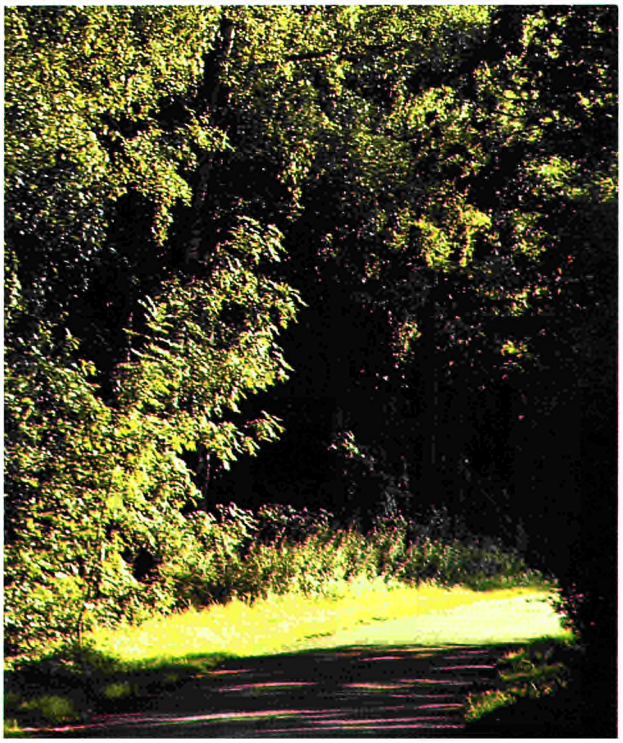
COMMISSION OF THE EUROPEAN COMMUNITIES

DIRECTORATE-GENERAL
FOR AGRICULTURE

EUROPEAN COMMUNITY

FOREST HEALTH REPORT 1987-1988



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Background

This report gives the results of national forest health reports and the Community forest damage survey in 1987 and 1988. The aim of the report is to give an overview of the state of forest health in the European Community.

The report is a result of the application for two years of Council Regulation (EEC) n° 3528/86 of 17 November 1986 on protection of the Community's forests against atmospheric pollution. Member States have set up a Community wide forest damage inventory and forwarded annual forest health reports to the Commission since 1987.

Under the same Regulation the Commission has granted Community financial aid for the completion of pilot projects and experiments to improve knowledge of air pollution in forests and its effects, to improve methods of observing and measuring damage to forests and to devise methods of maintaining and restoring damaged forests.

For the purpose of making the forest damage survey and national reports, a common methodology was used as laid dawn by Commission Regulation (EEC) n° 1696/87 of 10 June 1987. This methodology is based on guidelines for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests, as adopted by the parties to the Convention on Long-range Transboundary Air Pollution participating in the International Cooperative Programme for Assessment and Monitoring of Air Pollution Effects on Forests.

The Community's forest damage inventory is the first large scale transboundary inventory of its kind to be carried out in accordance with a common method, involving a unified sampling system and centralized data treatment. It enabled comparable data to be collected in respect of more than 37,000 sample trees throughout the Community.

The appearance of widespread forest decline, generally attributed to atmospheric pollution in many regions of the Community since the beginning of the 1980's, as well as the rapid spread of forest damage, were at the origin of the Community's action for the protection of forests against atmospheric pollution.

Summary findings

The results of the two years survey provide data on the extent and regional distribution of forest damage. Damage was observed both in the northern part of the Community and in the Mediterranean regions. Cartographic representations of the observed defoliation, plot by plot, provided an overview of regional distribution and evolution of damage. It appears that plots with high average defoliation were particularly evident in the eastern and south-western parts of the Federal Republic of Germany, Scotland, the Netherlands, north-east and south-east of France, northern and central regions of Greece, the south of Spain and in north-west Italy.

Observation of 19,651 trees in 1987 and in 1988 showed that 14.75 % and 12.86 % respectively had more than 25% defoliation in these two years. The results in 1988 from observation of a much larger sample, including notably many additional Mediterranean sample trees (total sample: 37,600 trees), showed that 10.15 % of trees were clearly defoliated that year. Discolouration was less pronounced with 3.75 % and 2.56 % of trees with moderate or severe discolouration in 1987 and 1988 respectively.

Both conifers and broadleaves showed reduced vitality but conifers were more damaged than broadleaves. The tendency as regards the vitality of trees between 1987 and 1988 was assessed on the results of observations made of 19,651 sample trees in both years. Globally there was a slight decrease of the percentage of trees with moderate or severe defoliation (-1.9%). However, whereas the improvement was significant for broadleaves (-3% of trees with moderate or severe defoliation, +2% of trees without any defoliation), it was limited for conifers to a slight transfer of sample trees from defoliation class "moderate" to defoliation class "slight". At the same time the percentage of conifers without any defoliation decreased by 3%.

For all species together, the percentage of trees showing some discolouration decreased by nearly 2% between 1987 and 1988. However, whereas conifers showed no significant variation, the percentage of broadleaves without any discolouration increased by nearly 4%.

Silver fir, Norway spruce, Beech and deciduous Oaks belong to the most damaged tree species. Whereas the vitality of the three first named species improved between 1987 and 1988, the condition of deciduous oaks deteriorated.

Easily identifiable damage due to known causes have been observed in 1988 on one third of all sample trees and on 62% of all sample plots. Insect attacks were particularly widespread. Trees without presence of identifiable damage were generally significantly less defoliated than trees with presence of such damage.

Damage showed a general tendency to increase with the age of sample trees. The survey results further confirmed the existence of correlations between site factors such as altitude and water availability on the one hand and observed defoliation or discolouration on the other.

Conclusions

Because of the non-specific character of the observed damage symptoms the inventory results are not sufficient in themselves to draw conclusions on the causes of the observed damage. They however confirm that the vitality of the forests is clearly reduced in many regions of the Community.

It has been generally admitted in scientific circles that this reduced vitality of forests, which has been observed in many parts of Europe since the beginning of the 1980's, is caused by a complex of biotic, abiotic and anthropogenic factors among which atmospheric pollution plays a significant role as a destabilizing factor of forest ecosystems. The influence of atmospheric pollution is regionnally variable. It may have direct and indirect effects on forest trees as well as on other parts of the forest ecosystem.

In order to improve the vitality of forests and in the same time their resistance to wide spread biotic damage factors and extreme climatic events, the present levels of atmospheric pollution should be reduced. Their continuation or increase may threaten the survival of forests in many regions of Europe.
Where necessary, forest management should be adapted and appropriate sylvicultural techniques applied in order to maintain or restore damaged forests.

The observed damage situation indicates a need for continued monitoring. The observation of the vitality of forest trees should be continued following the common methodology which has already proved its effectiveness. This will enable the evolution of forest damage to be followed over time. Furthermore, the visual observations of sample trees should be completed by a large scale coordinated forest ecosystem monitoring, including systematic identification of atmospheric deposits, soil conditions, chemical composition of leaves and needles and tree growth.

PART 1 THE COMMUNITY FOREST DAMAGE SURVEY 1987 & 1988

LEGISLATIVE BASIS

On 17 November 1986 the Council of Ministers of the E.C. adopted Regulation (EEC) No 3528/86 on the protection of the Community's forests against atmospheric pollution, which took effect from 1 January 1987 (1). Within the Regulation, a Community scheme is provided for establishing a periodic Community inventory of damage caused to forests and the drawing up by the Member States of a periodic forest health report. It also provides for the development of pilot projects and field experiments in order to improve the understanding of atmospheric pollution in forests and its effects, to improve methods of observing and measuring damage and to establish methods for the restoration of damaged forests.

Under Article 2, with respect to the Community inventory, the scheme in the above Regulation provides for :

- establishing on the basis of a common method a periodic inventory of damage caused to forests in particular by atmospheric pollution;

- establishing or extending, in a coordinated and harmonious way, the network of observation points required to draw up this inventory.

Following the inventory each Member State forwards to the Commission the data gathered at the observation points of the network.

In addition, in accordance with Article 3 of the above Regulation, each Member State draws up and forwards to the Commission a periodic forest health report based in particular on the inventory data referred to in Article 2.

In accordance with the opinion of the Committee on Forest Protection, established by the same Regulation (No 3528/86), the detailed rules of implementation of the inventory, and in particular the common methodology and the format of presentation of the national forest health reports have been adopted and are laid out in Commission Regulation (EEC) No 1696/87 of 10 June 1987 (2). This common method takes account of the recommendations of the ECE manual (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).

(1) OJ no. L 326, 21.11.1986, p. 2
(2) OJ no. L 161, 22.06.1986, p. 1

INVENTORY METHOD

The common method for establishing a periodic inventory of damage caused to forests, as described in Annex I of Commission Regulation (EEC) No 1696/87 of 10 June 1987 laying down certain detailed rules for the implementation of Council Regulation (EEC) No 3528/86, applies to both the Community inventory of forest damage and to the denser grid networks that might be used by the Member States to draw up their forest health reports to be forwarded to the Commission.

The common inventory methodology requires that a network of observation points should be established following a systematic grid covering the entire forest area of the Community. As regards the Community inventory the grid has a density of 16 km x 16 km for which the latitude and longitude coordinates of each point have been provided by the Commission to each Member State. Member States are however encouraged to collect additional information from denser networks using the common methodology, in order to obtain representative data at national or regional level to be included in their annual reports as foreseen by Council regulation (EEC) No 3528/86.

At each grid intersection point falling in a forest, a sample of 20-30 trees is selected for assessment according to a stringently defined, objective and unbiased statistical procedure. The sample includes all tree species provided the sample trees have a minimum height of 60 cm. Only predominant, dominant and co-dominant trees, according to the system of Kraft, qualify as sample trees.

At each observation plot the tree sample is assessed for defoliation and discolouration following the European classification (i.e. **Defoliation** : class 0-not defoliated (0-10%), class 1-slightly defoliated (11-25%), class 2-moderately defoliated (26-60%), class 3-severely defoliated (more than 60%), class 4-dead. Defoliation is estimated relatively to a tree with full foliage, the reference being a healthy tree in the vicinity or a photograph of a tree with full foliage, suitable for the region of investigation. **Discolouration** : class 0-no or negligible discolouration (0-10%), class 1-slightly discoloured (11-25%), class 2-moderately discoloured (26-60%), class 3-severely discoloured (more than 60%)).

Defoliation of trees or crown density is the basic index used in all surveys of forest health carried out throughout Europe in the framework of the Convention on long-range transboundary air pollution. It is influenced by a number of factors, of which pollution is one. The same is true for discoloration of foliage, another index used for evaluating the vitality of trees. Consequently, there is a major problem in separating any changes in crown density or coloration attributable to pollution from those attributable to other factors. However, research in some countries indicates that air pollution plays a significant role in forest decline. In many cases the existence and extend of forest damage cannot be exlained without considering the influence of air pollution.

In addition, for each sample plot, data are collected for the following parameters and classified into common categories laid down in Regulation 1696/87. These parameters include : country, actual latitude and longitude coordinates, observation point number, altitude, aspect, availability of water to principal species, humus type, mean age of dominant storey, date of observation, tree number, tree species and observations of easily identifiable damages.
For the Community network these data are collected on common census forms (see Annex 1) which are forwarded to the Commission.

1987 AND 1988 COMMUNITY INVENTORY OF DAMAGE CAUSED TO FORESTS

Completition

The aim of the Community scheme, provided for under Article 2 of Council Regulation (EEC) No 3528/86, is to establish a periodic inventory of the health status of forests in the Member States of the EEC by collecting representative and comparable data on the extent and intensity of forest damage and to monitor its development.

The installation of the Community network of observation plots began in 1987 and the first observations of forest damage were carried out during the summer. The Commission has received information from 1 009 Community observation plots and for 26 390 sample trees in 1987 and from 1526 plots and 37607 trees in 1988. In this two initial years total coverage of the Community's forests has not yet been accomplished; approximately 300 forest observation plots are still to be established. In 1988, about 85 % of the Community's forests were covered by the inventory.
The table hereafter gives the numbers of sample trees and plots by Member States for 1988.
In 1988 the grid network has been entirely established over the total forest territories of all member states except France and Italy. As regards Italy, most of the territory has been covered and damage data have been received for all regions except for Sardegna and Sicilia. Only about half of the french forests have been covered by the network. In 1987 the Community inventory did not cover a large part of the forested area of the Community and the 1987 results may therefor not be considered entirely representative of the Community's forests as a whole.
The representativity of the survey has been largely extended in 1988, most of the Member States having by now completed their network.

Main characteristics of sample trees

Within the sample of trees assessed in 1988, the following species, mentioned in declining order, are the most represented : Picea abies (12,4%), Pinus sylvestris (10%), Fagus sylvatica (9,1%) Pinus pinaster (7,6%), Quercus ilex 5,8%), Pinus halepensis (4,2%), Quercus suber (3,9%), Quercus robur (3,8%), Pinus nigra (3,6%), Abies alba, Quercus petraea, Quercus cerris ...
The total proportion of broadleaves and conifers is 44.92% and 55.08% respectively for the 1987 survey and 49,7% and 50,3% respectively for the larger and more representative sample of 1988.

In 1988 the great majority of sample trees was situated on plots which have been classified in the water availability class "sufficient" (86%), 12% in "insufficient" and 2% in "excessive".
As far as humus type is concerned, 37.5% of the trees were on mull type humus, 39% on moder, 13% on mor and only 0,5% and 1.5% respectively on anmor and peat. For 8% of all sample trees the humus type was not defined.

As to altitude, 52,9% of the total tree sample was situated at less than 500m, 30,3% between 500 and 1000m and 16,8% above 1000m. As to aspect the plots were generally fairly equally distributed among the classes except for class 9 (flat) which incudes the majority of sample-trees. There was a very slightly higher proportion of north-facing plots. As regards age classes, 59% of sample trees were located in less than 60 years old stands and 29,5% in standsof 60 years of age or more. 11,5% of trees were observed in stands with irregular age distribution.

Presentation and definitions

The damage results are presented in terms of the percentage of the tree sample assessed falling into each defoliation class. In addition certain tables also indicate the percentage of observed plots within each category; these figures indicate the percentage of all the plots for which at least one sample tree has been classified into the category in question. It is however unlikely that all sample trees within a plot fall into the same class and therefore the plot will be represented in more than one class and the total % of plots for all the classes will add to more than 100%. For this form of presentation the percentage of plots in the sence above is useful for obtaining an indication of whether the trees of a certain defoliation class are widely distributed or concentrated within a limited number of plots.

A distinction between the first two defoliation classes is often considered subjective and it is debatable whether a tree in the defoliation class 1 can really be described as "damaged" as this may be a natural state for many trees under certain conditions.
However, before trees reach higher defoliation classes, they pass at a certain phase of development the stage of defoliation class 1. This class may therefore be interpreted as a "warning class". Time trends of defoliation class 1 established on the base of recurring inventories can be highly indicative in this respect.
To facilitate interpretation of the results, defoliation class 0 "not defoliated " (10% or less)" and class 1 "slightly defoliated"(10-25%) have been combined for some tables and interpretations.

Defoliation classes 2,3 and 4 represent considerable defoliation. (Crown density less than 75% of what would be considered as normal)
The total percentage of sample trees classified in those three defoliation classes gives a reliable measure for the presence of significant damage.
Per definition trees classified in defoliation classes 2, 3 or 4 will be considered hereafter as "clearly damaged trees". A sample plot will in this report be considered as "damaged" if the weighted average defoliation class of the sample trees of this plot is 2, 3 or 4.

Comparability of 1987 and 1988 results - warning:

As the number of sample trees was largely increased in 1988 compared to 1987 (26390 sample trees in 1987, 37607 sample trees in 1988) the global results of these two first years are not fully comparable.
The increase of the number of sample trees is mainly due to the extension of the inventory grid in Spain, Portugal and Greece.
However in order to allow certain comparisons to be made between 1987 and 1988 results, a sub-sample has been defined which consists of those sample trees which have been observed in 1987 and in 1988. This sub-sample contains 19.651 trees referred to hereafter as common sample trees 1987/1988 (CST's).
All the comparisons between 1987 and 1988 observations given hereafter are based on this sub-sample.
The global results (total sample) of 1988 are largely representative for the Community's forests of which they give a highly interesting picture of their composition and health condition .

1987 and 1988 RESULTS

The following table gives the main results concerning defoliation for all species jointly, conifers and broadleaves. These results are based on common sample trees (CST's) for 1987 and 1988.

DEFOLIATION OF ALL TREE SPECIES BASED ON COMMON 1987/1988 TREE SAMPLE

Number of sample trees = 19.651	percentage of trees:	
Defoliation classes:	**1987**	**1988**
not	58,67	57,72
slightly	26,57	29,42
moderately	13,56	11,39
severely	1,07	1,12
dead	0,12	0,35

(see also FIG. 06)

DEFOLIATION OF BROADLEAVES BASED ON COMMON 1987/1988 TREE SAMPLE

Number of sample trees = 8.809	percentage of trees:	
Defoliation classes:	**1987**	**1988**
not	64,71	66,09
slightly	22,72	24,26
moderately	11,76	8,56
severely	0,60	0,74
dead	0,22	0,35

(see also FIG. 07)

DEFOLIATION OF CONIFERS BASED ON COMMON 1987/1988 TREE SAMPLE

Number of sample trees = 10.842	percentage of trees:	
Defoliation classes:	**1987**	**1988**
not	53,76	50,92
slightly	29,71	33,61
moderately	15,02	13,69
severely	1,46	1,44
dead	0,05	0,34

(see also FIG. 08)

Defoliation of sample trees

(See Tables TAB. 01, 03 and figures FIG 06, 07 and 08)

Within the Community inventory of damage caused to forests, the percentage of observed all trees classified into defoliation classes 2, 3 or 4 (moderately or severely defoliated or dead) was **14,61%** in **1987** and **10.15%** in **1988**. If only the common sample trees are compared, those two values are respectively **14.75%** and **12.86%**.

The difference between the two first values in the paragraphe above (total samples) is strongly influenced by the increase of the sample size between 1987 and 1988, whereas the difference between the two last values (CST's) gives an indication on the evolution of damage between 1987 and 1988 based on 19.651 common sample trees.

Comparison of the observed defoliation of all tree species jointly between 1987 and 1988 reflects a slight decrease of the percentage of considerably defoliated trees: - 1.91%. This difference is statistically significant. In 1988 there were however 2.85 % more trees in the "warning" class (class 1) than the year before.
Most of the defoliation in the joined classes 2, 3 and 4 refered to here above was "moderate" (13.56% in 1987 and 11.39% in 1988, percentages of CST's).

Between 1987 and 1988 the percentage of sample trees, all species taken together, showing less than 10 % or no defoliation (class 0) decreased by 0.95 % (CST's).
For conifers this percentage decreased by 2.85%.
The percentage of broadleaves showing less than 10 % or no defoliation however increased by 1.38 %.
This last interpretation thus shows a slight **deterioration** of the vitality off trees (all species together), a slight **deterioration** of the vitality of conifers and a slight **improvement** of the vitality of broadleaves.

For both, broadleaves and conifers, the percentage of trees classified in damage classes 2, 3 and 4 decreased during this periode, but whereas the percentage of trees in defoliation class 0 increased for broadleaves, it decreased for conifers. This means that the improvement in the situation for conifers exclusively consisted of a passage of trees from defoliation class 2 to defoliation class 1, and that the situation for conifers slightly worsened between 1987 and 1988 if the warning class is taken into consideration.
(see figures FIG 06, 07 and 08).

The distribution of the sample trees of different defoliation classes in all surveyed plots in 1987 and 1988 was as follows (total sample):

	percentage of observed plots with presence of at least one tree in the corresponding defoliation class:	
	1987	1988
defoliation classes:		
none	87.22	93.51
slightly	66.70	65.92
moderately	47.67	41.28
severely	11.30	10.48
dead	2.87	3.41
Total Number of plots:	1,009	1,526

As this table shows, moderate and severe defoliation was observed on fewer plots in 1988 than in 1987. While interpreting these results the increase in the number of sample plots between 1987 and 1988, notably in mediterranean regions, must be taken into consideration.

In 1987 there were 129 plots without any tree classified in defoliation class 0 (12.78% of observed plots), whereas in 1988 only 99 plots had no single tree showing less than 10% defoliation (6.49% of observed plots).

Discoloration of sample trees

(see tables TAB. 02, 04 and figures 06, 07 and 08)

With regard to discolouration within the total tree sample, **86.03%** showed **no or negligible discolouration** in **1987**. This was the case for **86.81%** in **1988**.Comparing discoloration observed on common sample trees, these percentages are respectively **85.6** and **87.4%**.

10% of CST's showed slight discoloration in both years whereas the percentage of CST's showing moderate or severe discoloration was respectively 3.7% and 2.5% in 1987 and 1988.

In **17.64%** of the plots observed in **1987** and in **16.12%** of all plots observed in **1988**, at least one tree was moderately or severely discoloured.

The percentage of trees showing discoloration decreased for broadleaves but not for conifers (see TAB 20 and 21).

The global results indicate a slight but significant improvement of the situation between 1987 and 1988.

Easily identifiable damage

Table TAB 28 indicates the presence of easily identifiable damages for the total 1988 sample.
These have been divided into eight categories : game and grazing (damage to trunk, bark ...), insects, fungi, abiotic agents (wind, drought, snow etc.), direct action of man (poor silvicultural practices, logging, ...), fire, known local/regional pollution (this does not include long-range air pollution), other.
For these categories, only the presence of such damage is indicated and is presented in terms of the percentage of the total tree/plot sample affected; there is no indication of the intensity of the damage. It is quite possible for a tree to show signs of more than one type of damage identifiable to a known cause and therefore to be represented more than once in the damage table.

25.97% of the total tree sample had one or more identifiable causes of damage attributed to it in 1987 which corresponds to **52.76%** of the plots having at least one tree affected. These two percentages were respectively **33.39%** and **62.19%** in 1988.

As these results show, easily identifiable damage factors were frequently observed on sample trees. Among them, the proportion of insect attack was particulary high with respectively **16.80%** and **19.42%** of the sample trees (36.13% resp. 40.10% of plots) affected in 1987 and in 1988..

For **6.49%** resp. **4.64%** of the sample fungi was present (17.71% resp. 15.6% of plots). For the remaining parameters the frequency percentages are all under 5%. For **0.48%** of all sample trees observed in 1987 and **0.32%** of those observed in 1988, damage could be attributed to a local pollution source; the percentage of plots affected was 0.72% resp. 0.66% which suggests that the damage was relatively concentrated.

In both 1987 and 1988 the defoliation pattern of all trees not showing any identifiable damage is quite different of the defoliation pattern of all trees showing some kind of identifiable damage:

	percentage of damaged sample trees: (defoliation classes 2, 3 and 4)	
	1987	1988
trees with presence of some identifiable damage	**21.46%**	**15.15%**
trees without any identifiable damage	**11.84%**	**7.65%**
abiotic agents	27.32%	26.33%
insects	23.87%	16.77%
fungi	24.02%	15.18%
game and grazing	41.24%	13.18%
action of man	20.52%	9.18%
fire	26.05%	13.55%
known pollution	26.99%	13.12%
other damage	27.44%	13.85%
multiple ident. damage	30.95%	17.98%
total number of sample trees:	26.390	37.607

(see also tables TAB 29 and TAB 30)

Differences between 1987 and 1988 may be due to a large extend to the extension of the survey notably in mediterranean regions between these two years. Nevertheless there appears in both years a significant difference in the percentages of damaged trees if one considers only sample trees with presence of some identifiable damage cause or if only sample trees without any such damage cause are considered.

The percentage of trees showing damage due to known air pollution and classfied in defoliation class 1 (sligthly defoliated) is particulary high compared to sample trees showing no such damage, wheras the percentage of considerably defoliated trees (defoliation classes 2,3 and 4) is not significantly higher among trees showing damage due to known pollution than among sample trees showing damage due to other identifiable causes :

	percentage of sample trees in defoliation class 1	
	1987	1988
no ident. damage	23.47%	19.93%
any ident. damage	33.78%	32.23%
known pollution damage	43.65%	43.44%

Comparison of broadleaves and conifers regarding defoliation

	percentages of **common** sample trees in each defoliation class:	
	broadleaves	**conifers**
	1987 / 1988	**1987 / 1988**
defoliation classes:		
none	64.7 / 66.1	53.7 / 50.9
slight	22.7 / 24.3	29.7 / 33.6
moderate	11.8 / 8.6	15.0 / 13.7
severe	0.6 / 0.7	1.5 / 1.5
dead	0.2 / 0.3	0.1 / 0.3
classes 2,3 and 4:	**12.6 / 9.6**	**16.6 / 15.5**
total number of common sample trees:	8.809	10.842

Evolution of the percentage of damaged trees between 1987 and 1988:
broadleaves: **- 3.0 %** conifers: **- 1.1%**

Evolution of the percentage of trees showing defoliation :
broadleaves: **- 1.4 %** conifers: **+ 2.8%**

As the table hereabove shows, conifers were globally more defoliated than broadleaves in 1987 and in 1988.

Vitality of both conifers and broadleaves improved between these two years but only the condition of the broadleaves improved significantly. The improvement of the vitality of conifers was however limited to a move of trees from defoliation class 2 to defoliation class 1.

The percentage of coniferous sample trees in defoliation class 0 "no defoliation" decreased by 2.8%, which means that the vitality of conifers between the two years could as well be interpreted as deteriorating.

For both years the percentage of trees with more than 10 % defoliation was high, as well for broadleaves (more than one third affected), as for conifers (nearly half of the sample trees affected):

conifers: 46.3 % in 1987 and 49.1 % in 1988

broadleaves: 35.3 % in 1987 and 33.9 % in 1988

It should however be noted that about two thirds of all these trees showing some defoliation, as well conifers as broadleaves, have been classified in defoliation class 1, "slightly defoliated".
Most of the trees considerted as "damaged" were classified in defoliation class 2, "moderately defoliated".

(Figures FIG. 06, 07, 08 and tables TAB 05, 12, 17 ,18 give detailed results)

Comparison of broadleaves and conifers regarding discolouration

	1987	1988
Percentage of broadleaves showing discoloration : (CST's)	15.57 %	11.56 %
Percentage of conifers showing discoloration : (CST's)	13.46 %	13.53 %

Wheras in 1987 discolouration was more frequently observed on broadleaves than on conifers, the opposite was true in 1988. Wheras discolouration remained unchanged on conifers, it significantly regressed on broadleaves.

Figures FIG 07, 08 and tables TAB 06, 19, 20, 21, 27 contain more details.

Defoliation and discolouration by species

In the field the species of each sample tree was identified and coded following a list of more than 100 species provided by the Commission. For this report, the species have been grouped and those most frequent within the sample are presented hereafter.

Three categories of oak are included in the following table : deciduous oak, Quercus ilex and Quercus suber. The latter two species are mentioned separately due to their importance in the Mediterranean region and the relative lack of information on the health status of these species. Although Quercus suber is relatively well represented in the total tree sample established for the inventory, only 261 trees had been assessed in 1987 because Portugal was unable to carry out the observations that year. In 1988 a total of 1.478 sample trees of this species were assessed, from which 1.160 were situated in Portugal and 317 in Spain. A fourth category of "other evergreen oak" was abandoned due to poor representation within the sample.

Detailed results are given by following tables:

TAB 12: Defoliation by species group, total sample 1988
TAB 13, 14, 15 and 16: Defoliation by species group and climatic regions for 1988
TAB 17 and 18: Defoliation by species group CST's for 1987 and 1988
TAB 19: Discolouration by species group, total sample 1988
TAB 20 and 21: Discolouration by species group CST's 1987 and 1988
TAB 26: Defoliation by species, total sample 1988
TAB 27: Discolouration by species, total sample 1988

Defoliation by species groups for 1987 and 1988
Survey results for common sample trees

	Defoliation				
	none	slight	moderate	severe	dead
	%	%	%	%	%
	1987/1988	1987/1988	1987/1988	1987/1988	1987/1988
Castanea sativa Nb.= 602	72.6/77.7	20.9/14.95	5.98/ 4.98	0.33/1.50	0.17/0.83
Eucalyptus sp. Nb.= 274	58.8/94.2	25.2/ 4.74	16.06/ 0.73	0.00/0.00	0.00/0.36
Fagus sp. Nb.= 2.226	**54.9/58.5**	30.0/29.25	14.29/11.50	0.76/0.63	0.00/0.09
Quercus sp.(dec.) Nb.= 2.129	71.9/66.6	16.1/20.10	11.27/11.98	0.52/0.89	0.23/0.42
Quercus ilex Nb.= 1.248	**53.8/59.1**	28.7/33.49	**16.67/ 6.89**	0.80/0.40	0.00/0.08
Quercus suber Nb.= 207	**33.8/43.5**	42.5/45.41	**23.19/ 9.66**	0.48/1.45	0.00/0.00
Other broadl. Nb.= 2.123	75.7/72.9	16.4/20.87	6.69/ 4.95	0.57/0.71	0.61/0.61
Abies sp. Nb.= 476	**45.4/47.7**	20.8/21.85	**27.31/27.10**	**5.88/2.10**	**0.63/1.26**
Larix sp. Nb.= 501	66.5/61.5	28.1/28.54	5.19/ 9.58	0.00/0.00	0.20/0.40
Picea sp. Nb.= 4.180	**45.7/43.8**	33.6/36.99	**19.50/17.87**	1.17/1.24	0.00/0.05
Pinus sp. Nb.= 5.311	59.5/55.8	27.9/32.59	11.22/ 9.40	1.37/1.68	0.02/0.49
Other conifers Nb.= 374	**55.9/50.0**	25.4/32.09	**16.58/16.31**	2.14/1.34	0.00/0.27
All broadl. Nb.= 8.809	64.7/66.1	22.7/24.26	11.76/ 8.56	0.60/0.74	0.22/0.35
All conifers Nb.= 10.842	53.8/50.9	29.7/33.61	15.02/13.69	1.46/1.44	0.05/0.34
All species Nb.= 19.651	58.7/57.7	26.6/29.42	13.56/11.39	1.07/1.12	0.12/0.35

TABLE DEFOL TAB 26 gives the detailed results for the total 1988 sample for the different species taken separately

The comparison of the results for the main forest tree species in 1987 and 1988 allows following statements:

Abies sp. showed the highest defoliation in both years with resp. **33.82** and **30.46 %** of CST's in defoliation classes 2+ 3 + 4 joined. If the total sample of **1988** containing 1188 trees is considered, the percentage of trees in defoliation classes 2+ 3 + 4 joined is **21.13%**.
The observed defoliation of Abies sp. is mainly due to the poor vitality of **Abies alba** for which **27.89 %** of the total **1988** sample was classified as moderately or severely defoliated.
Furthermore, Abies sp. had the highest proportion of dead trees in 1987 and in 1988: resp. 0.63 and 1.26 % of CST's.

Picea sp. showed considerable defoliation with resp. **20.67** and **19.16 %** of common 87/88 sample trees in defoliation classes 2+ 3 + 4 joined.
Of all sample trees observed in **1988** the percentages in these defoliation classes joined were as follows for the two most represented species of Picea:
Picea abies: 15.73 % (total number of sample trees: 4.677)
Picea sitchensis: 21.43% (total number of sample trees: 843)
The vitality of both Abies sp. and Picea sp. slightly improved between 1987 and 1988.

Pinus sp. and **Larix sp.** were less defoliated, but for both species groups **the percentage of defoliated sample trees increased** between 1987 and 1988.
Among the different species of Pinus, **P. contorta** showed the highest proportion of trees in the classes 2+3+4 joined in 1988 with 18.99% followed by **P. pinea** with 14.47%. 11.21% of **P. sylvestris** were classified in these three classes in 1988. 100% of P. mugo sample trees showed moderate or severe defoliation in 1988, but the sample size of only 24 trees of this species leads us to ignore that score in this context.

Among broadleaves, **Quercus suber** showed in **1987** the highest proportion of damaged trees with **23.67%** of CST's damaged. This proportion however strongly decreased in **1988** to reach **11.11%**. All those common 87/88 sample trees of the species Q. suber were situated in **Spain**.
In 1988 the number of sample tres of Q. suber was strongly increased by the extension of the survey to **Portugal** (+1160 trees). 97% of those new sample trees were classified in defoliation class 0. As a consequence, only 2.09% of the total **1988** sample of Q. suber (1.478 trees) was classified in defoliation classes 2, 3 or 4.

Fagus sp. and **deciduous species of Quercus** were in **1988** among broadleaves the two species presenting communitywide the highest proportion of damage with respectively **12.22** and **13.29 %** of common sample trees classified in defoliation classes 2, 3 or 4.
However, between 1987 and 1988 **Fagus sp. showed a net tendency to improvement, whereas deciduous Oaks deteriorated**:
+ 3.6% of sample trees in defoliation class 0 in 1988 for Fagus sp.
- 5.3% in defoliation class 0 in 1988 for deciduous Quercus sp.
Quercus frainetto showed a particulary high defoliation score in 1988 with **28.93%** of sample trees in defoliation classes 2, 3 or 4, and 51.2 % in defoliation class 1.
Q. petraea and **Q. robur** had resp. **14.41%** and **16.3%** in defoliation classes 2, 3 or 4 in **1988** (total sample).

Eucalyptus sp. which showed considerable defoliation in 1987 completely recovered in 1988. The common sample trees refered to were all observed in **Spain** where favorable wheather conditions in 1988 are considered as having caused this recovery. This result is confirmed by the 1988 survey including Portugese sample trees: 0.51% of all 979 sample trees classified in defoliation classes 2, 3 or 4 and 3.78% in class 1.

Discolouration by species groups for 1987 and 1988
Survey results for common sample trees

	Discolouration				
	none	slight	moderate	severe	dead
	%	%	%	%	%
	1987/1988	1987/1988	1987/1988	1987/1988	1987/1988
Castanea sativa Nb.= 602	**75.2/80.7**	18.6/16.78	5.81/ 1.66	0.17/0.66	0.17/0.83
Eucalyptus sp. Nb.= 274	**65.7**/97.8	**32.5**/ 1.46	1.82/ 0.36	0.00/0.00	0.00/0.36
Fagus sp. Nb.= 2.226	93.1/91.3	5.44/ 6.20	1.30/ 2.20	0.18/0.22	0.00/0.09
Quercus sp.(dec.) Nb.= 2.129	92.6/89.4	3.33/ 7.05	3.43/ 2.91	0.38/0.19	0.23/0.42
Quercus ilex Nb.= 1.248	**63.9**/88.2	**26.5**/11.62	**8.81**/ 0.00	0.72/0.08	0.00/0.08
Quercus suber Nb.= 207	**51.7/73.4**	**41.1/25.60**	**7.25**/ 0.97	0.00/0.00	0.00/0.00
Other broadl. Nb.= 2.123	87.5/87.2	8.1/ 9.75	3.49/ 2.17	0.38/0.24	0.61/0.61
Abies sp. Nb.= 476	89.9/**78.8**	8.6/**17.86**	0.84/ 2.10	0.00/0.00	0.63/1.26
Larix sp. Nb.= 501	87.0/88.4	11.0/ 9.98	1.40/ 1.20	0.40/0.00	0.20/0.40
Picea sp. Nb.= 4.180	91.4/91.1	6.8/ 5.81	1.36/ 2.70	0.36/0.38	0.00/0.05
Pinus sp. Nb.= 5.311	**81.9/83.3**	13.3/14.27	4.22/ 1.68	0.60/0.24	0.02/0.49
Other conifers Nb.= 374	93.3/87.2	6.2/12.57	0.53/0.00	0.00/0.00	0.00/0.27
All broadl. Nb.= 8.809	84.5/88.4	11.1/ 9.06	3.87/ 1.93	0.34/0.22	0.22/0.35
All conifers Nb.= 10.842	86.5/86.5	10.3/10.91	2.71/ 2.01	0.45/0.27	0.05/0.34
All species Nb.= 19.651	85.6/87.4	10.6/10.08	3.23/ 1.97	0.40/0.24	0.12/0.35

TABLE TAB 27 gives the detailed results for the total 1988 sample for the different species taken separately

In Table hereabove, which presents discolouration by species groups for common 87/88 sample trees, considerable discolouration has been noted for Quercus suber, Quercus ilex and to a lesser extent for Castanea sativa.
If one considers the total 1988 sample including also Quercus suber from Portugal, discolouration of this species appears as being less important: 86.5% of all 1.478 sample trees in discolouration class 0.

Hybrides of Populus sp., Quercus frainetto, Platanus orientalis, Quercus pubescens, Quercus robur and Fagus sylvatica are other important broadleaves showing notable discolouration (see table TAB 27). Most of the observed discolouration was however classified as "slight". Hybrides of Populus sp. had the highest score in discolouration classes 2, 3 or 4 in 1988.

Eucalyptus sp. which showed a high percentage of trees in discolouration class 1 in 1987, fully recovered in 1988. This is confirmed by the results of the total 1988 sample where 99.3% were classified in discolouration class 0.

Very cautious interpretation of these results is required as the most affected species are mainly from the southern regions of the Community where dry climatic conditions play an important role in forest health.

A notable increase in discolouration between 1987 and 1988 was noted for Fagus sp. and Abies sp.

Hybrides of Populus sp., Quercus frainetto, Castanea sativa, Platanus orientalis, Quercus robur and Fagus sylvatica are other important broadleaves showing notable discolouration if the total 1988 sample is considered.

Among conifers, Abies cephalonica has with 14.86% the highest percentage of trees in discolouration classes 2, 3 and 4 (total sample 1988) followed by Picea sitchensis (7.94%) and Pinus contorta (7.58%)..

Possible relationship between discolouration and defoliation

Discolouration may be due to a number of causes such as nutrient deficiency, insects, atmospheric pollution and so on. The following table shows that discolouration, besides being a vitality indicator in itself, to some degree can serve as a predictor of the future development of defoliation.
While trees presenting discolouration in 1987 generally deteriorated in respect to defoliation, trees without discolouration in 1987 showed no evolution or a slight improvement:

	Defoliation in 1988 as compared to 1987		
Discolouration in 1987:	Improvement Nb. of trees	Constant Nb. of trees	Deterioration Nb. of trees
none	2.484	12.207	2.101
slight	263	1.124	697
moderate	77	292	257
severe	6	37	30

Defoliation and discolouration by age class for broadleaves and conifers

See Tables TAB 05, 06, 07 and figures FIG 01, FIG 02

A very pronounced tendency for the percentage of moderately or severely defoliated and dead trees to increase with age is apparent in figures 01 and 02. For trees younger than approximately 61-80 years the degree of defoliation is around 10% (defoliation classes 2+3+4) and above this age class defoliation begins to increase.

Broadleaved trees appear to deteriorate from 80 years upwards.
For conifers the number of defoliated trees already increases from the age of 60 years and continues to worsen at a higher rate than broadleaves.

Table TAB 05 indicates the proportion of defoliation for broadleaves and conifers of less than 60 years and more than or equal to 60 years.
The total defoliation percentages (classes 2+3+4) for broadleaves and conifers are 8.61% and 11.75% respectively (total sample 1988).
For both broadleaves and conifers of less than 60 years the degre of defoliation is roughly of the same order (6.7 and 8.4%) but over 60 years there is a distinct difference with 19.57% of conifers in defoliation classes 2, 3 and 4 compared to 12.7% of broadleaves.

Discolouration is fairly similar for broadleaves and conifers under 60 years with 90.08% and 85.44% respectively showing no or negligible discolouration; the figures for moderate and severe discolouration are also of the same order. For broadleaves over 60 years there is approximately the same proportion of trees with signs of discolouration as those of the younger category but more of the older trees are slightly discoloured. Irregular stands appear to suffer somewhat more as only 80.03% of the broadleaves in this category have normal colour (Tables TAB 05 AND TAB 06).

Inventory results by climatic regions

In the Community survey certain site characteristics are collected at each sample plot, i.e. latitude, altitude, aspect, water availability and humus type.
Another major site characteristic, the climate type, has been attributed to each plot in the data processing stage in function of the geographical localisation of the plot.

Four large climatic regions are distinguished (see MAP 07):

- Mediterranean
- Atlantic
- Sub-atlantic
- Mountainous

The mediterranean region comprises areas with rather dry summers and winter rain. Greece, the greater part of Italy, a small part of France, most of Spain and Portugal are covered by this zone. 44% of all plots belonged to this zone in 1988.

The atlantic region comprises a broad belt along the Atlantic coast, starting at the nothern border of Portugal, running across parts of France and Belgium and covering all of the Netherlands, Denmark, United Kingdom and Ireland. The climate in this region is generally moist and windy with moderate temperatures both in summer and winter and with long transitional seasons. 16 % of the sample plots were located in this region in 1988.

The sub-atlantic region comprises Luxembourg, the greater part of the Federal Republic of Germany part of Belgium and France and a small part of Italy.
The climate in this region generally shows bigger differences between summer and winter and less wind than in the Atlantic region. 35 % off the sample plots belonged to this region in 1988.

The mountainous region consists of plots that have been excluded from their original climatic region because of high altitude. In the southern part of the Community (up to the latitude running along the southern edge of the Alps and trough Lyon) plots situated more than 1500 m above sea level have been considered mountainous. North of this delimiting latitude, plots situated more than 1000 m above sea level have been considered mountainous.
5 % of the sample plots belonged to this region in 1988.

In this attempt to define climatic regions simplicity has been striven at in order to avoid excessive splitting up of the data material and to match the use and collecting method of the data.

The table on page 20 shows **defoliation** observed in **1988** for the **total sample** and for conifers and broadleaves by large climatic regions. It also indicates the **sample sizes** for conifers and broadleaves in each region for 1988.
More information is given by figure FIG 09 and tables TAB 08, 09, 10, 11 (defoliation) and TAB 22, 23, 24, 25 (discolouration).

The 1988 results show little difference in **defoliation** between the **atlantic and sub-atlantic** regions if **all** species are taken together. **Mediterranean and mountainous** regions however show for all species together significantly less defoliation than the two other regions.

Conifers show the highest defoliation in the **sub-atlantic** region (51.79 % of sample trees with more than 10 % defoliation, against 45.18 % in the atlantic region), whereas **broadleaves** are the most defoliated in the **atlantic** region (42.11 % with more than 10 % of defoliation against 32.6 % in the sub-atlantic region).

Comparison of 1987 and 1988 results shows most evolution in the **atlantic** region with 5.3 % fewer common sample trees in defoliation class 0 in the second year (44.2 % of CST's showed some defoliation in 1987 and 49.5 % in 1988).

In the **mountainous** region the percentage of trees showing some defoliation climbed from 28.2 in 1987 to 31.4 % in 1988.

In the **mediterranean** region the total percentage of CST's with defoliation showed no variation between 1987 and 1988, however the percentage of CST's with more than 25 % defoliation (classes 2, 3 and 4) decreased from 11.3 to 7.4 %.

The percentage of common sample trees in the **sub-atlantic** region showing **no** defoliation (class 0) slightly decreased between 1987 and 1988 (from 50.8 to 49.5 %) but the percentage of CST's showing moderate or severe defoliation decreased too (from 17.83 to 15.8 %).

As regards **discolouration**, this was in 1987 most frequently observed in the **mediterranean** region with 24.0 % of common sample trees showing some discolouration (classes 1+2+3+4). This percentage decreased to 17.3 % in 1988.

The situation in the **atlantic** region also improved between 1987 and 1988: 16.6 % of the common sample trees (CST's) showed signs of discolouration in 1987 and 14.2 % in 1988. Between 1987 and 1988 however that percentage increased in the **mountainous** region (from 18.4 % to 22.4 %) and in the **sub-atlantic region** (from 4.8 % to 6.2 %).
In 1988 the highest percentage of trees showing discolouration was observed in the mountainous region.

climatic region :	variation between 1987 and 1988:	
	defoliation	discolouration
atlantic	+	-
sub-atlantic	+	+
mediterrainean	-	-
mountainous	+	+

Defoliation and discolouration by large climatic regions

1988

Species group: Climatic region :	DEFOLIATION (% of sample trees): none	slight	moderate	severe	dead	sample size: total nb.
ATLANTIC						
Broadleaves	57.89	30.69	9.85	1.36	0.21	2.356
Conifers	54.82	28.98	12.90	2.69	0.60	3.495
All species	**56.06**	**29.67**	**11.67**	**2.15**	**0.44**	**5.851**
SUB-ATLANTIC						
Broadleaves	67.40	22.23	9.76	0.50	0.12	6.033
Conifers	48.21	35.70	15.26	0.68	0.15	6.613
All species	**57.36**	**29.27**	**12.64**	**0.59**	**0.13**	**12.646**
MEDITERRANEAN						
Broadleaves	74.96	18.00	5.79	0.98	0.27	9.785
Conifers	74.68	19.12	5.25	0.82	0.12	7.276
All species	**74.84**	**18.47**	**5.56**	**0.91**	**0.21**	**17.061**
MOUNTAINOUS						
Broadleaves	87.08	10.76	2.15	0.00	0.00	511
Conifers	65.02	25.68	8.71	0.33	0.26	1.538
All species	**70.52**	**21.96**	**7.08**	**0.24**	**0.20**	**2.049**
EEC						
Broadleaves	70.70	20.77	7.49	0.85	0.20	18.685
Conifers	60.98	27.27	10.44	1.08	0.23	18.922
All species	**65.81**	**24.04**	**8.97**	**0.96**	**0.22**	**37.607**

Defoliation and discolouration by altitude

Figures 03, 04, 05 indicate defoliation (classes 2+3+4) in relation to altitude which is presented graphically with the application of a 150m moving average to identify the general trend. In general, the lower altitude classes (550m) are the most represented in the total sample and the number of trees in each class then gradually declines with increasing altitude. The relation altitude-defoliation is represented for three climatic regions separately.

High altitude has frequently been considered as a contributing factor in reducing resistance of stands against damaging agents including atmospheric pollution. The results of the Community inventory in fact show a positive correlation between altitude and defoliation in the **sub-atlantic** climatic region as defined above. This increase in defoliation is clearly observed up to 900 m. The same trend is observed in the **mediterranean** region but here the increase of defoliation with altitude is less pronounced.
However, if the **atlantic** climatic region is considered, the observed trend is opposite, defoliation showing here a negative correlation with altitude. This fact has not yet been mentioned in the literature and surely merits further investigations in the context of research on cause-effect relations. The above described correlations may be influenced by multiple factors, some being linked to regional differences in age- and species distributions or the confinement of high altitude sample plots to relatively few regions.

The inventory results for the **sub-atlantic** region further indicate a tendency of defoliation to decrease with altitude at levels higher than 900 m above sea level.

Percentages of sample trees in defoliation classes 2 + 3 + 4 jointly by altitude and climatic regions

Altitude	Atlantic region		Sub-atlantic region		Mediterranean region	
	%	sample size	%	sample size	%	sample size
0- 150 m	16,1	3.263	7.7	402	5.1	1.756
151- 300 m	14.4	1.227	10.1	2.406	2.1	2.736
301- 450 m	11.7	571	12.9	3.388	5.0	2.215
451- 600 m	8.1	322	16.6	2.888	8.0	1.727
601- 750 m	10.1	256	17.0	1.522	7.9	2.091
751- 900 m	12.1	116	18.5	868	8.2	1.928
901-1050 m	0.0	72	11.5	715	8.1	1.636
1051-1200 m	-	0	7.3	591	12.6	1.382
1201-1350 m	-	0	11.9	444	7.2	900
1351-1500 m	0	24	4.7	170	7.3	660
above 1500 m	-	0	4.2	381	5.0	900
All	14.3	5,851	13.0	13,775	6.6	17,931

The highest levels of defoliation were observed in the sub-atlantic region of the Community between 450 and 900 m altitude with up to 18.5 % of sample trees showing a defoliation of more than 25% (defoliation classes 2 + 3 + 4 jointly).

A relatively high percentage of moderately or severely defoliated trees was also observed in the atlantic region at altitudes lower than 300 m with maximum defoliation below 150 m. (16.1%).

Percentages of sample trees in discolouration classes 1, 2, 3 and 4 by altitude and climatic regions

Altitude	Atlantic zone		Sub-atlantic zone		Mediterranean zone	
	%	sample size	%	sample size	%	sample size
0- 150 m	13.0	3.262	3.6	394	12.9	1.756
151- 300 m	21.9	1.223	10.7	2.398	7.2	2.736
301- 450 m	20.7	571	6.8	3.378	11.7	2.215
451- 600 m	19.9	321	9.1	2.886	17.6	1.727
601- 750 m	9.8	256	13.2	1.520	20.2	2.090
751- 900 m	12.9	116	16.0	867	20.8	1.923
901-1050 m	0.0	72	13.4	714	15.9	1.636
1051-1200 m	-	0	9.5	591	14.0	1.382
1201-1350 m	-	0	13.6	441	18.1	899
1351-1500 m	0	24	12.4	169	17.3	660
above 1500 m	-	0	12.6	381	24.9	900
All	15.6	5,845	10.1	13,739	15.4	17,924

As table hereabove shows, the highest percentages of trees showing discolouration are observed
- in the mediterranean region at altitudes higher than 450 m with two peaks, one between 600 and 900 m and another above 1500 m,
- in the atlantic region between 150 and 600 m.

In the sub-atlantic region the observed percentages of trees showing discolouration are somewhat lower with a peak between 750 and 900 m.

The general variation of discolouration with altitude is similar to that observed for defoliation, except for the lower altitudes in the atlantic region, where discolouration seems to be less frequently observed than in higher altitudes in the same zone.

Defoliation and discolouration by water availability

Inventory results of 1987 and 1988 indicate higher defoliation on sites with insufficient or excessive water availability than on sites with sufficient water availability.
On plots with sufficient water availability (the most represented water availability class within the sample), 9.39% of the trees had in 1988 a degree of defoliation greater than 25%. On plots with "excessive" and "insufficient" water supply this percentage was respectively 19.10% and 14.61% (See TAB 31).
A similar tendency was observed in 1987.

	Percentage of sample trees in defoliation classes 2 + 3 + 4 jointly	
Water availability:	**1987** (total sample)	**1988** (total sample)
Sufficient	14.06 %	9.39 %
Insufficient	18.48 %	14.61 %
Excessive	17.89 %	19.10 %

As regards **discolouration** as observed in 1988, again the most healthy trees may be observed where sufficient water is available.
(Table TAB 32).

	Percentage of sample trees showing some discolouration	
Water availability:	**1987** (total sample)	**1988** (total sample)
Sufficient	13.08 %	12.40 %
Insufficient	18.25 %	17.90 %
Excessive	21.06 %	22.80 %

Defoliation and discolouration by humus type

Table TAB 33 presents defoliation in terms of humus type for 1988. In 1987 and in 1988 the lowest percentages of trees in defoliation classes 2 + 3 + 4 jointly were observed on mull and anmor. The anmor type however was not much represented in the total sample with only 4.9 % of sample trees having been observed on this type of soil in 1988.

	Percentage of sample trees in defoliation classes 2 + 3 + 4 jointly	
Humus type:	**1987** (total sample)	**1988** (total sample)
Mull	10.58 %	6.36 %
Moder	13.90 %	10.59 %
Mor	13.63 %	13.28 %
Anmor	3.64 %	1.92 %
Peat	11.96 %	18.87 %
Other	17.85 %	19.67 %

The highest proportion of trees showing **discolouration** was observed on moder and peat, and the lowest on mull. Sample trees on anmoor showed even less discolouration, but as already mentioned, plots with this humus type were too few in number to allow any conclusions.

	Percentage of sample trees showing some discolouration	
Humus type:	**1987** (total sample)	**1988** (total sample)
Mull	8.72 %	9.83 %
Moder	22.32 %	15.95 %
Mor	15.35 %	14.53 %
Anmor	6.88 %	2.56 %
Peat	22.16 %	37.85 %
Other	15.87 %	9.82 %

Defoliation and discolouration by aspect

In 1988 no significant difference in **defoliation** was observed between sample trees on different aspects. The percentage of trees in defoliation classes 2 + 3 + 4 jointly varied between 8 and 11.7 %. (See TAB 35)
A slight tendency of defoliation to be more pronounced on south, south-east and east facing plots however exists.
In 1987, with a reduced sample, the observed range was somewhat higher: Defoliation then ranged from 9.18% to 19.44% (percentage of sample trees in defoliation classes 2 + 3 + 4 jointly).
In 1987 the southwest and southeast facing stands were somewhat less defoliated than those facing eastwards or on flat ground.

The percentage of trees showing **discolouration** varied between 9.33 (flat) and 18.98 % (east). As for defoliation there seems to exist a tendency of discolouration to be the highest on plots which are orientated between East and South.

LIST OF TABLES AND FIGURES

PERCENTAGE OF TREES DAMAGED THROUGHOUT THE COMMUNITY

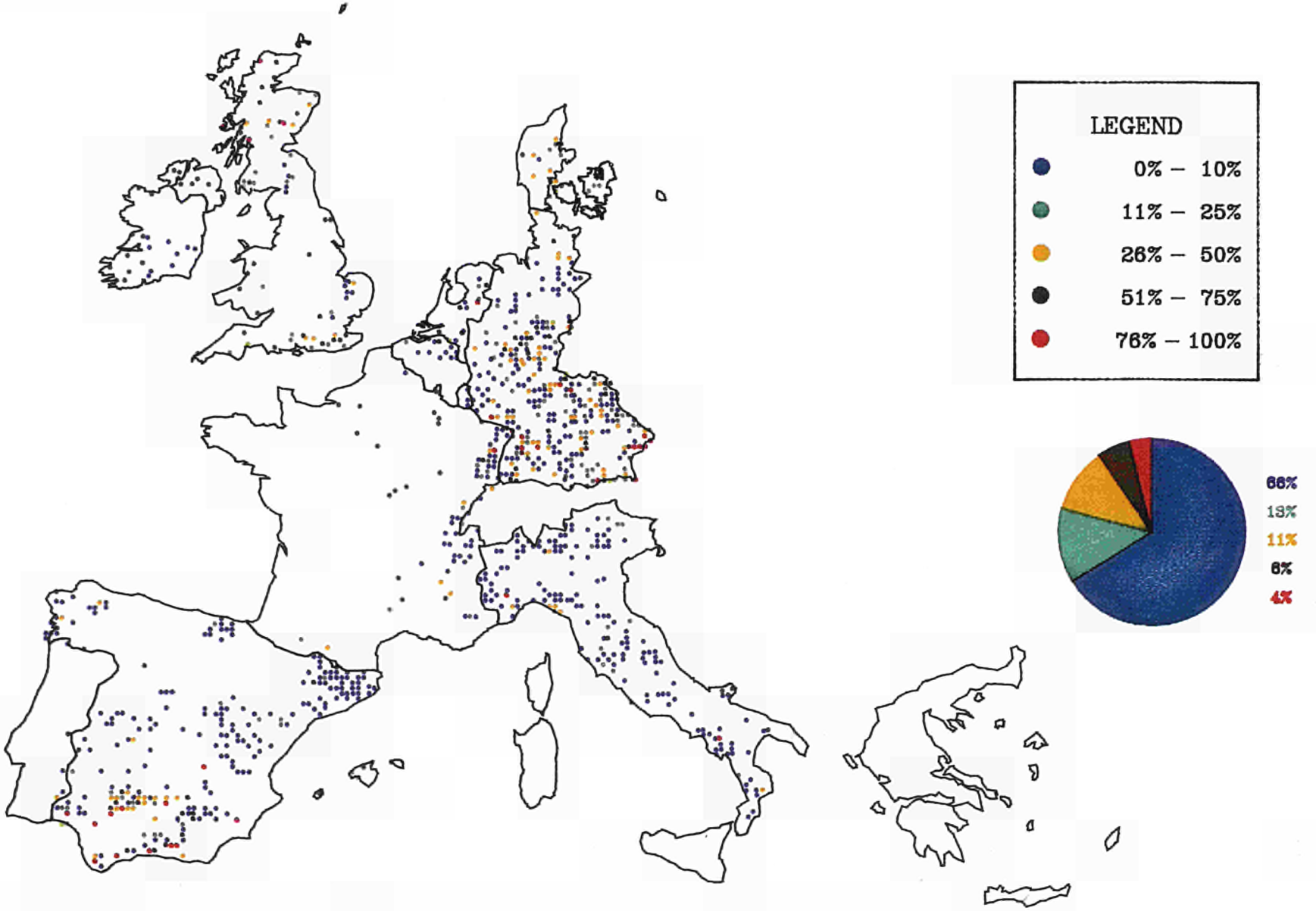
MAP 01 1987
MAP 02 1988

Each spot represents one sample plot.

The spot colour indicates the percentage of trees which on the corresponding plot have been classified into defoliation classes 2 + 3 + 4 jointly. For example: a red point represents a plot on which more than 75% of the sample trees have been evaluated as moderately or severely defoliated or dead.

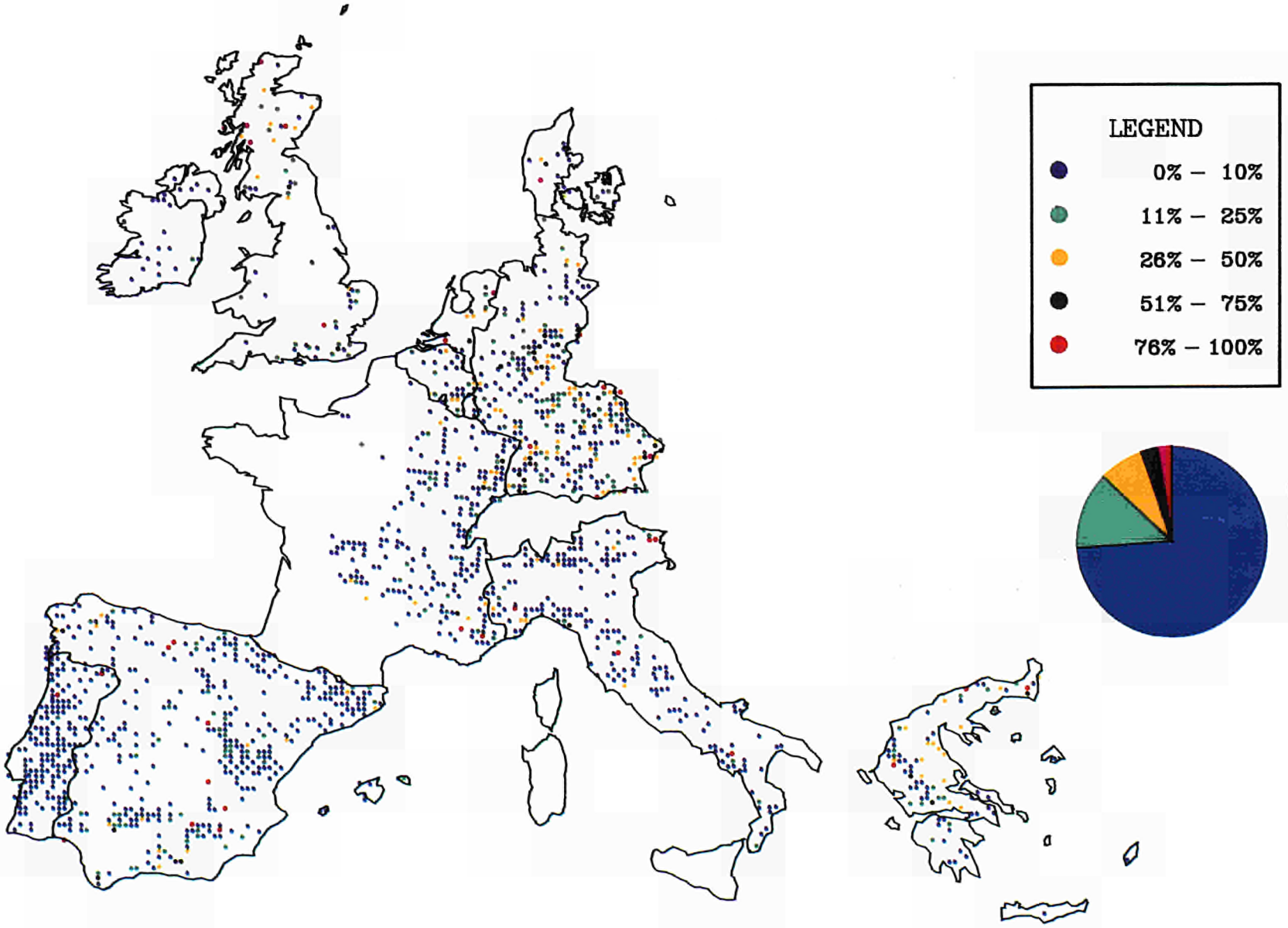
The circular diagram shows the proportion of sample plots having less than 10%, 11 to 25%, 26 to 50%, 51 to 75% or more than 75% of sample trees in defoliation classes 2 + 3 + 4.

PERCENTAGE OF TREES DAMAGED OVER THE COMMUNITY



MAP 01 Source: 1987 Community Inventory of Forest Damage

PERCENTAGE OF TREES DAMAGED OVER THE COMMUNITY



MAP 02 Source: 1988 Community Inventory of Forest Damage

PLOT DISCOLOURATION FOR THE COMMUNITY

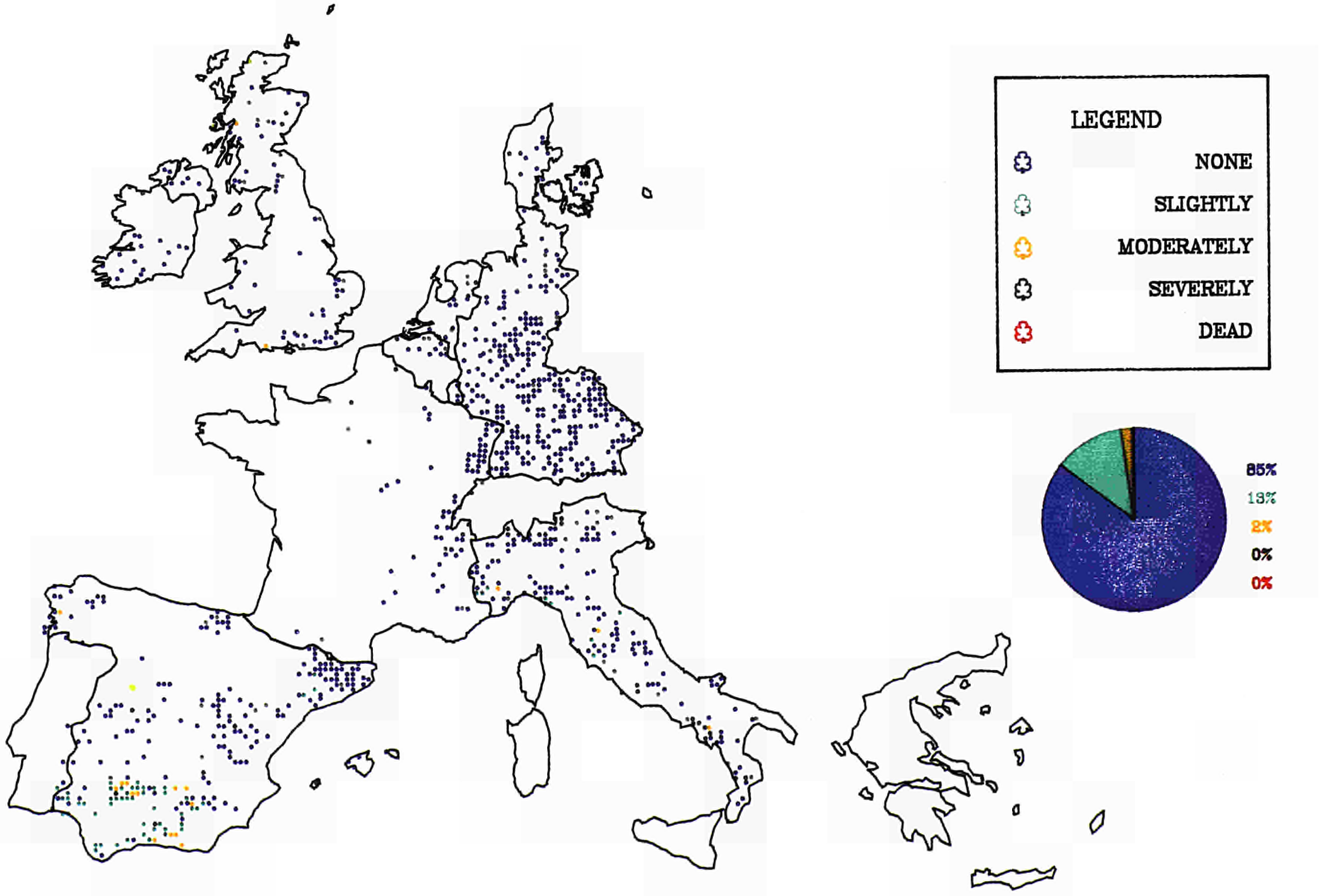
MAP 03 1987
MAP 04 1988

Each spot represents one sample plot. Its colour reflects the average plot discolouration class. This has been obtained after attributing to each sample tree a discolouration percentage corresponding to the average discolouration of its class (class 0; 5%, class 1: 17.5%, class 2: 42%, class 3: 80%, class 4: 100%), adding these percentages for all sample trees of the plot and dividing the sum by the number of sample trees of the plot. Following the resulting percentage, an average plot defoliation class was attributed to the plot, according to the general definition of defoliation classes.

The circular diagram represents the proportion of plots classified into each discolouration class.

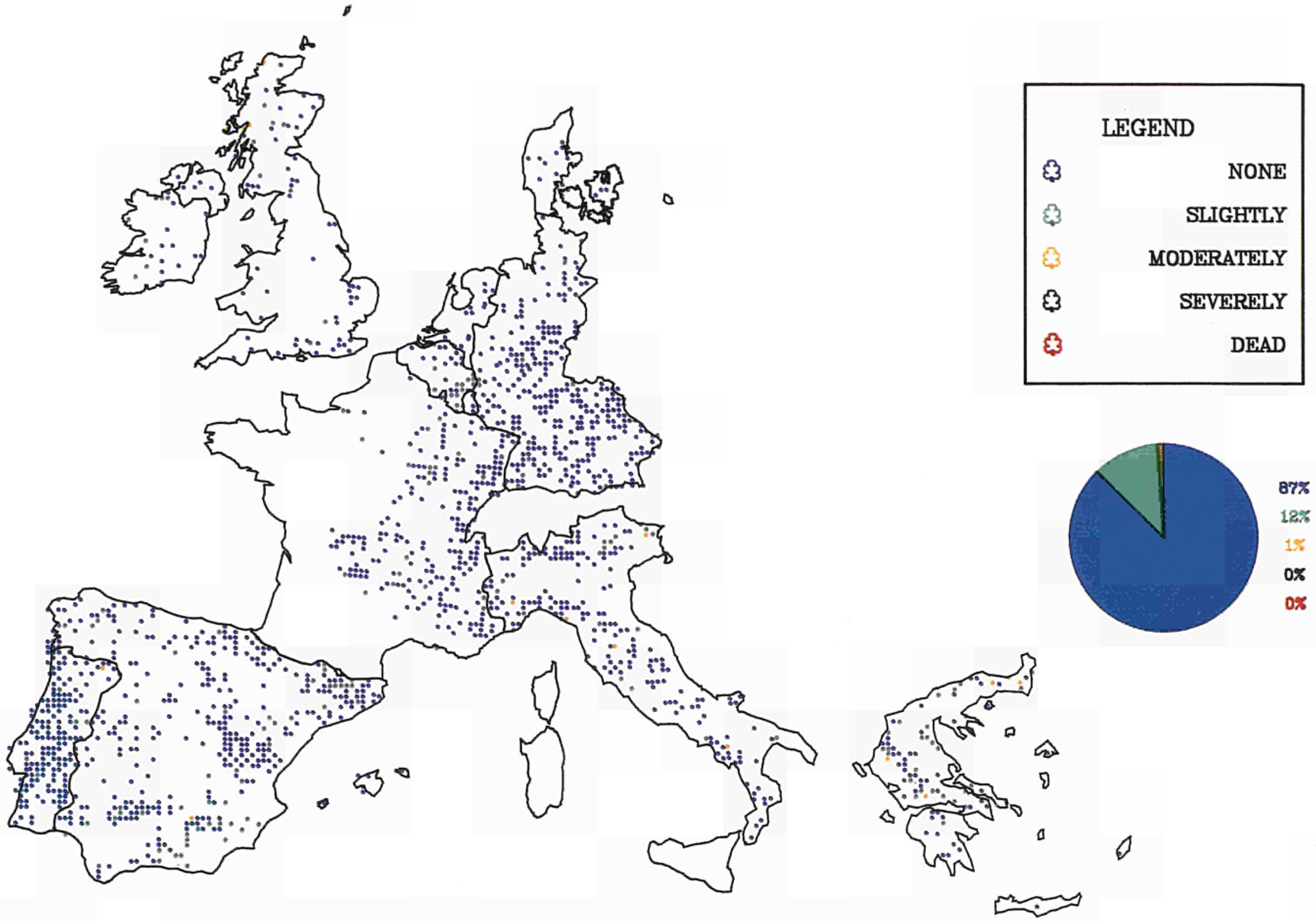
For example: in 1988 12% of all plots had an average discolouration class of 1, "slight" and 1% had an average discolouration evaluated as "moderate".

PLOT DISCOLOURATION FOR THE COMMUNITY



MAP 03 Source: 1987 Community Inventory of Forest Damage

PLOT DISCOLOURATION FOR THE COMMUNITY



MAP 04 Source: 1988 Community Inventory of Forest Damage

PLOT DEFOLIATION

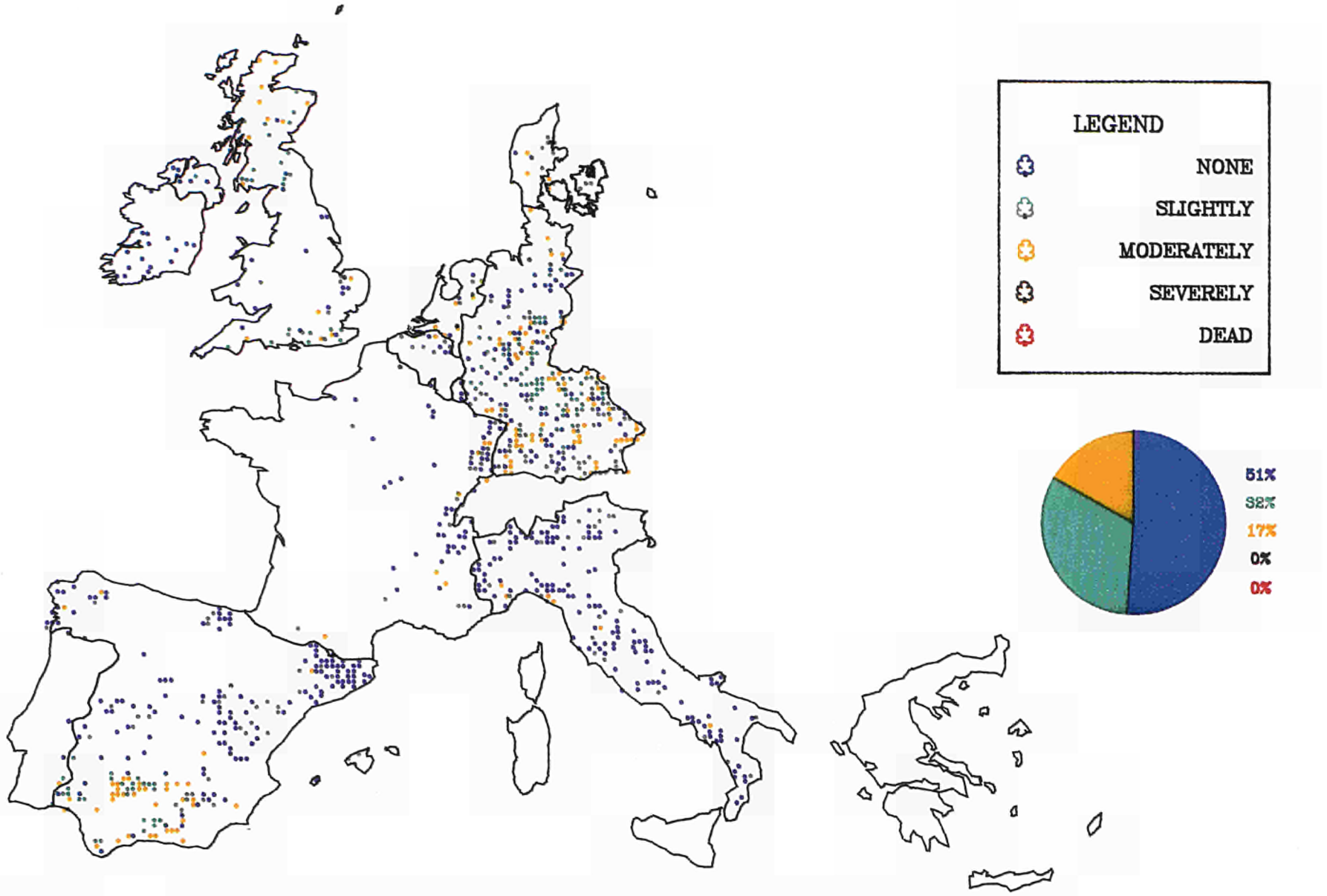
MAP 05 1987
MAP 06 1988

Each spot represents one sample plot. Its colour indicates the "average plot defoliation class".

This has been obtained by attributing to each sample tree a defoliation percentage corresponding to the average defoliation of its class (class 0: 5%, class 1: 17.5%, class 2: 42%, class 3: 80%, class 4: 100%), adding these percentages for all sample trees of the plot and dividing the sum by the number of sample trees of the plot. Following the resulting percentage, an average plot defoliation class was attributed to the plot, according to the general definition of defoliation classes.

The circular diagram represents the proportion of plots classified into each defoliation class. For example: in 1988, 9% of all sample plots had an average defoliation evaluated as "moderate".

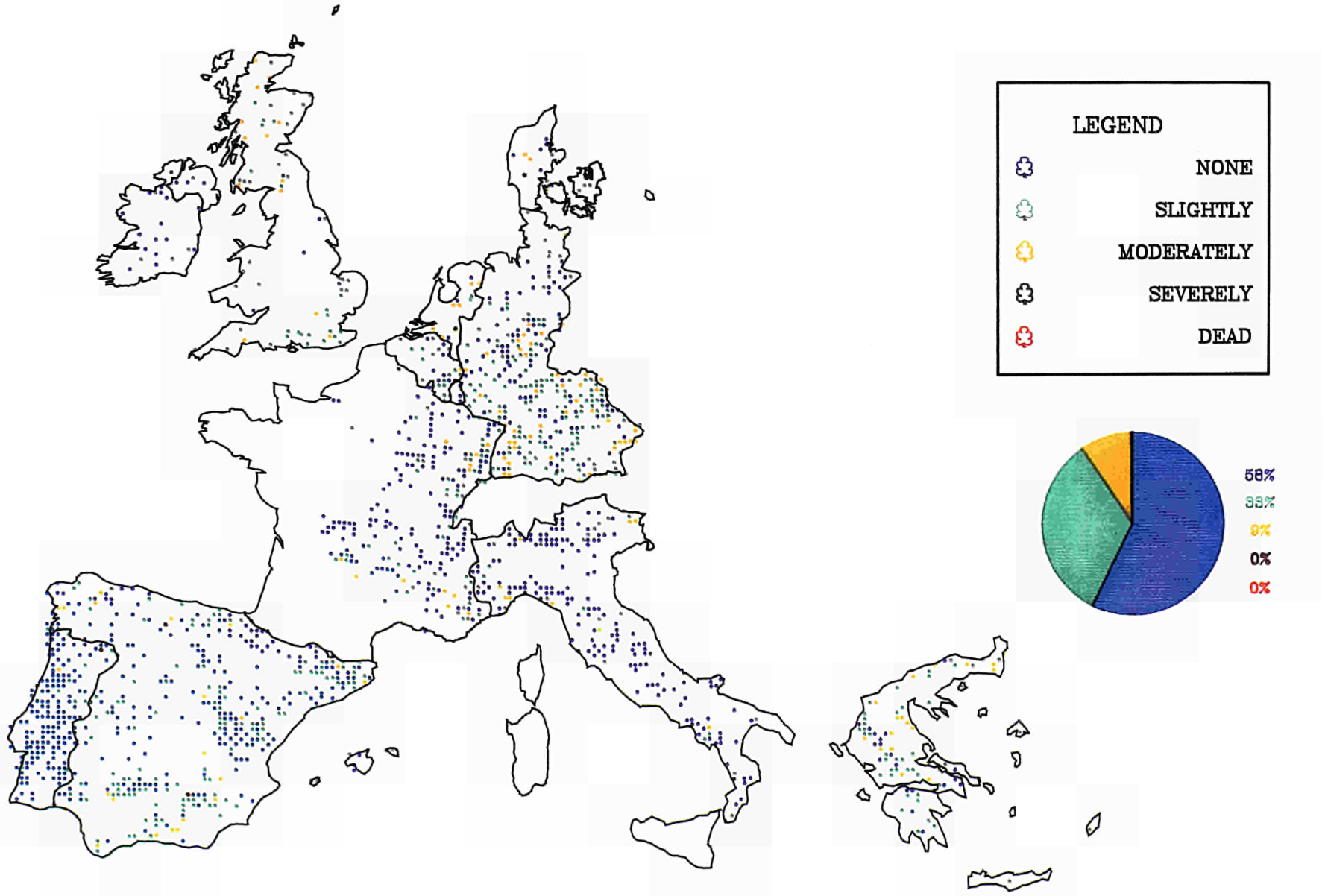
PLOT DEFOLIATION FOR THE COMMUNITY



MAP 05

Source: 1987 Community Inventory of Forest Damage

PLOT DEFOLIATION FOR THE COMMUNITY



MAP 06

Source: 1988 Community Inventory of Forest Damage

CLIMATIC REGIONS ACROSS THE COMMUNITY

MAP 07

Each spot represents one sample plot. Its colour indicates to which climatic region it was attributed.

CHANGES IN PLOT DAMAGE CLASSES THROUGHOUT THE COMMUNITY

MAP 08

Each spot represents one sample plot which has been observed in 1987 and in 1988.

For both years, "average plot defoliation classes" were attributed to each plot (see MAP 05 and 06).

The spot colour indicates whether the average defoliation class of the corresponding plot has evolved from

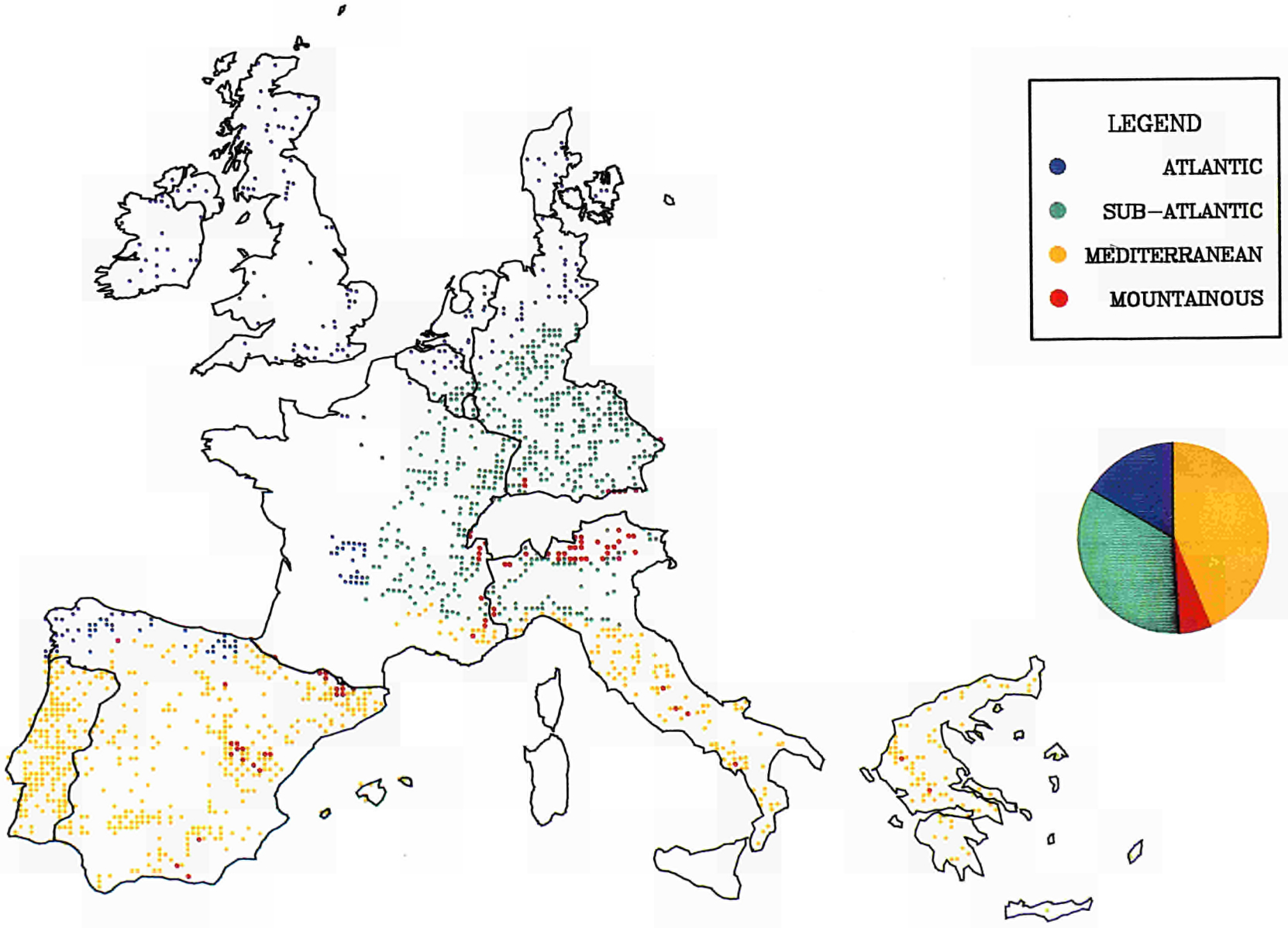
- damaged (average defoliation class 2, 3 or 4) to undamaged (average defoliation class 0 or 1): green spots

- undamaged to damaged: yellow spots

or whether no move of the average plot defoliation between these two defoliation class groups had occurred (blue and red spots).

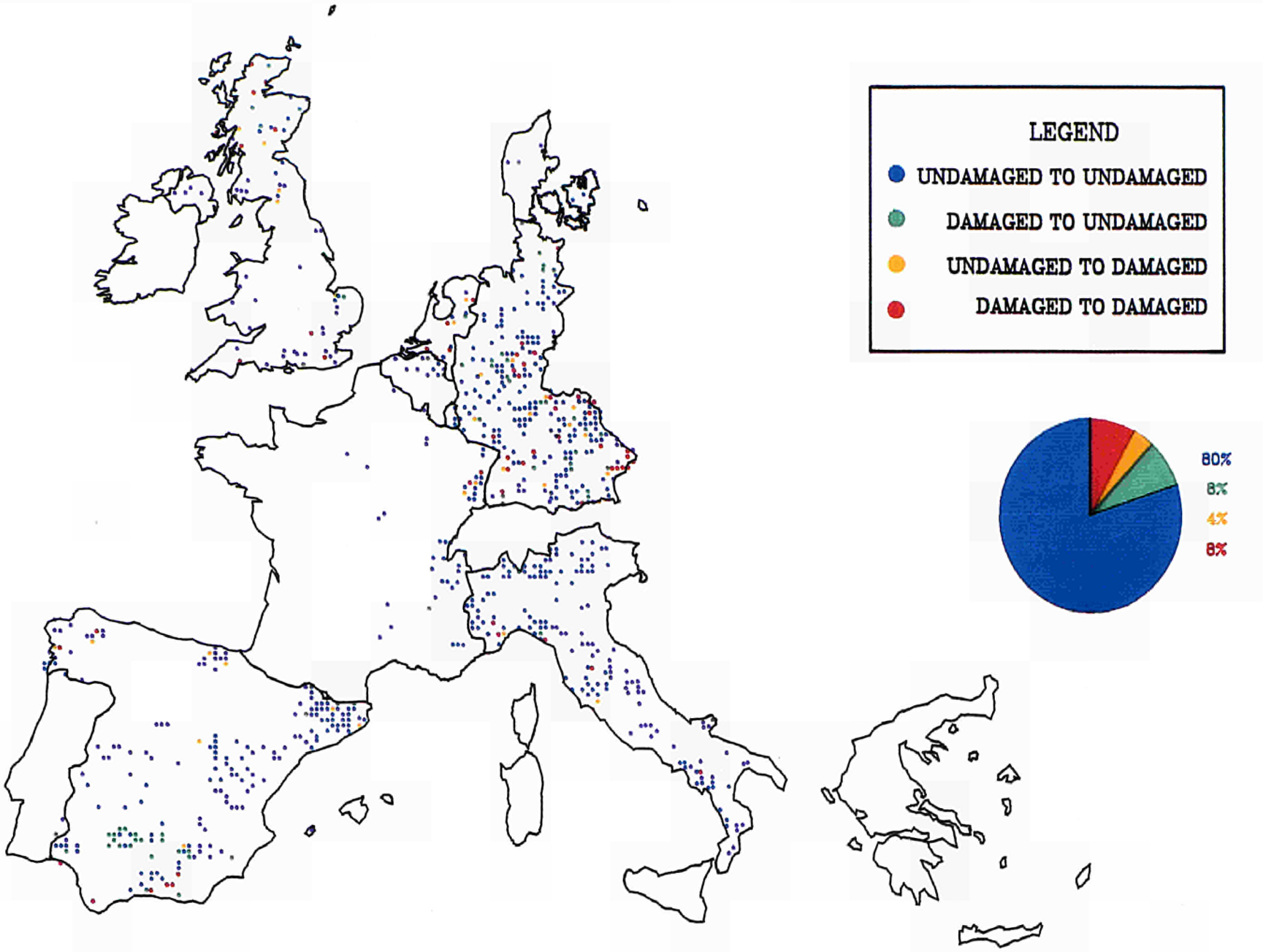
The circular diagram shows the proportion of plots concerned by each type of evolution. For example: between 1987 and 1988 the average defoliation of 8% of plots passed from "damaged" to "undamaged", whereas the opposite was true for only 4% of the plots.

CLIMATIC ZONES ACROSS THE COMMUNITY



MAP 07 Source: 1988 Community Inventory of Forest Damage

CHANGES IN PLOT DAMAGE CLASSES OVER THE COMMUNITY



MAP 08

Source: Trees Common to the 1987 & 1988 Inventories of Forest Damage

CHANGES IN PLOT DEFOLIATION

MAP 09

Each spot represents one sample plot which has been observed in 1987 and 1988.

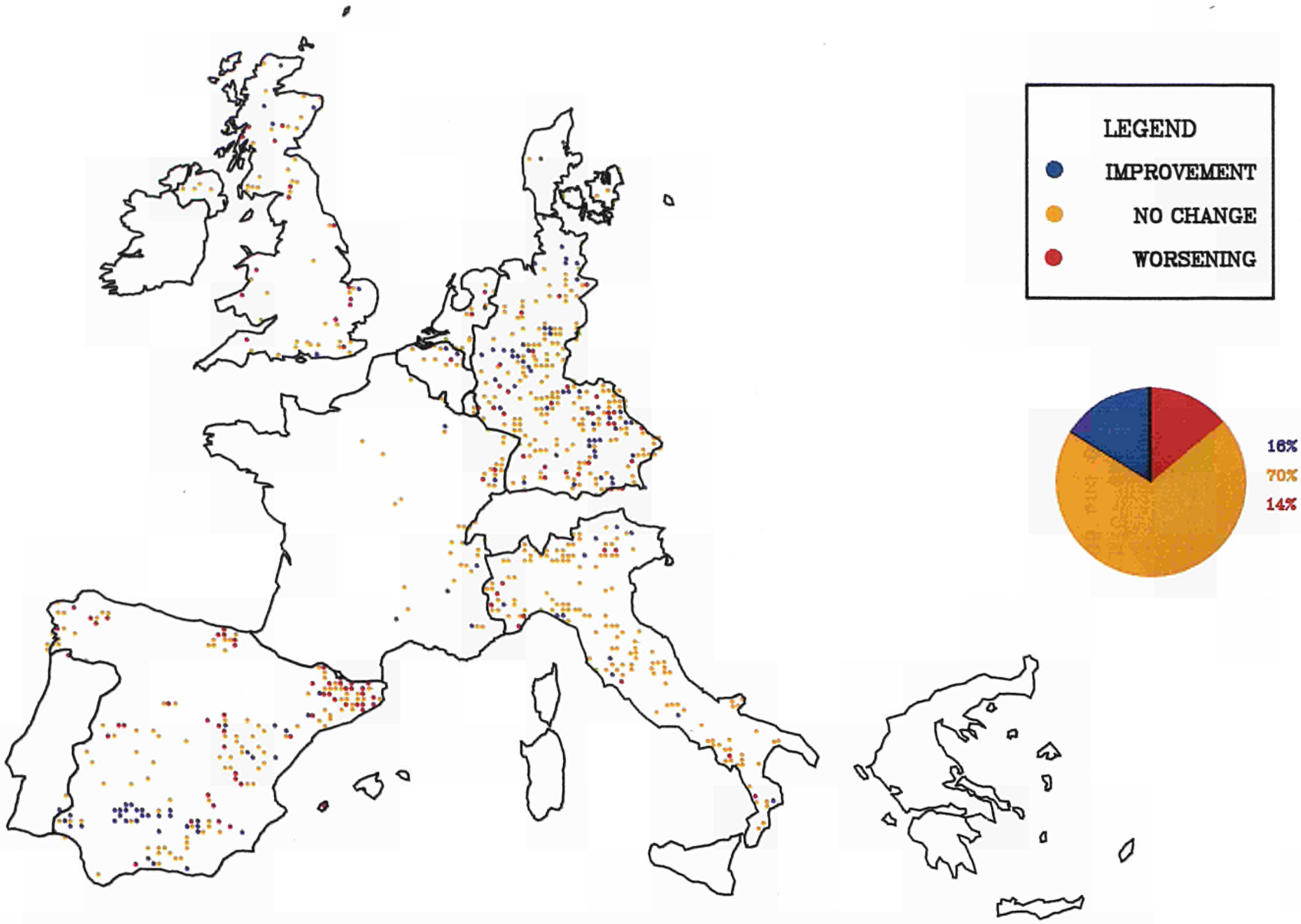
For both years an average plot defoliation class was attributed to each sample plot (see MAP 05 and 06).

The spot colour indicates whether on the corresponding sample plot the average plot defoliation increased or decreased between 1987 and 1988.

This map reflects for each plot the evolution of the absolute average defoliation whereas MAP 08 indicates for each plot the move of the average defoliation class between combined defoliation classes (0 + 1) and (2 + 3 + 4).

The circular diagram represents the proportion of plots showing no change, improvement or worsening of the average plot defoliation. For example: in 16% of all plots the average plot defoliation decreased between 1987 and 1988 whereas it increased in 14% of the plots.

CHANGES IN PLOT DEFOLIATION OVER THE COMMUNITY



MAP 09

Source: Trees Common to the 1987 & 1988 Inventories of Forest Damage

BROADLEAVES AND CONIFERS THROUGHOUT THE COMMUNITY - 1988

MAP 10

Each spot represents one sample plot. Its colour indicates whether broadleaves (green spots) or conifers (blue spots) dominate on the corresponding sample plot.

Example: conifers are considered as dominating on one plot when they represent more than 50% of the sample trees of that plot.

DAMAGE COMPARISION

FIGs. 06, 07, 08 AND 09

These diagrams allow comparison of the percentages of sample trees classified in the different defoliation and discoloration classes in 1987 and 1988.

FIG. 06 gives results for all species together
FIG. 07 gives results for broadleaves
FIG. 08 gives results for conifers.

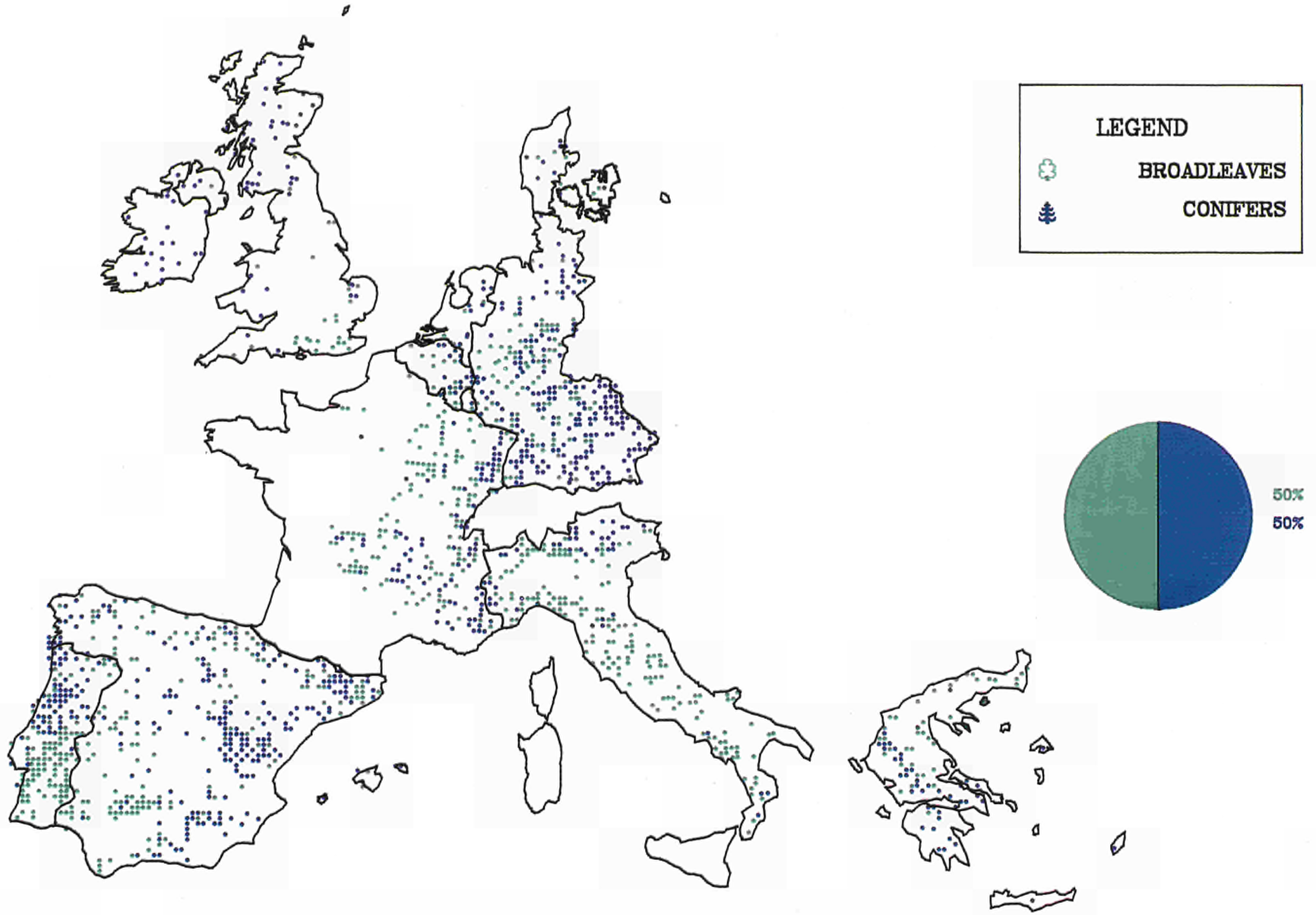
The numbers at the top of each column give the corresponding sample sizes.

For each year defoliation and discoloration results are given separately for all observed sample trees (total samples) and for those sample trees which had been observed in 1987 and 1988 (common 1987/1988 sample trees, CSTs).

Results for the total samples are marked with a "T". Results for the common 1987/1988 samples are marked with a "C".

Comparison between 1987 and 1988 should be made exclusively on the "C" results based on comparable samples in 1987 and 1988.

BROADLEAVES AND CONIFERS OVER THE COMMUNITY



MAP 10 Source: 1988 Community Inventory of Forest Damage

DAMAGE COMPARISONS FOR TOTAL SPECIES

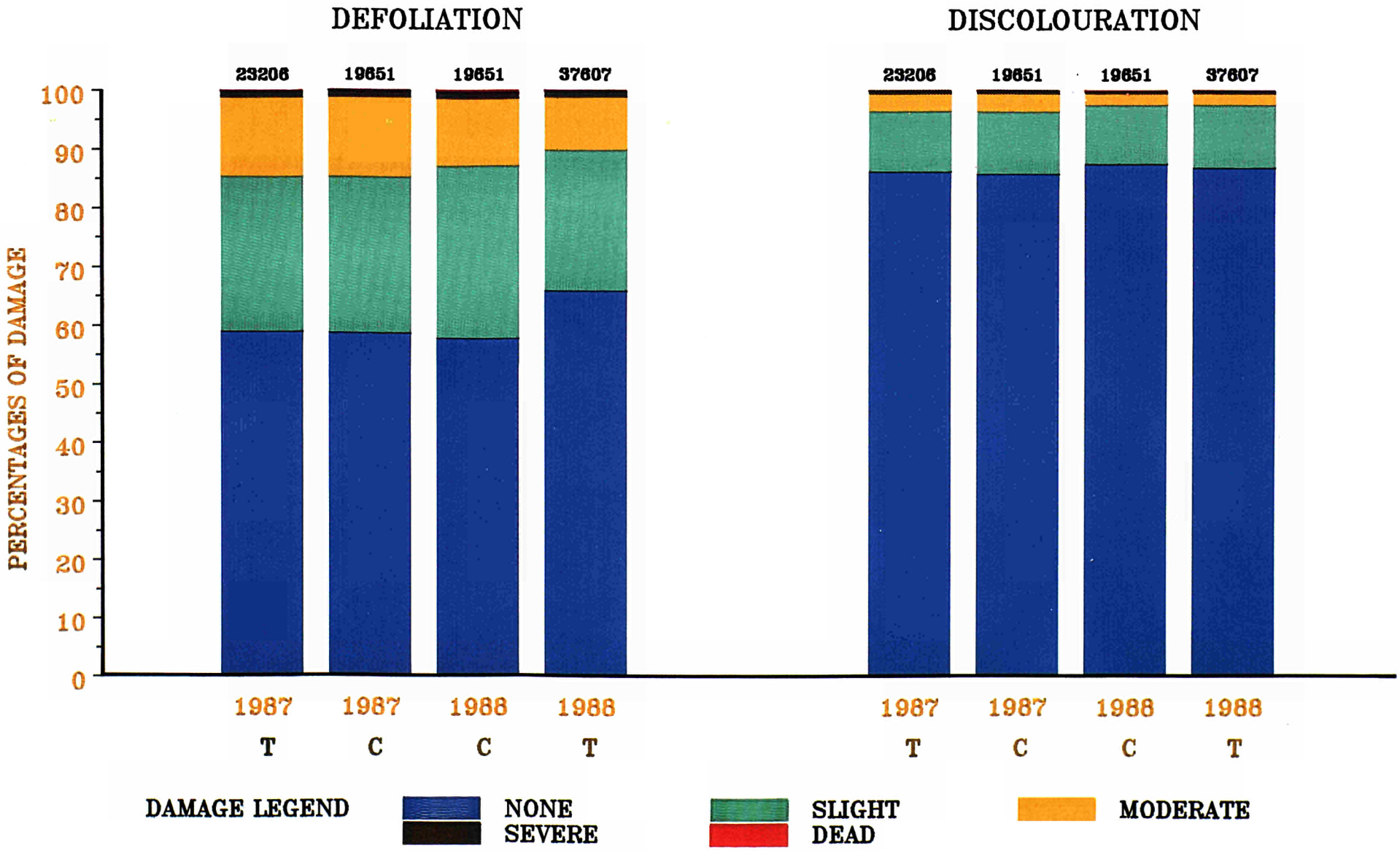


FIG 06 Source: The 1987 and 1988 Community Inventories For Forest Damage

DAMAGE COMPARISONS FOR BROADLEAVES

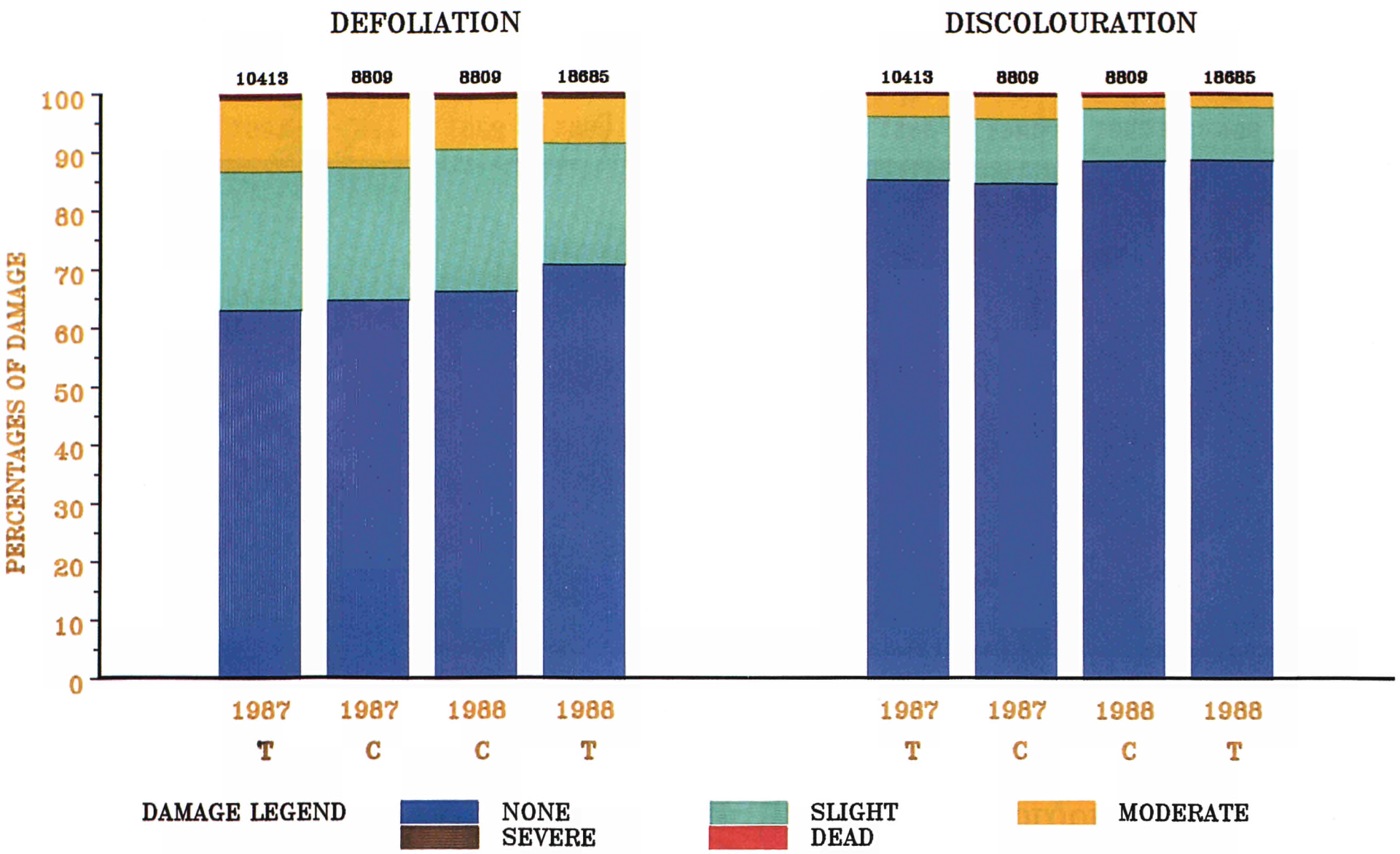


FIG 07 Source: The 1987 and 1988 Community Inventories For Forest Damage

DAMAGE COMPARISONS FOR CONIFERS

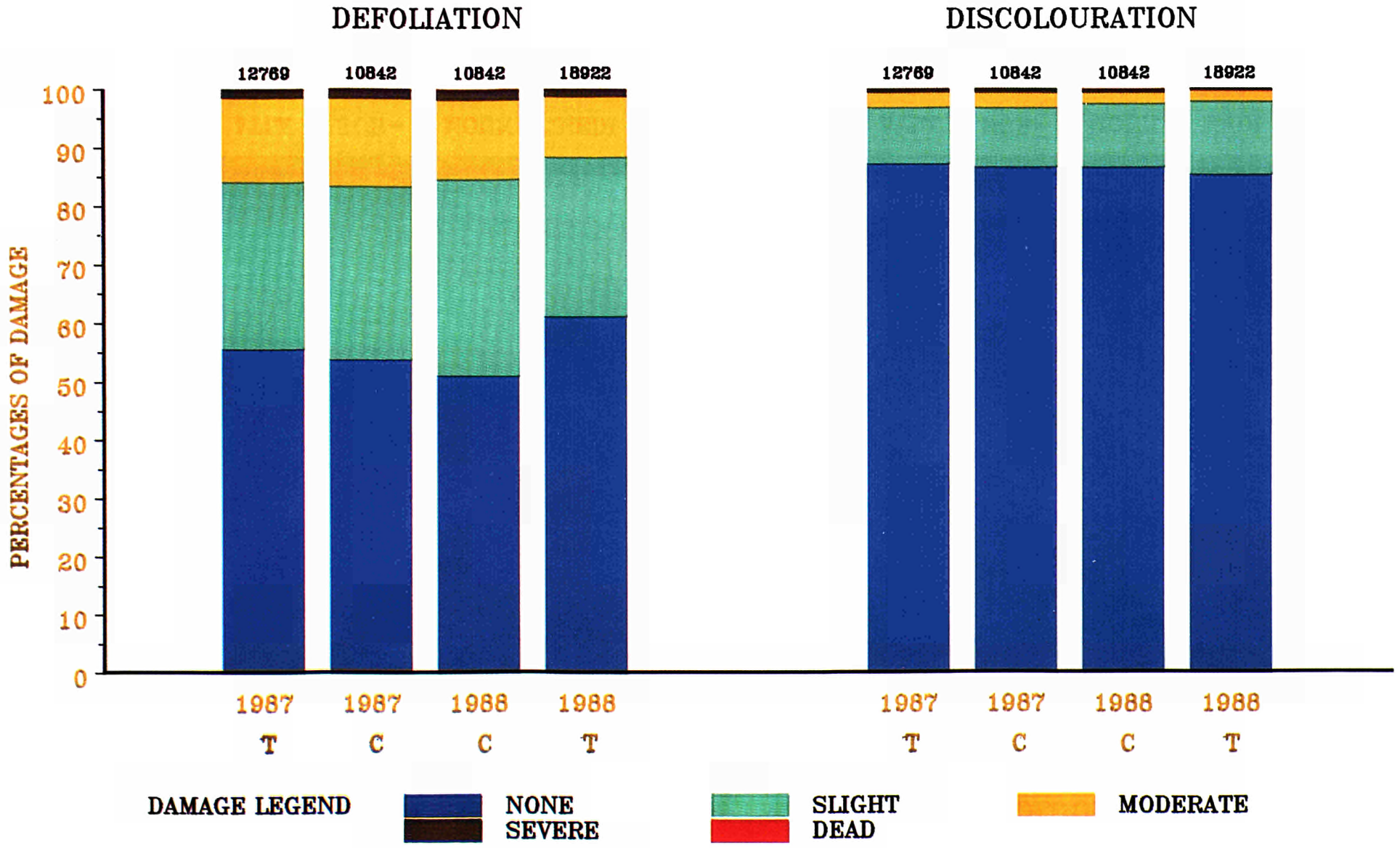


FIG 08 Source: The 1987 and 1988 Community Inventories For Forest Damage

DAMAGE COMPARISONS BY CLIMATIC ZONES

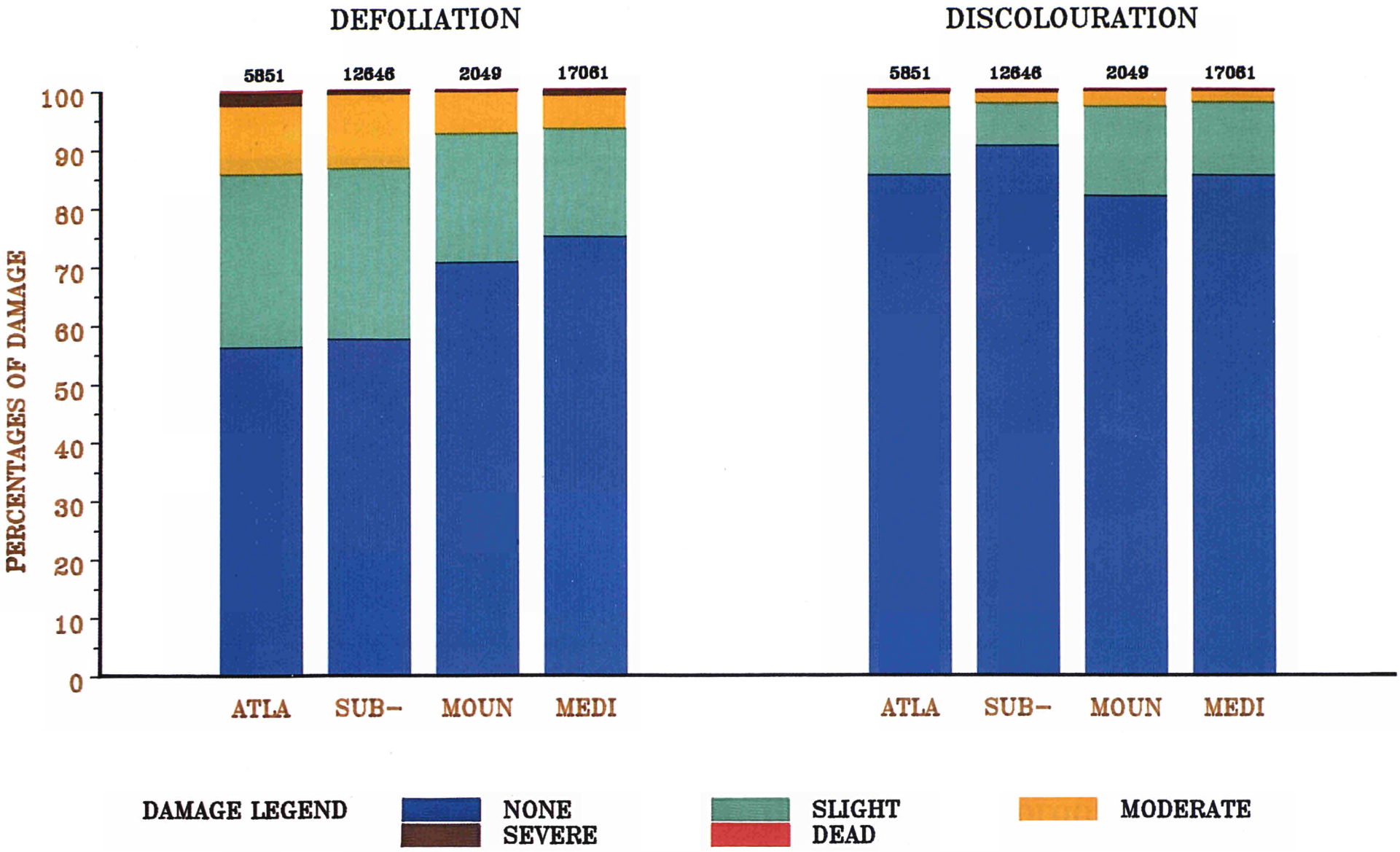


FIG 09

Source: 1988 Community Inventory For Forest Damage

TAB. 01 : DEFOLIATION OF SAMPLE TREES 1988

EUROPEAN COMMUNITY	OBSERVED TREES		PLOTS
	NUMBER	%	%
DEFOLIATION			
NONE	24748	65.81	93.51
SLIGHT	9040	24.04	65.92
MODERATE	3375	8.97	41.28
SEVERE	362	0.96	10.48
DEAD	82	0.22	3.41
TOTAL	37607	100.00	

TAB. 02 : DISCOLOURATION OF SAMPLE TREES 1988

EUROPEAN COMMUNITY	OBSERVED TREES	
	NUMBER	%
DISCOLOURATION		
NONE	32648	86.81
SLIGHT	4028	10.71
MODERATE	756	2.01
SEVERE	93	0.25
DEAD	82	0.22
TOTAL	37607	100.00

TAB. 03 : DEFOLIATION OF SAMPLE TREES AND PLOTS 1988

EUROPEAN COMMUNITY		TYPE OF OBSERVATION		
		AVERAGE FOR TREES	INCLUDED IN PLOTS	AVERAGE FOR PLOTS
NONE	NUMBER	24748	1427	476
	PERCENT	65.81	93.51	51.13
SLIGHTLY	NUMBER	9040	1006	299
	PERCENT	24.04	65.92	32.12
MODERATELY	NUMBER	3375	630	156
	PERCENT	8.97	41.28	16.76
SEVERELY	NUMBER	362	160	0
	PERCENT	0.96	10.48	.
DEAD	NUMBER	82	52	0
	PERCENT	0.22	3.41	.

TAB. 04 : DISCOLOURATION OF SAMPLE TREES AND PLOTS 1988

EUROPEAN COMMUNITY		TYPE OF OBSERVATION		
		AVERAGE FOR TREES	INCLUDED IN PLOTS	AVERAGE FOR PLOTS
NONE	NUMBER	32648	1490	794
	PERCENT	86.81	97.64	85.28
SLIGHT	NUMBER	4028	623	116
	PERCENT	10.71	40.83	12.46
MODERATE	NUMBER	756	203	20
	PERCENT	2.01	13.30	2.15
SEVERE	NUMBER	93	43	1
	PERCENT	0.25	2.82	0.11

TAB. 05 : DEFOLIATION BY AGE GROUPS, BROADLEAVES/CONIFERS 1988

EUROPEAN COMMUNITY		DEFOLIATION				
		NOT OR SLIGHTLY	MODERATELY	SEVERELY	DEAD	TOTAL
		%	%	%	%	%
BROAD-LEAVES	MEAN AGE					
	< 60 years	93.30	5.70	0.73	0.27	100.00
	≥ 60 years	87.29	11.46	1.15	0.11	100.00
	Irregular Stands	92.82	6.31	0.71	0.16	100.00
	SUB-TOTAL	91.39	7.55	0.85	0.21	100.00
CONIFERS	MEAN AGE					
	< 60 years	91.61	7.12	1.09	0.19	100.00
	≥ 60 years	80.43	18.21	0.99	0.37	100.00
	Irregular Stands	89.56	9.01	1.31	0.11	100.00
	SUB-TOTAL	88.25	10.44	1.08	0.23	100.00
TOTAL		89.80	9.01	0.97	0.22	100.00

TAB.06 : DISCOLOURATION BY AGE GROUPS, BROADLEAVES/CONIFERS 1988

EUROPEAN COMMUNITY		DISCOLOURATION					
		NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
		%	%	%	%	%	%
BROAD-LEAVES	MEAN AGE						
	< 60 years	90.80	6.71	1.96	0.25	0.27	100.00
	≥ 60 years	84.43	12.59	2.59	0.28	0.11	100.00
	Irregular Stands	87.57	10.27	1.45	0.55	0.16	100.00
	SUB-TOTAL	88.40	9.00	2.09	0.30	0.21	100.00
CONIFERS	MEAN AGE						
	< 60 years	85.44	12.43	1.75	0.19	0.19	100.00
	≥ 60 years	86.37	10.81	2.33	0.11	0.37	100.00
	Irregular Stands	80.03	17.40	1.94	0.11	0.11	100.00
	SUB-TOTAL	85.20	12.44	1.93	0.20	0.23	100.00
TOTAL		86.79	10.74	2.01	0.25	0.22	100.00

TAB. 07 : DEFOLIATION BY SMALL AGE GROUPS
BROADLEAVES/CONIFERS 2988

EUROPEAN COMMUNITY		DEFOLIATION				
		NOT OR SLIGHTLY	MODERATELY	SEVERELY	DEAD	TOTAL
		%	%	%	%	NO.
BROAD-LEAVES	MEAN AGE					
	0- 20 years	94.51	4.34	1.05	0.11	2767
	21- 40 years	92.38	6.52	0.66	0.44	5016
	41- 60 years	93.78	5.38	0.52	0.12	2508
	61- 80 years	92.54	6.69	0.66	0.11	1810
	80-100 years	90.14	8.82	0.97	0.06	1542
	101-120 years	89.19	9.77	0.81	0.23	860
	>120 years	76.60	21.20	2.13	0.07	1453
	Irregular Stands	92.82	6.31	0.71	0.16	2550
	SUB-TOTAL	91.39	7.55	0.85	0.21	18506
CONIFERS	MEAN AGE					
	0- 20 years	92.39	6.23	1.28	0.10	2968
	21- 40 years	91.68	6.92	1.10	0.29	5532
	41- 60 years	90.78	8.25	0.89	0.09	3274
	61- 80 years	90.10	8.56	0.91	0.43	2090

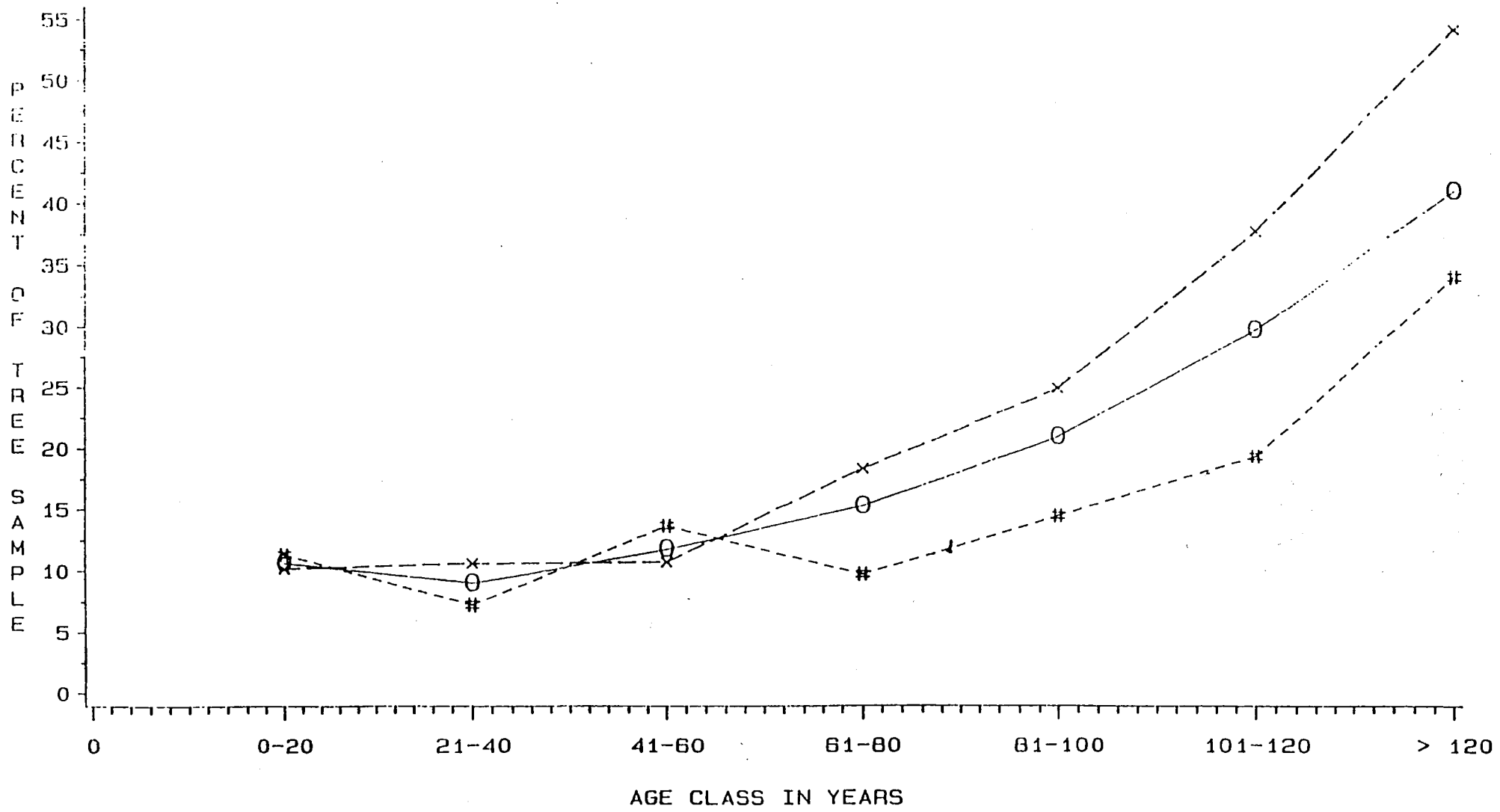
(CONTINUED)

TAB. 07 : DEFOLIATION BY SMALL AGE GROUPS,
BROADLEAVES/CONIFERS 1988

EUROPEAN COMMUNITY		DEFOLIATION				
		NOT OR SLIGHTLY	MODERATELY	SEVERELY	DEAD	TOTAL
		%	%	%	%	NO.
CONIFERS	MEAN AGE					
	80-100 years	77.64	21.82	0.30	0.24	1673
	101-120 years	76.30	21.90	1.58	0.23	886
	>120 years	63.60	33.57	2.12	0.71	706
	Irregular Stands	89.56	9.01	1.31	0.11	1753
	SUB-TOTAL	88.25	10.44	1.08	0.23	18882
TOTAL		89.80	9.01	0.97	0.22	37388

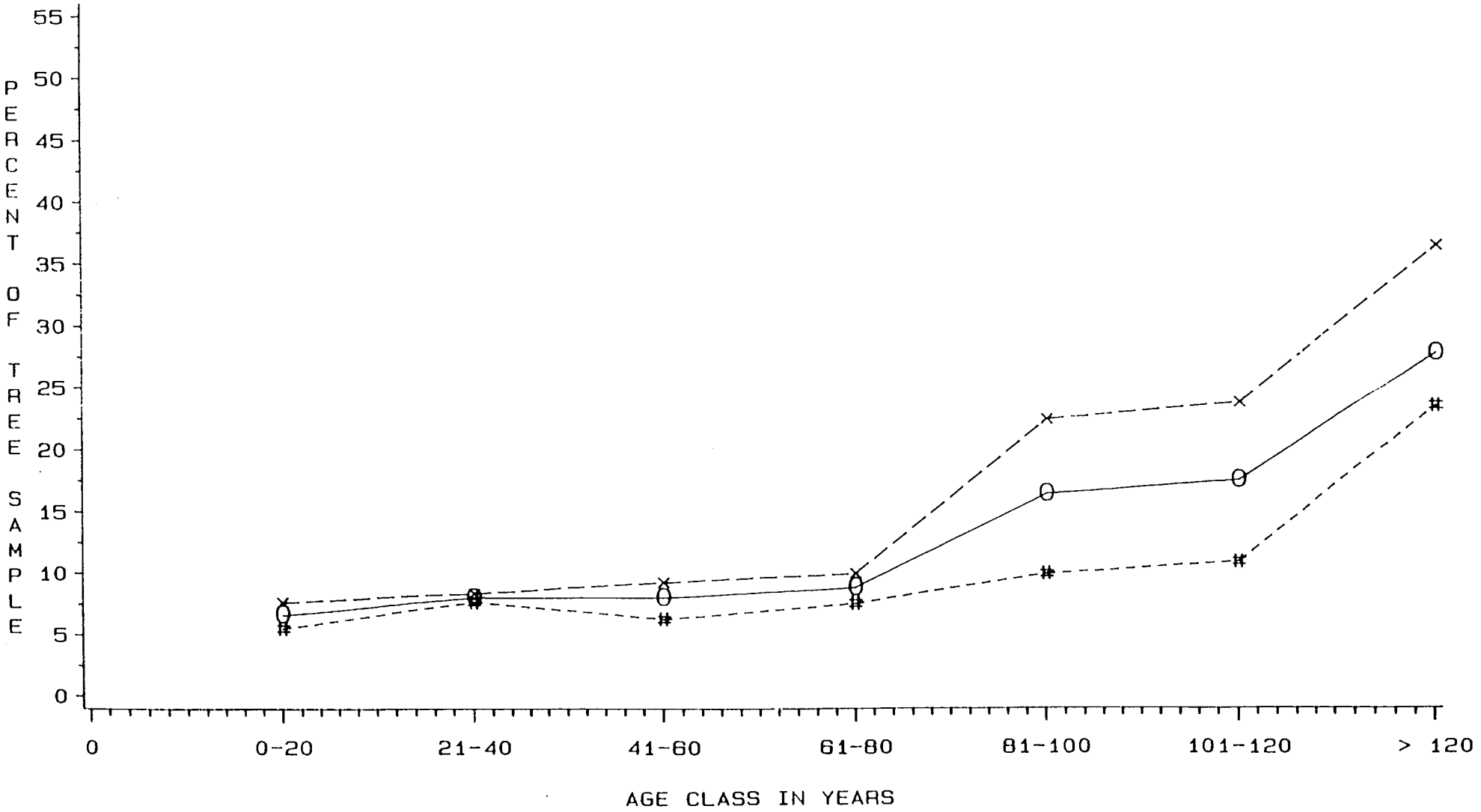
EUROPEAN COMMUNITY	DEFOLIATION					
ALL SPECIES	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	%
MEAN AGE						
0- 20 years	77.98	15.43	5.32	1.17	0.10	100.00
21- 40 years	75.25	16.77	6.73	0.89	0.36	100.00
41- 60 years	64.10	27.98	7.09	0.73	0.10	100.00
61- 80 years	57.05	34.18	7.69	0.79	0.28	100.00
80-100 years	46.38	37.26	15.58	0.62	0.16	100.00
101-120 years	47.37	35.28	15.92	1.20	0.23	100.00
>120 years	37.93	34.41	25.24	2.13	0.28	100.00
Irregular Stands	71.49	20.01	7.41	0.95	0.14	100.00
TOTAL	65.67	24.13	9.01	0.97	0.22	100.00

FIG. 01 : PERCENTAGE OF ALL TREES IN DEFOLIATION CLASSES 2+3+4
PRESENTED BY MEAN AGE
(0 = TOTAL # = BROADLEAVES x = CONIFERS)



Source: 1987 Community Inventory of Forest Damage

FIG. 02 : PERCENTAGE OF ALL TREES IN DEFOLIATION CLASSES 2+3+4
PRESENTED BY MEAN AGE
(O = TOTAL # = BROADLEAVES x = CONIFERS)



Source: 1988 Community Inventory of Forest Damage

TAB.08 : DEFOLIATION BY CLIMATIC ZONE TOTAL SAMPLE 1987

EUROPEAN COMMUNITY 1987 TOTAL SAMPLE	DEFOLIATION NONE NO.	NONE %	SLIGHT NO.	SLIGHT %	MODERATE NO.	MODERATE %	SEVERE NO.	SEVERE %	DEAD NO.	DEAD %	TOTAL NO.	TOTAL %
CLIMATIC ZONE												
ATLANTIC	3003	59.1	1326	26.1	648	12.7	103	2.03	4	0.08	5084	100
SUB-ATLANTIC	4831	50.3	3114	32.4	1553	16.2	78	0.81	22	0.23	9598	100
MOUNTAINOUS	1113	71.2	293	18.7	138	8.83	17	1.09	2	0.13	1563	100
MEDITERRANEAN	4486	68.7	1311	20.1	669	10.2	42	0.64	19	0.29	6527	100
TOTAL	13433	59	6044	26.5	3008	13.2	240	1.05	47	0.21	22772	100

TAB.09 : DEFOLIATION BY CLIMATIC ZONE TOTAL SAMPLE 1988

EUROPEAN COMMUNITY 1988 TOTAL SAMPLE	DEFOLIATION NONE NO.	NONE %	SLIGHT NO.	SLIGHT %	MODERATE NO.	MODERATE %	SEVERE NO.	SEVERE %	DEAD NO.	DEAD %	TOTAL NO.	TOTAL %
CLIMATIC ZONE												
ATLANTIC	3280	56.1	1736	29.7	683	11.7	126	2.15	26	0.44	5851	100
SUB-ATLANTIC	7254	57.4	3702	29.3	1598	12.6	75	0.59	17	0.13	12646	100
MOUNTAINOUS	1445	70.5	450	22	145	7.08	5	0.24	4	0.20	2049	100
MEDITERRANEAN	12769	74.8	3152	18.5	949	5.56	156	0.91	35	0.21	17061	100
TOTAL	24748	65.8	9040	24	3375	8.97	362	0.96	82	0.22	37607	100

TAB. 10 : DEFOLIATION BY CLIMATIC ZONE CST 1987

1987 CST	DEFOLIATION														TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD							
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%					NO.	%
CLIMATIC ZONE																
ATLANTIC	2353	55.8	1187	28.1	579	13.7	94	2.23	4	0.09					4217	100
SUB-ATLANTIC	3828	49.2	2570	33	1320	17	60	0.77	5	0.06					7783	100
MOUNTAINOUS	1078	71.8	281	18.7	125	8.33	16	1.07	1	0.07					1501	100
MEDITERRANE-AN	4270	69.4	1184	19.3	641	10.4	41	0.67	14	0.23					6150	100
TOTAL	11529	58.7	5222	26.6	2665	13.6	211	1.07	24	0.12					19651	100

FOR 1987 FROM TREES COMMON TO 1987 AND 1988

TAB. 11 : DEFOLIATION BY CLIMATIC ZONE CST 1988

1988 CST	DEFOLIATION														TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD							
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%					NO.	%
CLIMATIC ZONE																
ATLANTIC	2129	50.5	1371	32.5	581	13.8	110	2.61	26	0.62					4217	100
SUB-ATLANTIC	3933	50.5	2623	33.7	1172	15.1	43	0.55	12	0.15					7783	100
MOUNTAINOUS	1029	68.6	345	23	119	7.93	4	0.27	4	0.27					1501	100
MEDITERRANE-AN	4252	69.1	1442	23.4	366	5.95	64	1.04	26	0.42					6150	100
TOTAL	11343	57.7	5781	29.4	2238	11.4	221	1.12	68	0.35					19651	100

FOR 1988 FROM TREES COMMON TO 1987 AND 1988

TAB.12 : DEFOLIATION BY SPECIES GROUP TOTAL SAMPLE 1988

EUROPEAN COMMUNITY 1988 TOTAL SAMPLE	DEFOLIATION					TOTAL
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	76.82	13.43	5.17	3.98	0.60	1005
Eucalyptus sp.	95.71	3.78	0.41	.	0.10	979
Fagus sp.	59.67	28.23	11.56	0.48	0.06	3546
Quercus (deciduous) sp.	64.08	22.81	11.52	1.32	0.27	4766
Quercus ilex	61.99	31.29	6.13	0.54	0.05	2202
Quercus suber	87.55	10.35	1.89	0.20	.	1478
Other broadleaves	77.98	16.52	4.69	0.49	0.32	4709
TOTAL BROADLEAVES	70.70	20.77	7.49	0.85	0.20	18685
Abies sp.	52.78	26.09	18.86	1.52	0.76	1188
Larix sp.	65.47	26.82	7.43	.	0.28	727
Picea sp.	49.26	34.15	15.43	1.10	0.05	5522
Pinus sp.	67.06	24.36	7.23	1.08	0.27	10727
Other conifers	68.87	20.58	9.23	1.19	0.13	758
TOTAL CONIFERS	60.98	27.27	10.44	1.08	0.23	18922
TOTAL	65.81	24.04	8.97	0.96	0.22	37607

TAB. 13 : DEFOLIATION BY SPECIES GROUP ATLANTIC 1988
TOTAL SAMPLE

ATLANTIC	DEFOLIATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	82.61	13.04	3.38	0.97	.	207
Eucalyptus sp.	81.02	17.52	1.46	.	.	137
Fagus sp.	38.08	45.35	15.70	0.87	.	344
Quercus (deciduous) sp.	48.42	32.32	16.36	2.51	0.40	758
Quercus ilex	50.00	43.75	6.25	.	.	16
Other broadleaves	64.43	29.53	4.92	0.89	0.22	894
TOTAL BROADLEAVES	57.89	30.69	9.85	1.36	0.21	2356
Abies sp.	82.05	12.82	5.13	.	.	39
Larix sp.	36.76	50.00	12.50	.	0.74	136
Picea sp.	52.92	27.83	15.42	3.75	0.08	1200
Pinus sp.	58.32	27.84	10.42	2.42	1.00	1900
Other conifers	41.36	35.00	22.27	1.36	.	220
TOTAL CONIFERS	54.82	28.98	12.90	2.69	0.60	3495
TOTAL	56.06	29.67	11.67	2.15	0.44	5851

(CONTINUED)

TAB. 14 : DEFOLIATION BY SPECIES GROUP SUB-ATLANTIC 1988
TOTAL SAMPLE

SUB-ATLANTIC	DEFOLIATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	82.47	9.79	5.93	1.55	0.26	388
Fagus sp.	53.03	32.65	13.80	0.46	0.05	2159
Quercus (deciduous) sp.	69.30	21.52	8.83	0.17	0.17	1733
Other broadleaves	79.86	12.84	6.56	0.63	0.11	1753
TOTAL BROADLEAVES	67.40	22.23	9.76	0.50	0.12	6033
Abies sp.	44.05	22.74	30.20	2.31	0.71	563
Larix sp.	77.49	19.29	3.22	.	.	311
Picea sp.	46.75	37.00	15.85	0.37	0.03	3773
Pinus sp.	43.10	42.70	12.95	1.02	0.23	1768
Other conifers	87.37	11.11	1.01	.	0.51	198
TOTAL CONIFERS	48.21	35.70	15.26	0.68	0.15	6613
TOTAL	57.36	29.27	12.64	0.59	0.13	12646

(CONTINUED)

TAB. 15 : DEFOLIATION BY SPECIES GROUP MEDITERRANEAN 1988, TOTAL SAMPLE

MEDITERRANEAN	DEFOLIATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	68.54	17.07	5.37	7.80	1.22	410
Eucalyptus sp.	98.10	1.54	0.24	.	0.12	842
Fagus sp.	75.11	17.16	7.03	0.56	0.14	711
Quercus (deciduous) sp.	65.46	20.28	12.12	1.83	0.31	2244
Quercus ilex	62.08	31.20	6.13	0.55	0.05	2186
Quercus suber	87.55	10.35	1.89	0.20	.	1478
Other broadleaves	82.24	13.90	3.08	0.21	0.57	1914
TOTAL BROADLEAVES	74.96	18.00	5.79	0.98	0.27	9785
Abies sp.	54.15	34.85	9.34	1.04	0.62	482
Larix sp.	100.00	.	.	.	.	3
Pinus sp.	76.11	18.11	4.93	0.76	0.09	6467
Other conifers	76.54	16.05	5.56	1.85	.	324
TOTAL CONIFERS	74.68	19.12	5.25	0.82	0.12	7276
TOTAL	74.84	18.47	5.56	0.91	0.21	17061

(CONTINUED)

TAB. 16 : DEFOLIATION BY SPECIES GROUP MOUNTAINOUS 1988,
TOTAL SAMPLE

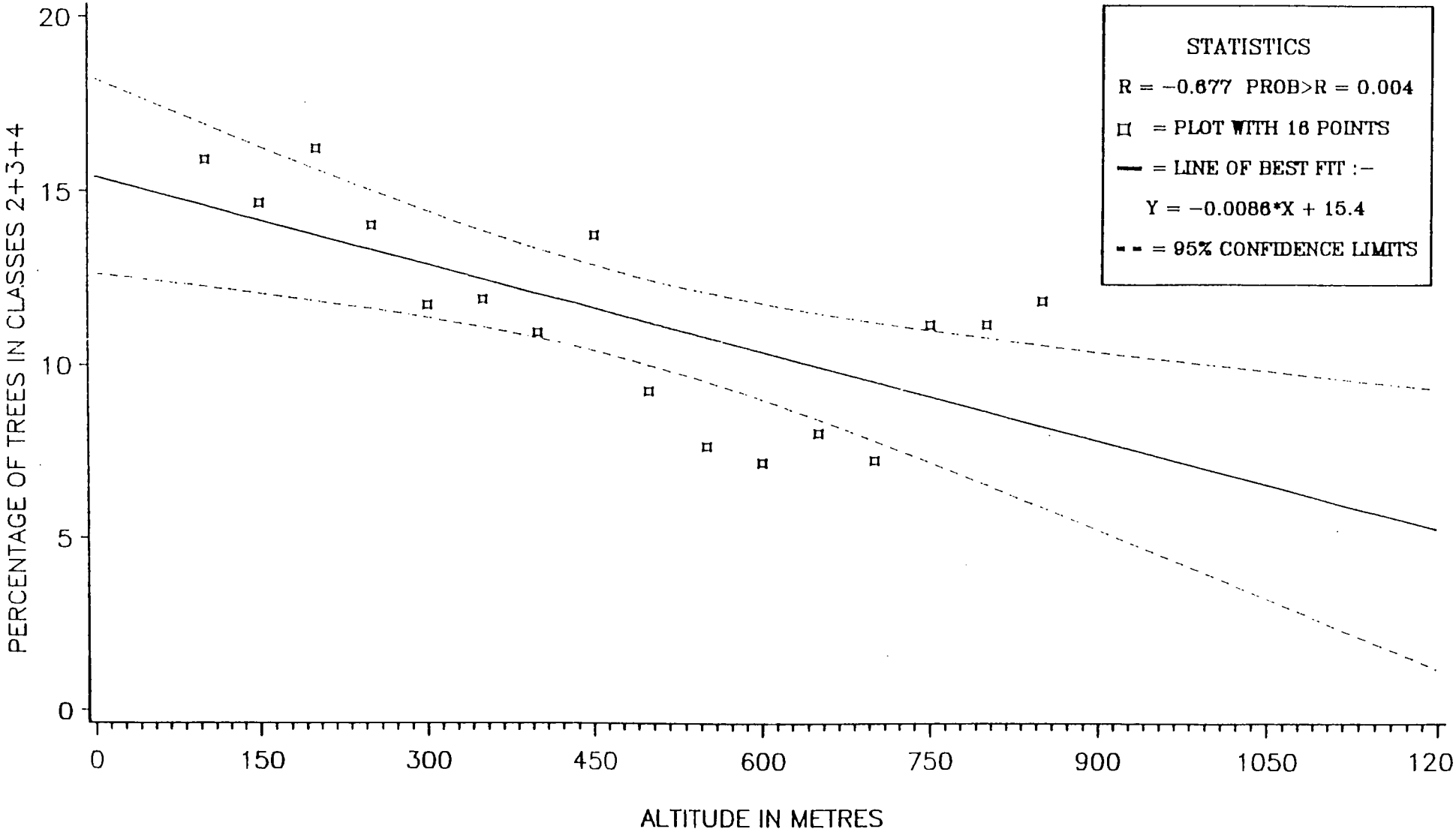
MOUNTAINOUS	DEFOLIATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Fagus sp.	92.17	5.42	2.41	.	.	332
Quercus (deciduous) sp.	54.84	45.16	.	.	.	31
Other broadleaves	82.43	15.54	2.03	.	.	148
TOTAL BROADLEAVES	87.08	10.76	2.15	.	.	511
Abies sp.	82.69	8.65	6.73	.	1.92	104
Larix sp.	65.70	24.19	9.75	.	0.36	277
Picea sp.	58.47	28.42	12.57	0.36	0.18	549
Pinus sp.	67.74	26.69	5.07	0.51	.	592
Other conifers	62.50	31.25	6.25	.	.	16
TOTAL CONIFERS	65.02	25.68	8.71	0.33	0.26	1538
TOTAL	70.52	21.96	7.08	0.24	0.20	2049

(CONTINUED)

FIG. 03

REGRESSION OF ATLANTIC DEFOLIATION AND ALTITUDE

DATA OBTAINED FROM A MOVING AVERAGE OVER 150 METRES

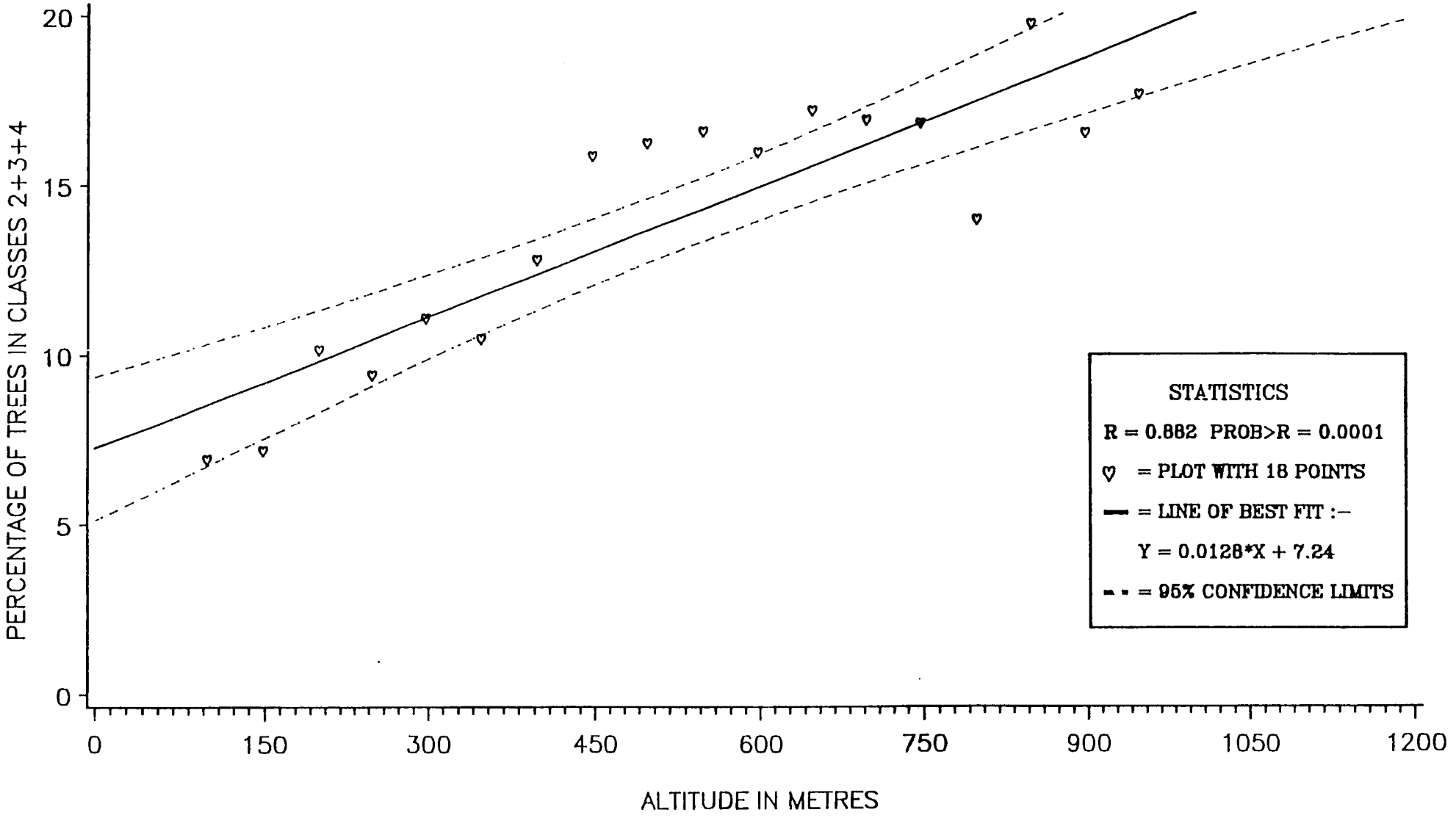


Source: 1988 Community Inventory of Forest Damage

FIG. 04

REGRESSION OF SUB-ATLANTIC DEFOLIATION AND ALTITUDE

DATA OBTAINED FROM A MOVING AVERAGE OVER 150 METRES

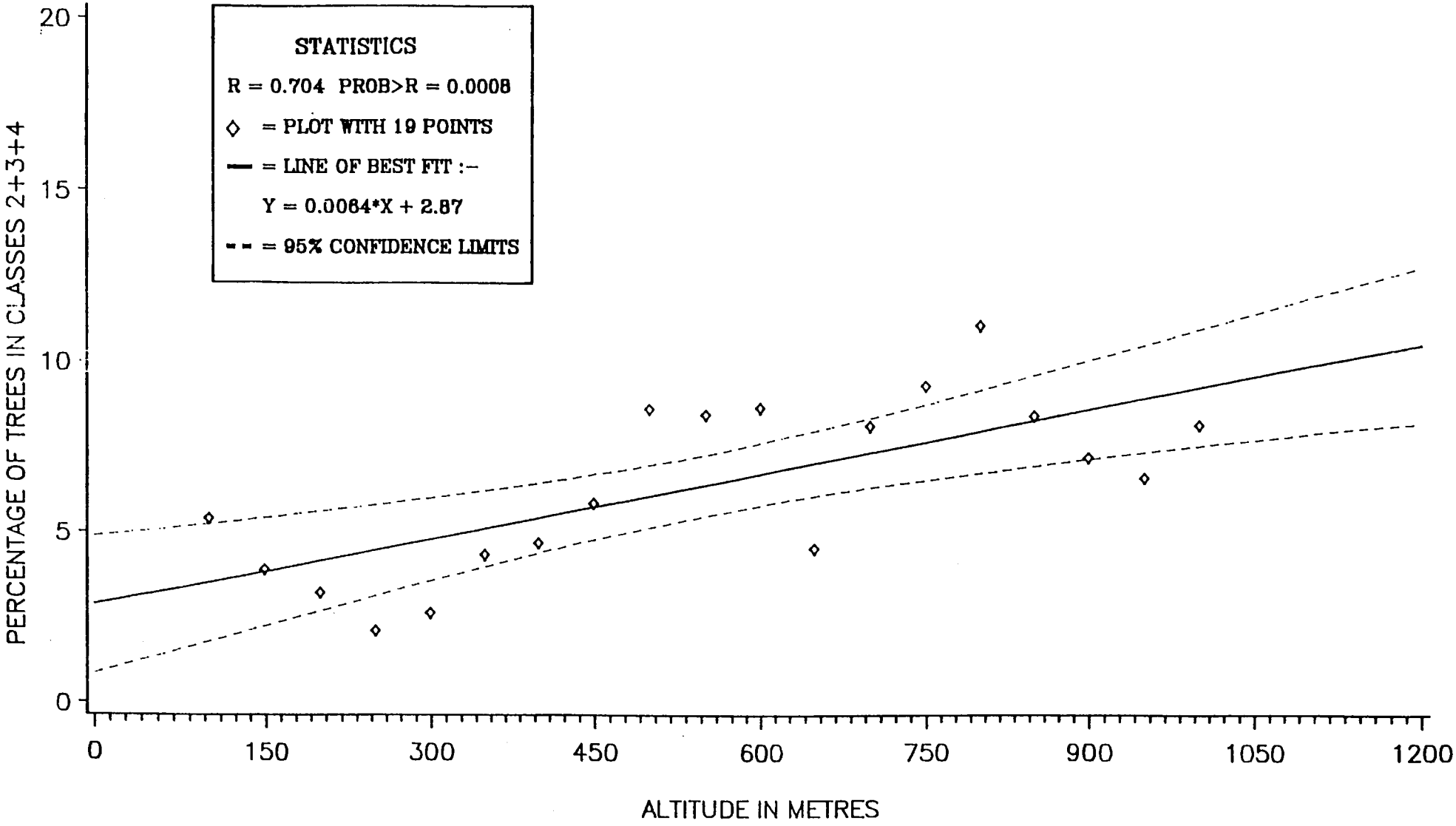


Source: 1988 Community Inventory of Forest Damage

FIG. 05

REGRESSION OF MEDITERRANEAN DEFOLIATION AND ALTITUDE

DATA OBTAINED FROM A MOVING AVERAGE OVER 150 METRES



Source: 1988 Community Inventory of Forest Damage

TAB. 17 : DEFOLIATION BY SPECIES GROUP 1987 CST

EUROPEAN COMMUNITY 1987 CST's	DEFOLIATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	72.59	20.93	5.98	0.33	0.17	602
Eucalyptus sp.	58.76	25.18	16.06	.	.	274
Fagus sp.	54.94	30.01	14.29	0.76	.	2226
Quercus (deciduous) sp.	71.86	16.11	11.27	0.52	0.23	2129
Quercus ilex	53.85	28.69	16.67	0.80	.	1248
Quercus suber	33.82	42.51	23.19	0.48	.	207
Other broadleaves	75.69	16.44	6.69	0.57	0.61	2123
TOTAL BROADLEAVES	64.71	22.72	11.76	0.60	0.22	8809
Abies sp.	45.38	20.80	27.31	5.88	0.63	476
Larix sp.	66.47	28.14	5.19	.	0.20	501
Picea sp.	45.74	33.59	19.50	1.17	.	4180
Pinus sp.	59.48	27.90	11.22	1.37	0.02	5311
Other conifers	55.88	25.40	16.58	2.14	.	374
TOTAL CONIFERS	53.76	29.71	15.02	1.46	0.05	10842
TOTAL	58.67	26.57	13.56	1.07	0.12	19651

TABL 18 : DEFOLIATION BY SPECIES GROUP 1988 CST

EUROPEAN COMMUNITY 1988 CST's	DEFOLIATION					TOTAL
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	77.74	14.95	4.98	1.50	0.83	602
Eucalyptus sp.	94.16	4.74	0.73	.	0.36	274
Fagus sp.	58.54	29.25	11.50	0.63	0.09	2226
Quercus (deciduous) sp.	66.60	20.10	11.98	0.89	0.42	2129
Quercus ilex	59.13	33.49	6.89	0.40	0.08	1248
Quercus suber	43.48	45.41	9.66	1.45	.	207
Other broadleaves	72.87	20.87	4.95	0.71	0.61	2123
TOTAL BROADLEAVES	66.09	24.26	8.56	0.74	0.35	8809
Abies sp.	47.69	21.85	27.10	2.10	1.26	476
Larix sp.	61.48	28.54	9.58	.	0.40	501
Picea sp.	43.85	36.99	17.87	1.24	0.05	4180
Pinus sp.	55.85	32.59	9.40	1.68	0.49	5311
Other conifers	50.00	32.09	16.31	1.34	0.27	374
TOTAL CONIFERS	50.92	33.61	13.69	1.44	0.34	10842
TOTAL	57.72	29.42	11.39	1.12	0.35	19651

(CONTINUED)

TAB. 19 : DISCOLOURATION BY SPECIES GROUP TOTAL SAMPLE 1988

EUROPEAN COMMUNITY 1988 TOTAL SAMPLE	DISCOLOURATION					TOTAL
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	83.98	11.14	3.68	0.60	0.60	1005
Eucalyptus sp.	99.28	0.51	0.10	.	0.10	979
Fagus sp.	87.08	10.21	2.37	0.28	0.06	3546
Quercus (deciduous) sp.	85.73	9.90	3.61	0.48	0.27	4766
Quercus ilex	91.60	8.22	0.05	0.09	0.05	2202
Quercus suber	86.47	13.33	0.20	.	.	1478
Other broadleaves	90.15	7.35	1.87	0.32	0.32	4709
TOTAL BROADLEAVES	88.47	8.96	2.07	0.30	0.20	18685
Abies sp.	74.33	19.61	5.05	0.25	0.76	1188
Larix sp.	90.92	7.84	0.96	.	0.28	727
Picea sp.	88.66	8.11	2.84	0.33	0.05	5522
Pinus sp.	83.68	14.54	1.36	0.15	0.27	10727
Other conifers	92.61	7.26	.	.	0.13	758
TOTAL CONIFERS	85.18	12.44	1.96	0.20	0.23	18922
TOTAL	86.81	10.71	2.01	0.25	0.22	37607

TAB. 20 : DISCOLOURATION BY SPECIES GROUP 1987 CST

EUROPEAN COMMUNITY 1987 CST's	DISCOLOURATION					TOTAL
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	75.25	18.60	5.81	0.17	0.17	602
Eucalyptus sp.	65.69	32.48	1.82	.	.	274
Fagus sp.	93.08	5.44	1.30	0.18	.	2226
Quercus (deciduous) sp.	92.63	3.33	3.43	0.38	0.23	2129
Quercus ilex	63.94	26.52	8.81	0.72	.	1248
Quercus suber	51.69	41.06	7.25	.	.	207
Other broadleaves	87.47	8.05	3.49	0.38	0.61	2123
TOTAL BROADLEAVES	84.45	11.12	3.87	0.34	0.22	8809
Abies sp.	89.92	8.61	0.84	.	0.63	476
Larix sp.	87.03	10.98	1.40	0.40	0.20	501
Picea sp.	91.44	6.84	1.36	0.36	.	4180
Pinus sp.	81.87	13.29	4.22	0.60	0.02	5311
Other conifers	93.32	6.15	0.53	.	.	374
TOTAL CONIFERS	86.54	10.25	2.71	0.45	0.05	10842
TOTAL	85.60	10.64	3.23	0.40	0.12	19651

FOR 1987 FROM TREES COMMON TO 1987 AND 1988

TAB. 21 : DISCOLOURATION BY SPECIES GROUP 1988 CST

EUROPEAN COMMUNITY 1988 CST's	DISCOLOURATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	NO.
SPECIES						
Castanea sativa	80.07	16.78	1.66	0.66	0.83	602
Eucalyptus sp.	97.81	1.46	0.36	.	0.36	274
Fagus sp.	91.28	6.20	2.20	0.22	0.09	2226
Quercus (deciduous) sp.	89.43	7.05	2.91	0.19	0.42	2129
Quercus ilex	88.22	11.62	.	0.08	0.08	1248
Quercus suber	73.43	25.60	0.97	.	.	207
Other broadleaves	87.24	9.75	2.17	0.24	0.61	2123
TOTAL BROADLEAVES	88.44	9.06	1.93	0.22	0.35	8809
Abies sp.	78.78	17.86	2.10	.	1.26	476
Larix sp.	88.42	9.98	1.20	.	0.40	501
Picea sp.	91.05	5.81	2.70	0.38	0.05	4180
Pinus sp.	83.32	14.27	1.68	0.24	0.49	5311
Other conifers	87.17	12.57	.	.	0.27	374
TOTAL CONIFERS	86.47	10.91	2.01	0.27	0.34	10842
TOTAL	87.35	10.08	1.97	0.24	0.35	19651

FOR 1988 FROM TREES COMMON TO 1987 AND 1988

TAB. 22 : DISCOLOURATION BY CLIMATIC ZONE 1987 TOTAL SAMPLE

EUROPEAN COMMUNITY 1987	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
TOTAL SAMPLE	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
CLIMATIC ZONE												
ATLANTIC	4345	85.5	550	10.8	165	3.25	20	0.39	4	0.08	5084	100
SUB-ATLANTIC	9121	95	365	3.80	81	0.84	9	0.09	22	0.23	9598	100
MOUNTAINOUS	1283	82.1	207	13.2	66	4.22	5	0.32	2	0.13	1563	100
MEDITERRANEAN	4951	75.9	1132	17.3	375	5.75	50	0.77	19	0.29	6527	100
TOTAL	19700	86.5	2254	9.90	687	3.02	84	0.37	47	0.21	22772	100

TAB. 23 : DISCOLOURATION BY CLIMATIC ZONE 1988 TOTAL SAMPLE

EUROPEAN COMMUNITY 1988	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
TOTAL SAMPLE	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
CLIMATIC ZONE												
ATLANTIC	4997	85.4	675	11.5	138	2.36	15	0.26	26	0.44	5851	100
SUB-ATLANTIC	11419	90.3	927	7.33	244	1.93	39	0.31	17	0.13	12646	100
MOUNTAINOUS	1673	81.6	314	15.3	53	2.59	5	0.24	4	0.20	2049	100
MEDITERRANEAN	14559	85.3	2112	12.4	321	1.88	34	0.20	35	0.21	17061	100
TOTAL	32648	86.8	4028	10.7	756	2.01	93	0.25	82	0.22	37607	100

TAB. 24 : DISCOLOURATION BY CLIMATIC ZONE 1987 CST

1987 CST	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
CLIMATIC ZONE												
ATLANTIC	3517	83.4	518	12.3	160	3.79	18	0.43	4	0.09	4217	100
SUB-ATLANTIC	7407	95.2	300	3.85	64	0.82	7	0.09	5	0.06	7783	100
MOUNTAINOUS	1225	81.6	204	13.6	66	4.40	5	0.33	1	0.07	1501	100
MEDITERRANEAN	4673	76	1069	17.4	345	5.61	49	0.80	14	0.23	6150	100
TOTAL	16822	85.6	2091	10.6	635	3.23	79	0.40	24	0.12	19651	100

FOR 1987 FROM TREES COMMON TO 1987 AND 1988

TAB. 25 : DISCOLOURATION BY CLIMATIC ZONE 1988 CST

1988 CST	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
CLIMATIC ZONE												
ATLANTIC	3620	85.8	430	10.2	126	2.99	15	0.36	26	0.62	4217	100
SUB-ATLANTIC	7298	93.8	371	4.77	97	1.25	5	0.06	12	0.15	7783	100
MOUNTAINOUS	1165	77.6	279	18.6	48	3.20	5	0.33	4	0.27	1501	100
MEDITERRANEAN	5083	82.7	901	14.7	117	1.90	23	0.37	26	0.42	6150	100
TOTAL	17166	87.4	1981	10.1	388	1.97	48	0.24	68	0.35	19651	100

FOR 1988 FROM TREES COMMON TO 1987 AND 1988

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
SPECIES	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Acer campestre	66	85.7	9	11.7	1	1.30	1	1.30	.	.	77	100
Acer monspessulanum	9	90	1	10	.	.	.	.	.	.	10	100
Acer opalus	14	100	.	.	.	.	.	.	.	.	14	100
Acer platanoides	4	100	.	.	.	.	.	.	.	.	4	100
Acer pseudoplatanus	215	87.4	23	9.35	6	2.44	2	0.81	.	.	246	100
Alnus cordata	66	89.2	6	8.11	2	2.70	.	.	.	.	74	100
Alnus glutinosa	155	72.8	48	22.5	8	3.76	2	0.94	.	.	213	100
Alnus incana	6	40	7	46.7	2	13.3	.	.	.	.	15	100
Alnus viridis	2	50	2	50	.	.	.	.	.	.	4	100
Betula pendula	233	73.7	67	21.2	11	3.48	3	0.95	2	0.63	316	100
Betula pubescens	38	44.2	43	50	5	5.81	.	.	.	.	86	100
Buxus sempervirens	3	100	.	.	.	.	.	.	.	.	3	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Carpinus betulus	261	82.3	44	13.9	12	3.79	.	.	.	.	317	100
Carpinus orientalis	2	100	.	.	.	.	.	.	.	.	2	100
Castanea sativa	772	76.8	135	13.4	52	5.17	40	3.98	6	0.60	1005	100
Corylus avellana	23	88.5	3	11.5	.	.	.	.	.	.	26	100
Eucalyptus sp.	937	95.7	37	3.78	4	0.41	.	.	1	0.10	979	100
Fagus moesiaca	39	34.2	59	51.8	16	14	.	.	.	.	114	100
Fagus orientalis	.	.	.	.	1	100	.	.	.	.	1	100
Fagus sylvatica	2077	60.5	942	27.5	393	11.5	17	0.50	2	0.06	3431	100
Fraxinus angustifolia	2	100	.	.	.	.	.	.	.	.	2	100
Fraxinus excelsior	246	68.5	85	23.7	25	6.96	3	0.84	.	.	359	100
Fraxinus ornus	47	95.9	2	4.08	.	.	.	.	.	.	49	100
Ilex aquifolium	12	92.3	1	7.69	.	.	.	.	.	.	13	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Juglans regia	.	.	.	.	1	100	.	.	.	.	1	100
Olea europaea	75	74.3	25	24.8	1	0.99	.	.	.	.	101	100
Ostrya carpinifolia	192	90.1	2	0.94	16	7.51	1	0.47	2	0.94	213	100
Platanus orientalis	22	28.9	34	44.7	20	26.3	.	.	.	.	76	100
Populus alba	26	96.3	1	3.70	.	.	.	.	.	.	27	100
Populus hybrides	256	77.8	35	10.6	36	10.9	1	0.30	1	0.30	329	100
Populus nigra	47	52.8	39	43.8	3	3.37	.	.	.	.	89	100
Populus tremula	81	92	7	7.95	.	.	.	.	.	.	88	100
Prunus avium	105	76.6	20	14.6	11	8.03	1	0.73	.	.	137	100
Prunus dulcis	7	100	.	.	.	.	.	.	.	.	7	100
Pyrus communis	13	92.9	1	7.14	.	.	.	.	.	.	14	100
Quercus cerris	501	92.3	29	5.34	10	1.84	.	.	3	0.55	543	100
Quercus coccifera	4	80	1	20	.	.	.	.	.	.	5	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
SPECIES	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Quercus faginea	221	70.4	74	23.6	19	6.05	.	.	.	.	314	100
Quercus frainetto	60	19.9	154	51.2	83	27.6	3	1.00	1	0.33	301	100
Quercus fruticosa	12	66.7	5	27.8	1	5.56	.	.	.	.	18	100
Quercus ilex	1365	62	689	31.3	135	6.13	12	0.54	1	0.05	2202	100
Quercus macrolepsis	3	14.3	14	66.7	4	19	.	.	.	.	21	100
Quercus petraea	573	58.1	272	27.6	135	13.7	5	0.51	2	0.20	987	100
Quercus pubescens	713	75.5	140	14.8	83	8.79	6	0.64	2	0.21	944	100
Quercus pyrenaica	404	77.2	60	11.5	32	6.12	26	4.97	1	0.19	523	100
Quercus robur	760	53.6	427	30.1	204	14.4	23	1.62	4	0.28	1418	100
Quercus rotundifolia	635	94.5	37	5.51	.	.	.	.	.	.	672	100
Quercus rubra	43	86	5	10	2	4.00	.	.	.	.	50	100
Quercus suber	1294	87.6	153	10.4	28	1.89	3	0.20	.	.	1478	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
SPECIES	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Quercus trojana	9	29	22	71	.	.	.	.	.	.	31	100
Robinia pseudacacia	157	89.7	11	6.29	4	2.29	.	.	3	1.71	175	100
Salix alba	6	100	.	.	.	.	.	.	.	.	6	100
Salix caprea	23	92	2	8.00	.	.	.	.	.	.	25	100
Salix eleagnos	5	100	.	.	.	.	.	.	.	.	5	100
Salix sp.	13	65	7	35	.	.	.	.	.	.	20	100
Sorbus aria	21	75	6	21.4	1	3.57	.	.	.	.	28	100
Sorbus aucuparia	29	82.9	4	11.4	2	5.71	.	.	.	.	35	100
Sorbus domestica	10	83.3	1	8.33	1	8.33	.	.	.	.	12	100
Sorbus torminalis	5	55.6	3	33.3	.	.	1	11.1	.	.	9	100
Tilia cordata	106	86.2	15	12.2	2	1.63	.	.	.	.	123	100
Tilia platyphyllos	10	58.8	7	41.2	.	.	.	.	.	.	17	100
Ulmus glabra	13	92.9	.	.	.	.	1	7.14	.	.	14	100
Ulmus minor	12	52.2	1	4.35	3	13	.	.	7	30.4	23	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Other broadleaves	150	61.5	63	25.8	24	9.84	7	2.87	.	.	244	100
Abies alba	372	52.8	136	19.3	178	25.2	13	1.84	6	0.85	705	100
Abies borisii-regis	114	60.6	65	34.6	9	4.79	.	.	.	.	188	100
Abies cephalonica	120	44.6	105	39	36	13.4	5	1.86	3	1.12	269	100
Abies grandis	6	85.7	1	14.3	.	.	.	.	.	.	7	100
Abies nordmanniana	15	78.9	3	15.8	1	5.26	.	.	.	.	19	100
Cedrus deodara	1	100	.	.	.	.	.	.	.	.	1	100
Cupressus sempervirens	31	100	.	.	.	.	.	.	.	.	31	100
Juniperus communis	16	94.1	1	5.88	.	.	.	.	.	.	17	100
Juniperus oxycedrus	56	93.3	2	3.33	2	3.33	.	.	.	.	60	100
Juniperus phoenica	18	100	.	.	.	.	.	.	.	.	18	100
Juniperus sabina	3	42.9	3	42.9	1	14.3	.	.	.	.	7	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION											
	NONE		SLIGHT		MODERATE		SEVERE		DEAD		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Juniperus thurifera	140	65.7	51	23.9	16	7.51	6	2.82	.	.	213	100
Larix decidua	392	69.1	135	23.8	39	6.88	.	.	1	0.18	567	100
Larix kaempferi	84	52.5	60	37.5	15	9.38	.	.	1	0.62	160	100
Picea abies	2318	49.6	1624	34.7	710	15.2	23	0.49	2	0.04	4677	100
Picea omorika	1	50	1	50	.	.	.	.	.	.	2	100
Picea sitchensis	401	47.6	261	31	142	16.8	38	4.51	1	0.12	843	100
Pinus brutia	27	26	69	66.3	7	6.73	1	0.96	.	.	104	100
Pinus cembra	36	85.7	6	14.3	.	.	.	.	.	.	42	100
Pinus contorta	129	44.5	106	36.6	44	15.2	11	3.79	.	.	290	100
Pinus halepensis	1017	63.9	460	28.9	95	5.97	17	1.07	2	0.13	1591	100
Pinus leucodermis	.	.	10	90.9	1	9.09	.	.	.	.	11	100
Pinus mugo	.	.	.	.	11	45.8	13	54.2	.	.	24	100
Pinus nigra	978	71.7	317	23.2	61	4.47	8	0.59	.	.	1364	100
Pinus pinaster	2429	85	285	9.98	114	3.99	20	0.70	9	0.32	2857	100

(CONTINUED)

TAB. 26 : DEFOLIATION BY SPECIES 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Pinus pinea	225	66.4	65	19.2	44	13	4	1.18	1	0.29	339	100
Pinus radiata	100	64.5	30	19.4	14	9.03	4	2.58	7	4.52	155	100
Pinus strobus	34	97.1	1	2.86	.	.	.	.	.	.	35	100
Pinus sylvestris	2143	56.5	1222	32.2	377	9.95	38	1.00	10	0.26	3790	100
Pinus uncinata	75	60	42	33.6	8	6.40	.	.	.	.	125	100
Pseudotsuga menziesii	239	62.1	93	24.2	50	13	3	0.78	.	.	385	100
Thuya sp.	2	66.7	1	33.3	.	.	.	.	.	.	3	100
Tsuga sp.	1	33.3	2	66.7	.	.	.	.	.	.	3	100
Other conifers	15	75	3	15	1	5.00	.	.	1	5.00	20	100
TOTAL	24748	65.8	9040	24	3375	8.97	362	0.96	82	0.22	37607	100

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Acer campestre	70	90.9	6	7.79	1	1.30	.	.	.	.	77	100
Acer monspessulanum	6	60	4	40	.	.	.	.	.	.	10	100
Acer opalus	14	100	.	.	.	.	.	.	.	.	14	100
Acer platanoides	4	100	.	.	.	.	.	.	.	.	4	100
Acer pseudoplatanus	221	89.8	24	9.76	1	0.41	.	.	.	.	246	100
Alnus cordata	66	89.2	7	9.46	1	1.35	.	.	.	.	74	100
Alnus glutinosa	205	96.2	6	2.82	2	0.94	.	.	.	.	213	100
Alnus incana	13	86.7	2	13.3	.	.	.	.	.	.	15	100
Alnus viridis	4	100	.	.	.	.	.	.	.	.	4	100
Betula pendula	285	90.2	28	8.86	1	0.32	.	.	2	0.63	316	100
Betula pubescens	70	81.4	15	17.4	1	1.16	.	.	.	.	86	100
Buxus sempervirens	3	100	.	.	.	.	.	.	.	.	3	100
Carpinus betulus	272	85.8	41	12.9	4	1.26	.	.	.	.	317	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION											
	NONE		SLIGHT		MODERATE		SEVERE		DEAD		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Carpinus orientalis	2	100	.	.	.	.	.	.	.	.	2	100
Castanea sativa	844	84	112	11.1	37	3.68	6	0.60	6	0.60	1005	100
Corylus avellana	25	96.2	1	3.85	.	.	.	.	.	.	26	100
Eucalyptus sp.	972	99.3	5	0.51	1	0.10	.	.	1	0.10	979	100
Fagus moesiaca	60	52.6	47	41.2	7	6.14	.	.	.	.	114	100
Fagus orientalis	1	100	.	.	.	.	.	.	.	.	1	100
Fagus sylvatica	3027	88.2	315	9.18	77	2.24	10	0.29	2	0.06	3431	100
Fraxinus angustifolia	2	100	.	.	.	.	.	.	.	.	2	100
Fraxinus excelsior	344	95.8	7	1.95	4	1.11	4	1.11	.	.	359	100
Fraxinus ornus	47	95.9	2	4.08	.	.	.	.	.	.	49	100
Ilex aquifolium	13	100	.	.	.	.	.	.	.	.	13	100
Juglans regia	1	100	.	.	.	.	.	.	.	.	1	100
Olea europaea	98	97	3	2.97	.	.	.	.	.	.	101	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Ostrya carpinifolia	191	89.7	7	3.29	13	6.10	.	.	2	0.94	213	100
Platanus orientalis	53	69.7	16	21.1	7	9.21	.	.	.	.	76	100
Populus alba	27	100	.	.	.	.	.	.	.	.	27	100
Populus hybrides	285	86.6	6	1.82	31	9.42	6	1.82	1	0.30	329	100
Populus nigra	65	73	24	27	.	.	.	.	.	.	89	100
Populus tremula	87	98.9	1	1.14	.	.	.	.	.	.	88	100
Prunus avium	124	90.5	6	4.38	7	5.11	.	.	.	.	137	100
Prunus dulcis	7	100	.	.	.	.	.	.	.	.	7	100
Pyrus communis	14	100	.	.	.	.	.	.	.	.	14	100
Quercus cerris	514	94.7	14	2.58	11	2.03	1	0.18	3	0.55	543	100
Quercus coccifera	5	100	.	.	.	.	.	.	.	.	5	100
Quercus faginea	256	81.5	52	16.6	6	1.91	.	.	.	.	314	100
Quercus frainetto	176	58.5	99	32.9	24	7.97	1	0.33	1	0.33	301	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION														TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD							
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%					NO.	%
SPECIES																
Quercus fruticosa	.	.	18	100	.	.	.	.	.	.					18	100
Quercus ilex	2017	91.6	181	8.22	1	0.05	2	0.09	1	0.05					2202	100
Quercus macrolepsis	20	95.2	1	4.76	.	.	.	.	.	.					21	100
Quercus petraea	883	89.5	73	7.40	19	1.93	10	1.01	2	0.20					987	100
Quercus pubescens	797	84.4	86	9.11	57	6.04	2	0.21	2	0.21					944	100
Quercus pyrenaica	485	92.7	37	7.07	.	.	.	.	1	0.19					523	100
Quercus robur	1181	83.3	163	11.5	61	4.30	9	0.63	4	0.28					1418	100
Quercus rotundifolia	658	97.9	14	2.08	.	.	.	.	.	.					672	100
Quercus rubra	50	100	.	.	.	.	.	.	.	.					50	100
Quercus suber	1278	86.5	197	13.3	3	0.20	.	.	.	.					1478	100
Quercus trojana	10	32.3	21	67.7	.	.	.	.	.	.					31	100
Robinia pseudacacia	166	94.9	5	2.86	1	0.57	.	.	3	1.71					175	100
Salix alba	6	100	.	.	.	.	.	.	.	.					6	100
Salix caprea	25	100	.	.	.	.	.	.	.	.					25	100

(CONTINUED)

TABEL 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION													
	NONE		SLIGHT		MODERATE		SEVERE		DEAD		TOTAL	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Salix eleagnos	5	100	.	.	.	.	.	.	.	.	5	100
Salix sp.	20	100	.	.	.	.	.	.	.	.	20	100
Sorbus aria	19	67.9	8	28.6	1	3.57	.	.	.	.	28	100
Sorbus aucuparia	33	94.3	1	2.86	1	2.86	.	.	.	.	35	100
Sorbus domestica	11	91.7	1	8.33	.	.	.	.	.	.	12	100
Sorbus torminalis	6	66.7	1	11.1	2	22.2	.	.	.	.	9	100
Tilia cordata	118	95.9	2	1.63	3	2.44	.	.	.	.	123	100
Tilia platyphyllos	10	58.8	7	41.2	.	.	.	.	.	.	17	100
Ulmus glabra	14	100	.	.	.	.	.	.	.	.	14	100
Ulmus minor	15	65.2	1	4.35	.	.	.	.	7	30.4	23	100
Other broadleaves	230	94.3	8	3.28	1	0.41	5	2.05	.	.	244	100
Abies alba	572	81.1	114	16.2	13	1.84	.	.	6	0.85	705	100
Abies borisii-regis	125	66.5	50	26.6	12	6.38	1	0.53	.	.	188	100
Abies cephalonica	160	59.5	69	25.7	35	13	2	0.74	3	1.12	269	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Abies grandis	7	100	.	.	.	.	.	.	.	.	7	100
Abies nordmanniana	19	100	.	.	.	.	.	.	.	.	19	100
Cedrus deodara	1	100	.	.	.	.	.	.	.	.	1	100
Cupressus sempervirens	30	96.8	1	3.23	.	.	.	.	.	.	31	100
Juniperus communis	15	88.2	2	11.8	.	.	.	.	.	.	17	100
Juniperus oxycedrus	59	98.3	1	1.67	.	.	.	.	.	.	60	100
Juniperus phoenica	18	100	.	.	.	.	.	.	.	.	18	100
Juniperus sabina	4	57.1	3	42.9	.	.	.	.	.	.	7	100
Juniperus thurifera	195	91.5	18	8.45	.	.	.	.	.	.	213	100
Larix decidua	511	90.1	48	8.47	7	1.23	.	.	1	0.18	567	100
Larix kaempferi	150	93.8	9	5.62	.	.	.	.	1	0.62	160	100
Picea abies	4254	91	312	6.67	102	2.18	7	0.15	2	0.04	4677	100
Picea omorika	2	100	.	.	.	.	.	.	.	.	2	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Picea sitchensis	640	75.9	136	16.1	55	6.52	11	1.30	1	0.12	843	100
Pinus brutia	104	100	.	.	.	.	.	.	.	.	104	100
Pinus cembra	42	100	.	.	.	.	.	.	.	.	42	100
Pinus contorta	125	43.1	143	49.3	21	7.24	1	0.34	.	.	290	100
Pinus halepensis	1123	70.6	440	27.7	18	1.13	8	0.50	2	0.13	1591	100
Pinus leucodermis	11	100	.	.	.	.	.	.	.	.	11	100
Pinus mugo	17	70.8	4	16.7	3	12.5	.	.	.	.	24	100
Pinus nigra	1108	81.2	235	17.2	19	1.39	2	0.15	.	.	1364	100
Pinus pinaster	2573	90.1	246	8.61	27	0.95	2	0.07	9	0.32	2857	100
Pinus pinea	273	80.5	62	18.3	3	0.88	.	.	1	0.29	339	100
Pinus radiata	136	87.7	9	5.81	3	1.94	.	.	7	4.52	155	100
Pinus strobus	34	97.1	.	.	1	2.86	.	.	.	.	35	100
Pinus sylvestris	3391	89.5	341	9.00	45	1.19	3	0.08	10	0.26	3790	100
Pinus uncinata	39	31.2	80	64	6	4.80	.	.	.	.	125	100

(CONTINUED)

TAB. 27 : DISCOLOURATION BY SPECIES 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
SPECIES												
Pseudotsuga menziesii	355	92.2	30	7.79	.	.	.	.	.	.	385	100
Thuya sp.	3	100	.	.	.	.	.	.	.	.	3	100
Tsuga sp.	3	100	.	.	.	.	.	.	.	.	3	100
Other conifers	19	95	.	.	.	.	.	.	1	5.00	20	100
TOTAL	32648	86.8	4028	10.7	756	2.01	93	0.25	82	0.22	37607	100

TAB. 28 : PRESENCE OF IDENTIFIABLE DAMAGE CAUSES 1988

EUROPEAN COMMUNITY		TYPE OF OBSERVATION	
		TREES	PLOTS
TOTAL	NO. OF OBSERVATIONS	37607	1526
GAME AND GRAZING	NUMBER	273	30
	PERCENT	0.73	1.97
INSECTS	NUMBER	7314	612
	PERCENT	19.45	40.10
FUNGI	NUMBER	1746	238
	PERCENT	4.64	15.60
ABIOTIC AGENTS	NUMBER	1352	220
	PERCENT	3.60	14.42
ACTION OF MAN	NUMBER	1863	179
	PERCENT	4.95	11.73
FIRE	NUMBER	406	32
	PERCENT	1.08	2.10
KNOWN POLLUTION	NUMBER	122	10
	PERCENT	0.32	0.66
OTHER	NUMBER	3121	313
	PERCENT	8.30	20.51
NUMBER OF OBSERVATIONS WITH SOME DAMAGE	NUMBER	12558	949
	PERCENT	33.39	62.19

TAB. 29 : DEFOLIATION BY IDENTIFIABLE DAMAGE CAUSES, TREES 1988

EUROPEAN COMMUNITY	DEFOLIATION OF SAMPLE TREES					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	ALL
	%	%	%	%	%	NO.
GAME AND GRAZING	45.42	41.39	10.62	2.56	.	273
INSECTS	45.97	37.26	14.64	2.09	0.04	7314
FUNGI	61.57	23.25	13.12	1.83	0.23	1746
ABIOTIC AGENTS	41.35	32.32	21.23	4.73	0.37	1352
ACTION OF MAN	66.56	24.26	8.16	0.97	0.05	1863
FIRE	63.05	23.40	9.61	3.94	.	406
KNOWN POLLUTION	43.44	43.44	12.30	0.82	.	122
OTHER	52.71	33.45	11.73	1.83	0.29	3121
ANY IDENT. DAMAGE	52.63	32.23	12.93	2.04	0.18	12558
NO IDENT. DAMAGE	72.41	19.93	6.99	0.42	0.24	25049
MULTIPLE DAMAGE	46.23	35.79	15.52	2.46	.	2881

TAB. 30 : DEFOLIATION BY IDENTIFIABLE DAMAGE CAUSES, PLOTS 1988

EUROPEAN COMMUNITY	AVERAGE DEFOLIATION OF SAMPLE PLOTS				
	NONE	SLIGHT	MODERATE	SEVERE	ALL
	%	%	%	%	NO.
GAME AND GRAZING	43.33	46.67	10.00	.	30
INSECTS	48.60	41.05	10.02	0.33	609
FUNGI	51.95	37.66	10.39	.	231
ABIOTIC AGENTS	50.46	35.65	13.89	.	216
ACTION OF MAN	61.58	31.07	7.34	.	177
FIRE	59.38	31.25	6.25	3.13	32
KNOWN POLLUTION	20.00	70.00	10.00	.	10
OTHER	54.19	38.06	7.74	.	310
ANY IDENT. DAMAGE	53.25	36.63	9.80	0.32	939
NO IDENT. DAMAGE	63.99	27.63	8.20	0.18	561
MULTIPLE DAMAGE	49.40	40.77	9.82	.	336

TAB. 31 : DEFOLIATION BY WATER AVAILABILITY 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
WATER AVAILABILITY												
INSUFFICIENT	2477	55.2	1350	30.1	607	13.5	40	0.89	10	0.22	4484	100
SUFFICIENT	21806	67.5	7486	23.2	2663	8.24	302	0.93	70	0.22	32327	100
EXCESSIVE	338	50.8	201	30.2	105	15.8	20	3.00	2	0.30	666	100
TOTAL	24621	65.7	9037	24.1	3375	9.01	362	0.97	82	0.22	37477	100

TAB. 32 : DISCOLOURATION BY WATER AVAILABILITY 1988

EUROPEAN COMMUNITY	DISCOLOURATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
WATER AVAILABILITY												
INSUFFICIENT	3682	82.1	545	12.2	231	5.2	16	0.4	10	0.2	4484	
SUFFICIENT	28325	87.6	3392	10.5	470	1.5	70	0.2	70	0.2	32327	
EXCESSIVE	514	77.2	88	13.2	55	8.3	7	1.1	2	0.3	666	
TOTAL	32521	86.8	4025	10.7	756	2.0	93	0.2	82	0.2	37477	

TAB. 33 : DEFOLIATION BY HUMUS TYPE 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
HUMUS TYPE												
MULL	10679	75.6	2545	18	796	5.64	84	0.59	19	0.13	14123	100
MODER	8979	60.8	4225	28.6	1421	9.62	111	0.75	32	0.22	14768	100
MOR	3040	62.9	1150	23.8	528	10.9	90	1.86	25	0.52	4833	100
ANMOR	131	84	22	14.1	3	1.92	.	.	.	.	156	100
PEAT	296	55.7	135	25.4	72	13.6	28	5.27	.	.	531	100
OTHER	1536	49.5	960	30.9	555	17.9	49	1.58	6	0.19	3106	100
TOTAL	24661	65.7	9037	24.1	3375	9.00	362	0.96	82	0.22	37517	100

TAB. 34 : DISCOLOURATION BY HUMUS TYPE 1988

EUROPEAN COMMUNITY	DISCOLOURATION					TOTAL
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	
	%	%	%	%	%	%
HUMUS TYPE						
MULL	90.17	8.24	1.20	0.25	0.13	100.00
MODER	84.05	13.22	2.31	0.20	0.22	100.00
MOR	85.47	11.09	2.65	0.27	0.52	100.00
ANMOR	97.44	2.56	.	.	.	100.00
PEAT	62.15	30.32	5.65	1.88	.	100.00
OTHER	90.18	6.66	2.80	0.16	0.19	100.00
TOTAL	86.79	10.73	2.02	0.25	0.22	100.00

TAB. 35 : DEFOLIATION BY ASPECT 1988

EUROPEAN COMMUNITY	DEFOLIATION										TOTAL	
	NONE		SLIGHT		MODERATE		SEVERE		DEAD			
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
ASPECT												
N	3260	68.6	1019	21.4	432	9.09	36	0.76	7	0.15	4754	100
NE	2816	65.9	1030	24.1	363	8.50	52	1.22	12	0.28	4273	100
E	2043	66.7	674	22	309	10.1	28	0.91	7	0.23	3061	100
SE	2162	68.5	742	23.5	201	6.37	37	1.17	14	0.44	3156	100
S	2411	62.4	1088	28.2	337	8.73	18	0.47	7	0.18	3861	100
SW	2242	71.2	650	20.6	226	7.17	25	0.79	7	0.22	3150	100
W	2347	68.5	679	19.8	350	10.2	35	1.02	14	0.41	3425	100
NW	2750	63.7	1113	25.8	401	9.29	47	1.09	7	0.16	4318	100
FLAT	4668	61.8	2039	27	756	10	84	1.11	7	0.09	7554	100
TOTAL	24699	65.8	9034	24.1	3375	8.99	362	0.96	82	0.22	37552	100

TAB. 36 : DISCOLOURATION BY ASPECT 1988

EUROPEAN COMMUNITY	DISCOLOURATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	%
ASPECT						
N	88.35	10.14	1.20	0.17	0.15	100.00
NE	85.77	12.03	1.68	0.23	0.28	100.00
E	81.02	13.26	4.93	0.56	0.23	100.00
SE	85.01	12.23	1.68	0.63	0.44	100.00
S	83.58	14.09	1.99	0.16	0.18	100.00
SW	86.79	10.92	1.87	0.19	0.22	100.00
W	87.80	8.50	3.09	0.20	0.41	100.00
NW	86.94	11.07	1.76	0.07	0.16	100.00
FLAT	90.67	7.64	1.39	0.21	0.09	100.00
TOTAL	86.81	10.71	2.01	0.25	0.22	100.00

TAB. 37 : DEFOLIATION BY ALTITUDE GROUP 1988

EUROPEAN COMMUNITY	DEFOLIATION				
	NOT OR SLIGHTLY	MODERATELY	SEVERELY	DEAD	TOTAL
	%	%	%	%	%
ALTITUDE					
0- 250 m	89.73	8.71	1.34	0.23	100.00
251- 500 m	90.02	9.12	0.67	0.19	100.00
501- 750 m	88.12	10.96	0.62	0.29	100.00
751-1000 m	89.94	8.59	1.27	0.20	100.00
1001-1250 m	88.97	9.25	1.56	0.21	100.00
1251-1500 m	93.58	5.57	0.57	0.28	100.00
>1500 m	95.24	4.53	0.23	.	100.00
TOTAL	89.84	8.98	0.96	0.22	100.00

TAB. 38 : DISCOLOURATION BY ALTITUDE GROUP 1988

EUROPEAN COMMUNITY	DISCOLOURATION					
	NONE	SLIGHT	MODERATE	SEVERE	DEAD	TOTAL
	%	%	%	%	%	%
ALTITUDE						
0- 250 m	88.20	9.38	1.89	0.31	0.23	100.00
251- 500 m	89.99	8.20	1.34	0.29	0.19	100.00
501- 750 m	84.90	11.69	3.04	0.09	0.29	100.00
751-1000 m	83.93	13.41	2.10	0.36	0.20	100.00
1001-1250 m	85.42	11.83	2.39	0.15	0.21	100.00
1251-1500 m	83.99	13.40	2.04	0.28	0.28	100.00
>1500 m	78.84	19.52	1.48	0.16	.	100.00
SUB-TOTAL	86.81	10.71	2.01	0.25	0.22	100.00

PART 2

NATIONAL FOREST HEALTH REPORTS

1987 AND 1988

Accomplishment, Results, Conclusions

A. Legislative background, procedures

As provided for under Article 3 of Council Regulation (EEC) No 3528/86 and in accordance with Article 3 of Commission Regulation (EEC) No 1696/87, each Member State draws up, annually, a forest health report. This report is based in particular, on the data from the Community network of observation points and from any other network that is representative at national or regional level and in respect of which the common methodology is applied.

Each Member State forwards to the Commission its periodic health report containing information as to how the forest damage inventory has been carried out, the forest damage results, the possible causes of observed damage, the measures taken to restore damaged forests and the socio-economical impact of forest damage.

The results are sent on a set of tables provided by the Commission so as to ensure that the data may be presented in comparable terms for each Member State. These tables are designed to present the percentage of sample trees falling in each defoliation, discolouration and combined defoliation and discolouration (optional) class in terms of the total sample, by conifers and broadleaves, by species and by age groups (60 years, ¦ 60 years). Where possible, results are also submitted by administrative regions providing they are sufficiently representative.

B. Accomplishment of the national surveys

Coverage

Results were obtained from 10 Member States in 1987 and from 11 in 1988. For most of the results presented the coverage of the national forested area is complete although for some countries these results relate to only part of the total area. Detailed information on coverage etc. for each Member State can be found in table 1.

For 1987 national reports were not received from Portugal and Greece. For France results were obtained for one fifth of the forested area, notably covering the eastern part of the country. For Belgium a report was received for the Flemish Region. For Italy the regions Sardegna, Sicilia and Friuli Venezia Giulia were not covered. In Spain 71% of the forest was covered; the non-sampled part was situated in the north. In the Netherlands

TABLE 1

SUMMARY OF NATIONAL FOREST DAMAGE INVENTORIES 1987 AND 1988

Information applies to both 1987 and 1988 unless space is subdivided;
then upper half gives 1987 value and lower half gives 1988 value

	BELGIE BELGIQUE	DANMARK	DEUTSCH LAND	ELLAS	ESPANA	FRANCE	IRELAND	ITALIA	LUXEM-BOURG	NEDER-LAND	PORTU-GAL	UNITED KINGDOM
Total wooded area (1000 hectares)	617	460	7 388	2 512	11 921	13 845	335	8 675	84	330	3 060	2 103
												2 112
Approximate proportion of national forest area covered by the network	19% (Flanders) e)	100%	100%	0% e) 100% c)	71% 100% e)	20% 47% f)	100%	83% 85% f)	100%	85%	e) 100%	100%
Grid density	8x8km 8x8km + additional plots:	16x16km	av. e) 5.6x5.6km: av. e) 4.2x4.2km:	16x16km	16x16km	16x1 km 16x16km	16x16km	16x16km	2x2km	1x1km	16x16km	16x16km
Total number of observation plots	20 a) (41) 41+5 b)	21	2 316 4 117	0 e) 84	316 387	1 531 228	22 d)	178 218 f)	210	1 400 2 800e) (3400)	e) 155	75
Total number of trees assessed	480 984	466	57 311	0	5 725	25 712	535	5 004	4 885	33 475	e)	1 800
	1104	456	132 492	1 980	9 218	4 468	462	5 009	4 976	69 575	4 650	

a) In 1987 21 of the 41 plots were assessed too late in the season. The results for 1987 given in the tables above relate only to 20 plots (480 trees).

b) In Flanders 5 extra non-grid observation points were set out in 1988 to get a better representation of some important species.

c) No plots set out in maquis vegetation. d) The 22 observation points in 1988 are all different from those of 1987.

e) See text below. f) Figure not supplied by Member State, but estimated by the Commission.

85% of the forested area was covered by a dense grid.
The remaining Member States (Luxemburg, Germany, Denmark, United Kingdom and Ireland) submitted national reports for the entire forest area.

In 1988 the coverage was enlarged. Greece and Portugal are now covered. In Italy results are only lacking for Sardegna and Sicilia. The whole of Spain is covered by the 16 x 16 km grid and included in the national report, but due to cartographical problems a few plots, distributed over the whole country, could not be assessed. These plots are expected to be assessed in 1989 thus leading to a 10% increase in the number of Spanish plots.

Grid density and sampling procedures

Half of the Member States submitted national reports based on a 16 x 16 km grid, thus basing their reports on the same data as they supplied to the Community survey.

Particularly dense grids have been used in the Netherlands, Luxemburg and in most parts of Germany. See table 1 for details on sample intensity.

Ireland established new observation points in 1988 as compared to 1987; the results from the two years are therefore not fully comparable.

In the Federal Republic of Germany the grid density varies greatly from Land to Land. The number of observation plots was almost doubled from 1987 to 1988, leading to an increase in average grid density from 5.6 x 5.6 km to 4.2 x 4.2 km in 1988. In the Netherlands a 1 x 1 km grid is applied, and 1400 grid intersection
points were observed in 1987. In 1988 the number of sample points were increased to 3400 of which 2800 could be assessed. The increased number of observations in 1988 is part of the Dutch survey plan which implies more intensive sampling every 4 years; thus the increase in observation points does not represent a better coverage.

For drawing conclusions on national levels some Member States have denser grids than the Community grid (Italy, France in 1988) or have other additional sampling systems (Denmark) for which results are not available for inclusion in the tables and diagrams below. The French additional net just mentioned (réseau bleu), also includes dominated tress, as opposed to the Community net (see description in Part 1), and can thus not be compared exactly with the results of the Community net. The results sampled in the "Réseau Bleu" are slightly more pessimistic than those from the Community grid.

C. Results of the National Surveys

1. All species by Member State

For all species together (table 2) the percentage of trees in defoliation classes 2 + 3 + 4 range from 0% (Ireland) to 23% (Denmark) in 1987, and from 1% (Portugal) to 25% (United Kingdom) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 5% (Ireland, where the sample plots were not identical for the two years) and 3% (United Kingdom) while the largest recovery was of 5% (Spain, Denmark).

The average for the 12 Member States shown on the extreme right in this and later tables gives the average for the Community grid sample and not the average of the figures in the particular table.

Diagrams 1 and 2 show the same data as discussed above.

Diagram 1 shows the clearly damaged trees split up into defoliation classes 2, 3 and 4. The countries in the northern part of the Community often have higher percentages of trees in damage classes 2 + 3 + 4 jointly than than is the case elsewhere in the Community; Ireland and Greece are the most outstanding exceptions to this tendency. Most of the defoliation is of the moderate type (class 2). There is generally some proportionality between the percentages of trees in classes 2 and 3 inside a Member State; note though that in Germany and Greece the defoliation is largely of the moderate type.

Diagram 2 shows the largely undamaged trees split up into defoliation classes 0 and 1. The percentage of largely undamaged trees (classes 0 and 1 jointly) is often smaller in the northern part of the Community than elsewhere in the Community; Ireland and Greece are the most outstanding exceptions to this picture.

As to the distribution of trees in defoliation classes 0 (not defoliated) and 1 (slightly defoliated) inside the group of largely undamaged trees included in this diagram, it may be noted that some of the southern Member States have a relatively large proportion of trees in class 0 (not defoliated) especially Greece and Ireland do not fit into this picture though.

Table 3 shows the discoloration for all species in each Member State. The proportion of trees showing signs of discoloration is for several Member States quite different from that of defoliation. Denmark and Germany have no noticable discoloration in 1987 and 1988, while they had appreciable defoliation. For Ireland the situation is the opposite, hardly any defoliation is coupled with considerable discoloration in 1988.

TABLE 2

PERCENTAGES OF TOTAL DEFOLIATION FOR ALL SPECIES BY MEMBER STATE

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIË/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	–	95,8	87,4	–	90,3	87,5	92,1	83,0	81,8	77,0	78,0	100,0	85,2
	88	83,0	94,3	92,9	98,7	93,1	89,6	89,7	85,1	81,7	82,0	75,0	95,2	87,1
2 MODERATELY DEFOLIATED	87	–	3,7	11,9	–	8,5	11,9	6,8	16,1	15,7	18,0	18,0	0,0	13,6
	88	15,9	4,8	6,0	0,7	6,0	8,7	9,3	14,0	15,0	13,0	21,0	4,5	11,4
3 SEVERELY DEFOLIATED	87	–	0,3	0,7	–	0,9	0,6	0,7	0,8	?	5,0	4,0	0,0	1,1
	88	0,8	0,4	1,1	0,6	0,8	1,7	0,9	0,7	2,6	5,0	4,0	0,3	1,1
4 DEAD	87	–	0,2	0,0	–	0,3	0,0	0,4	0,1	?	0,0	0,0	0,0	0,1
	88	0,3	0,5	0,0	0,0	0,1	0,0	0,1	0,2	0,7	0,0	0,0	0,0	0,4

DIAGRAM 1

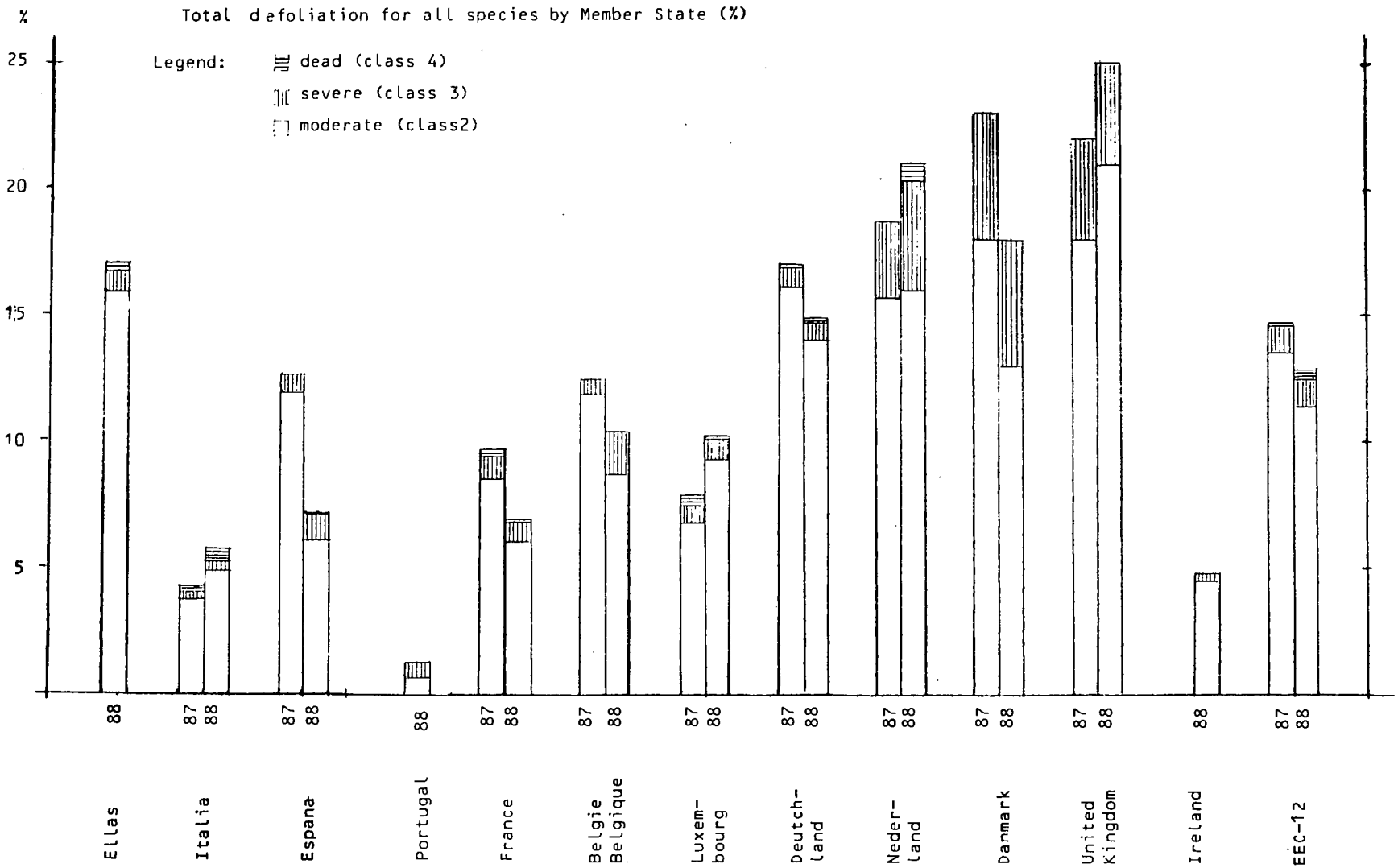

%
Total defoliation for all species by Member State (%)
Legend:
dead (class 4)
severe (class 3)
moderate (class2)
25
20
15
10
5
87
88
Ellas
Italia
Espana
Portugal
France
Belgie Belgique
Luxem-bourg
Deutch-land
Neder-land
Danmark
United Kingdom
Ireland
EEC-12

DIAGRAM 2

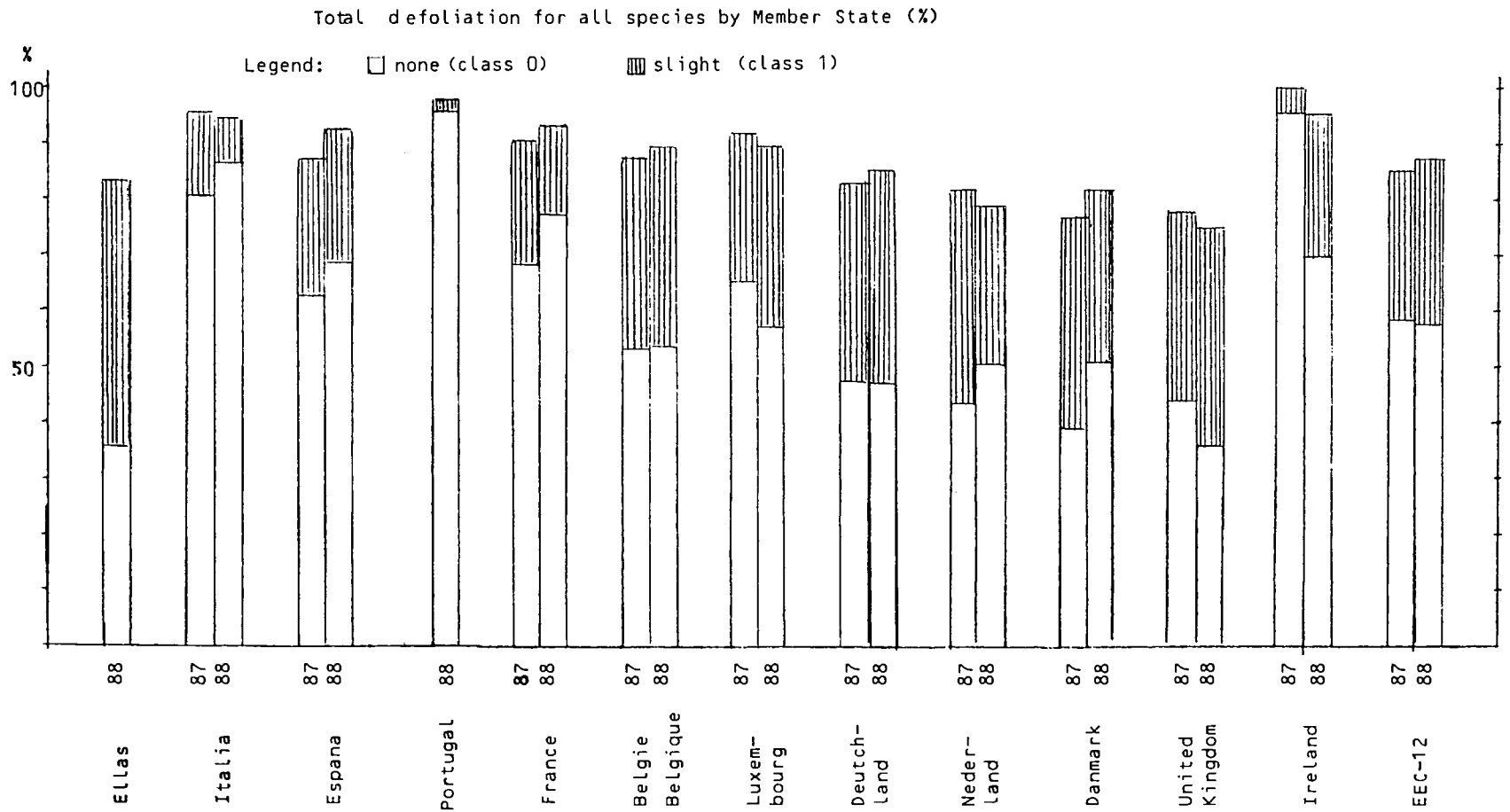

Total defoliation for all species by Member State (%)
Legend: none (class 0) slight (class 1)
%
100
50
87 88
Ellas
Italia
Espana
Portugal
France
Belgie Belgique
Luxem-bourg
Deutch-land
Neder-land
Danmark
United Kingdom
Ireland
EEC-12

TABLE 3

PERCENTAGES OF TOTAL DISCOLOURATION FOR ALL SPECIES BY MEMBER STATE

MEMBER STATE / DISCOLORATIION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0 NOT DISCOLOURED	87	–	88,8	72,3	–	85,2	88,8	88,4	95,7	69,2	96,0	80,0	97,8	86,2
	88	64,2	90,0	83,7	95,9	88,4	88,3	78,2	94,8	54,9	97,0	78,0	68,6	87,0
1 SLIGHTLY DISCOLOURED	87	–	6,9	20,8	–	?	4,6	11,2	3,3	24,3	3,0	15,0	1,7	10,3
	88	28,1	6,6	15,4	3,5	8,9	9,4	18,3	4,1	38,9	2,0	16,0	30,5	10,8
2 MODERATELY DISCOLOURED	87	–	4,1	6,0	–	?	5,6	0,3	0,8	2,9	1,0	5,0	0,5	3,1
	88	7,5	3,0	0,8	0,6	2,1	1,9	3,5	0,9	2,7	1,0	5,0	0,9	2,0
3 SEVERELY DISCOLOURED	87	–	0,2	0,9	–	?	1,0	0,1	0,1	3,6	0,0	0,0	0,0	0,4
	88	0,2	0,4	0,1	0,0	0,6	0,4	0,0	0,1	2,8	0,0	1,0	0,0	0,2

2. All broadleaved species by Member State

For all broadleaved species together (table 4) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 4% (Italy) to 23% (the Netherlands) in 1987 and from 1% (Portugal) to 29% (Greece) in 1988. The largest decline between 1987 and 1988 (increase of trees in defoliation classes 2 + 3 + 4) was of 3% (the Netherlands) and the largest recovery was of 7% (Denmark, Spain).

Table 5 shows the discoloration for all broadleaved species together in each Member State. The proportion of trees showing signs of discoloration is for some Member States quite different from that of defoliation. Denmark had hardly any discoloration in both of the two years, while the defoliation was appreciable.

3. All coniferous species by Member State

For all coniferous species together (table 6) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 0% (Ireland) to 24% (Denmark) in 1987 and from 2% (Portugal) to 27% (United Kindgom) in 1988.

The largest decline between 1987 and 1988 (increase of trees in defoliation classes 2 + 3 + 4) was of 7% (Luxembourg) and the largest recovery was of 3% (Spain, Denmark).

Table 7 shows the discoloration for all coniferous species together in each Member State.

The proportion of trees showing signs of discoloration is for some Member States quite different from that of defoliation. German and Denmark have little discoloration, but appreciable defoliation, and Ireland and Greece have on the contrary, appreciable discoloration with little defoliation.

4. Broadleaved species over and under 60 years of age

For broadleaved species under 60 years (table 8) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 5% (Luxembourg) to 24% (Denmark) in 1987 and from 0% (Portugal) to 28% (Greece) in 1988. The largest decline between 1987 and 1988 (increase in percentage of trees in defoliation classes 2 + 3 + 4) was of 4% (the Netherlands) and the largest recovery was of 12% (Denmark).

TABLE 4

DEFOLIATION FOR ALL BROADLEAVED SPECIES BY MEMBER STATE (%)

DEFOLIATION CLASS	MEMBER STATE		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIË/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY DEFOLIATED	87	–	96,0	86,3	–	–	84,0	90,3	80,8	77,2	79,0	80,0	–	87,4
		88	71,5	94,4	93,1	99,2	94,7	89,9	90,2	83,5	74,6	86,0	80,0	–	90,3
2	MODERATELY DEFOLIATED	87	–	3,4	13,1	–	–	15,1	8,5	18,4	19,1	20,0	19,0	–	11,8
		88	27,1	4,5	5,8	0,0	4,3	8,4	9,0	15,7	20,3	13,0	18,0	–	8,6
3	SEVERELY DEFOLIATED	87	–	0,3	0,6	–	–	0,9	0,8	0,7	?	1,0	1,0	–	0,6
		88	1,1	0,5	1,1	0,8	1,0	1,6	0,6	0,7	4,4	1,0	2,0	–	0,7
4	DEAD	87	–	0,3	0,0	–	–	0,0	0,4	0,1	?	0,0	0,0	–	0,2
		88	0,3	0,6	0,0	0,0	0,0	0,0	0,2	0,1	0,7	0,0	0,0	–	0,4

TABLE 5

DISCOLOURATION FOR ALL BROADLEAVED SPECIES BY MEMBER STATE (%)

MEMBER STATE / DISCOLORATIION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIË/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0 NOT DISCOLOURED	87	–	90,8	65,3	–	–	83,7	83,1	96,3	63,2	100,0	87,0	–	85,1
	88	55,5	91,2	88,5	96,2	91,7	84,1	72,3	94,1	57,0	99,0	81,0	–	88,6
1 SLIGHTLY DISCOLOURED	87	–	5,2	26,9	–	–	6,6	16,3	2,8	29,0	0,0	11,0	–	11,1
	88	33,5	5,5	10,8	2,9	5,5	11,5	23,4	4,8	33,4	1,0	16,0	–	9,0
2 MODERATELY DISCOLOURED	87	–	3,8	7,0	–	–	8,2	0,6	0,8	4,3	0,0	2,0	–	3,5
	88	10,8	2,9	0,6	0,9	2,1	3,7	4,3	1,0	5,3	0,0	3,0	–	2,1
3 SEVERELY DISCOLOURED	87	–	0,2	0,8	–	–	1,5	0,0	0,1	3,5	0,0	0,0	–	0,3
	88	0,2	0,4	0,1	0,0	0,7	0,7	0,0	0,1	4,3	0,0	0,0	–	0,3

TABLE 6

DEFOLIATION FOR ALL CONIFEROUS SPECIES BY MEMBER STATE (%)

DEFOLIATION CLASS	MEMBER STATE		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY DEFOLIATED	87	–	95,1	89,3	–	–	95,3	96,2	84,1	84,0	76,0	77,0	100,0	83,4
		88	92,3	93,8	92,7	98,3	90,9	89,2	89,1	86,0	85,5	79,0	73,0	95,2	84,5
2	MODERATELY DEFOLIATED	87	–	4,6	9,9	–	–	4,7	3,1	14,9	14,0	16,0	18,0	0,0	15,0
		88	6,8	5,7	6,2	1,5	8,0	9,0	9,6	13,2	12,1	14,0	22,0	4,5	13,7
3	SEVERELY DEFOLIATED	87	–	0,3	0,8	–	–	0,0	0,5	0,8	?	8,0	5,0	0,0	1,5
		88	0,6	0,4	1,1	0,2	0,8	1,8	1,1	0,6	1,7	7,0	5,0	0,3	1,5
4	DEAD	87	–	0,0	0,0	–	–	0,0	0,2	0,2	?	0,0	0,0	0,0	0,1
		88	0,3	0,1	0,0	0,0	0,3	0,0	0,2	0,2	0,7	0,0	0,0	0,0	0,3

TABLE 7

DISCOLOURATION FOR ALL CONIFEROUS SPECIES BY MEMBER STATE (%)

MEMBER STATE / DISCOLORATIION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0 NOT DISCOLOURED	87	–	81,7	79,0	–	–	100,0	96,8	95,5	72,2	93,0	76,0	97,8	87,1
	88	71,2	86,2	79,1	96,4	84,7	89,2	88,7	95,4	53,8	96,0	76,0	68,6	85,4
1 SLIGHTLY DISCOLOURED	87	–	13,1	14,8	–	–	0,0	3,2	3,5	21,9	5,0	17,0	1,7	9,7
	88	23,7	10,4	19,7	3,4	13,2	9,0	9,4	3,7	41,8	3,0	16,0	30,5	12,5
2 MODERATELY DISCOLOURED	87	–	5,1	5,2	–	–	0,0	0,0	0,8	2,2	2,0	6,0	0,5	2,8
	88	4,8	3,1	1,0	0,2	1,8	1,8	1,9	0,8	1,3	1,0	5,0	0,9	1,9
3 SEVERELY DISCOLOURED	87	–	0,1	1,0	–	–	0,0	0,0	0,1	3,7	0,0	1,0	0,0	0,4
	88	0,3	0,3	0,2	0,0	0,3	0,0	0,0	0,1	3,1	0,0	1,0	0,0	0,2

TABLE 8

DEFOLIATION FOR ALL BROADLEAVED SPECIES LESS THAN 60 YEARS BY MEMBER STATE (%)

DEFOLIATION CLASS	MEMBER STATE	ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	–	–	89,9	–	–	90,6	95,1	89,2	82,2	76,0	83,0	–	90,6
	88	72,0	–	93,3	99,9	94,9	96,1	92,0	92,3	78,0	88,0	88,0	–	93,3
2 MODERATELY DEFOLIATED	87	–	–	9,3	–	–	8,1	3,3	10,1	15,4	22,0	15,0	–	8,7
	88	26,9	–	5,5	0,0	3,9	3,5	5,9	7,1	17,7	10,0	10,0	–	5,7
3 SEVERELY DEFOLIATED	87	–	–	0,7	–	–	1,3	0,8	0,6	?	2,0	2,0	–	0,4
	88	0,9	–	1,2	0,1	1,2	0,4	1,6	0,5	3,7	2,0	2,0	–	0,7
4 DEAD	87	–	–	0,1	–	–	0,0	0,6	0,1	?	0,0	0,0	–	0,3
	88	0,2	–	0,0	0,0	0,0	0,0	0,5	0,1	0,6	0,0	0,0	–	0,3

For broadleaved species of 60 years or more (table 9) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 11% (Luxembourg) to 45% (United Kingdom) in 1987 and from 2% (Portugal) to 38% (the Netherlands) in 1988. The largest decline (increase in percentage of trees in defoliation classes 2 + 3 + 4) was of 3% (the Netherlands) and the largest recovery was of 10% (Spain).

A comparison of the two age classes (broadleaved species under 60 years and of 60 years or more) mentioned above shows that with one exception (Denmark in 1987), the proportion of defoliated, broadleaved species is higher for trees of 60 years or more than for those under 60. In 1987 this better performance of younger trees (smaller percentage of trees under 60 years as compared to trees of 60 years or more in defoliation classes 2 + 3 + 4) ranged from 28% (United Kingdom) to 7% (Luxembourg, Spain) with Denmark as the only exception. In 1988 the corresponding better performance of younger trees ranged from 25% (United Kingdom) to less than 1% (France).

The over-performance of younger, broadleaved trees dropped between 3 and 5% from 1987 to 1988 in Spain, Luxembourg and the United Kingdom; it was largely constant in Belgium, Germany and the Netherlands; Denmark was an exception, switching from under-performance to over-performance of younger, broadleaved species.

5. Coniferous species over and under 60 years of age

For coniferous species under 60 years (table 10) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 0% (Ireland) to 23% (United Kingdom) in 1987 and from 2% (Portugal) to 28% (United Kingdom) in 1988. The largest decline between 1987 and 1988 (increase in percentage of trees in defoliation classes 2 + 3 + 4) was of 5% (Belgium, Denmark, Ireland) and the largest recovery was of 3% (Spain).

For coniferous species of 60 years or more (table 11) in 1987 the percentage of trees in defoliation classes 2 + 3 + 4 range from 5% (Spain) to 30% (Germany) and 55% (Denmark), but the latter figure is based on only 31 trees. In 1988 the corresponding range was from 2% (Portugal) to 30% (Luxembourg) and 34% (Denmark), but the latter figure is based on only 24 trees.

The very small sample in Denmark and the absence of figures from the United Kingdom and Ireland for coniferous species of 60 years or more is due to the relative short rotation age often applied to coniferous species.

TABLE 9

DEFOLIATION FOR ALL BROADLEAVED SPECIES OF 60 YEARS OR MORE BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	–	–	83,2	–	–	77,8	88,6	74,3	65,5	84,0	55,0	–	80,9
	88	70,6	–	92,9	98,2	94,5	83,3	89,6	76,5	62,1	83,0	63,0	–	87,3
2 MODERATELY DEFOLIATED	87	–	–	16,4	–	–	21,6	10,3	24,8	27,8	16,0	39,0	–	17,6
	88	27,2	–	6,3	0,0	4,9	13,7	10,2	22,6	29,8	17,0	32,0	–	11,5
3 SEVERELY DEFOLIATED	87	–	–	0,4	–	–	0,6	0,8	0,8	?	0,0	6,0	–	1,2
	88	1,6	–	0,8	1,8	0,6	3,0	0,2	0,8	6,9	0,0	5,0	–	1,1
4 DEAD	87	–	–	0,0	–	–	0,0	0,3	0,1	?	0,0	0,0	–	0,3
	88	0,6	–	0,0	0,0	0,0	0,0	0,0	0,1	1,2	0,0	0,0	–	0,1

TABLE 10

DEFOLIATION FOR ALL CONIFEROUS SPECIES LESS THAN 60 YEARS BY MEMBER STATE

DEFOLIATION CLASS	MEMBER STATE		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIË/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY DEFOLIATED	87	–	–	87,7	–	–	95,3	98,4	93,7	83,6	80,0	77,0	100,0	89,5
		88	92,7	–	92,6	98,2	95,6	90,1	95,5	93,9	84,7	80,0	72,0	95,2	91,6
2	MODERATELY DEFOLIATED	87	–	–	11,4	–	–	4,7	0,8	5,8	14,3	14,0	18,0	0,0	9,3
		88	6,5	–	6,4	1,6	4,0	8,5	3,5	5,7	12,8	13,0	23,0	4,5	7,1
3	SEVERELY DEFOLIATED	87	–	–	0,9	–	–	0,0	0,4	0,3	?	6,0	5,0	0,0	1,2
		88	0,8	–	1,0	0,2	0,4	1,4	0,8	0,3	2,0	7,0	5,0	0,3	1,1
4	DEAD	87	–	–	0,0	–	–	0,0	0,4	0,2	?	0,0	0,0	0,0	0,0
		88	0,0	–	0,0	0,0	0,0	0,0	0,2	0,1	0,5	0,0	0,0	0,0	0,2

TABLE 11

DEFOLIATION FOR ALL CONIFEROUS SPECIES OF 60 YEARS OR MORE BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK (a)	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	-	-	95,1	-	-	-	89,2	69,8	85,3	45,0	-	-	72,9
	88	92,1	-	93,2	98,3	84,4	81,5	70,4	74,1	88,0	66,0	-	-	80,4
2 MODERATELY DEFOLIATED	87	-	-	4,4	-	-	-	10,1	28,6	13,1	32,0	-	-	25,1
	88	7,1	-	5,4	1,5	13,6	13,0	27,5	24,3	9,9	17,0	-	-	18,2
3 SEVERELY DEFOLIATED	87	-	-	0,5	-	-	-	0,7	1,5	?	23,0	-	-	1,7
	88	0,3	-	1,4	0,2	1,3	5,6	1,9	1,2	1,0	17,0	-	-	1,0
4 DEAD	87	-	-	0,0	-	-	-	0,0	0,1	?	0,0	-	-	0,3
	88	0,5	-	0,0	0,0	0,6	0,0	0,2	0,4	1,1	0,0	-	-	0,4

(a) small sample

A comparison of the two age classes (coniferous species under 60 years and of 60 years or more) shows that with four exceptions (Spain and the Netherlands in both years), the proportion of defoliated coniferous species is higher for trees of 60 years or more than for those under 60 years. For Portugal there is no difference between the 2 age classes.

In 1987 this better performance of younger trees (smaller percentage of trees under 60 years as compared to trees of 60 years or more in defoliation classes 2 + 3 + 4) was of 35% (Denmark), 24% (Germany), 8% (Luxembourg), with the Netherlands (- 2%) and Spain (- 7%) having the reverse tendency. In 1988 this comparison is possible for more Member States and the over-performance of younger trees ranges from 25% (Luxembourg), 20% (Germany) down to 1% (Greece) and 0% (Portugal), with the Netherlands and Spain again having the opposite trend (- 3% and - 1% respectively.

The over-performance of younger coniferous trees dropped by 21% (Denmark), 4% (Germany) between the two years while it increased by 17% in Luxembourg. The under-performance of younger trees in Spain in 1987 was largely irradicated in 1988 (a drop of 7%) while it was emphasised in the Netherlands (+ 2%).

6. Defoliation by genus and Member State
(Picea, Pinus, Larix, Abies, Fagus and Quercus)

For Picea (spruce) (table 12) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 0% (Ireland) to 23% (the Netherlands) in 1987 and from 3% (Ireland, Italy) to 31% (United Kingdom) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 11% (United Kingdom) and the largest recovery was of 6% (Denmark).

For Pinus (pine) (table 13) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 4% (Belgium) to 41% (United Kingdom) in 1987 and from 2% (Portugal) to 16% (France) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 7% (Belgium) and the largest recovery was of 9% (United Kingdom).

For Larix (larch) (table 14) where results are only available from a few Member States, the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 2% (France) to 8% (United Kingdom) in 1987 and from 2% (France) to 18% (United Kingdom) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 10% (United Kingdom) and the largest recovery was less than 1% (France).

TABLE 12

DEFOLIATION FOR PICEA BY MEMBER STATE (%)

DEFOLIATION CLASS	MEMBER STATE		ELLAS	ITALIA (a)	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND (a)	DANMARK	UNITED KINGDOM (b)	IRELAND (c)	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY	87	–	96,7	–	–	91,9	–	95,9	83,0	77,1	82,0	80,0	100,0	79,3
	DEFOLIATED	88	–	96,7	–	–	96,3	–	88,4	85,5	82,5	88,0	69,0	96,6	80,8
2	MODERATELY	87	–	3,3	–	–	7,0	–	3,4	16,4	18,9	13,0	16,0	0,0	19,5
	DEFOLIATED	88	–	3,3	–	–	3,3	–	10,2	13,9	14,6	7,0	24,0	3,4	17,9
3	SEVERELY	87	–	0,0	–	–	0,7	–	0,5	0,5	?	5,0	4,0	0,0	1,2
	DEFOLIATED	88	–	0,0	–	–	0,4	–	1,1	0,5	2,5	5,0	7,0	0,0	1,2
4	DEAD	87	–	0,0	–	–	0,3	–	0,2	0,1	?	0,0	0,0	0,0	0,0
		88	–	0,0	–	–	0,0	–	0,3	0,1	0,4	0,0	0,0	0,0	0,1

(a) Picea abies
(b) Picea sitchensis
(c) Picea abies + Picea sitchensis

TABLE 13

DEFOLIATION FOR PINUS BY MEMBER STATE (%)

DEFOLIATION CLASS		MEMBER STATE	ELLAS	ITALIA	ESPAÑA (a)	PORTUGAL (d)	FRANCE	BELGIE/ BELGIQUE (b)	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND (b)	DANMARK	UNITED KINGDOM (c)	IRELAND	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY DEFOLIATED	87	–	93,6	88,3	–	85,7	95,8	–	88,1	86,9	–	58,8	–	87,4
		88	95,3	92,3	92,7	98,3	84,5	89,1	–	88,4	89,4	–		92,7	88,4
2	MODERATELY DEFOLIATED	87	–	5,7	11,0	–	12,3	4,2	–	10,8	11,7	–	31,3	–	11,2
		88	4,5	6,4	6,3	1,5	13,5	9,1	–	10,6	9,0	–		6,7	9,4
3	SEVERELY DEFOLIATED	87	–	0,7	0,7	–	1,3	0,0	–	0,8	?	–	9,9	–	1,4
		88	0,2	1,3	1,0	0,2	1,6	1,8	–	0,6	0,8	–		0,6	1,7
4	DEAD	87	–	0,0	0,0	–	0,7	0,0	–	0,3	?	–	0,0	–	0,0
		88	0,0	0,0	0,0	0,0	0,4	0,0	–	0,4	0,8	–		0,0	0,5

(a) Pinus pinaster + P. halepensis + P. sylvestris + P. nigra + P. pinea
(b) Pinus nigra + P. sylvestris
(c) Pinus sylvestris + P. contorta
(d) Pinus sylvestris + P. pinaster + P. pinea

TABLE 14

DEFOLIATION FOR LARIX BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM (a)	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87		95,8			97,6				-		92,0		94,6
	88		91,2			98,3				94,5		82,0		90,0
2 MODERATELY DEFOLIATED	87		4,2			2,4				-		7,0		5,2
	88		8,5			1,7				4,6		17,0		9,6
3 SEVERELY DEFOLIATED	87		0,0			0,0				-		1,0		0,0
	88		0,0			0,0				1,0		1,0		0,0
4 DEAD	87		0,0			0,0				-		0,0		0,2
	88		0,3			0,0				0,0		0,0		0,4

(a) Larix kaempferi (leptolepis)

For Abies (fir) (table 15) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 7% (Italy) to 48% (Germany) in 1987 and from 6% (Italy) to 45% (Germany) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was less than 1% (France) and the largest recovery was of 4% (Germany). Also for this species results were only available from a few Member States.

For Fagus (beech) (table 16) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 0% (Spain, Italy) to 46% (Belgium) in 1987 and from 2% (Spain) to 24% (Greece) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 4% (Italy) and the largest recovery was of 41% (Belgium).

For Deciduous Quercus (oak) (table 17) the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 1% (Spain) to 42% (United Kingdom) in 1987 and from 0% (Portugal) to 44% (United Kingdom) in 1988. The largest decline between 1987 and 1988 (increase of percentage of trees in defoliation classes 2 + 3 + 4) was of 12% (Spain) and the largest recovery was of 5% (Belgium).

The situation for Evergreen Quercus (oak) (table 18) is relatively good in the three Member States from which results are available; the percentage of trees in defoliation classes 2 + 3 + 4 ranges from 0% to 18% and from 0% to 8% in the two years respectively.

D. Summary information regarding possible causes of observed damage

A chapter on possible causes of observed damage is included in the National Report of each Member State.

In their reports most Member States point to a variety of causes, most common of which are insects, fungi, climatic stress and nutrient deficiency.

Air pollutants and related leaching and soil toxicity are mentioned as a possible cause by some Member States, but most of them avoid any definite conclusion in this respect.

Among other causes mentioned by a few Member States are storms, fires, grazing, management and tree-provenance.

The effects on the trees of climate, insects, fungi, etc. are not questioned by any Members States in their National Reports, while the effectof air pollution and its interaction with other stress factors is debated. Some selected and abbreviated quotations from the National Reports may serve to illustrate the variety of opinions put forward concerning air pollution.

TABLE 15

DEFOLIATION FOR ABIES BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	-	93,5			83,7			51,6					66,2
	88	88,4	94,0			82,9			55,5					69,5
2 MODERATELY DEFOLIATED	87	-	6,5			15,8			42,9					27,3
	88	9,9	6,0			15,5			39,8					27,1
3 SEVERELY DEFOLIATED	87	-	0,0			2,1			4,7					5,9
	88	1,1	0,0			1,0			4,3					2,1
4 DEAD	87	-	0,0			0,4			0,8					0,6
	88	0,6	0,0			0,5			0,4					1,3

TABLE 16

DEFOLIATION OF FAGUS BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS			ELLAS (a)	ITALIA	ESPAÑA	PORTUGAL	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1	NOT OR SLIGHTLY DEFOLIATED	87	–	99,8	100,0	–	91,8	53,8	87,4	78,7	69,1	77,0	88,2	–	84,9
		88	75,8	96,2	98,4	–	97,0	94,5	91,7	83,5	78,1	84,0	88,0	–	87,8
2	MODERATELY DEFOLIATED	87	–	0,0	0,0	–	7,5	38,5	11,5	20,7	26,7	23,0	17,0	–	14,3
		88	23,7	3,3	1,1	–	2,9	4,8	8,3	16,0	19,1	16,0	11,0	–	11,5
3	SEVERELY DEFOLIATED	87	–	0,2	0,0	–	0,5	7,7	0,8	0,6	?	0,0	1,0	–	0,8
		88	0,5	0,3	0,5	–	0,2	0,7	0,0	0,5	2,4	0,0	1,0	–	0,6
4	DEAD	87	–	0,0	0,0	–	0,2	0,0	0,3	0,0	?	0,0	0,0	–	0,0
		88	0,0	0,2	0,0	–	0,0	0,0	0,0	0,0	0,4	0,0	0,0	–	0,1

(a) Fagus moesiaca + F. sylvatica

TABLE 17

DEFOLIATION FOR DECIDUOUS QUERCUS BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS (d)	ITALIA	ESPAÑA (b)	PORTUGAL (e)	FRANCE	BELGIE/ BELGIQUE (c)	LUXEM-BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND (a)	DANMARK	UNITED KINGDOM (a)	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87	–	94,9	99,0	–	94,8	81,2	92,2	77,9	69,4		58,0	–	88,0
	88	68,1	94,3	87,0	100,0	96,9	86,0	88,6	76,0	63,0		56,0	–	86,7
2 MODERATELY DEFOLIATED	87	–	4,9	1,0	–	4,6	18,8	6,6	21,4	25,5		38,0	–	11,3
	88	29,5	5,2	7,2	0,0	2,9	11,5	9,8	22,9	29,0		39,0	–	12,0
3 SEVERELY DEFOLIATED	87	–	0,2	0,0	–	0,5	0,0	0,8	0,5	?		4,0	–	0,5
	88	1,8	0,2	5,8	0,0	0,2	2,5	1,2	1,0	6,8		5,0	–	0,9
4 DEAD	87	–	0,1	0,0	–	0,1	0,0	0,4	0,1	?		0,0	–	0,2
	88	0,6	0,3	0,0	0,0	0,0	0,0	0,4	0,1	1,2		0,0	–	0,4

(a) Quercus robur
(b) Quercus pyrenaica
(c) Quercus robur + Quercus subra (borealis)
(d) Quercus frainetto + Q. robur + Q. petrea
(e) Quercus pyrenaica

TABLE 18

DEFOLIATION FOR EVERGREEN QUERCUS BY MEMBER STATE (%)

MEMBER STATE / DEFOLIATION CLASS		ELLAS	ITALIA	ESPAÑA (a)	PORTUGAL (b)	FRANCE	BELGIE/ BELGIQUE	LUXEM- BOURG	BUNDESREP. DEUTSCHLAND	NEDERLAND	DANMARK	UNITED KINGDOM	IRELAND	EEC-12 COMMUNITY SURVEY
0+1 NOT OR SLIGHTLY DEFOLIATED	87		100,0	81,8										
	88		100,0	92,4	100,0									
2 MODERATELY DEFOLIATED	87		0,0	17,5										
	88		0,0	7,0	0,0									
3 SEVERELY DEFOLIATED	87		0,0	0,7										
	88		0,0	0,6	0,0									
4 DEAD	87		0,0	0,0										
	88		0,0	0,0	0,0									

(a) Quercus ilex + Q. suber
(b) Quercus suber + Q. rotundifolia

Germany: " . . . adverse substances in the air and their reaction products are involved in the new type of forest decline . . . a complex of biotic and abiotic factors are responsible and air pollutants play an important role there although the importance of the single factors can vary considerably with time and site . . . all attempts to explain forest decline neglecting air pollutants have after appropriate scrutiny been turned down or rest unproven. . . . the most important adverse substances are sulphur oxide and nitrogen compounds as well as the acids and photoxidants they form in the air. The combined effect of more adverse substances, additive or even synergistic effects, deserves special attention . . .

The noxious effect of air pollution works in two ways: directly and by means of acid and nitrogen in the soil . . . Forest ecosystems will be exposed to a higher load of air pollutants than will the surrounding open land. This is due to the height of the trees, their filter effect, etc. . . . evidence has been collected as to the harmful effect of photo-oxidants (e.g. ozone) and acidification . . . a reduction of the soil content of interchangeable bases and an increase in the content of inter-changeable acids and acid formers can be verified . . . Acidification can lead to aluminium and heavy metals in the ground and in water sources."

United Kingdom: "Detailed analysis of the results of the 1987 forest damage surveys undertaken in the United Kingdom suggests that the main factors affecting the crown densities of trees are climatic. While air pollution may be having some effect on the trees, it is not easy to distinguish any such effect from those caused by other factors."

Ireland: "Difficulties arise in attributing defoliation and diss-colouration specifically to the effects of atmospheric pollution. In most plots of the current survey, needle loss and yellowing were generally attributed to insect or fungal activity, nutrient deficiency or climatic stress.

As in the defoliation, the discolouration was generally attributed to factors other than atmospheric pollution. The yellowing in the spruces was mostly caused by green spruce aphid attack with some slight nutrient deficiency symptoms."

Greece: "So far we have not observed damages resembling those attributed to air pollution."

The Netherlands: "Concerning air pollution it should be noted that this may emphasise or weaken the effect of traditional factors. Preliminary results from ongoing research show that the effect of air pollution is serious. It can be established that the vitality of forest in the Netherlands is influenced by air pollution inter alia."

Denmark: " . . . the improvement between 1987 and 1988 may probably be attributed mainly to abundant rain in the growing season and the absence of storms for some years . . . Research has shown that air pollution can directly harm the trees by way of deposition on the foliage . . . this requires however concentrations of pollutants not normally seen in Denmark.

Besides, air pollution has an indirect action because the gases dissolved in precipitation render it acidic so that the soil and later the trees will be influenced by way of leaching. This will first be seen on oligotroph soils. It is uncertain whether the indirect effect of air pollution has already manifested itself in the northwestern part of Jutland (oligotroph soils), as a number of other known damaging agents occur at the same time. It is difficult to distinguish between the reasons behind defoliation, as the damaging agents act in combination - it is the total stress on a tree that decides its state of health."

Italy: "Among the possible causes behind forest damage in Italy are, of course, all factors for which a toxic effect on vegetation has been demonstrated (SO2, NOx, cations of heavy metals, etc.) or factors where such an effect is only yet a hypothesis (electro-magnetism, radioactivity, CO2, etc.)."

France: "One should not exclude the hypothesis that atmospheric pollution may have contributed to those effects (repercussions of earlier dryness) thus preventing restoration of trees that otherwisse had overcome the consequences of the drought: it has in fact been demonstrated experimentally that most pollutants act synergetically with climatic problems, coldness or water deficiency."

E. EPILOGUE

A compilation of the data from the National Reports of the Member States allows analysis of the development from 1987 to 1988 and a comparison between Member States. Analysis of other trends, as carried out for the Community net, is not possible for the data from the National Reports.

As to a possible evolution in time for the national results, it is difficult to draw any definite conclusions yet. Firstly, because one year is too short a period and secondly because the survey nets inside some Member States were modified between the two years. So even though the present National Reports are based on more data than is the Community network (and especially the common sample trees thereof: CST) they are likely to be less suited to indicate Community-wide damage evolution.

Exmaination of the data, however, does not suggest that the situation has deteriorated from 1987 to 1988; a conclusion that is in line with the results of the Community survey.

A comparison between Member States shows that neighbouring countries often have similar damage pictures; pronounced exceptions to this tendency however exist. This tendency to similarity between neighbouring countries is indeed to be expected as climate, soil conditions, some biotic damaging agents, and long range air pollution are to a large extent transboundary. The similarity between neighbouring countries may indeed be taken as a confirmation of the feasibility of the applied survey method, including eye-estimation of the damage.

First analysis of the data from the Community Network however suggests that the state of health of forests varies with a multitude of factors such as climate and other site characteristics, abiotic or biotic damaging agents, and the use of observers operating nationally/regionally may have contributed to some bias between Member States too. For these reasons as well as because of the very short time period available, it is premature to draw conclusions as to differences between individual Member States. The present compilation however is an important complement to the results of the Community network, particularly at national and regional level.

ANNEX 1

The research into effects of air pollution on forests in the framework of the Community's Research and Development Programmes

Since 1984 research into causes of the deteriorating health of forests has been the subject of European projects financed and coordinated by the Commission in the framework of its Research and Development Programmes on environmental protection. The scientific work relates to (a) an objective, precise description of the symptoms observed, which takes account of their development over time and their spatial variations, (b) a thorough knowledge of the environmental, natural and human factors likely to influence the health of forests, (c) the search for early indicators, which might indicate the specific simple (a single determining factor) or complex (several determining factors) cause-and-effect relationships, thus taking account of synchronic or asynchronic interactions between the factors, and (d) a thorough investigation and verification of all the main hypotheses put forward to explain the deterioration of the health of forests, namely:

- the multiple stress hypothesis,
- acidification of the soil,
- the direct ozone effect, in combination with acid deposition,
- mineral deficiencies,
- excessive deposition of nitrogen compounds,
- the influence of climatic and weather factors,

and the variants and combinations of those hypotheses.

Substantial scientific progress has been made in respect of the investigation and verification of all the hypotheses, both as regards the theoretical study (laboratory work) of the physiological and ecological mechanisms to which those hypotheses relate and as regards the occurrence of such mechanisms in forests.

Alongside investigation of the hypotheses, major scientific progress has also been made as regards knowledge of the environmental factors likely to play a part in the deterioration process (soil, climate, meteorology, pollution climate, forestry cultivation methods). In many cases, differences by region were established. This factor proved to be of the highest importance as regards in particular the choice of explanatory hypotheses. On the other hand, a precise and objective comparative description of the symptoms and of their development was made possible thanks to the coordinated research programme.

Progress made is described in detail in Commission Scientific documents published in the framework of the Research and Development Programmes on environmental protection between 1985 and 1988 (list appended); A summary of that work is currently being prepared.

PUBLICATIONS

Indirect effects of air pollution on forest trees Root-rhizoshere interaction	XII/ENV/24/86
Direct effects of dry and wet deposition on forest ecosystems – canopy interactions Air pollution research report n° 4	EUR 11264
Air pollution and Ecosystems Air pollution research report n° 7	EUR 11244
Microclimate and plant growth in Open-Top Chambers Air pollution research report n° 5	EUR 11257
Pollution climates in Europe and their perception by terrestrial ecosystems Air pollution research report n° 6	EUR 11432
Relationships between above and below ground influences of air pollution on forest trees Air pollution research report n° 16	EUR 11738
Scientific basis of forest decline symptomatology Air pollution research report n° 15	EUR 11737

ANNEX 2

INITIATIVES AT COMMUNITY LEVEL IN RELATION TO REDUCTION OF ATMOSPHERIC POLLUTION

Regarding the reduction of atmospheric pollution, the activities of the Community have been orientated following three main lines:

1. Reduction of the emissions from non-moving sources;
2. Reduction of the emissions from moving sources;
3. Normalisation of products.

Non - moving pollution sources

The directive 88/609/EEC concerning the limitation of the emissions of pollutants into the air from large combustion installations is the first step towards a reduction of pollution coming from non moving sources.

This directive foresees for existing combustion installations a reduction of total annual emissions compared to 1980 quantities in three steps for SO2 (40% in 1993, 60% in 1998 and 70 % in 2003) and in two steps for the NOx (20% in 1993 and 40 % in 1998).

Derogations to these dispositions are foreseen for certain Member States considering their specific situations.

New installations (authorized after July 1987) will have to conform to limited emission values for the same pollutants and for solid particles.

Furthermore the Council achieved a political consensus on a proposal for a directive concerning the reduction of pollution by new installations for burning urban waste which foresees satisfactory norms of emissions of HCl; SO2 and solid particles.

A proposal for a directive concerning old installations has also been submitted to the Council.

2.Moving sources

Different directives have been adopted by the Council concerning the reduction of pollutant emissions by motor vehicles.

They mainly concern the emissions of CO, NOx, and combined emissions of NOx and hydrocarbons by particular vehicles equipped with a gas or diesel engine and by heavy vehicles equipped with diesel engines as well as the emissions of solid particles by vehicles equipped with diesel engines.

3. Product norms

The limitation of the content of certain products of polluting substances is foreseen by two directives fixing limit contents for Pb in gas and S in gas-oils.

Future development

The Commission will continue to attach particular importance to the reduction of atmospheric pollution coming from specific sources such as small combustion units (less tha 50 MW) and combustion units for toxic waste,and will continue its actions in the field of moving sources.

The Commission is studying the possibilities to combat photochemical pollution (O3 mainly) by reducing chemical precursors such as NOx and VOCs (volatile organic compounds).

Finally the reduction of so called green house gases belongs to the priorities of the Commission's working programme for reducing atmospheric pollution.

Information on the state of the environment in the European Community:

The CORINE programme

The Corine programme for gathering, coordinating and ensuring the consistency of information on the state of the environment and natural resources in the European Community was adopted by the Council by the decision n° 85/338/CEE of 27 June 1985 for a duration of 4 years.

The objectives of this programme follow three main axes:

- gathering of information on the state of the environment;
- coordination of initiatives whith the aim of improving the quality of the environment;
- ensuring the consistency and the comparability of data.

As far as atmospheric pollution is concerned, Corine, together with other institutions concerned such as OCDE has :
- contributed to the achievement of the cartographic OCDE and EC inventory of the emissions of SO2, NOx, VOC (reference year 1980);
- together with OCDE developed a common method and vocabulary and on this basis realised the inventory of emissions for the year 1985;
- contributed to the Benelux pilot project for mapping the atmospheric concentrations of different substances (NO2, SO2, Pb).

The Corine project completes the environmental policy of the Community and allows better observation, monitoring and verification of the evolution of the state of the environment in general.

FORM 1

Common forest damage inventory data to be forwarded to the Commission

Country (1)					Date of observation (6)								
Observation point number (2)					Actual latitude coordinate (7)								
Availability of water to principal species (3)					Actual longitude coordinate (7)								
Humus types (4)					Aspect (8)								
Altitude (5)					Mean age of predominant story (9)								

Sample tree number (10)	Species (11)	Defoliation (12)	Discolouration (13)	Easily identifiable causes of damage Type: T (14)								Identification of damage type if possible (15)	Other observations (16):
				T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8		
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For the replacing of trees of the sample see the form in Annex.

FORM 1 — Annex

Replaced trees [17]

Sample tree number [10]	Species [11]	Defoliation [12]	Discolouration [13]	Easily identifiable causes of damage Type: T [14]								Identification of damage type if possible [15]
				T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	
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European Communities — Commission

European Community: Forest health report, 1987-1988

Luxembourg: Office for Official Publications of the European Communities

1989 — IV, 132 pp., 19 illus. — 21.0 × 29.7 cm

ES, DA, DE, GR, EN, FR, IT, NL, PT

ISBN 92-826-0949-9

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This report gives the results of national forest health reports and the Community forest damage survey in 1987 and 1988. The aim of the report is to give an overview of the state of forest health in the European Community.

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