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WHAT IS HAPPENING WITH WANDOO?

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OVER the last few years there has been growing community concern regarding the declining health of *Eucalyptus wandoo* subsp. *wandoo* (southern wandoo), throughout the Western Australian wheatbelt and in parts of the State forest. Wandoo is an important habitat tree, relatively widespread throughout the south-west and usually resilient. This present decline of the species is one in a series that have been documented in the latter half of the 20th century. I undertook a survey in 2002 on behalf of the Department of Conservation and Land Management's Science Division and explored several factors in order to determine likely potential causes and document the spatial extent of the present decline. Several factors were implicated but no cause or set of causes were isolated. The decline symptoms in tree crowns progress from where clumps of leaves become discoloured, twigs and branchlets firstly begin to defoliate followed by secondary and even primary branches. Progressive crown decline is characterised by intermittent flushes of epicormic growth that may undergo cyclical patterns of decline. Ultimately, there have been some tree deaths.

For this survey, 3 transects comprising a total of 129 sites were assessed. Transects were oriented in an east-west direction, with most sites having relatively easy access for future observations, if required. The extent and approximate latitudes of the transects were: the southern transect extending from Chillinup to just west of Manjimup along the 34th parallel; the central transect extending from just east of Kulin to Collie along the 32nd and part of the 33rd parallel; and the northern transect extending from just east of Kwolyn to Helena Valley along the 31st parallel, with some additional sites included further north in Julimar.

Summary of results

Statistical analysis showed that reliable indicators of healthier wandoo throughout this survey were a higher percentage of trees with minimal or no impact, where epicorms were not present or very old and where there was increasing presence of fruit and buds. Insect damage increased as crown health decreased. Insect damage, and specifically damage by lerp insects, may be implicated in the decline but this was more likely a contributory rather than a primary cause. Insects may also be acting as a vector for fungal infection of susceptible trees.

The longer a site was without high intensity fire, the healthier the trees crowns were, suggesting that fire-associated disturbance allowed or initiated tree decline. Similarly, there was evidence of a strong relationship between recent hot fire events and the acceleration of the present decline pattern. Two sites affected by wildfire in 1994 and 2000, in the Stirling Range National Park, showed epicormic recovery after the fires but the new growth was destroyed by mechanisms that displayed symptoms of the present decline pattern. In both years there were marked rainfall deficits, which implicated a lack of soil moisture that could not sustain a post-fire growth flush. However, an active fungal or other pathogen, after fire damage, should not be ruled out.

The higher the position in the landscape, the healthier wandoo crowns were, and steeper slopes also exhibited some of the higher crown health ratings. These areas where wandoo still exist have not been cleared or affected by rising watertables and their deeper root systems may not have been compromised by inundation, as has occurred in the lower landscape. The trees may thus be more resilient to drought-induced soil moisture storage reduction.

Lower crown health within National Parks, Nature Reserves and other bushland remnants, suggested that higher stem densities of both canopy and understorey, usually associated with these areas, were predisposing wandoo to less water availability during drought periods. Remnants on privately owned land (that were generally small) and road reserves exhibited the highest crown ratings. These sites were usually surrounded by cleared land, implicating higher availability of moisture that protected trees from decline. Also, roads often act as a water catchment or have a "damming" effect that may increase moisture availability to nearby trees. The data showed that the death rate was less than expected, demonstrating the resilience of wandoo. The loss of leaf biomass, however, throughout areas of decline was significant and has had a high visual impact.

There were some findings that reflected a temporal and spatial trend in decline across the wheatbelt. The decline was broadscale, the pattern was variable and not continuous across the landscape and canopy loss was both very recent and up to 10 years old. In general, regeneration stands across the range of wandoo (approximately less than 30 years old) were little affected. There were also sporadic occurrences of healthy veterans amongst stands of trees that showed marked decline. The zones between the rainfall isohyets of 400-450 mm and 600-650 mm showed the most marked crown decline on the southern and central transects. On the northern transect, there was no definitive improvement of crown health west of the 500 mm isohyet. From east to west, the

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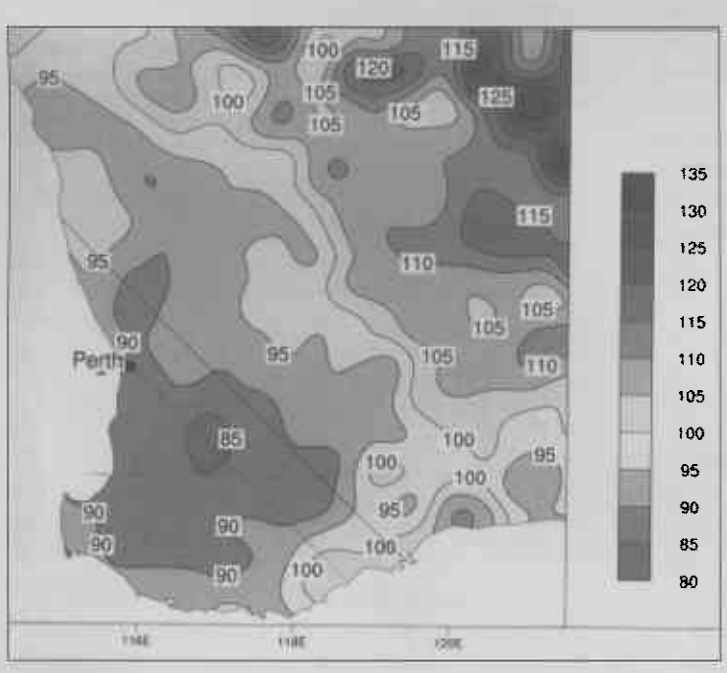

Map 2. Rainfall change 1925 - 2001. High figures, increase, low figures, decrease.

relationship between average annual rainfall and crown decline suggested that rainfall is relevant to wandoo decline, but could not be correlated directly with rainfall. However, recent rainfall deficits may be implicated in wandoo decline because zones of marked crown decline roughly coincided with areas where rainfall deficits, over the last 25 years after 1975, have been 10-15% below the average of the preceding 50 years.

Long term dieback, salinity-related dieback and the present decline pattern appeared to be separate events with variable but overlapping time frames. Apart from salinity, the underlying predisposing factors for all these decline events may have been the same. There was evidence throughout the survey that salinity had caused crown decline of wandoo but trees had adjusted and now survived with a contracted crown. It was also evident that the present decline was often not afflicting these trees but was occasionally coincident with them.

On the central transect, there was little structural change within 3 sites assessed for wandoo decline in 1991, and again in the 2002 survey. Old decline symptoms remained much the same, with dead branches, branchlets and even some twigs still intact above tree canopies. With regard to the present decline pattern, sites classed as healthy, intermediate and degraded in 1991 showed no impact, minimal impact and advanced symptoms of the present decline 11 years later, in that order. Therefore previous site condition may have predisposed trees to greater impacts from the present decline.

Over the past few decades, various reports on wandoo decline documented several common factors that may be causal. The greatest impact has been land clearing for agriculture, which has reduced the extent of wandoo and fragmented the remaining woodlands. Increased salinity and waterlogging, a

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consequence of clearing, were recognisable causes of decline. Some agricultural practices, such as chemical use, may also be having negative impacts. Climate change, periodic drought and decreasing annual rainfall may be contributing to broadscale decline of the species. A changed fire regime in the south-west of Western Australia was also implicated. This latest report addresses similar potential causes of wandoo decline which are proving difficult to isolate. The cumulative impact of periodic decline on the remaining wandoo population is likely to be an increasing rate of degradation and death across its range as older trees capitulate and little recruitment takes place.

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