Plantations 101 – Carbon Storage and Climate Change

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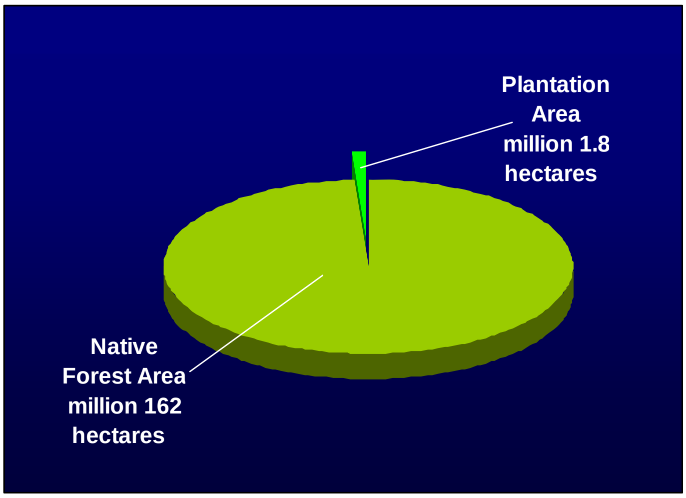
As the climate change issue reaches fever pitch, interest in the use of forests as a means of removing carbon dioxide (CO_2) from the atmosphere has accelerated rapidly. Carbon storage in the form of carbon sequestration in new forests can provide a potentially cost-effective form of net greenhouse gas abatement, and a valuable source of transitional emissions reductions until new energy technologies are further developed. As well, enhanced forest establishment can contribute to other valuable social and environmental outcomes.

It is estimated Australian forests store around 10.5 billion tonnes of carbon, the bulk of which is stored in native forests (Figure 1). Based on a total forest area of around 164 million hectares, this equates to an average 64 tonnes of carbon per hectare stored across the entire Australian forest estate.

Figure 1. Australian Forests



Sources: BRS National Plantation Inventory, Australia's Forests 2005

A tonne of carbon equates to 3.67 tonnes of CO_2, so each hectare of forest has removed 235 tonnes of greenhouse gas from the atmosphere, and the entire Australia forest estate is storing 38.5 billion tonnes of this greenhouse gas.

To put this in perspective, the Australian Greenhouse Office estimates that in 2005, Australia's total CO_2 equivalent emissions using the Kyoto accounting system were 559 million tonnes. In other words, Australian forests are storing around 69 years worth of 2005 level annual emissions.

Physically, the future potential of Australian forests to store more carbon is heavily dependant upon the rate of new plantings or forest regeneration, harvesting and growth rates and the impacts of tree deaths by fire, pests and disease. New plantations are being established at a rate of 74,000 ha per year, which is a positive for carbon sequestration, and around 40,000 ha of harvested plantations are re-established annually to meet the timber supply requirements of new investments in timber processing.

From an international policy perspective, the potential for Australian forests to store more carbon is based on both physical factors, and on how the rules for Australian carbon accounting are set.

In terms of generating a tradeable carbon commodity from the forest estate, under the Kyoto rules, only the carbon stored in forests planted post-1990 on cleared land are eligible. Australia's accounting rules explicitly exclude any carbon that might be stored through 'forest management' mechanisms from the national greenhouse gas inventory (eg. native forest management, management of older plantations), in part because of the downside risks to the national account.

The Pilliga forest after a recent fire – fire risk is one reason the management of native forests are presently excluded from national carbon accounting

A key point in the argument is the concept of additionality – to what extent are Australian forests removing *additional* greenhouse gases from the atmosphere, relative to say the Kyoto 1990 baseline? This measure is complicated to estimate, as fire, drought, pests and other factors (i.e. the downside risks) are having an unknown effect on the carbon stocks in the entire Australian forest estate (Keenan 2007). Despite the fact that plantation expansion may be storing more carbon, it is the annual change in the forest carbon stocks across the entire estate which is critical to the global warming issue, and this is something yet to be quantified.

There is an ironic positive feedback of climate change on forest sequestration in that impacts of climate change (drought, pest attack, fire frequency and intensity) may increase carbon fluxes from forests to the atmosphere, causing further climate change. This is an area of substantial current research.

From a forest industry perspective, there are some important factors which currently affect the desirability and profitability of using plantations as a greenhouse sink.

Current carbon trading schemes and Australia's emissions inventory approach do not recognise carbon stored in harvested timber as a valid sink. This is despite research indicating that the acknowledgement of carbon storage in wood products can significantly extend the carbon sequestration benefits of forests. In Australia, around 25 million cubic metres of wood are harvested annually. Not all of these timber removals store carbon long term, as the carbon in processing residues may be lost fairly quickly, but studies have shown that up to 70% of the carbon in commercial logs can be considered to remain in long term storage (this excludes storage in paper products).

The analysis hinges around the assumption that wood products harvested from forests do actually represent a carbon sink. This is something many conservation groups are unwilling to recognise. The Intergovernmental Panel on Climate Change (IPCC) approach to national carbon accounting assumes all carbon in trees is emitted at the time of harvest. And yet, studies show that even wood products placed in landfill lose only a maximum of 3.5% of their carbon after 46 years.

Carbon stored in timber products is not recognised as a reduction in greenhouse gases under current carbon trading schemes

It is vital that research continue to further clarify the longevity of carbon stored in harvested wood products, to support the amendment of international and national emissions inventory approaches so that these long-term storage benefits of forest products can be recognised.

Australia is meeting a large component of its Kyoto greenhouse gas commitments by reducing land clearing, a clear acknowledgment of the carbon storage potential of native vegetation. However native forest harvesting and silviculture are being wound back in most Australian states with their conversion to conservation reserves. From a carbon sequestration perspective, it has been shown that regrowth forests where most timber harvest occurs are in carbon balance over the longer term, so timber extraction from these forests is not adding to the problem.

The deforestation and climate change debate contains an interesting paradox. Conventional wisdom says that harvesting trees has a negative impact on climate change when in fact the science indicates that when a forest is harvested and regrown, its net CO_2 emissions are close to zero (Polglase and Stein 2001) and the raw material is entirely renewable. When non-renewable fossil fuels are used to manufacture products, the process represents a permanent net addition to greenhouse gases.

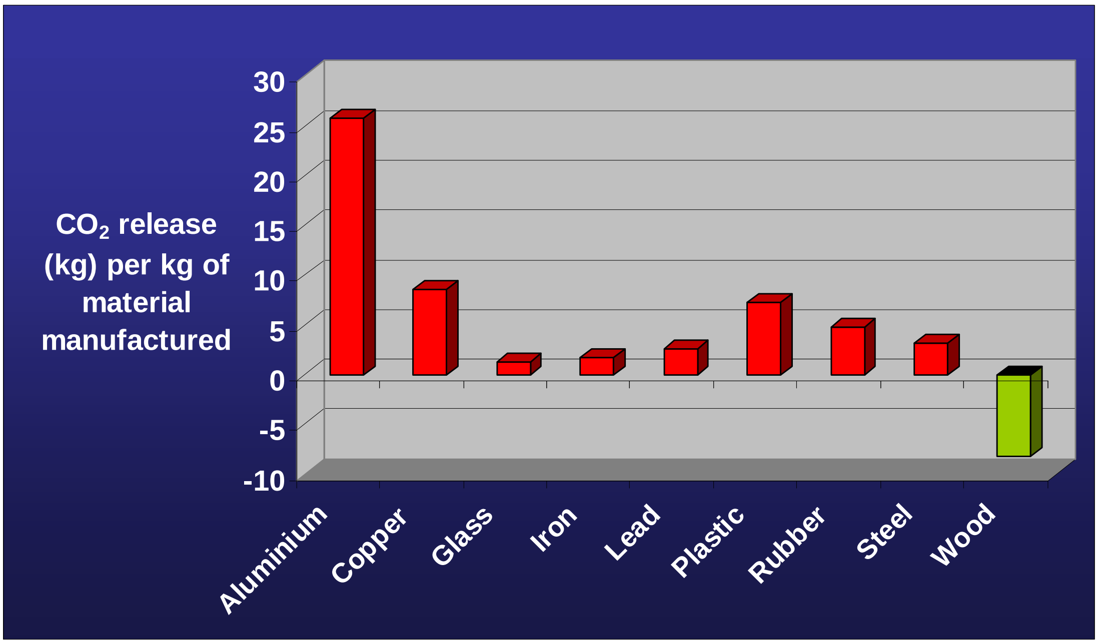
The potential positive environmental credentials of timber are lost on at least one international wilderness tour company who discourage clients using accommodation made from wood and promote the greenhouse benefits of tents. If the wooden accommodation were sourced from renewable sustainable forestry operations, its greenhouse gas credentials would in fact be superior to tents made from synthetics and aluminium which use larger amounts of fossil fuels and are net greenhouse contributors (see Figure 3). One study has indicated that timber can store up to 15 times the amount of carbon that is released during its manufacture.

Of course, where trees are permanently removed and the land converted to agricultural, urban or industrial uses, this will result in an increase in greenhouse gas production and reduced sequestration. But the clear distinction needs to be made between permanent deforestation and sustainable forestry to avoid the imposition of mis-guided environmental policy which removes incentives for reafforestation.

The lack of recognition of long-term carbon storage in harvested wood products may act as a disincentive for plantation expansion with the need to maintain trees in the ground for 70-100 years under current carbon credit schemes. The economics of growing timber in plantations could be improved if carbon credits were paid in the years leading up to harvest. In fact, economic studies have shown that carbon sequestration is likely to be most cost-effective with a harvest cycle of about 20 years (Richardson 2005).

Harvesting timber can improve the cost-effectiveness of carbon storage from plantations

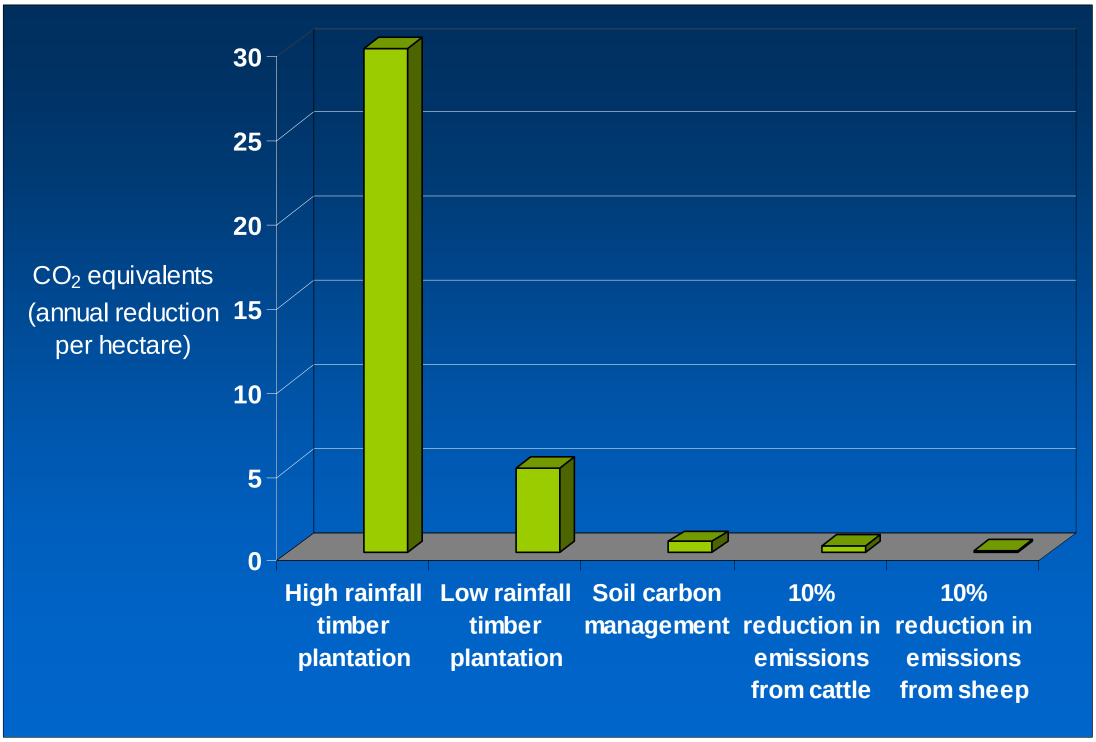
Figure 3. Greenhouse gas release in manufacture of construction materials



Source: Forests NSW 2005

The conversion of farming land to plantations is another issue causing concern in some regions of rural Australia. A positive environmental outcome from this process is the accelerated rate of greenhouse gas abatement from plantations relative to agricultural land uses. While a number of mechanisms are being investigated to curb agricultural emissions, current evidence suggests that plantations are well ahead in their capacity to remove CO_2 from the atmosphere (Figure 4).

Figure 4. Approximate rates of greenhouse gas sequestration or abatement



Source: Australian Farm Journal September 2007

The use of wood waste in bio-fuels and for bio-energy is a further mechanism whereby plantations and native forest residues can be used to lower greenhouse gas emissions, by substituting for the use of fossil fuels. Polglase and Stein (2001) have estimated that burning coal to produce electricity releases 8 times more CO_2 into the atmosphere than using wood residues from forests grown primarily for sawn timber in New South Wales. Studies overseas suggest that the net emissions of CO_2 may be up to 30 times higher from a coal-fired power station.

Plantations and regrowth native forests can clearly play an important role in the amelioration of global climate change, however capturing these benefits will require the development of sensible forestry policy based on science and economics, not popular environmental opinion and here-say.

The notion that timber harvesting should cease entirely to help stop global climate change is off-target, as alternative products are clearly less greenhouse gas friendly in their production (Figure 4). The inclusion of carbon stored in wood products in the accounting procedures for emissions trading schemes would be of significant benefit to the Australian wood products industry, generating additional incentive for investments in carbon sequestration projects.

References

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