October 2008
York, WA

5 Year review - wandoo crown decline

PROGRAM

8:30 am	Registration
	Attendees provided with information pack
	Publications on wandoo and other tree declines
8:50 am	*Video / slide show – wandoo decline across the landscape and presentation about sponsors*
9:00 am	**Welcome and introduction**
	Alan Sands, Department of Environment and Conservation (DEC)

Chair: Alan Sands (DEC)

9:05 am	Opening Address – *Alan Sands, DEC*
9:15 am	Setting the scene - *Liz Manning / Bruce McGregor, Wandoo Recovery Group*
9:30 am	Survey and mapping
	Community based surveys, 2006-2008 (Kim Whitford, DEC)
	Observations from Wundabiniring Brook (Allan Wills, DEC)
	Surveys of wandoo decline, 2002 & 2008 (Jack Mercer, consultant)
10:20 am	Panel discussion
10:30 am	**Morning tea**

Chair: Peter White (DEC)

10:50 am	Research projects
	Historical review of wandoo (Dr Andrea Gaynor, University of Western Australia)
	Water relations and genetic variability of wandoo (Dr Erik Veneklaas UWA)
	Insects and fungal pathogens (Ryan Hooper, PhD student UWA)
12.00 noon	Panel discussion

Book Launch

12:10pm Lunch

Chair Dr Pieter Poot (UWA)

1:00pm Other tree declines / stresses

Tuart and marri decline (Dr Paul Barber, Murdoch University)

Armillaria (Dr Richard Robinson, DEC)

Sudden heat stress (Peter White, DEC)

1:50 pm Panel discussion

2:00 pm Uniting research

State Centre of Excellence for Climate Change; Woodland and Forest Health (Associate Professor Giles Hardy, Murdoch University)

Climate change: tree, woodland and forest declines (Professor Tom Lyons, Murdoch University)

Future directions of WRG (Liz Manning, Wandoo Recovery Group)

2:35 pm Panel discussion

2:45 pm Closing (Alan Sands, DEC)

2:55 pm Afternoon tea

3:15 pm meeting of WRG / presenters to finalise outcomes

CVs AND ABSTRACTS

Opening Address

Alan Sands

Department of Environment and Conservation / Wandoo Recovery Group

CV

Alan Sands is the Chairman of the Wandoo Recovery Group, a role he has held since the group formed in 2003. Currently Alan is the Acting Director of Environmental Regulation Division with the Department of Environment and Conservation (DEC).

For the past six years, Alan has been the Regional Manager for DEC's Swan Region. Previously he worked with the Department of Conservation and Land Management as a District Manager, Regional Leader for Recreation and Tourism, Landscape Architect and Parks and Reserves Officer. Alan has tertiary qualifications in Landscape Architecture and Natural Resource Management.

Setting the scene – what wandoo means to us

Liz Manning

Wandoo Recovery Group

CV

Elizabeth Manning has been the Executive Officer of the Wandoo Recovery Group (WRG) since its inception in 2003. She manages and coordinates the work of the Group with government agencies, natural resource managers, research institutions and community groups. Prior to this Liz held the position of Landcare Coordinator for the York district from 2001 – 2004. Before moving to York, Liz lived in Arnhemland where she studied the rehabilitation of eucalypt forest ecosystems after mining and the effects of wildfires. Her interest in the environment spans 20 years during which time she has been an active member of numerous local and regional committees involved in natural resource management.

Bruce McGregor is a foundation community member of the Wandoo Group.
I have had my farm property in York since 1968. I became involved with the York LCDC somewhere around the late 80's/ early 90's and finished up as chairperson of this group. I have been a member of the Avon Nature Conservation Advisory Committee (ANCAC) since late 2002. As a member of the WRG and ANCAC my main focus is on the environment in general and our forests in particular.

ABSTRACT

The woodlands of south-west Australia are enormously valuable ecological and cultural assets. Wandoo is a widespread and valuable tree species, endemic to the region. Wandoo has played is a vital part of our history, culture and economy. The decline of wandoo and other woodland species is occurring on a regional scale across a range of climatic zones and landscapes and is a cause for significant concern. Although the cause is unclear, climate change, altered land use and management, and pest populations appear to be relevant factors.
This talk will look at the unique qualities and significance of wandoo and other iconic tree species and of woodlands in general; the formation of the Wandoo Recovery Group; factors contributing to decline of woodlands and to ensure these marvellous woodlands are preserved for future generations to enjoy.

Community-based surveys, 2006-2008

Kim Whitford

Department of Environment and Conservation

CV

Kim Whitford is a research scientist with the Department of Environment and Conservation. His research covers aspects of sustainable forest management in the jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus marginata*) forests. Kim's recent and current research focuses on fauna hollows in logs and standing trees, the impact of forest management practices on coarse woody debris volumes and decay, seed production and the seed cycle in jarrah, and soil disturbance caused by timber harvesting machinery. Kim also contributes to a project monitoring crown decline in *Eucalyptus wandoo*.

ABSTRACT

The WRG coordinates a project to assess the health of wandoo trees at sites across the south-west. This project assists in clarifying the geographic extent and severity of decline throughout wandoo's natural range and provides information on the annual progression of decline symptoms. The WRG provides training and support, and community volunteers, TAFE students and DEC staff conduct transect surveys. This presentation provides a brief description of the symptoms of wandoo crown decline, explains the survey technique and reports results from surveys conducted in 2006, 2007 and 2008 at twenty-two monitoring sites located between Chittering and Cranbrook. The changes observed on these sites and the value of these surveys are discussed.

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10 years of photo-observations from Wundabiniring Brook

Allan Wills

Department of Environment and Conservation

CV

Allan Wills graduated from University of WA in 1985 with an Honours degree Botany.
Technical officer 1987-1991 for CALM on research into *Pinus radiata* nutrition and water use.
Technical officer 1992 to present with CALM and DEC assisting in a variety of forest entomological research projects including:

- Fire effects on Jarrah Leafminer
- The effects of rainfall gradients on canopy invertebrate faunas of jarrah and marri.
- Canopy invertebrate faunas of Tasmanian bluegum plantations as an early survey of potential pests.
- The FORESTCHECK project, monitoring invertebrate faunas of the jarrah forest to determine their responses to silviculture and as benchmark to detect future effects of climate change.
- Walpole small grain fire mosaic project looking at the effect of scale and frequency of fire within landscapes on invertebrate biodiversity.
- Other invertebrate research has been on earthworms of the Porongurup Range and Swan coastal plain.

ABSTRACT

Following concern of residents of the Talbot area west of York at the deterioration during the 1990's in health of local Wandoo, Wandoo at Wundabiniring Brook was inspected and samples and photographs taken of a series of Wandoo trees. Decline in Wandoo is not unprecedented as an episode of decline and recovery was known form elsewhere from the 1980's. To capture a visual record of the event, 3 trees and 2 stands of trees representing a range of crown conditions were photographed from 1999 until May 2008 every year mostly in late autumn.

Wandoo crowns showed a range of symptoms including: death of clusters of foliage (flagging), thinning or complete loss of terminal foliage, and initiation of epicormic shoots some way down branches. There was considerable variation in severity of symptoms between trees. Loss of both terminal and epicormic foliage due to flagging was greatest from 1999 to 2001 however some loss of foliage continued to 2004. As the severity of flagging abated and particularly from 2004 onward, dense epicormic foliage replaced lost foliage. Attributes of crown condition were estimated from the photographic series. These attributes are percent of crown dieback, present foliage density averaged across the former extent of the crown, and foliage transparency or the amount of light that penetrates the current extent of the crown. These vary in ways characteristic of the extent crown decline within a tree. Effects of an episode of crown decline on crown condition were long-term in effect.

Surveys of wandoo decline in the Wheatbelt and in state forest, 2002 & 2008

Jack Mercer

Consultant for NRM assessment and planning

CV

Jack Mercer is an environmental consultant who has worked with several aspects of native plant conservation. His Honours thesis in 1991 was an investigation into the decline of *Eucalyptus wandoo* in the central wheat belt. This was followed up with investigation and trials into the re-introduction of wandoo into degraded remnants using ashbed regeneration. Similar work was also undertaken for the re-introduction of understorey species into farmland remnants, and the re-establishment of viable local species into saline and riparian lands. He undertook further investigation of wandoo in 2002 and again in 2008 across the wheat belt and state forest to establish what the trend was in WCD.

ABSTRACT

In 2008, although there have been regional changes in wandoo crown decline (WCD), several parameters analysed in this survey and that of 2002 have similar trends. Environmental disturbance, however, continued to cause WCD. As in 2002, crown health improved: where insect damage decreased; the longer a site was without fire; from lower to higher position in the landscape; on land with gradients of 4-6 degrees; in remnants on privately owned land and in road reserves, but was less healthy in National Parks and Nature Reserves; in sites adjoining bushland, but was less healthy inside bushland; in association with the presence of older epicorms (or none at all) as well as increasing presence of fruit, buds and new leaves. Trunk and large branch damage from borers showed a marked increase since 2002, indicating that wandoo are likely subject to ongoing stress. In 2008 variable trends in WCD were still evident but with more wandoo affected by decline in some districts while other districts were recovering. In 2002, 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. This was no longer the case in 2008 where the eastern and western extremities of the southern and central transects exhibited post 2002 decline. The northern transect also showed a similar time frame of decline on the eastern extremity but recovery was evident in the west. It was beyond the scope of this survey to show rainfall deficits were inciting decline in the landscape and that high stem density resulted in water deficits. Understorey decline, assessed only in 2008, was low and showed no significant correlation with increasing or decreasing wandoo decline. Regarding the presence of understorey, woody species and native monocots displayed less cover as wandoo crown health improved. On the other hand, litter cover increased as crown health improved. Apart from new decline recorded in the second survey, recovery was generally moderate to high, intermediate and slow on the northern, central and southern transects respectively.

Historical review of wandoo – in health and decline

Dr Andrea Gaynor

University of Western Australia

CV

ANDREA GAYNOR is Senior Lecturer in History at The University of Western Australia. Primarily an environmental historian, she pursues various questions relating to the historical relationships between people and places. She has published on topics as diverse as landscape art and feral cats, and in 2002 co-edited (with Mathew Trinca and Anna Haebich) Country: Visions of Land and People in Western Australia (W.A. Museum, 2002). Her latest book is Harvest of the Suburbs: An environmental history of growing food in Australian cities (UWA Press, 2006).

ABSTRACT

The aim of this research was to find out whether the current decline problem is historically unique or cyclical and canvass possible causes, as well as creating a record of the past relationships between people and wandoo. It involved interviews with people who have lived and worked in wandoo areas, as well as a review of photographic, archival and other historical documentary sources. Although this review sought evidence of crown decline anywhere in the range of wandoo, two focus areas were chosen for more detailed study: Kojonup and surrounds, and the areas north and east of Mundaring (including Julimar). Interviews were also conducted with interested and knowledgeable people living near or between these areas, and those who have worked with the tree across its range. Several of those interviewed commented on the long-standing tendency for twigs and branches to die off in some trees, particularly as they age. It is therefore against this backdrop of 'natural' dieback in the crown (whether due to insect attack, drought, or old age) that some have seen crown decline emerge. At least five interviewees observed the health of the trees deteriorating in the 1970s, most likely in association with a decline in rainfall, though most placed the emergence of actual crown decline in the 1980s, mid-late 1990s, or early 2000s. Although it is not possible to uneqivocally rule out any historical incidence of wandoo crown decline occurring, the testimony of so many keen observers, in conjunction with the documentary record, strongly suggests that it has only emerged at a significant level from the 1980s. This study also unearthed some fascinating insights into wandoo and its woodland settings, which may provide a useful context for further scientific research into the problem.

Does drought play a role in wandoo decline?

Dr Erik Veneklaas, Dr Pieter Poot & Eleftheria Dalmaris

University of Western Australia

CV

Dr Erik Veneklaas is a Senior Lecturer in Plant Physiological Ecology in the School of Plant Biology of the University of Western Australia. He obtained his PhD from Utrecht University (the Netherlands) in 1990 with a thesis on tropical cloud forest ecology and hydrology. He has since worked in the Netherlands, Syria, Colombia and Australia. In the ten years that he has been at UWA, his projects have addressed a wide range of issues related to plant functioning in natural, degraded and rehabilitated ecosystems, as well as crops and tree plantations. From 2003 he has led research into wandoo crown decline in the School of Plant Biology. This research will be continued in the Centre of Excellence for Climate Change and Woodland and Forest Health (funded by the WA State Government) in which he is a program leader.

Dr Pieter Poot is a Lecturer in Conservation Biology in the School of Plant Biology of the University of Western Australia, and a researcher for the Department of Environment and Conservation. He obtained his PhD from Utrecht University (the Netherlands) in 1996 with ecological/physiological research analyzing fitness consequences of male sterility in plants. Since his arrival in Australia he has worked on ecophysiological aspects of plant performance in ecosystems like *Banksia* woodland, shallow-soiled ironstone communities, and wandoo woodlands. In general he is interested in the ecological/physiological and evolutionary drivers of plant species distribution patterns with an emphasis on rare and endangered species.

Ms Eleftheria Dalmaris is a postgraduate student in the School of Plant Biology of the University of Western Australia. She holds a Forestry degree from the Aristotle University of Thessaloniki (Greece) and is now in the late stages of her PhD project which addresses the tolerance to drought and salinity and the genetic structure of wandoo.

ABSTRACT

Wandoo crown decline is a phenomenon that is occurring across the whole distribution range of the species. This region has experienced a marked drop in annual rainfall, and it therefore makes sense to investigate if reduced water availability may play a role in the decline. There is clear evidence that insects and fungi are associated with the symptoms of crown decline, but it is possible that these organisms are taking advantage of a weakening of the tree caused by drought stress. The observation that a number of other eucalypts in the same region also experience health problems, but are associated with different insects and fungi, suggests that there is a more general stress factor in the environment, and that the pests and diseases are a secondary rather than a primary factor in the decline.

As a species, wandoo is remarkably widespread, from high to low rainfall zones. This might suggest that the species is widely adapted and that water is not a critical factor for its distribution. Such a conclusion would not be correct, because water availability to a tree is not determined by rainfall alone. Moreover, a *change* in water availability may be more important than the actual amount of rainfall. The amount of water that a tree can access is the result of the balance between the ins and outs. Rainfall is an important factor, but other factors are runoff and runon water, evaporation losses, and competition with other plants including other wandoos, other trees and understorey. The water available to a wandoo tree in a dense forest on a slope in the high rainfall zone may be quite similar to that of a tree in an open woodland on the valley floor of the low rainfall wheatbelt. However, both trees would be affected by a 20% decrease in rainfall, whether it is from 1000 to 800 mm or from 350 to 280 mm.

Our hypothesis is that the observed long-term decline in rainfall is having a negative effect on tree health, and we have been trying to understand why this might affect wandoo more than other species. In particular, does wandoo have ecological or physiological properties that make it more vulnerable to a long-term reduction in water availability? We have studied the responses to seasonal drought of wandoo and three other eucalypts in healthy stands at Julimar State Forest. Wandoo proved to be a species that is able to extract large amounts of water from both moist and dry soils, in contrast to jarrah and marri which use water much more economically when soils dry down. Powderbark wandoo behaves similar to wandoo. While wandoo's ability to take up water from dry soils would seem a positive trait, it may actually be a liability in a drying climate. The extraction of water from dry soils requires the development of very large tensions in the sapwood, which can ultimately lead to hydraulic failure. Wandoo usually occurs on soils that contain clay and have a large water-holding capacity. In such conditions, wandoo's continued water uptake over summer was not a problem. However the long-term below-average rainfall combined with the continued water use of wandoo may have depleted the soil moisture to a critically low level.

Given the wide distribution of wandoo there is a possibilty that different populations do have different ecological and physiological properties. If there are populations that have a greater tolerance of stresses like drought or salinity, such populations would be useful sources of genetic material for plantings of the species in stressful habitats. Our screening of 30 wandoo populations for drought and salt tolerance in controlled experiments is inconclusive but suggests that there are no large differences between populations. Genetic analysis indicates that there are basically two large families of wandoo, one that contains the populations of the higher rainfall western edge of the distribution range, and one covering the wheatbelt populations. The western populations appear to be more ancestral, indicating that wandoo's presence in the drier climatic zone is of a more recent nature.

Introducing the face and facility of organisms involved in Wandoo Decline.

Ryan J. Hooper

Department of Environment and Conservation, University of Western Australia

CV

Ryan Hooper is a graduate environmental scientist and Project Officer at the Department of Environment and Conservation. He is trained in soil science and botany with a wide range of interests relating to natural ecosystems and their health. A particular affinity with the bush led to an interest in Wandoo decline as an undergraduate taking elective research in plant pathology, comparing the influence of different isolates of a soil-borne fungus (*Rhizoctonia solani*) on lupin and canola in 2002. Since then he has been engaged in field-based research as a postgraduate student working with Wandoo and DEC projects on the *Phytophthora cinnamomi* affected Banksia communities on the South coast. His vision is to place the failing health of natural systems in a larger context of global change and explore interactions with human health, wealth and well-being.

ABSTRACT

Identifying harmful organisms and their facility within *Eucalyptus wandoo* (Wandoo) trees is an important precursor to understanding the larger questions of *why* decline is occurring. In this paper, a wood-borer species (Coleoptera: Buprestidae) is introduced and aspects of its biology, activity and damage are described. The facultative association of fungal species (Ascomycotina: *Botryosphaeria* sp., *Cytospora* sp. and *Endothia gyrosa*) (i.e. how they benefit) with borer age structure is presented. A critical understanding of *how*, *where* and *when* these organisms contribute to decline symptoms has been gained over 5 years of research. Sites were located on the Eastern boundary of Helena, Dale and Canning River catchments. The implications of these findings in the context of the long-term health and survival of Wandoo require further investigation and reasons for this are discussed.

Other tree declines – tuart, marri and peppermint

Dr Paul Barber

Murdoch University

CV

I have been studying diseases of eucalypts in native forests and woodlands and plantations for the past 15 years. After graduating from La Trobe University I moved to Perth 5 years ago to take up the position of Project Co-ordinator for the Tuart Health Research Group (THRG) based at Murdoch University investigating the potential cause(s) and management of the decline of *E. gomphocephala.* I have a broad range of interests which include fungal pathogens of eucalypts in native ecosystems and

plantations, urban tree health, insect pests, plant nutrition, remote sensing and GIS, and treatment of tree health disorders.

ABSTRACT

Over the past two decades there has been an increase in the severity of the decline of some of the iconic tree species endemic to the south-west of W.A. Three of these species, the tuart (*E. gomphocephala*), marri (*Corymbia calophylla*) and peppermint (*Agonis flexuosa*) all exhibit different spatial and temporal patterns of decline and express the decline as a variety of symptoms. The decline in health of these species has very important social and environmental implications. This presentation will cover some of the most recent findings of research that has been conducted into the cause(s) of the decline of these species, and the current and future research and management approaches.

Armillaria root disease in native forest and woodlands in the southwest

Dr Richard Robinson

Department of Environment and Conservation

CV

Dr Richard Robinson is a Research Scientist with the Science Division in the Department of Environment and Conservation. Based at the Manjimup Research Centre since 1996, his work involes investigating the impacts of forest management on fungal communities and disease and defect caused by wood rotting fungi. His area of expertise is in the control and management of Armillaria root disease, the adaption of fungi to fire, the succession of fungal communities following fire, and the biology and ecology of wood decay fungi.

ABSTRACT

Armillaria luteobubalina is an endemic pathogen of sclerophyll forests and woodlands of southern Australia. The fungus infects the roots of susceptible hosts causing a root and butt rot, commonly referred to as Armillaria root disease (ARD). Under natural conditions, *A. luteobubalina* exists in a state of balance, but in modified or changing environments it appears to be more aggressive. In jarrah and wandoo stands, A. luteobubalina causes scattered or patchy deaths and crown decline. In wetter high quality regrowth karri stands, *A. luteobubalina* causes significant losses due to mortality and defect, which are exacerbated by intensive management practices such as thinning. Loss of roots due to rot often result in wind-thrown trees. Outside the forest environment, *A. luteobubalina* has also been recorded causing significant losses in some coastal heath and woodlands communities.

Sudden heat stress

Peter White

Department of Environment and Conservation

CV

Peter White is a Nature Conservation Advisory Officer with the Dep't of Environment and Conservation. Based in the Wheatbelt Region since 1990 his work has involved working with rural communities, providing advice on plant propagation, revegetation design and implementation, and plant health issues. He shared in the community concerns regarding the declining condition of *Eucalyptus wandoo* and has been part of the WRG since its inception.

ABSTRACT

On Friday 2nd and Saturday 3rd February 2007 record high temperatures and low RH's were experienced at many centres across the Wheatbelt. Several days later, the affects of these conditions became evident as the canopies of many tree species, including *Eucalyptus wandoo,* began to change colour and loose leaves.

This presentation tracks the visible effects of the heat stress on the tree canopies and their subsequent recovery over 12 months. There were some noticeable differences between this heat stress event and that of the very dry conditions which occurred at the same time. Some observations from a previous heat stress occurrence in 1991 are also included.

Uniting research efforts

Associate Professor Giles Hardy

Director; State Centre of Excellence for Climate Change; Woodland and Forest Health, Murdoch University

CV

Associate Professor Giles Hardy is the Director of the State Centre of Excellence on Climate Change and Woodland and Forest Health. His interests cover the biology, ecology, pathology and control of *Phytophthora* diseases in natural and managed ecosystems. He also has research interests in the diseases of plantation trees in Australia and overseas and in urban tree health. More recently his interests have extended to study the impact of diseases on ecosystem function and health, with an emphasis on woodlands and forests and ways to mitigate declining health of ecosystems. Consequently, he is involved in projects that cover a range of disciplines in order to understand the processes involved.

ABSTRACT

This talk will cover the new State Centre of Excellence on Climate Change and Woodland and Forest Health. He will give a broad overview of the Centre, its four programs; the people involved and give an overview of the type of work which is planned over the next five years.

Climate Change; Tree, woodland and forest declines

Professor Tom Lyons

Murdoch University

CV

Tom Lyons holds the established Chair of Environmental Science within the School of Environmental Science at Murdoch University. He is a boundary layer meteorologists whose research over the last thirty plus years has focused on land atmosphere interaction. He leads a major international experiment based in the Great Southern on the interaction between land use change and climate. As well he is undertaking extensive mesoscale meteorological modelling to understand the local impact of climate change.

ABSTRACT

Whilst climate change predictions suggest that the south west of Western Australia will become drier and warmer, these broadscale predictions are of limited use to the land managers. Dynamic downscaling offers the opportunity to link such predictions to their local impact and this is highlighted with respect to Wandoo by linking the observed decline to work proposed under the Centre of Excellence.

Future Directions

Liz Manning

Wandoo Recovery Group

ABSTRACT

In the face of climate change predictions there is strong likelihood that the incidence of decline affecting native tree species will continue. The work of the WRG has been extremely important in capturing and documenting this wandoo decline event as well as the recovery phase that is evident in some areas. Such work has provided the WRG with an important tool which can be used to guide future research projects and management actions. The Centre of Excellence will do much to unite research efforts into these declines, restore biodiversity values and put in place policies and actions for woodland restoration. WRG will strengthen and extend the successful partnerships that it has built.