Our native forests: a key to unlocking climate change solutions

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Introduction

Preserving our native forests, woodlands and native vegetation is an essential strategy to combat climate change. The destabilisation of our climate systems due to unchecked greenhouse gas emissions[1] and land clearing since industrialisation has become one of the most significant threats to life on the planet and the functioning of contemporary society. The Environmental Protection Authority (2007) has identified climate change as a top priority environmental concern for Western Australia.

Climate scientists, through the Intergovernmental Panel on Climate Change (IPCC) (2007) have advised that global greenhouse gas emissions must at least be halved by 2050 to avoid the average global temperature rising above the climate safe "guardrail" of 2°C . Highly industrialised developed countries such as Australia have a responsibility to reduce emissions at a more significant rate.

Since 2008 a number of Australian research studies have demonstrated the potential of increasing carbon biosequestration in trees, vegetation and soils to mitigate greenhouse gas emissions. Recent CSIRO research(2009) shows that the combination of increasing carbon stores in natural eucalypt forests, positively managing regrowth vegetation and remnant forests together with converting marginal agricultural land to industrial plantations could yield 503 million tonnes (Mt) CO_2-e per year of carbon capture by 2050. By comparison, Australia's current total greenhouse gas emissions are estimated to be around 600 Mt CO_2-e per year. Therefore, capturing just half of this biosequestration potential could improve Australia's annual carbon budget by 42 per cent.

Biosequestration, particularly through the preservation of our native forests, woodlands and native vegetation also has significant environmental benefits in protecting biodiversity and maintaining ecological services. The resilience that

[1] Carbon dioxide and equivalent gases (CO_2-e) that give rise to global warming and are increasing rapidly due to human activities particularly the burning of fossil fuels.

comes from natural ecosystems in self- regeneration and adaptive capacity will be critical in the south west as the climate becomes progressively hotter and drier.

Carbon abatement through a renewed approach in biosequestration is also likely to be much less costly than the deployment of less proven 'clean coal'/carbon capture and storage technologies (McKinsey & Company 2008; The Climate Institute 2008).

There is an opportunity also to secure international comparative advantage from the development of a comprehensive biosequestration policy, emissions accounting system for standing natural forests and technological advances in biosequestration management.

This paper argues that a comprehensive policy to realise the potential of biosequestration in Western Australia is needed, including the full protection of all native forests and woodlands, as a keystone strategy for climate change mitigation and adaptation.

Significance of Biosequestration

Our understanding of the vast potential for biosequestration to tackle Australia's climate change mitigation and adaptation challenge has been improved by a number of significant research papers over the past two years.

Garnaut Climate Change Review

The Garnaut Climate Change Review (Garnaut 2008) is one of the most comprehensive analyses of Australia's climate change policy options. The wide ranging coverage contained in the Review included an analysis of land use transformation which identified the potential for over 284 Mt CO_2-e per year through forestry initiatives. The Review highlighted that ceasing logging and other human disturbances in pre-1990 eucalypt forests (defined as those existing prior to the Kyoto protocol) alone would remove 136 Mt CO_2-e per year on average for 100 years.

Federal Treasury modelling which followed the Garnaut Review showed that converting former cleared grazing land into industrial forests and environmental plantings could provide a net cumulative carbon sink of up to 4.3 Gt CO_2-e by 2050 under various carbon price scenarios (Commonwealth of Australia 2008 p.186).

Green Carbon Report

Another significant report in 2008 on 'Green Carbon'[2] by ANU researchers provided further analysis of the biosequestration potential of Australia's south eastern eucalypt forests and the carbon carrying capacity of unlogged forests (Mackey *et al.* 2008). The researchers have refined a methodology for estimating the carbon stocks of intact natural forests which was first developed and peer-reviewed in 2006[3] . The natural carbon carrying capacity was defined as '… the mass of carbon able to be stored in a forest ecosystem under prevailing environmental conditions and natural disturbance regimes, but excluding disturbance by human activities' (p. 10). The Green Carbon report found that the south eastern intact natural forests have carbon stocks that are higher than those recognised internationally for temperate forests. This finding is due largely to the collection and analysis of local data from forests that have not been logged. The research shows that the average carbon stock of these unlogged forests is on average 640 tonnes of carbon (t C) per hectare (± 383 t C per hectare)[4] compared to the IPCC default values of 217 t C per hectare for temperate forests. This demonstrates the importance to climate change mitigation of unlogged forests and the need to establish local/regional specific baseline data to verify region specific carbon stocks.

The research also highlighted the substantial potential for carbon sequestration in previously logged natural forests if these forests are allowed to regrow and remain undisturbed by human activity. Numerous studies have shown that commercially logged forests have carbon stocks that are 40 to 60 per cent lower than unlogged forests. This is because most of the forest carbon is found in the living woody biomass of large old trees. The highest biomass carbon stocks were found to be in areas with large overstorey trees in cohorts of two or three different ages together with healthy wildfire rejuvenated understorey trees. Logging reduces the overall age of trees in the forest and results in most above ground biomass being removed. In addition, the emissions from the logging, roading, transportation and industrial processes in producing forest products and establishing regrowth must be taken into account to enable meaningful comparison of emissions outcomes between continued logging and the cessation of logging.

The Green Carbon report also made the case for allowing regrowth forests to reach their natural carbon carrying capacity to improve genetic diversity and

[2] Green carbon is defined as '…carbon sequestered through photosynthesis and stored in natural forests.' Natural forests are defined as '…forests that have not been disturbed by intensive human land-use activities, including commercial logging.' p. 11

[3] Roxburgh S H et al (2006) 'Assessing the carbon sequestration potential of managed forests: a case study from temperate Australia' *Journal of Applied Ecology*, 43, pp 1149-59.

[4] Standard deviation represents the variation in modelled estimates across the 14.5 million ha study region.

structural complexity. This would increase natural resilience of forests to the stresses of pests, diseases and climate change.

While the Green Carbon report focussed on the south-eastern eucalypt forests comparable research needs to be done to identify the carbon carrying capacity of our south west native forests.

CSIRO Biosequestration Report

In August 2009 CSIRO released a major report on biosequestration, commissioned by the Queensland Government. This report took the opportunity to review the estimates put forward by the Garnaut Review and conduct further research into the abatement potential of a wide range of biosequestration options nationally and for Queensland specifically. These options included greenhouse gas abatement potential in agriculture (restoring soil carbon, reducing savanna burning, reducing livestock gassy emissions); forestry (carbon forestry[5] and management of regrowth) and bio-energy from biomass resources (CSIRO 2009).

According to this report the stand-alone forestry sequestration potential, which is the easiest option to pursue, is 503 Mt CO_2-e per year for all of Australia. This would amount to offsetting almost 85 per cent of total national annual greenhouse gas emissions *and* provide other net benefits including the enhancement of biodiversity, improved water catchment, conservation of ecological corridors and increased tourism. However, the "attainable" abatement is likely to be less than this due to the need to avoid displacing productive agriculture and the uncertainty in overcoming all technical, management and policy/political constraints. In Queensland the attainable biosequestration for forestry initiatives is considered, conservatively, to be about half of the potential biosequestration. If translated nationally, the attainable abatement is still significant in the context of Australia's total emissions.

It is estimated that the cessation of native forest logging would contribute 47 Mt CO_2-e per year of abatement nationally and 21 Mt CO_2-e for Queensland over the 40 years between 2010 and 2050.

The CSIRO report has further refined the methodology for estimating the sequestration potential of native forests. In relation to pre-Kyoto eucalypt forests the report states:

> The technology exists for estimating the sequestration potential, and involves standard forest biomass and soil sampling techniques, the application of existing forest growth models, and the use of satellite and

[5] Carbon forestry refers to the change in land use to forestry for the specific goal of carbon sequestration.

> other aerial imagery. The major current limitations (and opportunities for future research) … are developing a spatial understanding of (i) historical land use history, particularly harvesting activity, at regional to continental scales; (ii) developing a spatial understanding of historical disturbance, particularly fire; and (iii) developing a spatial understanding of current carbon stocks across the large areas of Australian eucalypt forest that have undergone historical harvesting…
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> … the sequestration estimates of the recovering forests could theoretically be assessed with high precision, so long as permanent monitoring sites were established and maintained, and the fate of those sites recorded through time. (p.95)

The report also proposes that a comprehensive economic and environmental analysis is required to identify the benefits and consequences of ceasing logging. This analysis should include: (i) the full economic and carbon cost of logging and replanting; (ii) the possible compensation for existing industry; (iii) the cost benefits of increased tourism and forest management; and (iv) the benefits for biodiversity, water catchment and conservation and their role in climate change adaptation.

Wentworth Group of Concerned Scientists

In October 2009 the Wentworth Group of Concerned Scientists released their report 'Optimising Carbon in the Australian Landscape' in the context of a market (price signal) for carbon. The report estimates that 54.7 Gt CO_2-e is currently stored in Australia's forests as living biomass, debris and soil. Land clearing of native vegetation releases an estimated 77 Mt CO_2-e per year, which represents 13 per cent of Australia's total emissions and also causes land degradation and biodiversity loss. The report draws on the options for biosequestration developed by the CSIRO and also reiterates the fact that the carbon stock of native forests is higher than that of regrowth and plantation forests. The report acknowledges that native forests have a higher resilience to climate variability.

The Wentworth Group has stressed the importance of appropriate regulation of the green carbon market that complements the introduction of an emissions trading scheme. Complementary regulations (by both federal and state governments) are required to: (i) ensure that food production on agricultural land is not compromised; (ii) reduce broad scale land clearing; (iii) protect fresh water resources; (iv) recognise environmental co-benefits such as restoring water resources and creating incentives for biodiversity plantings; and (v) encourage natural regrowth of native vegetation over monoculture plantings. The Federal Government also needs to ensure that native forest management is included in our national carbon accounts.

Green Carbon in the Great Western Woodlands

Most research on biosequestration and the potential of green carbon has focussed at the national scale or in state or regional areas on the eastern seaboard. So far, only one major study has been conducted on green carbon in Western Australia. This has occurred in the globally significant Great Western Woodlands (GWW), which is the largest temperate woodland remaining in the world. The GWW covers 16 million hectares between the south-east edges of the Wheatbelt and the north-west edges of the Nullarbor Plain and Great Sandy Desert.

The 'Green Carbon in the Great Western Woodlands' report (Berry *et al.* 2009) found that 950 Mt C is stored in the vegetation and soil of the GWW. Sixty seven per cent of the carbon is found in the soil with the rest in the trees, shrubs, roots, woody debris and branches. The highest amounts of carbon are found in mature eucalypt woodlands that have not been logged, mined or exposed to stocking. The study found that an additional 600 Mt C (that is 39 per cent more) could be stored in the GWW if fire was excluded and there was little or no other disturbance from vegetation clearing.

The report has been provided as research input for the State's Great Western Woodlands Biodiversity Conservation Strategy.

Priorities for Western Australia

The research work on biosequestration that has emerged over the past two years has demonstrated the great potential in our native forests, woodlands and native vegetation to store carbon and contribute to urgent climate change mitigation. Investment in these proven natural carbon sinks has significant economic benefits as it lowers the overall cost of mitigation and allows for higher emissions reduction targets to be achieved. There are additional environmental benefits to be gained in that preserving native forests and woodlands strengthens the resilience of our ecosystems to the stresses of climate change, thereby achieving major climate adaptation goals.

However, research specific to Western Australia's biosequestration and green carbon potential is sparse and there is an urgent need for research evidence to underpin a comprehensive policy to realise this potential.

Key priorities are to:

- Provide a scientifically robust base line carbon assessment of Western Australia's native forests.

- Conduct a full economic and environmental analysis of native forest logging in the context of climate change mitigation and adaptation requirements.

- Adjust forest use and management to take account of the green carbon potential of our native forests and woodlands.

- Ensure that appropriate complementary regulations and measure are in place to realise the climate change mitigation and adaptation potential of native forests, woodlands and vegetation.

- Commission a broader study, along the lines of the 2009 CSIRO report, that analyses all the options for greenhouse gas mitigation and carbon biosequestration within Western Australia.

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