Green Carbon in the

Great Western Woodlands

A Global Opportunity

This Great Western Woodlands Collaboration paper draws on the latest scientific research including the Australian National University (ANU) Enterprise report: *Biomass Carbon Stocks in the Great Western Woodlands*. Berry, S.L., Keith, H., Mackey, B.G., Brookhouse, M., and Jonson, J. (2009) ANU Enterprise.

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Key Findings of the ANU Enterprise report

- The estimated amount of carbon currently stored in the vegetation and soil of the Great Western Woodlands is 950 million tonnes - equivalent to more than six times Australia's greenhouse gas emissions for 2008[1].
- Most of this 'green carbon' is stored in the soil, with every hectare containing an average of 40 tonnes of carbon. An additional 20 tonnes of carbon per hectare, on average, is stored in the trees, roots, woody debris, branches, and shrubs across the region.
- Sites located in the mature woodlands have higher carbon stocks than those sites that contained fewer or smaller trees (e.g., shrublands and mallee ecosystems).
- The highest amount of carbon is found in mature eucalypt woodlands that had not been disturbed by logging, pastoralism or mining.
- Large, unplanned fire is the biggest threat to carbon found in the Great Western Woodlands, with an estimated 4.5 million hectares burnt over the last 36 years, including more than 2.5 million hectares that has been burnt since 2000.
- With improved management, especially of large, intense and frequent wildfires, emissions from further degradation could be avoided, and the carbon stocks of currently degraded woodlands could be restored. The study found that under a scenario where fire was excluded and there was little or no other disturbance from vegetation clearing almost 1,550 million tonnes of carbon could be stored in the Woodlands – more than 600 million tonnes of carbon greater than is currently stored in the Great Western Woodlands.

Footnote

1. This calculation assumes 1 tonne of carbon = 3.664 tonnes of carbon dioxide equivalent, and Australia's annual emissions in 2008 were correctly estimated by the Commonwealth to be 0.55 billion tonnes of carbon dioxide equivalent.

Background

In 2007, the United Nations Climate Change Conference in Bali (UNFCCC CoP 13) agreed that if global temperature rise is to be kept below the dangerous level of 2 degrees, urgent action would be required to substantially reduce greenhouse gas emissions.

In order to achieve this target, this conference found that preventing emissions from deforestation and forest degradation offers the prospect of relatively cheap 'early' action and will be a critical part of the solution to global climate change.

The Intergovernmental Panel on Climate Change (IPCC) has identified the need for reliable baseline carbon accounts to enable assessment of the best ways of reducing emissions from natural forests and woodlands. Given this, the Great Western Woodlands Collaboration provided funding support for research to assess the current and potential carbon carrying capacity of the Great Western Woodlands.

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The Great Western Woodlands

The largest and healthiest tracts of temperate woodlands remaining on Earth are found in the region known as the Great Western Woodlands. Extending from the edge of the Western Australian Wheatbelt to the mulga country on the northern boundary and the treeless Nullarbor Plain to the east, the region covers almost 16 million hectares. Nearly three times as large as Tasmania, this region is dominated by eucalypt woodlands (or 'open forest') intermixed with mallee, low shrublands, and salt lakes.

The region is now recognised as having biodiversity of global conservation significance. For example, more than 20% of all Australia's native plant species and 30% of Australia's Eucalyptus species ('gum trees') are found here. In addition, hundreds of species of native birds, mammals and reptiles are found in the area, and it is thought that near extinct native species like the numbat, woylie and scarlet-chested parrot still survive in this landscape. It also has significant cultural values, including being the homeland of many Indigenous language groups including the Ngadju, Wongi, Gubrun and Noongar. Further details of the exceptional natural values of the Great Western Woodlands are provided in the study '*The Extraordinary Nature of the Great Western Woodlands*' (downloadable from www.gww.net.au).

Because of these values, the Great Western Woodlands is increasingly the focus of state, national and international scientific and conservation activity. Universities, museums and other scientific bodies across Australia are now involved in research in the region.

However, despite being globally significant, the region's natural values are threatened by fire, feral animals and weeds, as well as direct human disturbance. At present these threats are not managed because the majority of the region is designated 'Unallocated Crown Land'.

Figure 1. Map of southern Western Australia showing the boundary of the Great Western Woodlands.

Battye Library (GMWA74)

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‘Green carbon’: What is it and why is it important?

Carbon that is stored in natural ecosystems such as forests and woodlands is referred to as ‘green carbon’. It is an outcome of photosynthesis –where plants absorb carbon dioxide from the atmosphere, and use the sun’s energy to direct the carbon into plant growth, producing oxygen as a by-product.

Green carbon is stored in all living and dead plant material including leaves, stems, roots and tree trunks, including dead timber on the ground, and organic matter (from decomposition of plants) in the upper soil layers.

This green carbon is stored in all types of bushland and is a significant component of the global carbon cycle. It’s estimated about 20% of annual global greenhouse gas emissions come from deforestation (land clearing). Emissions from other degrading processes like fire, grazing and logging have not yet been assessed on a national or global scale. These disturbances can all lead to increased carbon stored in plants being released into the atmosphere as greenhouse gas pollution when plant material is burnt, eaten or rots.

Measuring and managing natural ecosystems, and the carbon they store, is therefore a crucial part of any comprehensive approach to addressing the climate change problem.

For more information about green carbon: http://epress.anu.edu.au/green_carbon_citation.html

Figure 2. Framework illustrating the ecological processes involved in estimating the carbon carrying capacity of natural forests and woodlands (that is, green carbon stocks). Boxes represent stocks of carbon, and arrows represent fluxes (movement) of carbon (from Mackey *et al.* 2008).

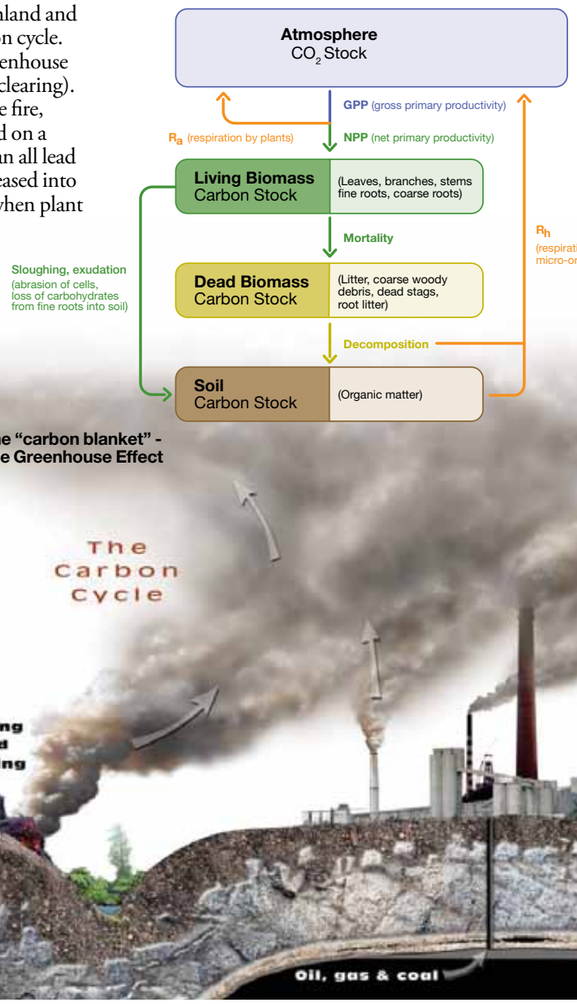

Figure 3. Illustrates the carbon cycle.

What is happening to the Great Western Woodlands green carbon?

Although the Great Western Woodlands is very intact relative to equivalent ecosystems in Australia and elsewhere around the world, some of the landscape has been extensively utilised and disturbed by humans for more than 100 years.

The ANU Enterprise report found that recent and ongoing human activities have had a direct impact on the carbon stocks found in the Great Western Woodlands.

The present fire regime, with increasing frequency of large and intense fires, has been identified as the most significant threat to the carbon stock of the region.

Although not as significant, past logging activities and mining have also had an effect. For example, the research finds that areas that have been previously logged have only 40-50% of the carbon carrying capacity of unlogged woodlands[1]. Areas disturbed by mineral exploration are slightly higher, estimated at 70% of the carbon carrying capacity of undisturbed areas.

The current estimate of 950 million tonnes of carbon represents the current carbon stock inclusive of the impacts of these disturbances.

With better management, especially of large, intense and frequent wildfires, the ANU Enterprise report indicates that an additional 600 million tonnes of carbon could be stored in the Woodlands.

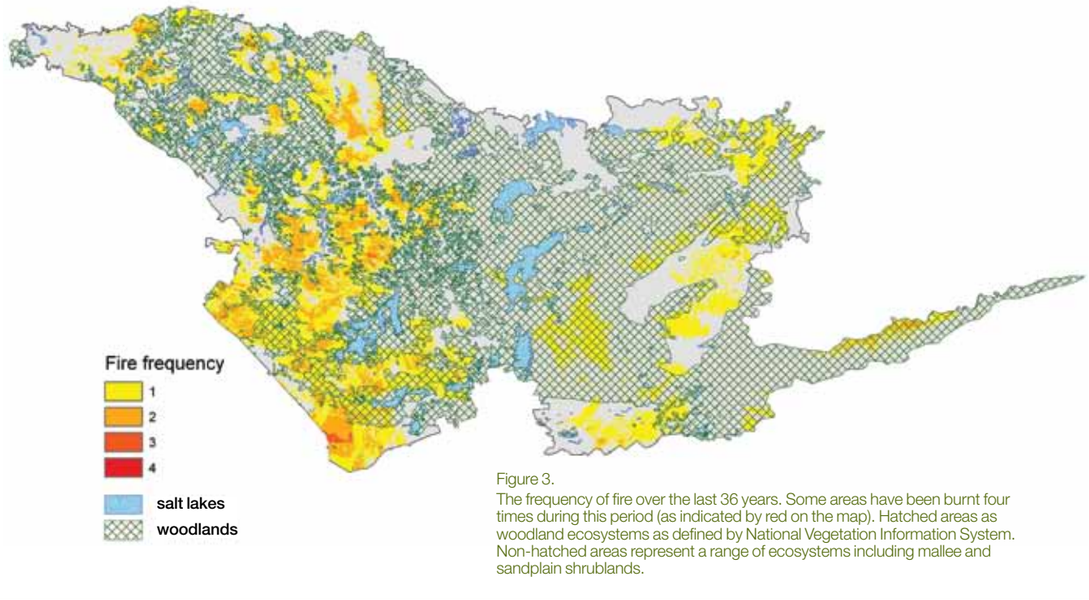

Figure 3.
The frequency of fire over the last 36 years. Some areas have been burnt four times during this period (as indicated by red on the map). Hatched areas as woodland ecosystems as defined by National Vegetation Information System. Non-hatched areas represent a range of ecosystems including mallee and sandplain shrublands.

Footnote

1. Almost 4 million hectares of the Great Western Woodlands are thought to have been affected by historical logging (Kealley, 1991).

Fire

It is estimated that 4.4 million hectares, 30% of the Great Western Woodlands, have been burnt by intense fire over the past 36 years. Of this, 1.46 million hectares were eucalypt dominated woodland, with the rest comprising the more fire prone shrublands and mallee dominated communities. These fires have resulted in the death of mature eucalypt trees over much of the landscape.

The number and the extent of fires appear to be increasing at an alarming rate. For example, in the seven years between 2000 to 2007 for which MODIS NDVI satellite imagery is available, intense fires burnt more than 2.6 million hectares of the Great Western Woodlands. In other words, more than half of the area affected by fire over the 36 years was recorded in the last decade.

Why so many fires?

The two sources of ignition of fires in the Great Western Woodlands are natural (lightning) and human. Lightning strikes undoubtedly ignite some fires within the Woodlands. More research is required to verify ignition sources. There is currently a lack of capacity for the early detection and rapid suppression of fires before they become large and intense wildfires.


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Fire in the Eucalypt woodlands of the region

The mature woodland ecosystems found in the Great Western Woodlands rarely burn if undisturbed by humans. This is because trees are so widely spaced, and litter levels are so low and patchy, that lightning strikes rarely start a large bushfire.

Evidence from the University of Western Australia suggests that these mature woodlands may have a natural fire cycle of more than 400 years. The Traditional Owners that lived in the Woodlands for at least 50,000 years are not thought to have regularly burned these ecosystems, possibly because they didn't 'carry' fire – or because there was simply no significant benefit from large scale burning.

The fire regimes have changed for reasons which are not fully understood.

A range of factors may be involved. Increased human use may have led to increased numbers of ignition. Climate change may have already led to worsening fire conditions. Extensive logging in the early 1900's of some woodland ecosystems in the Great Western Woodlands may have made these ecosystems more fire prone. Young re-growth after logging is much denser than the previously occurring mature woodlands, creating a more continuous fuel layer that may carry fire more readily than mature woodland.

The future of green carbon in the Great Western Woodlands

Global analysis by a Technical Expert Group set up under the Convention on Biological Diversity to advise the United Nations Framework Convention on Climate Change makes it clear that protecting and restoring biodiverse, natural forests and woodlands makes a longer term, more resilient contribution to solving climate change than planting monocultures of trees.

The Great Western Woodlands has significant potential in mitigating greenhouse gas emissions and hence climate change. The future management of the green carbon in the region therefore represents an important opportunity for Western Australia.

Currently, the Great Western Woodlands stores much less than its potential carbon carrying capacity. Maximizing the regions' carbon stocks depends on both avoiding emissions from further degradation and restoring currently degraded ecosystems by allowing them to grow through to maturity (in particular the eucalypt woodlands). Fire plays a major role in the reduction of green carbon in the Woodlands and any attempt to maximize green carbon stocks necessarily requires a reduction in fire frequency, extent and intensity.

Returning the area to a fire regime that protects its outstanding conservation values, and allows woodlands to mature, will be a difficult task. There are many options to work through, but all will involve greatly increased recognition of the area's importance, increased understanding of the ecosystems, and increased resources to support the more intensive conservation management that is required. This also includes upgrading the tenure of Unallocated Crown Land to tenures which better reflect and protect the area's outstanding natural and cultural values while allowing for economic activity including sustainable tourism and mining.

The emerging carbon economy provides a major potential source of investment for protecting and restoring green carbon stocks in the Great Western Woodlands.

Voluntary carbon reduction schemes that involve improvements to land management are already underway in parts of Australia, e.g., the West Arnhem Land Fire Abatement project (www.nailsma.org.au/projects/walfa.html). These programs both reduce carbon emissions and improve the quality of land management for biodiversity, especially via establishment of Indigenous Rangers programs and the re-introduction of Indigenous management.

References:

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The WA State Government has recently commenced work on a Biodiversity Conservation Strategy for the Great Western Woodlands. We commend them on this effort and alert them to the accompanying ANU Enterprise report as a contribution to our improved understanding of the importance of the area – including the massive opportunities for regional benefits from improved protection and management.


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The Great Western Woodlands Collaboration

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