DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Wandoo Recovery GROUP

Bulletin No.2 March 2005

Introduction

The Wandoo Recovery Group (WRG) was formed in February 2003 by the Minister for the Environment, Dr Judy Edwards, in response to community concern about wandoo's failing health. The WRG's role was to investigate the causes of crown decline and develop appropriate strategies and actions. This bulletin provides an overview of research into wandoo health, which includes studies of borers and cankers.

Members of the WRG include representatives from the Department of Conservation and Land Management, the York and Cranbrook Land Conservation District Committees, the Department of Environment, Greening Australia WA, the Water Corporation, Beverley Naturalists Club, World Wide Fund for Nature (Woodland Watch), The University of Western Australia, the Forest Products Commission, Western Power and the general community.

Background

Wandoo (*Eucalyptus wandoo*) is found across much of south-western Australia.

It is a common component within conservation reserves but also of remnant bushland vegetation and paddock trees within the agricultural areas of the western Wheatbelt.

In recent times the onset of a severe crown decline has been observed in many wandoo trees throughout its natural range. There is undocumented evidence that decline events have occurred previously.

Crown decline characteristics

Crown decline is a syndrome affecting wandoo and occasionally some other eucalypt species.

Symptoms can be expressed in a number of ways but most commonly it is the process known as 'flagging' that occurs. Flagging is where the upper and outer branchlets in the tree crown die. The tree responds by sending up epicormic shoots as the tree attempts to recover. These epicormic shoots may eventually die, resulting in progressive downward movement of the tree crown and redistribution of the canopy. Over several years there can be a noticeable decline in the tree canopy, sometimes resulting in death of the tree.

Another form of decline is expressed in the death of large branches and main stems. The onset of symptoms is often quite rapid and can result in sudden death of the entire tree.

The Wandoo Recovery Group

The WRG aims to raise the profile of wandoo crown decline through the coordination of government and community-based actions and building partnerships with stakeholders and interest groups.

A declining stand of wandoo trees.

Flagging (above) is where the upper branchlets in the tree crowns die.

The WRG is focussing on three key areas. These are:

• **research**, to promote, support and coordinate research into wandoo decline and recovery, to better understand the nature and causes of the decline;

• **mapping**, to accurately assess the extent of wandoo's distribution, its present health and the history of the wandoo crown decline through a coordinated vegetation mapping survey, with the benefit of local community knowledge about previous decline events; and

• **communication**, to raise awareness of the severity of wandoo crown decline and the need for sustained action, while continuing to provide feedback on the WRG's progress.

Likely causes of wandoo crown decline

There is some evidence that insects and fungal pathogens are likely causes of the crown decline. Rainfall deficit, salinity, waterlogging, altered fire regimes and changes in agricultural practices are thought to be contributing factors toward wandoo decline.

CURRENT RESEARCH

The WRG is working closely with The University of Western Australia, which is conducting the principal research into wandoo crown decline.

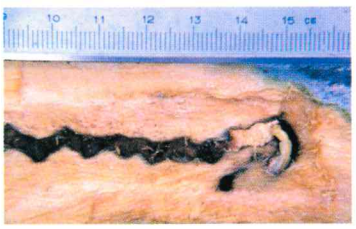
Based on the link between pests and pathogens and their environment, new research will focus on the relationships between climate, tree physiology and the wood-boring insect/fungal pathogen relationship as a priority.

Insects and fungal studies (Phytopathological research)

In 2003, Ryan Hooper from UWA completed an honours project that aimed to assess the nature of damage to wandoo canopies and determine links with foliage loss and the organisms involved. Hooper (2003) developed a model describing the relationship between a wood-boring insect (Type-one) and fungal pathogens causing canker likely to be responsible for the damage found in declining wandoo canopies.

Two borers and their effect on wandoo

Two borers were identified in wandoo. Type-one borers and associated fungal cankers (infected lesions) were found to cause the most common localised patches of flagging occurring in declining stands of wandoo. In addition, ring-barking borers were found to cause broad regions of flagging and considerable canopy loss.



Type-one larvae burrowing beneath the branch surface.

Canker development

Canker types including fusiform, cracking and permanent cankers are always associated with Type-one borer invasion.

Fusiform cankers form shortly after invasion by Type-one borer and look like a narrow scar that meanders down the length of the branch, following Type-one borer corridors beneath the surface.

Insects and fungal studies (Phytopathological research) continued

These cankers are often located on one side of the branch. The combination of a number of fusiform cankers leads to the cracking and flaking of bark tissue. Cracking type cankers have a black colour, generated from extensive regions of cracking and flaking bark tissues on large twigs and branches. These eventually result in a permanent canker with a broad region of severe decay causing flagging by affecting the wandoo tree's ability to take up water and nutrients, which ultimately results in the branch death and canopy decline.

Type-one borer corridors (dark brown lines) associated with the decayed region (brown) and adjacent healthy tissue. Photo - Ryan Hooper.

The research identified an association between Type-one borers and fungal cankers on every declining branch sampled, but never on healthy trees.

Although many trees did not show signs of flagging throughout 2003, Hooper's study found evidence that healthy branches had been subject to the same type of damage in previous decline events. This evidence suggests that fungal pathogen dispersal mechanisms and/or the population dynamics of the Type-one borer may hold the key to where the crown decline syndrome is expressed from year to year.

The findings were presented to the American Phytopathological Society's annual conference in 2004. Hooper is currently submitting a scientific paper *The characterisation of damage and biotic factors associated with the decline of wandoo in South Western Australia*, to the *Canadian Journal of Forest Research*, NRC Research Press.

Future research directions

The next stage in Hooper's research is to undertake a PhD project to identify the Type-one borer, describe its biology and life history, and clarify the interactions between the wood-borer and fungal pathogen(s) in relation to environmental change that result in the decline of tree health.

Environmental studies (Ecophysiological research)

In May 2004, Dr Pieter Poot from UWA led a research survey team to gain some insight into the geographic extent of wandoo crown decline and the possible underlying environmental causes.

Sample sites were selected where:

- wandoo was the dominant tree species;
- the population of wandoo was relatively large; and
- the sites chosen were evenly spread across wandoo's known distribution range.

These criteria excluded single paddock trees or relatively small populations.

At each of the 30 sites, health ratings were given to 12 randomly selected average-sized trees, with a maximum rating of 100 per cent. The ratings were based on six tree characteristics – previous canopy damage, recent canopy damage, recent canopy growth, crown size, crown density and epicormic growth. Where possible, one co-occurring eucalypt species (jarrah, marri, powderbark, salmon gum) was included in the analysis.

The results confirmed the field observation that the average health of other eucalypt species (64 per cent) at the sample areas is better than that of wandoo (48 per cent). Figure 1 indicates there is no clear regional pattern of the health status of wandoo.

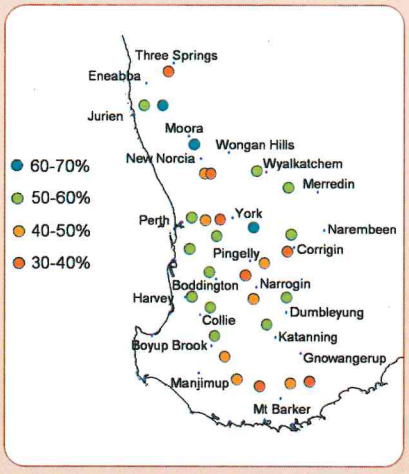


Figure 1. Health status (percentage of maximum possible score) and approximate location of 30 wandoo sample populations.

Environmental studies (Ecophysiological research) continued

Leaf and soil samples were taken at each site for each tree for subsequent chemical analysis and may provide clues on whether individual tree health or average site health is related to salinity stress, drought stress or nutrient imbalance.

Another line of the research is screening the tolerances of wandoo populations (seedlings grown in glasshouse) to salinity, drought and waterlogging.

Data will provide information on the genetic and physiological variation within and among populations of wandoo for these stress factors. This could be important for future rehabilitation projects.

CALM's Wheatbelt Rural Advisory Officer, Peter White, and WRG Executive Officer, Liz Manning.

Future direction

The research team believes that drought conditions over the last two decades may be partly responsible for wandoo decline by weakening the tree and making it more vulnerable to insect attack. A continuing drought could start to affect other species in the future. Therefore much of the research to be undertaken in the coming year will focus on the water relations of wandoo and some of the co-occurring eucalypt species at a few core sites.

The research team will be seeking funding and collaborative support to better understand the consequences of long-term drought on a catchment scale from a hydrological and a vegetation perspective.

The UWA research team (from left) is Ryan Hooper, Lotte Westerhof, Dr Pieter Poot, Dr Erik Veneklaas, Professor Hans Lambers and Eleftheria Dalmaris.

More information

Government and community based action is under way to map the extent of decline, and monitor trends, in the health and condition of wandoo forests. For further information on the work of the WRG and how you can help, contact Executive Officer Liz Manning on 0427 441 482 or Chairman Alan Sands on (08) 93684399.

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