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1988 – 2002: 15 YEARS OF FOREST CROWN CONDITION MONITORING RESULTS IN GREECE

Economou A., Michopoulos P., Skouteri A. and A. Bourletsikas

Terma Alkmanos, 11528, Ilissia, Athens e-mail: oika@fria.gr

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1988-2002: 15 YEARS OF FOREST CROWN CONDITION MONITORING RESULTS IN GREECE

The forest condition monitoring in Greece is carried out annually, since 1988, according to the European Union regulation no. 3528/86 and the ICP-Forest manual. Here the results of the 1988 to 2002 monitoring are presented and discussed for all species and separately for broadleaves and conifers and for some of the major forest species of the country (fir, black pine, Aleppo pine, deciduous oaks and beech).

Key words: Forest crown condition, forest health, forest tree defoliation, crown transparency

Network of forest observation plots (Level I) in Greece

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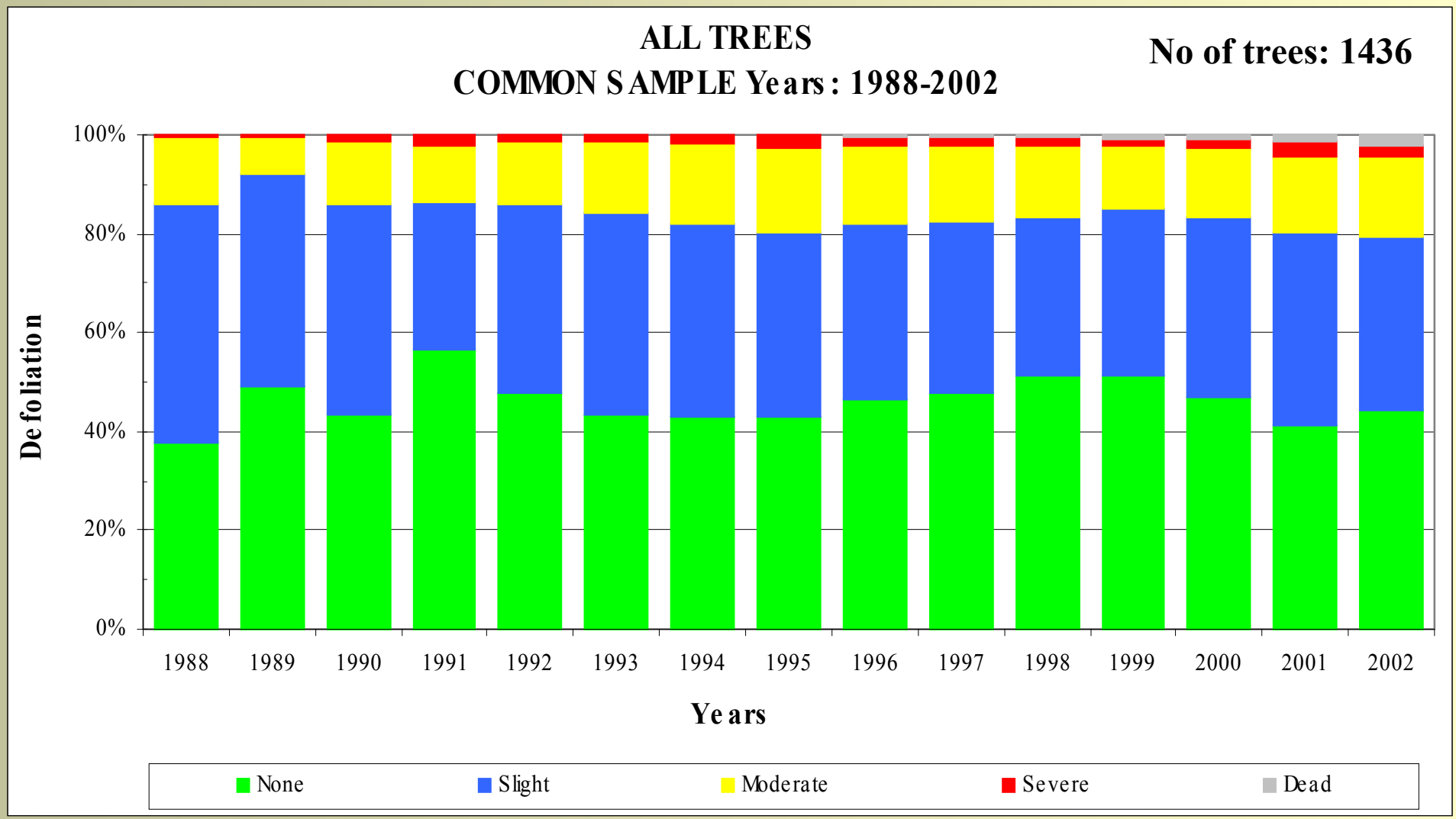

ALL ASSESSED TREES

1). When all forest trees are considered together, it seems that their condition has slightly deteriorated, especially for the trees in classes 2, 3 and 4. This is true particularly for conifers because of the fir trees decline and necrosis due to extreme weather conditions (drought, high temperatures, frost) and the intense insect attacks (*choristoneura murinana* et al.).

2). With regard to the fir trees, their condition has obviously deteriorated since the beginning of the monitoring, so has Aleppo pine but black pine has been in a better condition the last 3 years considering the mean tree defoliation.

3). The 1988 was a year with a very dry growing season and high temperatures (burning heat) as well as insect attacks (33.6% of the trees affected). During the period 1995 to 97 more than 30% of the trees were affected by insects, while more than 25% were also affected in 1992, 1993 and 2001.

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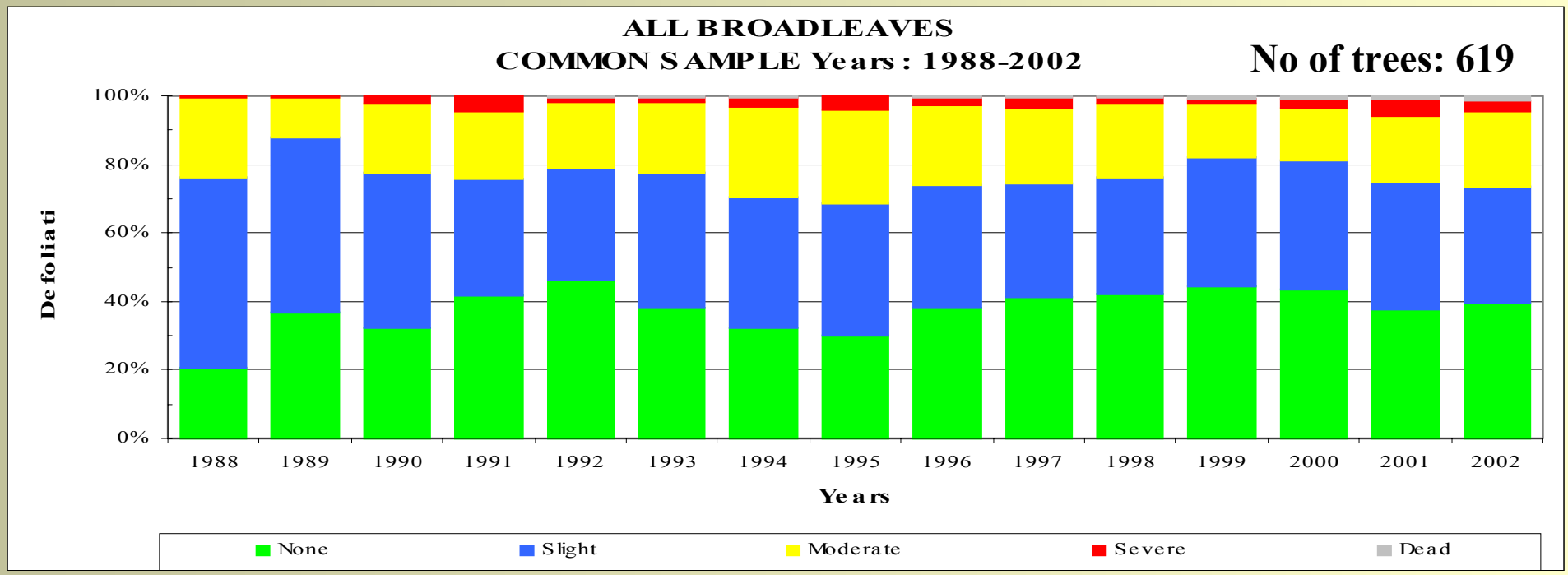

1). Broadleaves were found in their worst condition in 1988, a year with a very dry growing season and high temperatures, during which many branches and shoots of old oak trees growing on dry areas died. Then, decline was observed in 1990, 1993-95 and 2001-2.

2). The 1990, 1993, 2000 and 2001 were years with dry growing seasons too, but 1989, 1991 and 1999 were years with relatively high amounts of precipitation and the tree crown condition was improved.

3). The number of broadleaved trees in class 0 has slightly increased since the beginning of the monitoring, so have those in class 3 and 4 (severely damaged and dead, respectively).

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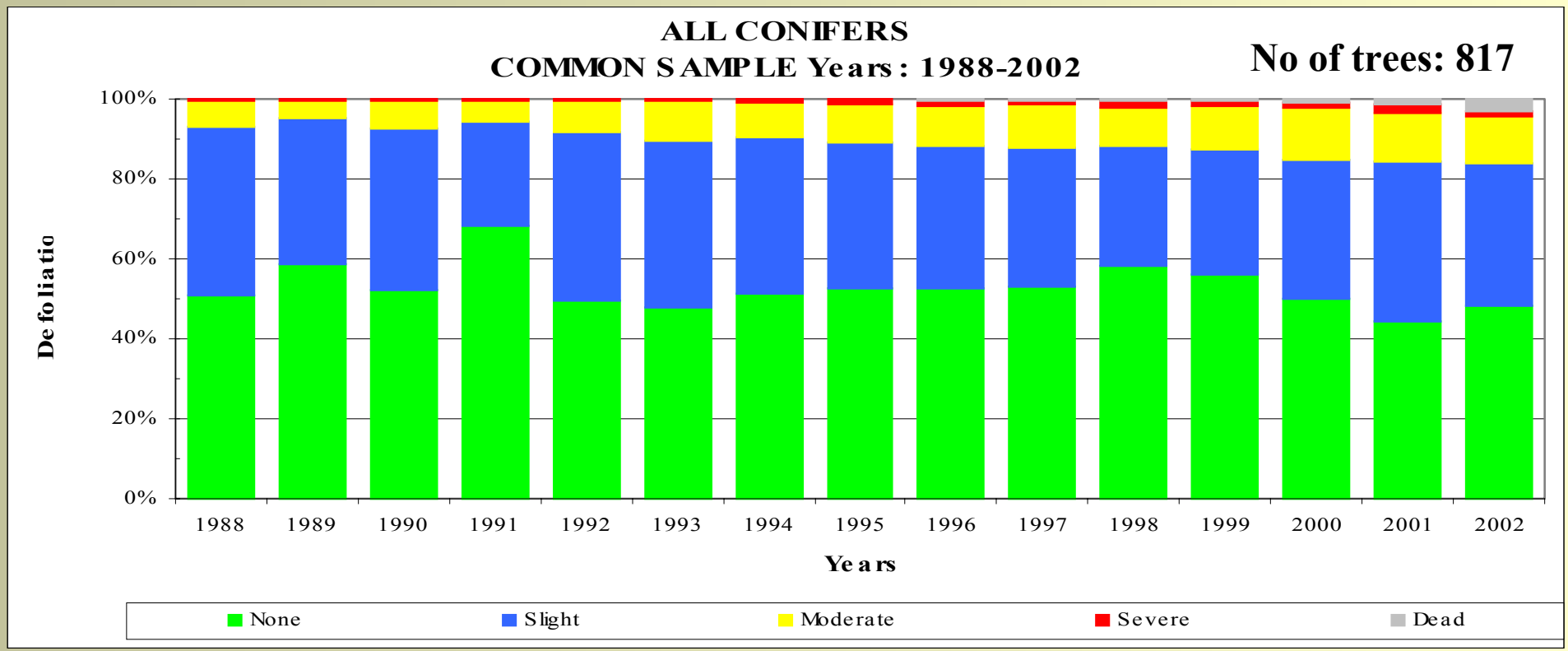

1). Conifers, in general, presented a slight decline since 1988 because the number of trees in classes 0 and 1 decreased and that of the classes 2, 3 and 4 increased.

2). However, conifers are in a better condition compared with broadleaves, a fact which is attributed to the bad condition of oak trees growing as coppices in shallow and eroded sites.

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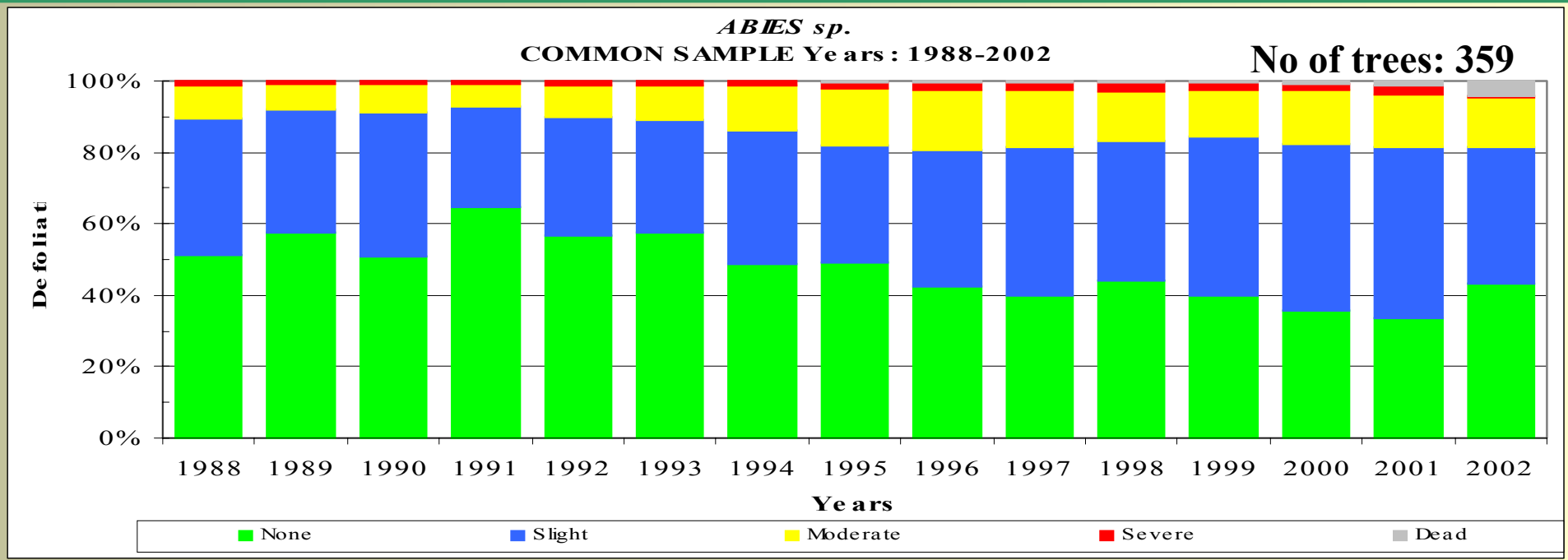

1). Fir tree condition has deteriorated since the beginning of the monitoring. The number of trees in the class 0 has decreased, while that of the classes 1, 2, 3 and 4 has increased.

2). The consequences of the years with dry and warm growing season are obvious, as well as the increase of the number of dead fir trees, as a result of the adverse weather conditions. Fir trees stressed by such adverse weather conditions usually die within 3-4 months or the next year.

3). During the past 15 years of monitoring 95 fir trees, of the total number established (448), were replaced (died, uprooted, overthrown, broke down) that is 21.2% of the trees was lost. In other words a 1.4% of the fir trees is lost every year.

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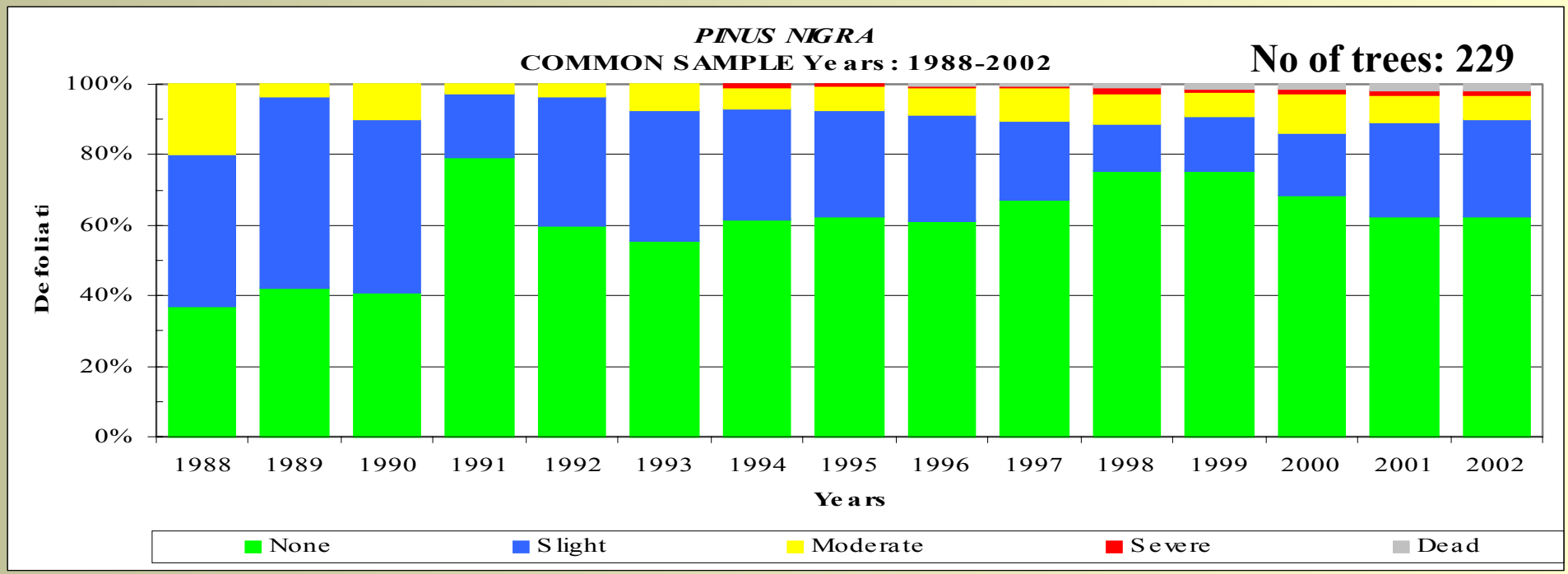

1). The crown condition of this low nutrient demanding and drought resistant species revealed a quite different behavior than that of the other conifers.

2). During the years 1988 up to 1990 its condition was almost stable with regard to decline. In 1991, a year with high precipitation, its improvement was impressive. During the last two years (2001-02) there was a slight deterioration, while the number of trees in classes 3 and 4 increased compared with the previous years assessment.

3). The black pine's condition the last decade seems to be better compared with fir and Aleppo pine.

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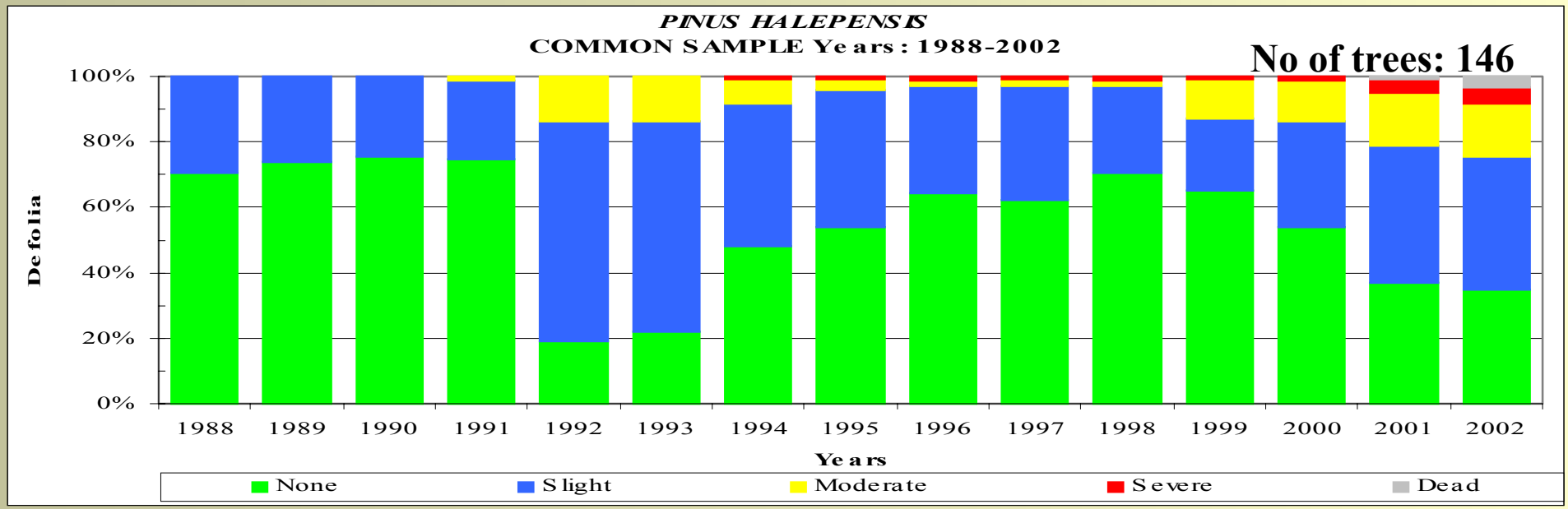

1). The health condition of Aleppo pine trees has seriously deteriorated since 1988.

2). It was in its best during 1988 to 91 and in its worse in 92 to 93, when it started recovering again up to the year 1998, afterward declined again up to 2002, a year with the highest number of trees in classes 2, 3 and 4.

3). In 1992 the Aleppo pine condition was seriously affected by the insect *Thaumetopea Pytiocampa* attacks. This influence lasted for the two consecutive years 1993-94.

4). During the monitoring period 4 plots, over the total 11 originally established, were destroyed by wild fires, that is a 33% of the original plots were destroyed. If we take into account that two more plots of Calabrian pine also were destroyed by fires, then the percentage of the coastal pines lost by fires increased to 40%, which is a very high percentage for these valuable Mediterranean forests.

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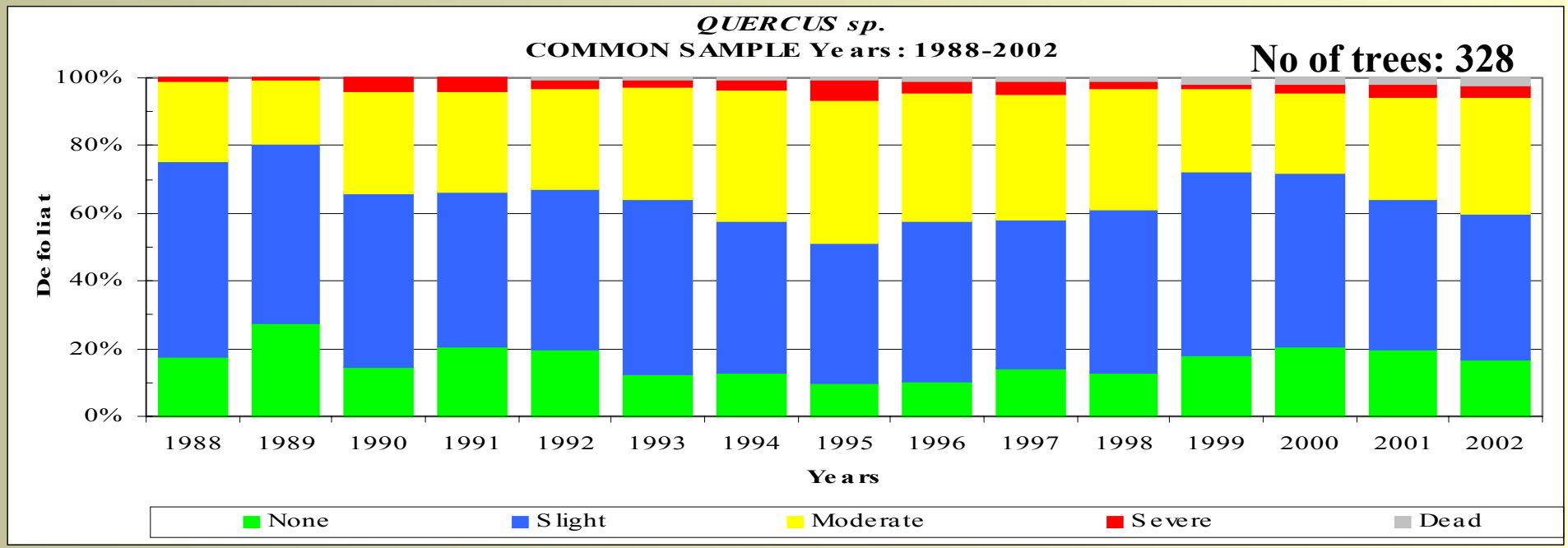

1). The crown condition of deciduous oaks is the worst of all the other species examined. This is mainly due to the fact that these species grow on degraded forest soils, are managed as coppices and grazed by domestic animals. They also suffer frequently by insect and fungi attacks.

2). Their best condition was in 1989. From that time a graduate decline went on until to 1995 after which there was a slight recover lasted to the year 2000.

3). During the very warm and dry growing seasons shoots and lateral branches, mainly of old oak trees, die in combination with the effects of semi-parasites (mistletoe) and their recovery takes more than a year, depending on the severity of the damage, as happened in 1990 and 1991.

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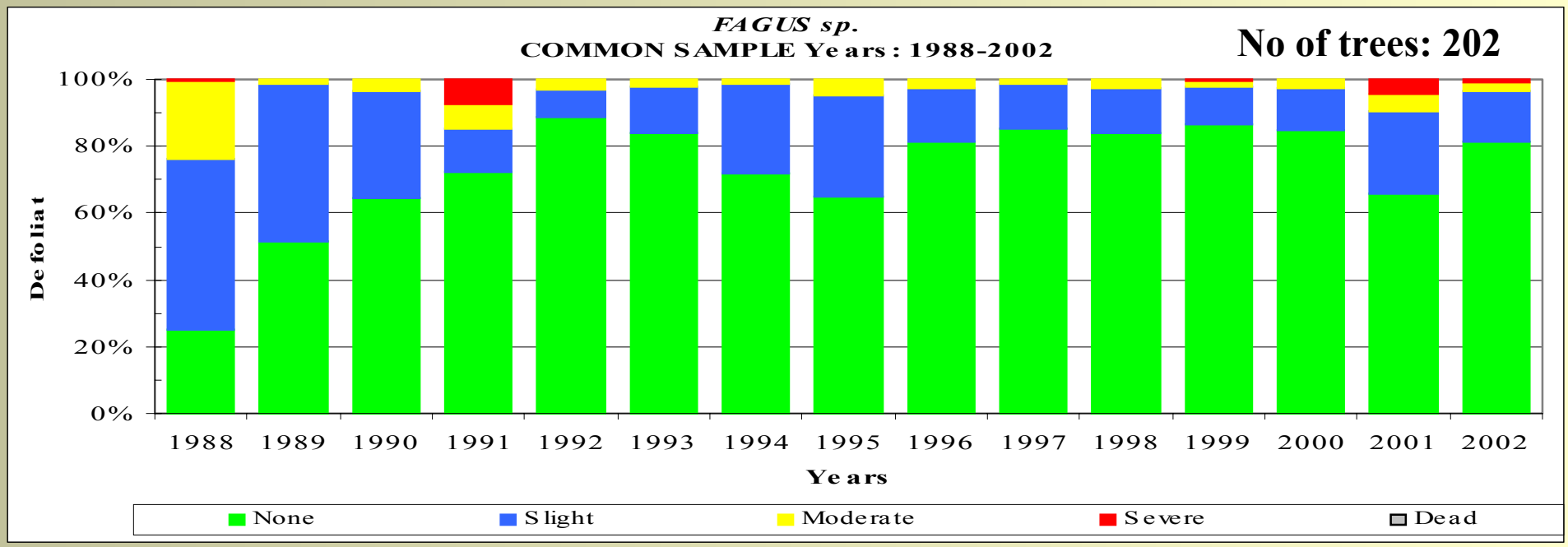

1). Beech species grow at a higher elevation and on northern geographic regions than fir trees, where the precipitation and in general the available moisture to plants is greater and the water stress milder.

2). The year 1988 was the worst year for beech of the whole monitoring period, with a 23.3% of the trees moderately defoliated (class 2). In 1991, a 7.4% of the trees was assessed to be in the defoliation class 3, while in 2001 a 5% and 4.5% of the trees in defoliation classes 2 and 3, respectively. This fact was mainly due to the late frost, which damaged the new tree leaves and buds.

3). Within the years 1996 to 2000 beech condition was relatively good, as well as in 2002. In 1992 and afterwards beech was in its best, compared with all the other forest trees.

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STATISTICAL ANALYSIS

For each year (1988 – 2002), the annual mean defoliation was calculated, while the dead trees were excluded. The accidental or not distribution of annual mean defoliation for the period (1988 – 2002) in the species of fir, beech, deciduous oaks, Aleppo and black pine was checked statistically (Zar, 1996). For the conformity of percentages of mean defoliation with the criterion of normal distribution the logarithmic transformation was used and more specifically the log(defoliation + 2). The tendencies were found statistically significant at $p \leq 0,05$.

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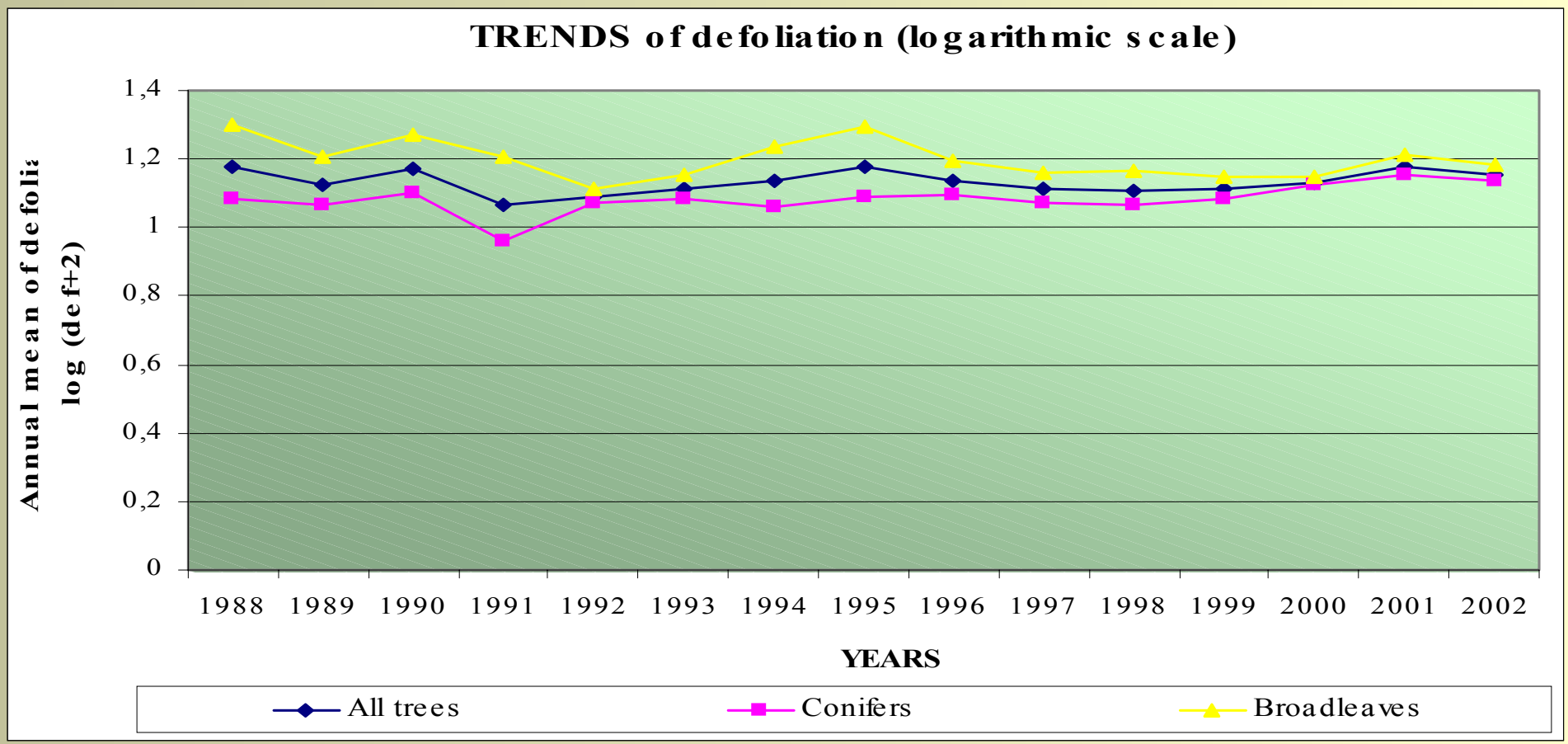

No of tree sample

All trees = 1404 **Conifers = 793** **Broadleaves = 611**

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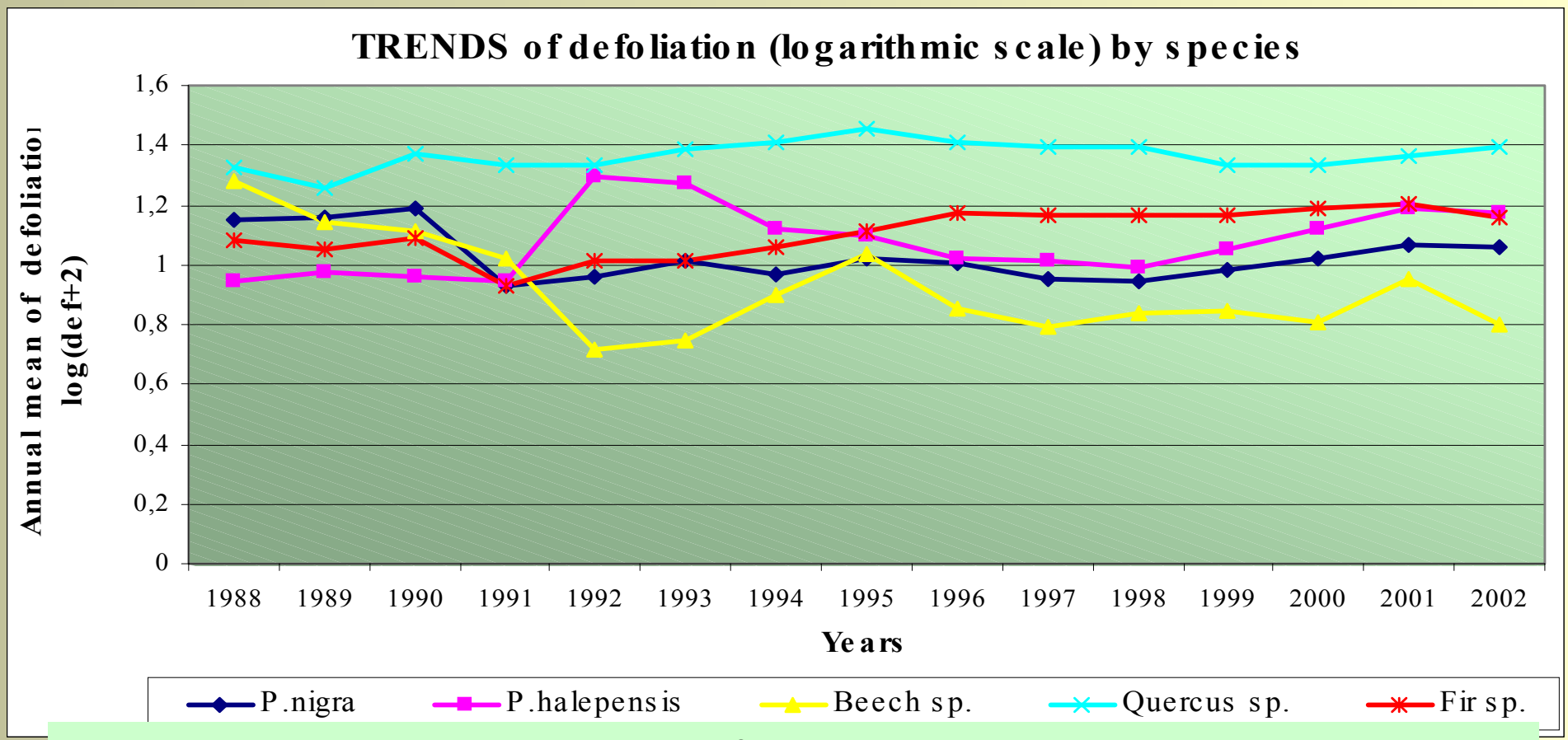

No of tree sample

P. nigra = 225 **P. halepensis = 141** **Beech sp. = 203** **Quercus sp. = 321** **Fir sp. = 344**

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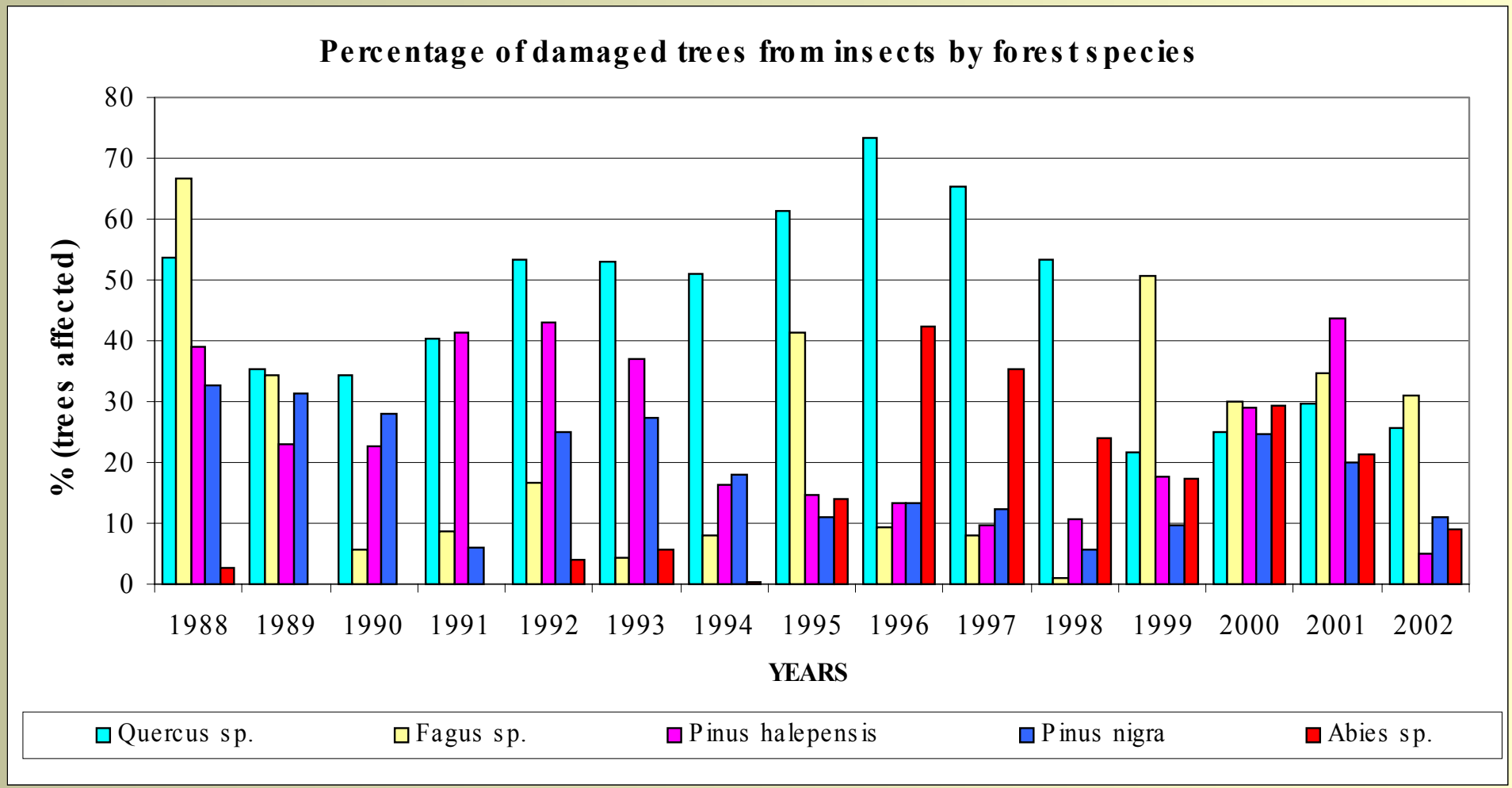

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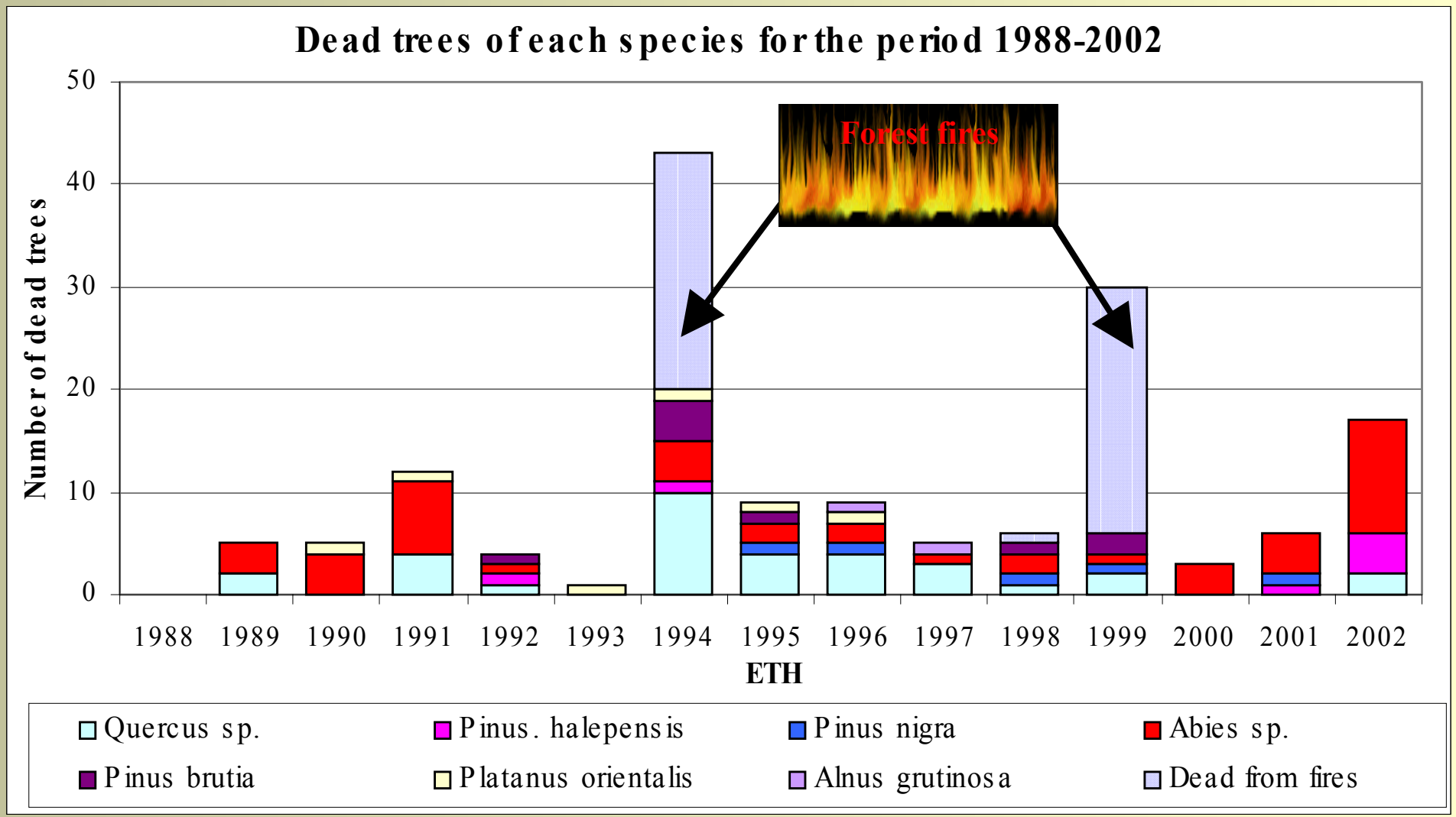

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CONCLUSIONS

1. The causes of forest trees foliage loss are generally attributed to abiotic and biotic factors (drought, high temperatures, frost, insects, etc.).
2. Although acid rain events have been recorded on certain areas of central Greece for a considerable time of the year, however no visual damages were detected on forest trees, a fact attributed to the high buffer capacity of the Greek forest soils.
3. The percentage of all forest trees in the defoliation classes 0 and 1 (without and with slight defoliation, respectively), during the years 2001-2 is the lower of the whole assessed period (15 years).
4. The crown condition of conifers seems to be better than the deciduous broadleaves. However, the percentage of dead conifer trees is higher.
5. Deciduous oaks are in the worst condition compared to all other forest species, while beech is in the best.
6. The health condition of black pine in the last decade is better than that of the other conifer species (Aleppo pine, fir).