



RESEARCH FINDINGS 2011

Wandoo woodland in Stirling Range
National Park, WA.

Is *Eucalyptus wandoo* health affected by climate change?

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Southwest Western Australia (WA), known for its high biodiversity, has experienced a decline in rainfall since the early 1960s, and the projections are unanimous that this trend will continue. This trend, together with the global increases in temperature and more frequent extreme weather events like drought, is having an increasingly negative impact on the health of the diverse forest ecosystems in this region.

In southwest WA, declines in health have been observed for a variety of native tree species, including *Eucalyptus gomphocephala* (tuart), *Corymbia calophylla* (marri), *E. marginata* (jarrah) and *E. wandoo* (wandoo). These declines may, at least partially, be the result of the observed changes in climate; however, this relationship has been difficult to assess. This study reports on the relationships between observed declines in crown health of wandoo and the changes in climate in southwest WA.

Wandoo is endemic to southwest WA. Wandoo has a wide distribution across southwest WA, generally occurring in areas with loamy soils and an annual rainfall of 350 to 1000mm per year. Wandoo occurs in association with a variety of other plant species, mainly as open woodland characterised by less than 40% overstorey crown cover.

Observations suggest that wandoo has been in decline over the last 45 years. The causes for these declines have been investigated at various small spatial scales across the landscape; however, no clear set of factors have been found that explain this apparent negative trend in health. The aim of the present study was to assess environmental and climate factors that may correlate with wandoo health over the species' distribution range.

Methods & Results

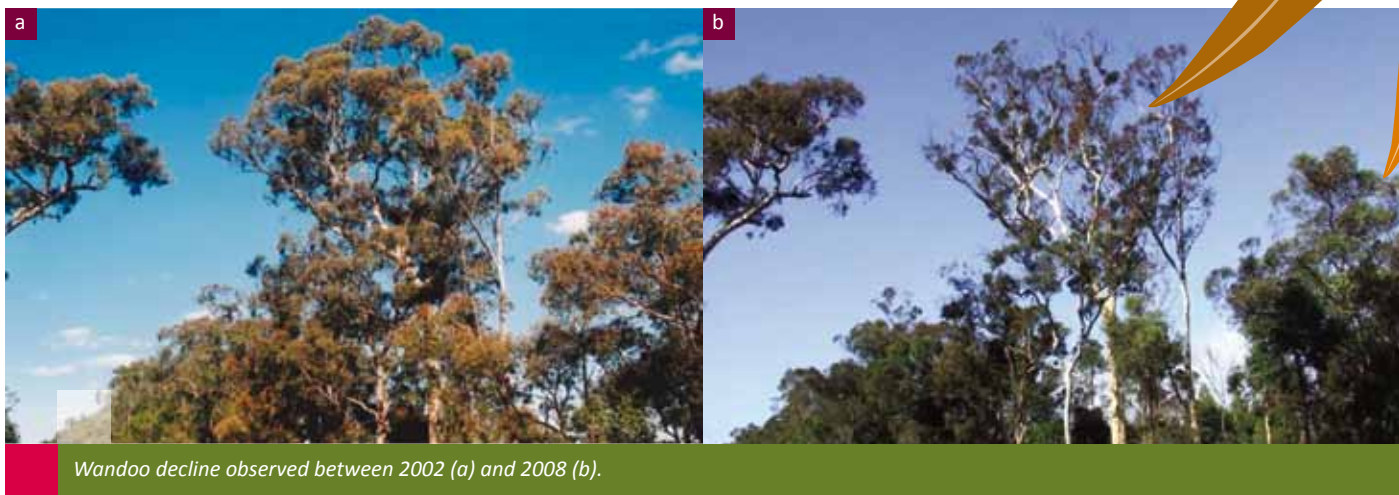
In 2002, a landscape-scale survey of crown health in 126 wandoo-dominated stands was undertaken, which was repeated in 2008



Wandoo woodlands provide substantial habitat for wildlife. For instance, the endangered Carnaby's black cockatoo uses hollows in wandoo trees for nesting. The preservation of wandoo woodland is therefore important in terms of biodiversity conservation.

(Wandoo Recovery Group). Wandoo crown health was assessed, including leaf density, incidence of epicormic growth and dead branches. In the present study, the difference between the crown rating of 2002 and 2008 was converted into a fraction (-1 to 1) representing crown health change. This change in tree health score was compared with site geographic variables (height, slope, aspect), soil properties (salinity, rock/gravel/sand content) and climate (rainfall and temperature: Bureau of Meteorology; soil moisture estimates: Australian Water Availability Project, CSIRO; and the changes in these variables between 2002 and 2008).

Between 2002 and 2008, rainfall had declined up to 15% at the surveyed sites. The greatest reduction was for winter rain (Jun-Aug), declining between 2-24% across all sites. Additionally, the majority of sites experienced an increase in temperature of up to 0.4°C in autumn (Mar-May), and a decrease of up to 24% in soil moisture availability.



Wandoo decline observed between 2002 (a) and 2008 (b).

Significant relationships are evident between wandoo crown health and winter rainfall and autumn temperature. The greatest decrease in health was evident at sites in the winter dry areas of the species' range (see Figure 1) where winter rainfall decreased and autumn temperatures increased (see Figure 2) between 2002 and 2008. No relationships were found between crown health and geographical variables or soil properties.

Conclusions & Recommendations

Changes in wandoo health appear to be correlated with recent changes in climate observed in southwest WA. Declining wandoo health was most evident at eastern sites, which are characterised by low winter and annual rainfall. These areas experienced a decrease in rainfall and an increase in temperature between 2002 and 2008, resulting in a reduction in water availability for wandoo. We predict that, under the current climatic changes, progressive decline in wandoo health is likely, which may result in

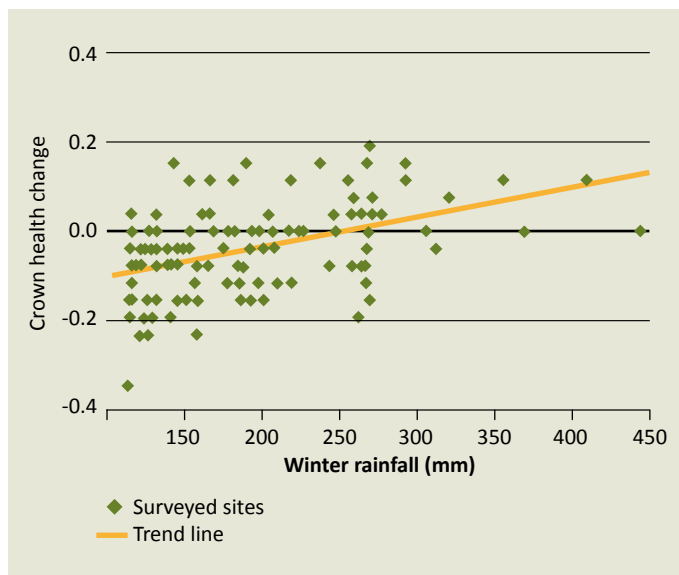


Figure 1 Crown health decreased up to 38% mainly in areas receiving low average winter rainfall.

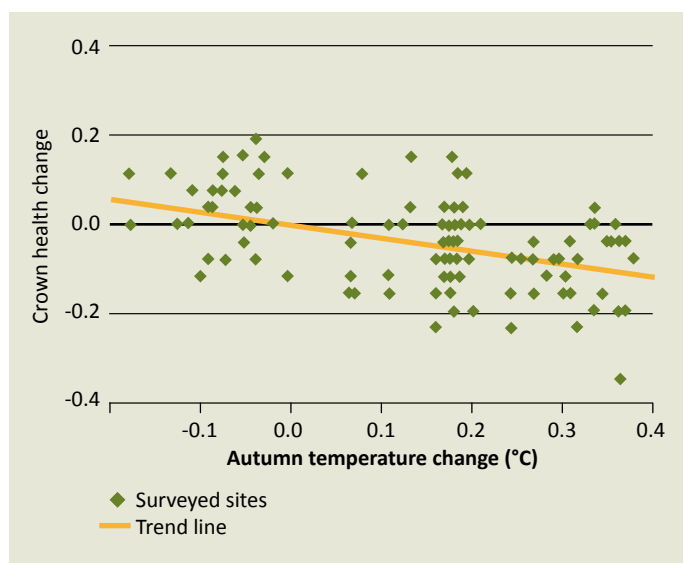


Figure 2 Crown health decreased mainly in areas where autumn temperatures increased between 2002 and 2008.

the complete loss of this species and biodiversity associated with these woodlands in the drier regions of southwest WA.

In the face of ongoing climate change, this study highlights the need to focus conservation management on remnants of wandoo woodland that are likely to be the most resilient to the ongoing changes in climate. Therefore, it appears that areas where average winter rainfall exceeds 250mm are likely to have the greatest success at retaining healthy wandoo woodlands.

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