

EUCALYPT DIEBACK ON THE NORTHERN TABLELANDS
OF NEW SOUTH WALES

BY

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SUMMARY

This study was initiated in order to attempt to describe the nature and extent of eucalypt dieback on the Northern Tablelands.

It was found that the typical symptoms of eucalypts exhibiting dieback involved general deterioration of the crown with thinning of foliage and progressive death of twigs and branches. Most of the declining trees were severely defoliated by a variety of native insects, in particular paropsine and scarabaeid beetles. Partial recovery usually occurred in the form of bursts of epicormic shoots, but the new growth was also liable to deterioration. The trees usually died with a few intact leaves remaining, but occasionally trees wilted while still bearing a significant portion of their leafy crown. Wood decay was common in the affected eucalypts, but the rotting of live sapwood was only occasionally evident. Semi-quantitative scales were constructed to facilitate the assessment of tree vigour and foliage cover.

A broadscale road survey of the Northern Tablelands was undertaken during 1980 to ascertain the extent of eucalypt dieback and which species were involved; 48 species of naturally occurring eucalypts were encountered. The stretch of country in which most dieback had occurred runs from Bendemeer and Yarrowitch in the south to Tenterfield in the north. Dieback was largely confined to pastoral areas and the

more heavily cleared areas tended to be worst affected. Saplings were more affected by dieback than mature trees and few of the trees in the areas surveyed were past maturity. All eucalypts of the eastern forests and the gorge communities were relatively healthy. Dieback was less prevalent in western areas. After the autumn of 1980 some trees on the Tablelands showed acute drought effects, but the great majority of woodland trees were relatively unaffected. No eucalypt species suffered dieback over its entire geographical range. Ten species of eucalypts showed severe or extensive dieback; these included all the common species on the central tract of the Northern Tablelands. *Eucalyptus nova-anglica* was the species most seriously affected by dieback, and the condition of that species was usually worse than that of other associated eucalypts. Most of the species that were not seriously affected by dieback did not grow in areas where dieback was prominent.

The eucalypts on "Kiparra", a property near Armidale, were permanently tagged and visually assessed to examine the association of dieback with specific site and tree factors. Five common species of eucalypts were present: *E. melliodora*, *E. blakelyi*, *E. caliginosa*, *E. nova-anglica*, and *E. bridgesiana*. Practically all the trees on the property were affected by dieback, but the average vigour ratings of *E. nova-anglica* and *E. bridgesiana* were lower than those of the other 3, more numerous species. Canonical correlation analysis indicated that greater vigour of *E. melliodora* was

associated with: larger tree girth, higher position on slope, proximity to neighbouring trees, and absence of mistletoe. Greater vigour of *E. blakelyi* was associated with the presence of a sheep camp, larger tree-girth and higher position on slope. Greater vigour of *E. caliginosa* was associated with larger tree-girth.

Other permanent plots were set up to monitor the changes in vigour of trees on 14 sites in the Armidale-Wollomombi district. There was a general recovery of trees during the period of observation (March 1980 to March 1983). After damage from accidental human interference was excluded the average vigour of the trees that were still alive at the end of the period of observation had increased in every plot. The trees that were initially severely affected by dieback continued to die while the less affected trees usually recovered to some extent. The vigour of *E. melliodora* was generally greater than the vigour of *E. blakelyi*; relative differences in the improvement of *E. melliodora* and *E. blakelyi* during the period were associated with a strong preference of Christmas beetles (*Anoplognathus* spp.) for the latter species. Differences in vigour between associated *E. melliodora* and *E. caliginosa* were not marked.

In the absence of stress the vigour rating of trees fluctuated seasonally in association with shoot growth, leaf fall and flower production. Leaf-grazing insects periodically damaged eucalypt crowns, immediately affecting the vigour rating. Trees with lower vigour ratings tended to be grazed

to a greater extent. During the period there were numerous localized insect outbreaks each involving one or a number of insect species. Some insects, in particular scarabæids, appeared to emerge almost simultaneously over large areas.

A field trial was set up at "Kiparra" to test the responses of trees to an insecticide (monocrotophos) and a selective fungicide (metalaxyl) active against pythiaceus fungi. Prior to the application of metalaxyl the soil beneath the base of trees was tested for the presence of pythiaceus fungi. *Phytophthora cryptogea* was the most common species isolated, but there was no relationship between the presence of pythiaceus fungi and the vigour of trees. Application of metalaxyl significantly reduced the recovery of pythiaceus fungi. There was a significant response to insecticide in both *E. melliodora* and *E. blakelyi*, and a significant positive interaction between insecticide and fungicide treatments in *E. melliodora*, but no response to the fungicide by any eucalypt species. It is argued that the water from the aqueous solution of fungicide was likely to have caused the interaction.

P. cryptogea was the only species found in a preliminary survey of *Phytophthora* spp. in the Armidale district. The effects of the fungus on potted seedlings were tested. The fungus caused only minor damage to *E. nova-anglica* seedlings, and no significant damage to seedlings of *E. blakelyi* or *E. caliginosa*. The results support other studies which indicate that *P. cryptogea* is a weak pathogen.

The factors likely to contribute to stress on trees and the process of dieback are critically discussed. It is concluded that excessive defoliation resulting from outbreaks of leaf-grazing insects was likely to have been the most important immediate cause of dieback, though other factors have contributed to the dieback of trees locally. These factors include: infestation by mistletoes, damage attributable to human activity (e.g. herbicide spray drift), wind-damage, and girdling of trunks by cattle. The process of decline is influenced by the growing conditions of the eucalypts; recovery is retarded by adverse weather, shortfalls in the supply of water and mineral nutrients and possibly by other factors, e.g. interference from pasture plants and the presence of secondary disease-causing agents.

The factors likely to have contributed to development of insect outbreaks are discussed. These factors include: (a) long term changes associated with agricultural development, e.g. a reduction in the habitat available for natural enemies of the insects and reduced spatial heterogeneity (both floristic and structural); (b) weather conditions favouring breeding and survival of the insects; and (c) changes in the condition of eucalypts associated with chronic defoliation, e.g. a reduction in the average age of leaves.

It is argued that lignotuberous advanced growth is critical for the survival of eucalypt populations during periods of intense dieback.

PREFACE

At the time this project was initiated (September 1979) eucalypt dieback was rapidly intensifying. The study was initially intended to focus on the involvement of pathogenic disease in the disorder. Following the onset of dry conditions (summer of 1979/80) and the rapid improvement in the general condition of eucalypts, the scope of the project was broadened - with increased emphasis on monitoring changes in the condition of trees - and less emphasis on looking for pathogens, which may no longer have been present.

The thesis is organised into 3 parts (see Section 1.3 for an overview). In contrast to normal practice, most of the literature reviews have been placed in the latter parts of the thesis so that the information could be related to what was learnt about the nature of the syndrome from the field studies reported in Part 1. In essence, the literature reviews are extended discussions.

The authorities for the names of vascular plants used in the thesis are as given by Jacobs and Pickard (1981); the authorities for insects are as given by Carne et al (1980). Latin names are distinguished by bold type because the printing device used to produce the thesis did not have facilities for italics. Grid references of locations cited in the text are based on the 1:100,000 Series Topographic Maps, Division of National Mapping, Department of National Resources.

I would like to thank Mr J.B. Williams and Associate Professor J.F. Brown for their supervision of the project. My ideas were clarified by discussions with Mr R.A. Boyd, Mr J.B. Williams, Assoc. Professor J.F. Brown, Dr S.C. Cairns, Mr I.W. Smith and many other people.

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I certify that the contents of this thesis have not been submitted previously for any degree, and that all assistance received, and all sources used, in the preparation of the thesis have been acknowledged.

Christopher Nadolny

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