr>
<td>discolouration class</td>
<td>percentage of needles disc.</td>
</tr>
<tr>
<td>0 not discoloured</td>
<td>0 - 10%</td>
</tr>
<tr>
<td>1 slightly discoloured</td>
<td>&gt;10 - 25%</td>
</tr>
<tr>
<td>2 moderately discoloured</td>
<td>&gt;25 - 60%</td>
</tr>
<tr>
<td>3 severely discoloured</td>
<td>&gt;60%</td>
</tr>
<tr>
<td>4 dead</td>
<td></td>
</tr>
</tbody>
</table>

Total

100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0

*Return to: PCC of ICP Forests, Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, D-21031 Hamburg, Federal Republic of Germany, e-mail: luebker@holz.uni-hamburg.de*
**Survey 2006**

**BROADLEAVES**

*Form B3*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage of trees damaged (defoliation and yellowing combined)</th>
<th>trees up to 59 years old</th>
<th>trees 60 years and older</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7(1-6) 8 9 10 11 12 13 14(8-13) 15(7+14)</td>
<td>others total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>others total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>grand total</td>
</tr>
<tr>
<td>Species:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of species:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of sample trees:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined damage class</td>
<td></td>
<td>% % % % % % % % % % % %</td>
<td></td>
</tr>
<tr>
<td>0 not damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 slightly damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 moderately damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 severely damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 dead</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Return to:* PCC of ICP Forests, Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, D-21031 Hamburg, Federal Republic of Germany, e-mail: luebker@holz.uni-hamburg.de
CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION  
INTERNATIONAL CO-OPERATIVE PROGRAMME ON ASSESSMENT AND MONITORING OF AIR POLLUTION EFFECTS ON FORESTS AND LIKELY EFFECTS ON HUMAN HEALTH  
EUROPEAN UNION SCHEME ON THE PROTECTION OF FORESTS AGAINST ATMOSPHERIC POLLUTION  
ANNUAL REPORT ON HEALTH STATUS OF MAIN TREE SPECIES ON THE BASIS OF DEFOLIATION:

**SURVEY 2006**  
ALL SPECIES  
(Continued)

Country:

All species

<table>
<thead>
<tr>
<th>no. of sample plots</th>
<th>no. of sample trees</th>
<th>% trees defoliated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>class 0: not defoliated</td>
</tr>
</tbody>
</table>

Return to: PCC of ICP Forests, Bundesforschungsanstalt für Forst- und Holzwirtschaft, Leuschnerstr. 91, D-21031 Hamburg, Federal Republic of Germany, e-mail: luebker@holz.uni-hamburg.de
Annex 4: Design of International Cross-Calibration Courses

Elaborated by
Expert Panel on Crown Condition Assessments
Marco Ferretti, Volker Mues, in collaboration with:

Dave Durrant, Johannes Eichhorn, Martin Lorenz, and Andras Szepesi

updated 06/2006
A4.1 The concept of the ICC system

Details concerning the “New Design of International Cross-Calibration Courses of ICP Forests and the EU Scheme”, hereafter referred to as International Cross-comparison Courses (ICCs), are described by Ferretti et al. (2002).

A4.2 Basic design elements

The system of the International Cross-comparison Courses (ICCs) is installed to provide exercises with sufficient space and time replication for the most frequent tree species of the transnational surveys under realistic work condition. It incorporates formally photo QA exercises and its link with the traditional field exercises.

For each of the most frequent tree species ICC sites are spread across Europe. These ICC sites are selected by the hosting countries to ensure the possibility of re-assessments of the same plots in a periodic system to provide data for the documentation of temporal consistency. The willingness of the host countries and of the forest owners to provide the ICC site must therefore be ensured.

A4.2.1 Plot and tree selection

For each ICC site, a number of visual assessment plots (hereafter referred to as visual plots), eventually supplemented by a special photo assessment plot (hereafter referred to as photo-plot), are selected. Each ICC in principle is dealing assessments on two tree species, 3-4 plots per species are used as visual plots, each of them covering a wide range of defoliation values. According to available field conditions the host countries should select the plots varying according to only one or two environmental factors. The plots should be designed consistently with the actual Level I plots in the host country. This will help to provide realistic assessment conditions.

All plots should be located as close together as possible in order to prevent cost and time consuming travelling between the ICC plots. Each visual plot should consist of 24-30 trees of the same species. Trees within the visual plots should be selected according to the usual Level I tree selection criteria of the host country. When visual plots are unsuitable for the purposes of photo QA, an ad-hoc photo plot with 24-30 trees should be selected in the surroundings.

The plots should be managed as permanent plots. Plot locations should be recorded and trees permanently numbered and/or geo-referenced to enable the re-assessment of the same trees. Photo-QA exercises can be carried out on the visual plots when the trees fulfil the selection criteria reported in the annex on photo QA. When the visual plots are not suited for the photo QA exercise, then there is the need to select ad-hoc photo-plots. The photos of the photo exercise should be assessed as long as possible after the field assessment of the respective trees. The photos can be mirrored to ensure that objective assessments are made and not the field assessments be remembered by the participants. Furthermore, photos from other ICCs on the respective tree species should be re-assessed in terms of the documentation of temporal consistency.

A4.2.2 Invitation and participation

The host countries decide in co-operation with the Programme Co-ordinating Centre (PCC) of ICP Forests about the dates of the ICCs at the end of the survey period (usually this period lasts from end of June to end of August). For the evergreen tree species in the Mediterranean region, an extension up to the end of September can be allowed. The host countries invite all other NFCs by end of March of the respective year to send their National Reference Teams (NRT) for participation in the ICCs.

updated 06/2006
The participants of the ICCs should be the NRTs for the concerned species. The National Focal Centres decide about the participation. Ideally National Reference Teams should participate as it is important that the participants at the ICCs also participate in the national courses to get the linkage to the survey results.

A4.3 Implementation of the ICCs

A4.3.1 Field work, use of home references

It is important that the participants work independently and that there is no mutual influence of their assessments. Each team should use its own method and reference standard. Positions for assessments should be marked in the field. After assessing from this position the participants may make a second assessment according to their national methods.

The host country should present site and stand information (age, below/above average site, altitude, etc.). Usually, local reference trees will be not presented, unless a specific request will be made by the crews.

Any discussions or exchange of information, especially concerning individual trees, between the teams should be avoided before and during the cross-calibration field work for the concerned species. However, the experience gained in the past suggests that a brief discussion about the most diverse assessments could help clarification.

There is no evaluation/presentation of assessment results in the field before finishing the last plot of a given tree species. Nevertheless, e.g. presentations of national or regional evaluations could be a topic in the evening to introduce a discussion about special issues.

A4.3.2 Codes

A4.3.2.1 Participant code

Participants of National and International Courses as well as field teams will receive a unique ID number that stays the same through time (Country, Region, Person // CCRRPPPPP). “Country” refers to the usual country code; “Region” (when applicable) refers to the code of a given region in a country. If it is not necessary to develop a code for “region” the digits for RR should be filled with “99”. “Person” is the code given by the NFC to every members of its NRT. NFCs are responsible for the distribution of codes to their staff. Code lists and their annual updates are submitted to PCC by the National Focal Centres by the end of September.

A4.3.2.2 Plot code

The host countries provide the plot IDs for the ICC test ranges according to the following method: the plot ID should be the plot number in case of Level I plots, otherwise “99” and an ICC plot specific ongoing number of 4 digits both divided by an underline. The test range specific ongoing number consists of the country code (first two digits) followed by a plot specific ongoing number. An example of four plot IDs is given below with the second plot being a real Level I plot with plot ID 194:

99_5501, 194_5502, 99_5503, 99_5504

A4.3.3 Data to be recorded

The host countries are asked to provide the plot ID code and a detailed stand description for each ICC test site/plot including latitude, longitude, site type, altitude, exposition, canopy closure, tree species, tree heights, dbh, stand age and recent thinning.
### General data

- Calendar date: +
- Participant code: +

### Plot data

- Plot ID: +
- Latitude: +
- Longitude: +
- Altitude: +
- Aspect: +
- Canopy closure: +
- Tree species assemblage: +
- Tree height (dominant storey, average): +
- DBH (dominant storey, average): +
- Age (dominant storey, average): +

### Tree data

- Species: +
- Number: +
- Determine assessed part of crown (e.g. using photographs): +
- Defoliation (0,5,10,15 ... 95,99,100%): +
- Discolouration (0,1,2,3,4): +
- Specification of affected part (11, ..., 34), see: +
- Symptom (01, ..., 22): +
- Cause (codes see annex 2, e.g. 81001): +
- Scientific name of cause (codes see annex 6, e.g. LOPHSED): +
- Extent (0,1,2,3,4,5,6,7): +

**Table A4-1**: Overview of the data and parameters to be provided, collected and reported.

Ideally, all mandatory parameters of the Level I and II crown condition surveys should be covered by the ICCs. However, given the importance of defoliation and discolouration in the reporting of forest condition, these parameters have the highest priority. The mandatory damage parameters are to be assessed too. Additional parameters may be assessed after explicit requests of participating countries or in consequence of changes of the manual on a voluntary basis. Plot ID, date, and ICC participant code should be recorded by the participants once per plot. All these parameters and codes must be entered in the field form. The field forms should be supplied by the host countries.

**A4.4 Data submission**

If possible data should be digitised during the course. Thus, uncertainties could be clarified directly with the participants.

The data can be handed over to PCC directly at the end of the courses or should be sent to PCC latest by the end of September of the respective year. Furthermore the host country provides a list with the participants and their codes used during the ICC which should be the same as given for the field survey.

**Excel Format:**

All results of one species (ICC test range) are listed in one file (filename containing species, year, host country, e.g. “ICCFagusSylvatica2003Germany.xls”, or short: “ICCFagSylv03GER.xls”).

updated 06/2006
The file includes several sheets for the respective plots and parameters, the name of the sheet gives plot ID and parameter (e.g. 99_5501_defoliation, 194_5502_discolouration, ...).

Structure of table as follows

<table>
<thead>
<tr>
<th>Tree No.</th>
<th>NRT1 (CCRRPPPPP, CCRRPPPPP)</th>
<th>NRT2 (CCRRPPPPP, CCRRPPPPP)</th>
<th>NRT3 (CCRRPPPPP, CCRRPPPPP)</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

updated 06/2006
A4.5 References
Hornvedt, R., 1997. Relationship between visually assessed crown density and measured foliage density, and between visually assessed crown colour and measured chlorophyll content in mature Norway spruce. Aktuelt fra Skogforsk (Ås) 10/97. 23-25.

updated 06/2006


updated 06/2006