Reaching critical resource thresholds in WA’s forests and woodlands: How should we respond?

Presented By
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Who we are…….

A unique consortium of scientists, industries, and government agencies dedicated to understanding and developing solutions to declining forest health in an era of climate change.
Our model......

Program 1
Remote sensing and climatology

Program 2
Decline Ecology

Program 3
Restoring biodiversity values

Program 4
Social-political dimension

Forest Health
Our Aims……

Use sound science to develop an understanding of ecosystem and societal processes and provide solutions for an ailing forest

Program 1: Determine how climate and climate change impacts on trees, woodland and forest processes

Program 2: Establish the roles of environmental and pest stress in contributing to declining tree, woodland and forest health

Program 3: Evaluate the impacts of declining forest health on flora and fauna and develop methods for biodiversity restoration

Program 4: Ascertain the impacts of declining forest health on society and develop strategies for incorporating forest health solutions into policy
Many forest and woodland declines* are occurring in the south-west

*Tree mortality over many years leading to deteriorated condition

Eucalyptus gomphocephala (tuart)

Corymbia calophylla (marri)

Eucalyptus rudis (flooded gum)
Sudden massive canopy failure in the Northern Jarrah Forest (since Feb 2011)

We believe the collapse of key canopy and midstory species to be very different from other tree declines in terms of:

- Scale
- Severity
- Potential impacts and effects
Midstory Tree Mortality

*Banksia* and *Allocasuarina* foliage began yellowing in February and has since died. More trees are continuing to die.

Midstory tree mortality is often observed in the absence of canopy tree death.
Canopy Tree Mortality

Jarrah is the primary canopy tree observed collapsing throughout the forest. However, in the most severely affected areas marri has also failed. This observation is contrary to traditional thinking.
Symptoms prior to canopy collapse

Prior to total crown foliage death leaves wilt, dry, then turn pale green.

Stem sapwood is characteristically dry during this stage of senescence suggesting a sudden failure of water conduction.
During canopy tree collapse

Woodboring insects are invading collapsing trees, feeding within the dried sapwood, phloem, and cambium. Many trees are filled with hundreds of active larvae. Their secondary damage with likely retard the ability to re-sprout and the population spike could have dramatic unintended consequences for the remaining stressed trees in the future.
What we know about the scale of the damage

In a recent aerial survey of 8.8% of the Northern jarrah forest, approximately 1600 ha were determined to be severely affected, representing 1.6% of the sample. Additionally, an estimated 5% was showing severe crown chlorosis and discolouration.

Key
Blue Line = Flight Path
White Shading = sample area
Red Polygons = severely damaged areas
What we know about the scale of the damage
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What we know about the scale of the damage

Most damaged areas are closely associated with a shallow soil structure.

Large areas in the Northern section of the sample area are not yet dead but are severely chlorotic (yellowing) and is likely to tip towards death in the near future.
Implications for flora and fauna

By most accounts the scale of the disturbance affecting the Northern Jarrah Forest is unique, and as a result direct and indirect impacts on associated flora and fauna are unknown.

It is seems clear, the current canopy collapse is causing rapid ecosystem changes both in structure and function. This disturbance is in stark contrast to the steady crown dieback and gradual ecosystem transition that has been taking place in the jarrah forest for the last 25 years, which has likely contributed to many declines in associated fauna populations.

The increased fuel will likely have dramatic consequences on fire intensity, which has the potential to have many secondary effects.
The forest can teach us

What we hope to learn from the current situation

1. The overstory tree and understory plant species most and least susceptible
   - Develop susceptibility rankings based on observational and quantitative data

2. How the ecosystem structure and function changes as a result of the damage?
   - Successional changes following catastrophic natural disturbance
   - Impacts on flora (compositional shifts) and fauna behaviour

3. What insect and disease pests are proliferating as a result of the forests’ condition and their impact on neighbouring healthier plants?
   - Determine the potential for opportunism in damaging pest populations

4. The site (topography, soils) and stand factors associated with the collapsing patches
   - Develop risk ratings for sites throughout the forest
   - Enable targeted management of the most severely stressed sites
How should we respond?

Our personal and professional thoughts

The South-West of WA, while being one of the global hotspots for biodiversity, is expected to continue to get hotter and dryer. Many of the tree species currently dying are some of the most well-adapted for extreme soil water deficits on the planet. Their ability to sustain massive crown dieback, while preserving the ability to re-sprout enables many of these plants to survive during prolonged droughts. Despite these adaptations, many trees on the most susceptible sites are reaching their threshold and dying. We believe the scale and severity of the damage is a clear warning for what will happen on many more, larger areas of the forest if something does not change. The current trajectory of the forest is not sustainable in the current climate cycle. As a society we are faced with a decision to simply watch as large tracts of forest die, resulting in sudden and extreme ecosystem shifts, or explore ways to relieve stress, prevent large-scale mortality events, and preserve ecosystem structure and functioning.
# How we should use good science to give us options

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<th>Step 1</th>
<th>Understand what is happening and where it is happening</th>
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<td>- Develop a drought risk rating for sites throughout the forest</td>
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| Step 2 | Develop a series of management treatments aimed to relieve competition stress on forest trees and prevent further canopy collapse |

| Step 3 | Establish measurable parameters and monitor how forest trees, understory plants, associated fauna, and forest pests, are interacting on a set of large-scale, replicated sites within each of the drought risk ratings throughout the forest |

| Step 4 | Treat the experiment sites |

| Step 5 | Assess the effects on all parameters measured prior to treatment and develop a feasibility model identifying the benefits and shortcomings of each treatment including key higher order effects |
Summary

Many sites within the Northern Jarrah Forest and other areas of the South-West are currently reaching their thresholds for soil water and are dying on a large-scale. However, these are simply the first and most susceptible sites to be affected. We believe many more sites will be affected if nothing is done to relieve the stress in the forest. We propose that good science can contribute to developing a series of options for helping prevent the ecosystem catastrophe that may come. The South-West of WA is considered one of the global “guinea pigs” for the effects of climate change. The current disaster in the forest is one of the first signs that this prediction is true. The question now is, How should we respond?

For questions or comments please contact
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