GREEN CARBON
The role of natural forests in carbon storage

Synopsis prepared by The Wilderness Society of: GREEN CARBON, THE ROLE OF NATURAL FORESTS IN CARBON STORAGE, Brendan G Mackey, Heather Keith, Sandra L Berry and David B Lindenmayer (2008) ANU E Press.

Research from leading scientists at the Australian National University has found that Australia has some of the most carbon-dense forests in the world – with the potential to sequester carbon equivalent to 25% of our current annual emissions over a 100 year time frame.

BACKGROUND

In December last year the United Nations Climate Change Conference in Bali (UNFCCC CoP 13) decided to include the role of natural forests in storing carbon; and the need to reduce emissions from deforestation and forest degradation as a key part of the next international agreement to combat human forced climate change. The Conference agreed that if 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, 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.

KEY FINDINGS OF NEW AUSTRALIAN RESEARCH

A new Australian publication from the Australian National University (ANU) has pulled together findings from research conducted in Australia and overseas over the past 10 years and developed a new methodology for measuring the 'carbon carrying capacity' of Australia's forests and woodlands. The report shows that our forests can make a far more significant contribution to reducing greenhouse gas emissions and pulling carbon dioxide out of the atmosphere than previously thought.

The research has global application at the methodology and policy level. The following is a short synopsis of the report.

The research team '*conducted a series of investigations into the carbon stocks of intact, natural forests over large geographical areas, inclusive of environmental factors operating at landscape and regional scales. It also considered the carbon impacts of land-use activities, including commercial logging.*' The key question asked was: '*how much carbon can natural forests store when undisturbed by intensive human land-use activity*?'

The report presents a summary of results from case studies in 14.5 million hectares of eucalypt forests in south-eastern Australia and uses the results to highlight a number of policy implications.

The report strongly argues that a practical and policy distinction should be made between natural forests and plantations. Natural forests '*are more resilient to climate change and disturbances than plantations because of their genetic, taxonomic and functional biodiversity. This resilience includes regeneration after fire, resistance to and recovery from pests and diseases, and adaptation to changes in radiation, temperature and water availability (including those resulting from global climate change). While the genetic and taxonomic composition of forest ecosystems changes over time, natural forests will continue to take up and store carbon as long as there is adequate water and solar radiation for photosynthesis*'.

'*The green carbon in natural forests is stored in a more reliable stock than that in plantation forests, especially over ecological time scales. Carbon stored in plantation*

Central Highlands, Victoria 2008. **Photo:** Peter Halasz

forests has a greater susceptibility to loss than that stored in natural forests as they have reduced genetic diversity and structural complexity, and therefore reduced resilience to pests, diseases and changing climatic conditions.'

'The carbon stock of forests subject to commercial logging, and of monoculture plantations in particular, will always be significantly less on average (~40 to 60 per cent depending on the intensity of land use and forest type) than the carbon stock of natural, undisturbed forests.'

'The rate of carbon fixation by young regenerating stands is high, but this does not compensate for the smaller carbon pools in the younger-aged stands of re-growth and plantation forests compared with those of undisturbed, natural forests. Carbon accounts for logged forests must include the carbon emissions associated with land use and associated management, transportation and processing activities.'

'AUSTRALIAN NATURAL FORESTS HAVE FAR LARGER CARBON STOCKS THAN IS RECOGNIZED.'

Surprisingly, the research identifies that Australia has some of the most carbon dense forests on Earth – and that logging and clearing them has significant climate implications.

The analysis shows that the stock of carbon for intact natural forests in south-eastern Australia is on average about 640 t C ha^{-1} of total carbon (biomass plus soil).

The average net primary productivity (NPP) of these undisturbed, natural forests was 12 t C ha^{-1} yr^{-1}. *'The highest biomass carbon stocks, with an average of more than 1200 t C ha^{-1} and maximum of over 2000 t C ha^{-1}, are in the mountain ash (Eucalyptus regnans) forests of Victoria and Tasmania. This is cool temperate evergreen forest with a tall eucalypt overstorey and dense* Acacia spp. *and temperate-rainforest tree understorey.'*

'Access to appropriate ecological field data is critical for accurate carbon accounting in natural forests, as otherwise erroneous values will be generated. Models must be designed and calibrated to reflect the fact that the carbon dynamics of natural forests are significantly different to those of industrialized forests, especially monoculture plantations.'

The report draws an interesting comparison with the estimated carbon stocks from the National Carbon Accounting System and also with the default estimates by the International Panel on Climate Change (IPCC). Stocks of carbon in Australia's native forests are on average three times greater than the IPCC estimates and can be as much as twenty times greater in the most carbon dense forests.

Among other things, the carbon in natural forests has a longer residence time. The research concludes that *'the total stock of carbon that can be stored in the 14.5 million ha of eucalypt forest in the study region is 9.3 Gt if it is undisturbed by intensive human land-use activities; applying the IPCC default values would give only 3.1 Gt.'*

'The difference in carbon stocks between the ANU estimates and the IPCC default values is the result of 'using local data collected from natural forests not disturbed by logging. The estimates therefore reflect the carbon carrying capacity *of the natural forests.'*

In heavily disturbed forests, the current carbon stocks reflect landuse history. The difference between the

two is called the '*carbon sequestration potential*'—the maximum carbon stock that can be sequestered as the forest re-grows.

The researchers tested the Australian Government's National Carbon Accounting System (NCAS) (Australian Greenhouse Office 2007a) and found '*it underestimated the carbon carrying capacity of natural forests with high biomass stocks. NCAS was designed to model biomass growth in plantations and afforestation/reforestation projects using native plantings. The empirically based functions within NCAS were calibrated using data appropriate for that purpose. But, this meant that NCAS was unable to accurately estimate the carbon carrying capacity of carbon dense natural forests in south eastern Australia. However, the kinds of field data used in the study could be used to recalibrate NCAS so that it can generate reliable estimates of biomass carbon in these forests.*'

TWO KEY FINDINGS OF THE REPORT ARE THAT:

Australia's '*remaining intact natural forests constitute a significant standing stock of carbon that should be protected from carbon emitting land-use activities*'; and

'There is substantial potential for carbon sequestration in forest areas that have been logged if they are allowed to re-grow undisturbed by further intensive human land-use activities.'

To demostrate just how significant the carbon story for our forests is the researchers analysed the effect of retaining the current carbon stock in the 14.5 million ha of eucalypt forests in south-eastern Australia, '*the effect of retaining the current carbon stock (equivalent to 25.5 Gt CO_2 (carbon dioxide)) is equivalent to avoided emissions of 460 Mt CO_2 yr^{-1} for the next 100 years. Allowing logged forests to realize their sequestration potential to store 7.5 Gt CO_2 is equivalent to avoiding emissions of 136 Mt CO_2 yr^{-1} for the next 100 years. This is equal to 24 per cent of the 2005 Australian net greenhouse gas emissions across all sectors; which were 559 Mt CO_2 in that year.*'

The report also highlights that from a climate perspective, *'reducing emissions from deforestation and forest degradation is important in all forest biomes – boreal, tropical and temperate – and in developed as well as developing countries.'*

'*From a scientific perspective, green carbon accounting and protection of the natural forests in all nations should become part of a comprehensive approach to solving the climate change problem.*'

'*Part of the ongoing international climate change negotiations involves debate on the technical definition of key terms. 'Forest degradation' should be defined to include the impacts of any human land-use activity that reduces the carbon stocks of a forested landscape relative to its natural carbon carrying capacity.*'

'*The definition of 'forest' should also be revised to recognize the differences between the ecological characteristics of natural forests and plantations. These differences include the higher biodiversity, ecosystem resilience, and carbon residence time of natural forests.*'

Blue Tier, Tasmania. **Photo:** Kip Nunn

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