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FOREST CONDITION 1993, by Derek Redfern, Roger Boswell and John Proudfoot

Abstract

Five species – Sitka spruce, Norway spruce, Scots pine, oak and beech – were included in the survey, distributed over 361 plots. A total of 8664 trees was assessed. Similar surveys are carried out in many other European countries. This year, in order to permit a more satisfactory comparison with results obtained elsewhere, crown density was assessed with reference to a local standard rather than an ideal tree. This has resulted in higher crown density scores than those recorded in previous years. However, in order to maintain the existing time series of crown density figures, all trees were also assessed using the previous idealised standard. This showed there was an improvement in the crown condition of Norway spruce, Scots pine and beech compared with 1992. A marked two-year decline in Scots pine was reversed and a similar decline in oak was arrested. There was a continued recovery of beech following a decline in 1991.

Introduction

1. Since 1987 the Forestry Commission has monitored changes in tree health by annually re-assessing five species in plots distributed throughout Britain. In 1993, a total of 8664 trees was assessed, distributed over the following numbers of plots: 67 Sitka spruce (*Picea sitchensis* (Bong.) Carr.), 76 Norway spruce (*Picea abies* (L.) Karst.), 81 Scots pine (*Pinus sylvestris* L.), 77 oak (*Quercus* spp.) and 60 beech (*Fagus sylvatica* L.). The assessments were undertaken between 5 July and 3 September, 1993.

2. The survey was conducted using methods described by Innes (1990). The feature of greatest interest in the survey is an assessment of crown density, i.e. the degree of transparency of the crown, which is used to provide an index of tree condition. In previous years, the basis for comparison has been an 'ideal tree' carrying the maximum possible amount of foliage. Reductions in crown density were estimated in 5% classes by reference to standard photographs of such trees. This method is used in several other countries but comparisons are most commonly made with reference to a tree with full foliage under local conditions (the 'local tree' method) . These methods are discussed more fully elsewhere (Redfern, 1993), but essentially the local tree method involves selecting, in the general vicinity of a plot, the tree with the greatest amount of foliage, to act as a reference tree with which to compare plot trees. In order to permit more satisfactory comparison with results obtained in other countries, crown density estimates this year were made using the local tree method. However, since it is important to maintain the existing time series of crown density figures, all plot trees were also assessed using the previous idealised standard.

3. In order to check the consistency of scoring by the 12 survey teams involved, 11% of plots were re-surveyed by one experienced supervisor. The proportion of trees scored identically or within ±5% ranged from 81% in Sitka spruce to 89% in Norway spruce. The corresponding figures for 10% limits were 95% and 100% respectively.

The 1993 results

4. The crown density results, using both methods, are presented in 10% classes in Figure 1. The effect of using a local tree rather than an ideal tree as the basis for comparison is evident in all species. The greatest difference occurred with oak, and is probably due to the natural openness of the branch structure in many trees compared with those in the standard photographs. In conifers, particularly Scots pine, the effect of age is important. The crowns of young Scots pine (i.e. trees less than about 40 years old) are much less dense than in the standard photographs, which are of older trees.

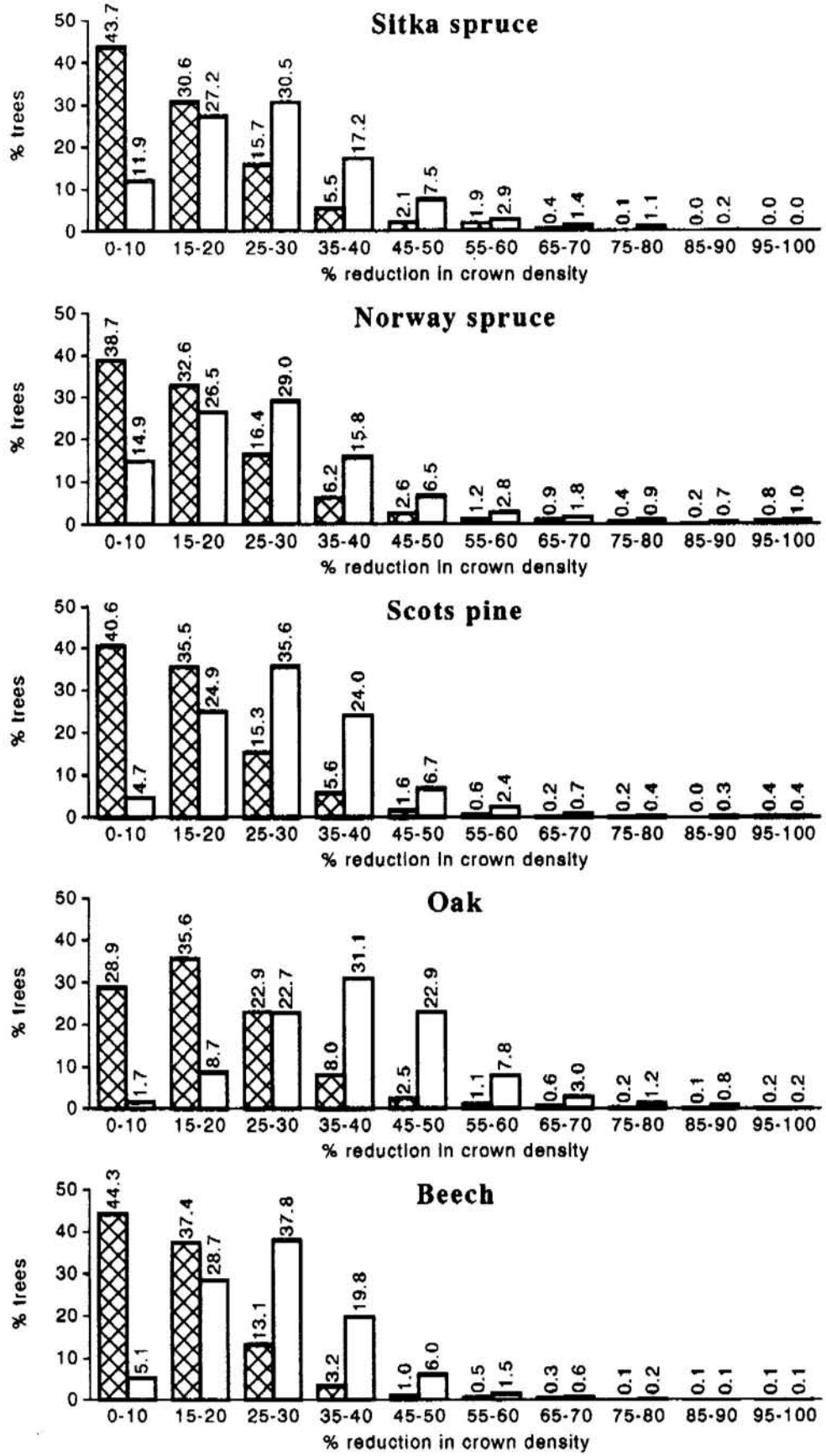

Figure 1: Proportions of trees in each crown density class for five species in 1993. Each 10% class represents a reduction in crown density compared with either an 'ideal tree' with full foliage ☐ or a tree with full foliage under local conditions ☒.

Note: The 0–10% class contains trees with crown density reductions of 0%, 5% and 10% whereas the 15–20% class contains trees scored as 15% and 20%, and so forth.

5. Figure 2 shows the changes in crown condition that have taken place since 1987 by recording the proportion of trees in which the reduction in crown density (compared with that of an ideal tree) has exceeded 25%. Crown density scores have fluctuated from year to year, revealing little evidence of a long-term trend for most species. Sitka spruce in particular has shown only minor changes during this period. The condition of Norway spruce improved slightly in 1993, after a marked three-year decline since 1989. In Scots pine a similar three-year decline was reversed by a significant improvement in 1993, and in oak the same decline was halted, there being no further deterioration in 1993. However, oak remains in poorer condition than any of the other species surveyed and is the only species in which there appears to have been a decline since 1987. Beech has recovered to its 1990 condition after a marked decline in 1991.

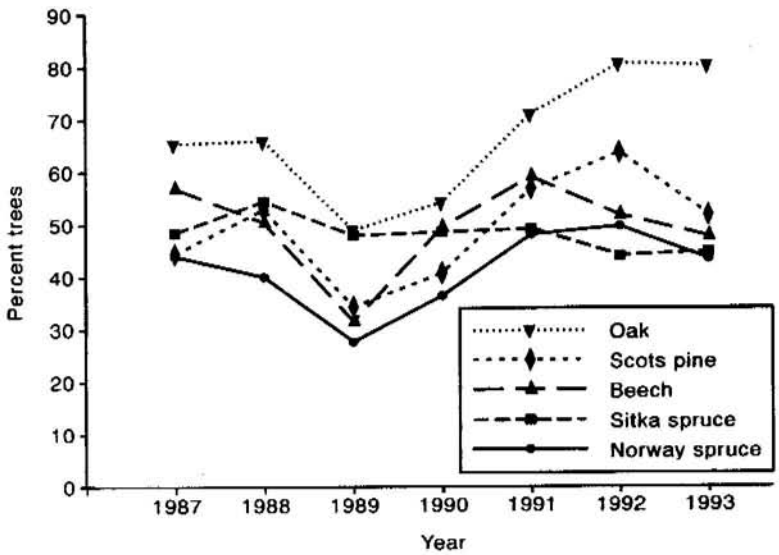

Figure 2: Changes in crown density since 1987 for five species surveyed annually. The proportion of trees in which crown density was reduced by more than 25% compared to an ideal tree is shown for each species.
Note: In 1987 and 1988, in contrast to later years, crown density was scored in 10% classes. For these years the 20–30% class was therefore split equally. Each figure is the mean value for all trees assessed that year.

Factors affecting crown condition in 1993

6. Observational evidence suggests most species benefited from the wet summer of 1993, particularly Scots pine and the two broadleaved species. However, the incidence of some foliage diseases increased. Oak mildew (*Microsphaera alphitoides*) was conspicuous in late summer, causing dieback of lammas growth and severe foliage discoloration, giving trees an overall silvery appearance. Trees which had been defoliated by winter moths, the oak leaf roller moth and other defoliators earlier in the season thus suffered a second setback. The effects of oak defoliators were widely reported but damage was only locally severe, for example in the Forest of Dean, Lincolnshire and Easter Ross.

7. Wind and snow are major factors affecting trees in Britain. Storm damage was generally unimportant in 1993 but breakage caused by earlier events still affects some trees, particularly in north Yorkshire. Wind abrasion reduced the amount of foliage on trees in some spruce plots.

8. Norway spruce is affected by a wind-related, lethal condition known as 'top-dying'. This is a progressive, climatic/physiological disorder which may be initiated by increased exposure and exacerbated by drought. Typically, affected trees suffer needle browning in late winter/early spring, followed by needle loss. The condition tends to be more common in the east of the country than in the west. Since the disorder is progressive within affected stands it can lead to large and long-lasting differences in the degree of defoliation between affected and unaffected plots, which may be in close proximity.

9. Attacks by the green spruce aphid (*Elatobium abietinum*) can have a major effect on crown density in Sitka spruce; it is the single most important defoliating agent on this species. Outbreaks vary in intensity on a local or regional scale from year to year but, as demonstrated in last year's report (Redfern *et al.*, 1993), the effects of a single outbreak may persist for several years. This year outbreaks have been reported from south-west Britain, particularly Wales, and from Galloway and Cumbria.

10. As already mentioned, the condition of Scots pine improved significantly this year. Nevertheless, the following damaging agents were recorded: *Lophodermium seditiosum* (needle browning), *Tomicus piniperda* (shoot death), *Brunchorstia pinea* (shoot death), *Peridermium pini* (death of stems/branches), squirrels and wind.

11. As suggested by the crown density results, the general condition of beech has improved. Attacks by the beech leaf miner *(Rhynchaenus fagi)*, which had a major effect on the appearance of beech in 1991, were mostly light and insignificant.

12. It should be noted that, for a variety of reasons, individual trees in hedgerows and on roadsides, particularly beech and oak, may be in much poorer condition than the woodland trees included in this survey.

Conclusions

13. Trees in Britain are affected by a variety of well-known biotic and climatic factors. The impact of such factors varies from place to place and from year to year, and fluctuations in crown density, either annually or on a longer cycle, are to be expected. Since 1987 crown density has fluctuated in this way, revealing little evidence of a long-term trend for most species. Oak is the only species in which there appears to have been a decline since 1987. In recent years, droughts, insect attacks and storm damage have all had an impact on various species (Innes and Boswell, 1991; Redfern *et al.*, 1993). 1993 was a good year for tree growth, and the condition of three out of the five species surveyed improved compared with the previous year. Beech improved for the second year in succession, and a marked three-year decline was arrested in oak and reversed in Scots pine and Norway spruce.

Acknowledgements

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