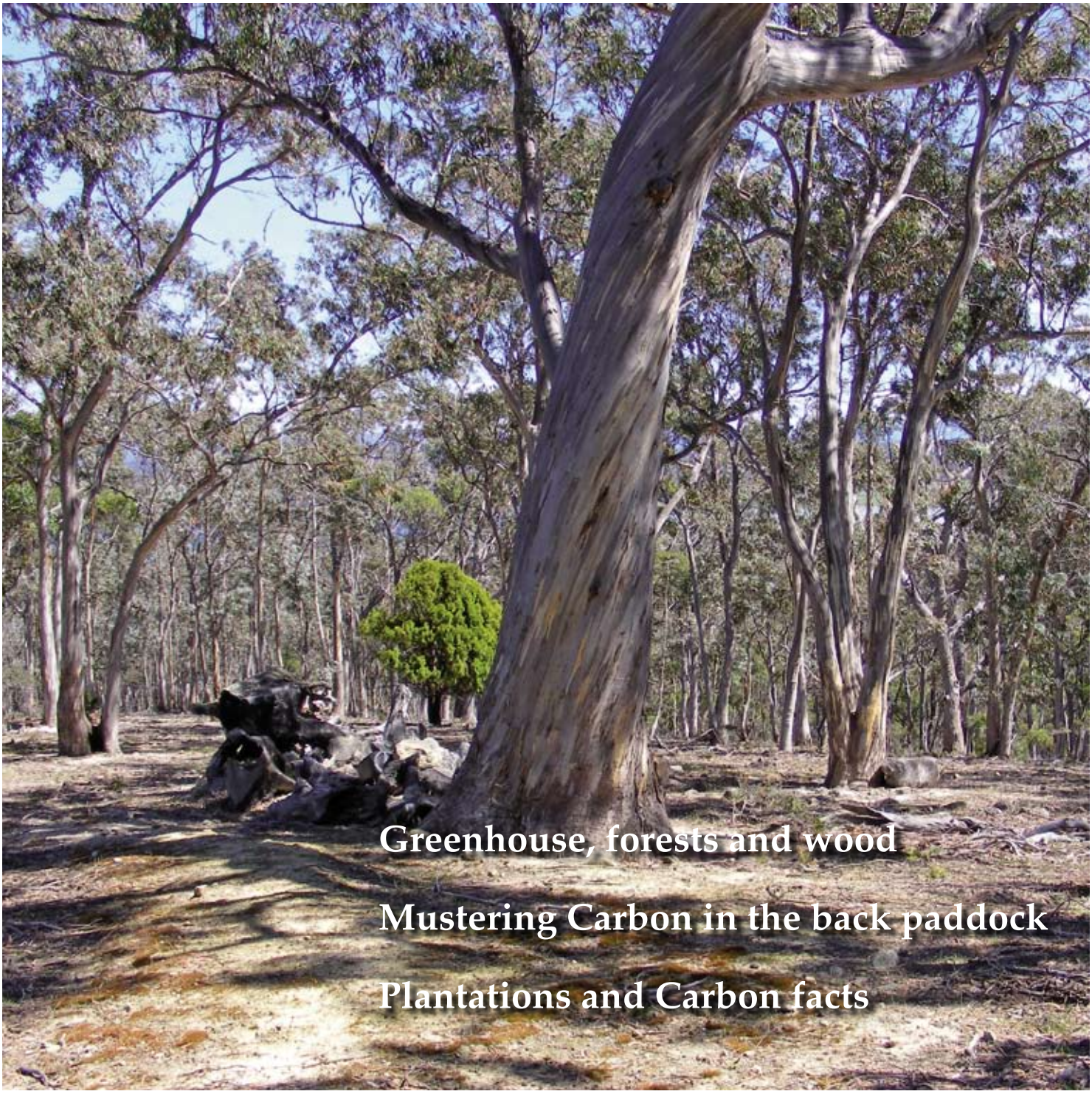
TREELine

PRIVATE FORESTS TASMANIA



Greenhouse, forests and wood

Mustering Carbon in the back paddock

Plantations and Carbon facts

Winter 2008 *A quarterly publication by Private Forests Tasmania*

Tasmania

Welcome

The climate is continually changing. Private forest owners, farmers and the whole community are about to enter a new world of carbon trading which the Australian Government will introduce in 2010. Climate change poses challenges for all sectors of the Australian economy including forestry and agriculture.

This issue of TREELine examines the role that plantations and native forests may have in the future and provides an insight into possible opportunities for private forest owners. The challenge to be carbon neutral is one we may all face.

My staff and I look forward to meeting you at the popular annual farm forestry dinners to be held at Somerset on 8 August and Launceston on the 14 August 2008.

Graham Sargison
Chief Executive Officer

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Cover photo:
Multi-aged eucalypt forest depicting various stages of carbon storage

Private Forests Tasmania promotes sustainable management of native forests and plantations, and fosters the use and value of trees in land management.

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Greenhouse, forests and wood

Wood is stored greenhouse gas, held together with stored sunlight – simply: *wood is air and water and sunlight*. If we are serious about trying to address greenhouse and the resulting climate change we should be growing and using more forests, for sustainable energy-efficient products that store carbon and for sustainable biomass-based energy systems. We need to use more wood, not less.

On photosynthesis

Photosynthesis is the process whereby plants use energy from the sun to turn atmospheric carbon dioxide into *stuff*, stuff we eat and stuff we can make things out of:

$$6CO_2 + 6H_2O + \text{energy} \rightarrow C_6H_{12}O_6\ (\textit{glucose}) + 6O_2$$

The glucose is used as a building block of plant material. The reverse reaction is oxidation, via combustion or respiration, releasing the stored solar energy:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}\ (\textit{sunlight})$$

For example, when we burn wood it seemingly disappears, releasing the stored sunlight as heat – carbon dioxide and water vapour are released back to the atmosphere. Similarly when we eat food we grab the stored sunlight and release CO_2.

Carbon dioxide is important because it is the most significant greenhouse gas.

The Greenhouse effect

The greenhouse effect is the name given to the action of the protective blanket of atmosphere that keeps the surface of the earth warm enough to sustain life. Without the greenhouse effect the average temperature of the earth surface would be around -20C. The insulating component of the atmosphere is mostly carbon dioxide, and some methane (CH_4).

The carbon cycle

Carbon naturally cycles between the atmosphere and the earth's surface (the *biosphere*): as plants grow CO_2 is absorbed from the atmosphere; when plants decay or are burned CO_2 is released back to the atmosphere from whence it came. If we clear forests to grow crops we shift the balance towards increasing the carbon in the atmosphere. If we grow trees on non-forested land we shift the balance towards decreasing the carbon in the atmosphere.

If we burn fossil fuels we introduce carbon to the atmosphere-biosphere cycle, carbon that originated from

the cycle but which has been stored out of the cycle for between 50 and 250 million years.

In the carbon cycle there are *carbon stores* (the atmosphere, the biosphere, the ocean); *carbon sources* which release carbon to the atmosphere; and *carbon sinks* which remove carbon from the atmosphere.

Forests are net *carbon sinks* whilst they are growing and increasing in biomass; *carbon stores* whilst they exist; and *carbon sources* when they are burned or decay. Mature forests achieve equilibrium when the uptake of carbon is balanced by the carbon losses due to decay.

All carbon flows considered, there appears to be a net addition of greenhouse gasses to the atmosphere equivalent to 12 giga-tonnes (twelve billion tonnes) of carbon dioxide per year:

CO_2 stores	Gt CO_2e
atmosphere	2,700
organic matter - earth surface	7,300
ocean	140,000
fossil fuel reserves (coal, oil, natural gas)	3,800

CO_2 sources	Gt CO_2e / year
respiration (release by plants and animals)	437
ocean respiration (release from the oceans)	323
land-use change (land clearing)	6
fossil fuel use	23
Total Co_2 released to the atmosphere	**789**

CO_2 sinks	Gt CO_2e / year
photosynthesis (uptake by plants)	440
absorption by oceans	330
land-use change (reforestation)	7
Total Co_2 removed from the atmosphere	**777**

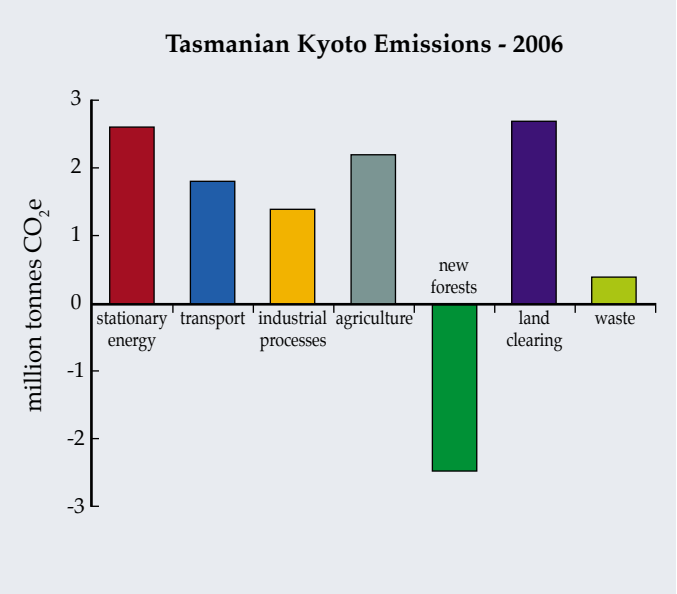
net CO_2 accumulating in the atmosphere	12 Gt/year

Global carbon balance

Current estimates indicate the atmosphere contains more greenhouse gas than it has at any time in the last 500,000 years, that global temperatures have increased, and that atmospheric greenhouse gasses will continue to increase resulting in greater warming of the earth's surface.

Tasmania's greenhouse emissions

Latest estimates indicate Tasmania's emissions reportable under the Kyoto protocol currently amount to around 8.5 million tonnes of carbon dioxide per year – equivalent to around 17 tonnes per person. The estimated greenhouse emissions from land clearing are currently in balance with carbon absorbed by new forests (Dept. of Climate Change 2008):



Kyoto-reported emissions do not currently include greenhouse gas emissions and sequestrations attributable to changes in native forest carbon stocks due to growth, harvest and bushfires. Under international convention these forests are assumed to have zero net emissions.

Every litre of petrol burned directly releases 2.4 kilograms of CO_2 into the atmosphere. Accounting for the emissions resulting from manufacturing the car, extracting, refining and transporting the petrol, and building the roads – every 10,000 kilometres a car travels results in the release of around 5 tonnes of greenhouse gas.

What trees can do to help

Forests as carbon stores

Biomass (wood, leaves, roots – all plant material) is essentially 50% elemental carbon. If we grow trees where currently there are none we will pull carbon dioxide from the atmosphere and store it in the biosphere – but only as long as the wood is not burned or allowed to decay.

The quantity of atmospheric carbon accumulated in a forest depends upon the forest type and the rate of growth: a eucalyptus plantation growing at a stem-volume mean-annual-increment of say 15 m^3/ha/year might be accumulating atmospheric carbon at a rate of 25 tonnes of CO_2 per year, and might achieve a store of around 375 tonnes of CO_2 at 15 years of age. Having grown the trees and stored the CO_2 we need to process them into products retaining as much wood as possible, and burning the remaining biomass to recover the stored carbon-neutral solar energy.

Forests as providers of low-carbon materials

Every wood-based product is storing greenhouse gas: one cubic metre of wood is essentially storing the equivalent of about one tonne of atmospheric carbon dioxide.

Producing wood materials also requires the release of much less greenhouse gas emissions than does the production of other materials. Building an average house using wood where possible results in savings of around 27 tonnes of carbon dioxide emitted compared to using non-wood construction (CRC for Greenhouse Accounting 2004):

Construction component	Option 1	Greenhouse gas emissions (CO_2e)	Option 2	Greenhouse gas emissions (CO_2e)
Floor structure	Timber sub-frame	1.9	Concrete slab	12
Floor covering	Hardwood T&G laid on particleboard	0.4	Ceramic tiles	5.2
Wall frame	Timber	0.4	Brick	6.8
Roof frame	Timber	1.2	Steel	5.3
Windows	Timber	0.8	Alum	2.2
	Total	**4.7**	**Total**	**31.5**

Forests as energy factories

A cubic metre of wood stores around 11 gigajoules of solar energy – equivalent to the energy stored in 340 litres of petrol. Whilst burning wood produces greenhouse gas, it is only the greenhouse gas from which the wood was made. Every time we burn wood to recover its stored solar energy instead of burning fossil fuel such as oil, we are avoiding the introduction of very very old carbon back into the atmosphere-biosphere cycle.

The full life-cycle analysis of embodied greenhouse emissions associated with firewood use for home heating are 0.03 kg of CO_2 per kWh of heat, compared to 0.31 for heating via gas or electricity (albeit in Victoria – Paul et al. 2003).

What can any of us do to help

We can all endeavour to use less electricity and fossil fuel, and we can use more sustainably-grown wood wherever possible: as material to make things out of and as fuel.

We can have trees grown to offset our emissions from burning fossil fuel, but this does not alter the problem that as the result of our energy consumption we have introduced carbon into the atmosphere-biosphere cycle that has been stored outside the cycle for 100 million years. Even reforesting all the areas that we have cleared will only remove the greenhouse gas associated with land-clearing: since 1850 around 70% of greenhouse emissions have come from the burning of fossil fuel and 30% from deforestation.

Emissions trading - the value of carbon

Australia has committed to introduce an emissions trading scheme by 2010. Whilst the structure is currently being developed, it will in essence result in price increases of goods and services proportional to their associated embodied greenhouse emissions.

A component of the scheme will be the ability to sell carbon offsets, which, in the sense of forestry, might mean that carbon stored in growing trees will have a value which could amount to $30 per cubic metre of wood grown – equivalent to $4,500 per hectare per year for a moderately productive plantation. The seller of carbon will then have an obligation to ensure the sold carbon remains stored, and that the trees are not burned or allowed to decay. The trees may not be harvested unless the resulting products bear the costs associated with the re-release of the stored carbon.

Current developments of the scheme suggest the majority of industrial plantations will not be eligible for inclusion in the scheme, i.e. that the sequestered carbon cannot be sold. Given the likely requirement to buy back sold carbon if ever the trees are harvested, exclusion from the scheme might be the best option commercially, particularly if the market price for carbon increases faster than inflation.

Sources

CRC for Greenhouse Accounting (2004), in InWood Issue 55.

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Dept. of Climate Change (2008). State and Territory Greenhouse Gas Inventories 2006.

Bruce Greaves

Manager – Projects, Forest Industries Association of Tasmania.

Mustering Carbon in the back paddock

'Nosswick', a family farm, is a mixed-grazing and irrigated enterprise managed for sustainable agricultural production and conservation. We believe we all have a responsibility to continually care for the environment. About 22% of our property is native forest, plantations and shelterbelts and we aim to increase this to 30%. We intensively crop under centre pivots and are working to improve soil structure and fertility. Riparian areas are fenced off and drains are grassed. We very carefully manage livestock on the drier forest to ensure conservation values are maintained. Of our wet forest, 40ha of remnant White Gum is covenanted. This stand represents 97% of this vegetation community left in North East Tasmania!

'Nosswick' runs 2,700 cross-bred breeding ewes (2 DSE) with a 120% lambing percentage, and carries about 3,000 lambs (0.75 DSE) for six months. These animals emit greenhouse gasses, primarily methane (composed of carbon and hydrogen), and contribute to climate change.

We are keen to make 'Nosswick' carbon neutral and planting trees appears an easy way to do so. Trees breathe in carbon dioxide (CO_2), thus taking carbon out of the atmosphere, therefore offseting greenhouse gas emissions. About 12 years ago we planted five hectares of native shelterbelts for shelter and biodiversity. Six years ago we started planting *Eucalyptus nitens* in strategic areas such as centre pivot corners (really our back paddocks) to provide shelter and to dry out the ground in winter, and these now total 18ha. With assistance from Private Forests Tasmania some of these plantations have been thinned and pruned to produce clearwood for veneer and sawlogs.

To do the sums, we found a calculator at www.carbonfarming.org.nz which estimates CO_2 emissions and sequestration (or carbon uptake). Surprisingly, we couldn't find one for Australian conditions that was anywhere as easy to use as the New Zealand calculator. We simply enter both the number of livestock units and area of trees, and play with these figures until the emissions and sequestration balance, or in other words are carbon neutral.

The calculator estimates my livestock annually emit 1,386 tonnes CO_2 and my 23 ha of trees take up 390 tonnes of CO_2. It seems that for our sheep enterprise to be carbon neutral we need to plant another 32ha of trees, making 55 ha of trees in total. This estimate only accounts for the carbon stored in the tree trunks and we have heard that tree roots can store nearly as much carbon again. If so, about 27 ha of trees will do the job and we are only about 4 ha off the mark!

Andrew Colvin's plantations help offset 'Nosswick's' livestock emissions

For 'Nosswick' to be carbon neutral we also have to offset, or reduce, the greenhouse gas emissions from our cropping activities. Currently it is difficult to calculate emissions and sequestration associated with these more intense activities. If anything, the carbon calculator has helped us get a better perspective of the carbon footprint of 'Nosswick's' forestry and sheep enterprises.

Andrew Colvin

'Nosswick', Blackwood Creek

Plantations and Carbon facts

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. Carbon storage in new forests can provide a cost-effective form of net greenhouse gas abatement and a valuable source of transitional emissions reductions until new energy technologies are developed. Forest establishment can also contribute to other social and environmental outcomes.

Key messages

- Forests planted on cleared agricultural land can remove 5-30 tonnes of CO_2 per hectare from the atmosphere annually.
- Plantations can play an important role in removing the greenhouse gas CO_2 from the atmosphere.
- Factors that encourage plantation expansion will generate climate change benefits.
- The attractiveness of plantations as a carbon sink investment will be heavily influenced by trading and accounting rules which are still being developed.
- Plantations generate large volumes of wood residues which have potential to replace fossil fuels as an energy source, reducing greenhouse gas emissions.

How much carbon and carbon dioxide do forests store?

Carbon represents about half the dry weight of a tree.

Australian forests store 10.5 billion tonnes of carbon, mostly in native forests. On average, 4 tonnes of carbon per hectare is stored across the Australian forest estate.

The entire Australian forest estate is storing 38.5 billion tonnes of CO_2. In 2005, the Australian Greenhouse Office estimated Australia's total CO_2 equivalent emissions were 559 million tonnes, so Australian forests are storing 69 years worth of 2005 annual emissions.

Future carbon storage by plantations

New plantations and replanting will only occur if a positive investment environment exists.

The potential of Australian forests to store more carbon depends on the rate of new plantings or forest regeneration, harvesting and growth rates, and tree deaths by fire, pests and disease.

New plantations are being established at a rate of 73,000 ha per year, and around 40,000 ha of harvested plantations are re-established annually to meet timber supply requirements of new investments in timber processing.

Accounting rules, plantation investment, carbon trading

In theory, under the Kyoto Protocol, only the carbon stored in forests planted post-1990 on cleared land is eligible for trading. Accounting rules exclude any carbon that might be stored through 'forest management' mechanisms (eg. native forest management, management of older plantations), in part because of the downside risks to the national account.

Fire is one risk to the national carbon accounts that can impact on Australia's net greenhouse gas emissions

Various trading schemes also have different rules about how many years the carbon must remain out of the atmosphere to count as a carbon credit.

Plantation investment for carbon

Several schemes are currently operating in Australia using forests to generate tradeable carbon credits and/or to offset greenhouse gas emissions. Rules for the inclusion of forests and wood products in a national Australian Emissions Trading Scheme (likely to commence in 2010) are still being developed.

A number of issues will determine the attractiveness of plantation investments for carbon storage.

The concepts of **additionality** (is a plantation additional to what would have been planted anyway) and **permanence** (how long do trees have to remain in the ground, is harvested timber regarded as a carbon emission) will be important.

The treatment of carbon stored in harvested timber products will impact on the attractiveness of plantations as carbon sink investments

Research indicates that harvested timber products, even in landfills, retain the majority of their carbon for decades and that the most cost-effective way to remove carbon is to allow timber harvesting (Richardson 2005).

Wood compares favourably to competing materials

Timber from plantations performs well compared to competing materials (Fig 1). One study has indicated that timber can store up to 15 times the amount of carbon that is released during its manufacture.

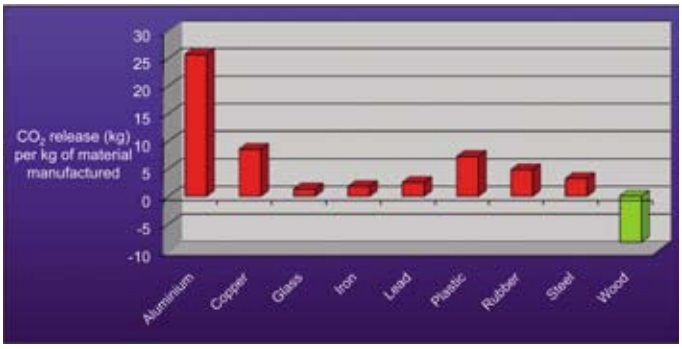

Figure 1. Greenhouse gas release in manufacture of construction materials Source: Forests NSW (2005)

A positive environmental outcome of plantation expansion is the accelerated rate of greenhouse gas abatement from plantations relative to agricultural land uses. A number of mechanisms are being investigated to curb agricultural emissions. Current evidence suggests that plantations are ahead in their capacity to remove CO_2 from the atmosphere (Fig 2).

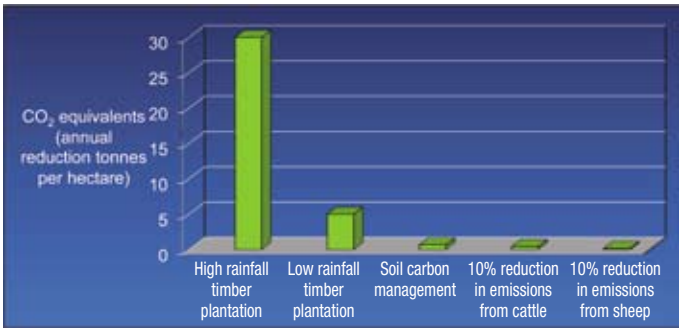

Figure 2. Approximate rates of greenhouse gas sequestration or abatement Source: Australian Farm Journal (2007)

Bioenergy

Waste from wood processing is already being used for heat and energy and replacing some fossil fuels.

Additional energy could be created using material from new plantations and residue materials, providing further greenhouse gas benefits.

Wood waste has potential to replace fossil fuels for energy, reducing greenhouse gas emissions

Polglase and Stein (2001) 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.

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http://www.planningplantations.com.au

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Polglase P and Stein W (2001), Relative CO2 Emissions from Power Stations Fired by Wood or Coal - Comments on the Peter Barnes' Model, available at http://www.ffp.csiro.au/fap/bioenergy.html

Forests NSW (2005), Forest, Timber and the Greenhouse Effect, available at http://www.forest.nsw.gov.au/publication/forest_facts/forests_timber_greenhouse_effect/default.asp

Australian Farm Journal (2007), Volume 17 No 07 pp16 Emissions trading: threat or opportunity?

Wood off the sheep's back

Lawrence and Winston Archer – trees and sheep made a winning combination

In the middle of a wool boom in 1980-82, my brother Stewart and I decided to grow pine woodlots for shelter for sheep and timber on our property 'Effingham' near George Town. I believed woodlots were a better way of providing shelter than narrow shelterbelts. I felt pines would grow on land suitable for sheep production. This land had been prepared for sowing down to pasture after being cleared of native forest. 'Effingham' receives 800mm average annual rainfall, but much less in the last 10 years; is very exposed to strong off-shore winds; has low fertile sandy soils; and has a high fire risk – not exactly the best environment for growing pine trees!

To date over 60 hectares of pine woodlots have been successfully integrated into 'Effingham'. The initial investment for livestock shelter has paid for itself many times over by improving lambing percentages and pasture growth in the sheltered areas.

In 1980, 1981 and 1982, Stewart and I planted woodlots at about 1,000 pines per hectare and fertilised each tree with one cup of N&P after planting. In 1985 I saw pines pruned in New Zealand and decided it could work here. I selected the future final crop trees at 450, 350 and 250 trees per hectare according to potential plantation productivity. Stewart and I pruned these trees to a height of six metres. We pruned the 1980 and 1981 plantings in three lifts when the trees were four, five and six years old. We pruned the 1982 planting in one operation when the trees were seven years old. This is not normal practice but we didn't have a lot of spare time and we found that pruning small trees in one go was a lot easier than pruning in three separate lifts. After pruning we felled the unpruned trees and left them on the ground. The pruned trees grew on relatively quickly with little inter-tree competition.

The farm has passed to my son Winston and he sold the trees this year. Dick Morgan, of Kevin Morgan Pty Ltd, harvested pulp logs, unpruned sawlogs and pruned sawlogs which were cut to 6.1, 5.5, 4.9, 4.3 and 3.7 metre lengths. Unpruned sawlogs and pulp logs were cut from the tops of the trees. Sawlogs were supplied to Auspine at Scottsdale and pulp logs to Gunns Tamar for export. Ben Roberts, Forest and Land Assessor for Gunns, oversaw

the harvest and said, 'Gunns processed a range of timber products and harvested pine sawlogs, pulp logs and hardwood pulp logs from this property. This was done with one contractor on site and the planning and operations include establishment of a new pine plantation after harvesting.'

This relatively low-cost woodlot venture yielded about 250 – 280 tonnes of wood per hectare consisting of about 40% pruned sawlogs, 20% unpruned sawlogs and 40% pulp logs. The net income ranged from $10,000 to $13,000 per hectare – not bad for what appeared to be a somewhat marginal site.

I have seen my timely pruning and thinning result in quality wood and good cash returns to make succession planning easier. My early decisions, based on observations and advice, were innovative and maybe a little courageous at the time but fortunately for the family have proved right.

Lawrence Archer

'Effingham'

Well-managed plantations – an aspiration for many landholders

Get your pruned trees certified

Pruned Stand Certification (PSC), a scheme approved by Australian Forest Growers (AFG), provides an independent guarantee to potential buyers of the quality of your clearwood. Buyers are prepared to buy well-pruned stands of trees and pay an up-front premium. PSC should ensure the best price as PSC certificates provide a detailed stand location map and tree measurements for all the pruning lifts.

Henry Chan is the national PSC trainer. Courses can be held anywhere in Australia if 10 or more people attend.

The one-day course for forest owners, consultants and pruning contractors includes hands-on training, costs $165 (AFG members) and $175 (non-members), and provides participants with:

- A PSC Manual and diameter tape
- Opportunity to become an AFG certified registered auditor
- Ability to conduct your own PSC assessments and thus reduce certification costs as you will only need to employ an auditor to audit 25% of your assessments.

The course includes:

- An interactive morning session to explain the basic steps to set up plots and measurement procedures. Worked examples and handy help sheets are provided to help participants do these tasks after the course.
- Lunch, followed by a measurement exercise at a local plantation where groups of participants establish a PSC plot and carry out the auditing process.

PSC course participants with Henry Chan, AFG National Trainer, (far left) in Launceston in June 2008

If you wish to learn more or attend a future course, please contact either Henry Chan, phone: 03 6434 6285, email henry.chan@privateforests.tas.gov.au, or Nicky Moffat at AFG National Office, Canberra, phone: 02 6162 9000, email nicky.moffat@afg.asn.au.

Henry Chan

Private Forest Advisor
Private Forests Tasmania

Emissions trading scheme, where the bloody hell are we?

Unless you have been living on a deserted island with no communications with the outside world you are probably aware that we are entering a new twilight zone (or is it a black hole). The zone of uncertainty I refer to is, of course, the development of an emissions trading scheme as part of the Commonwealth's response to climate change.

Since the Rudd Government assumed control of the levers in November last year there has been a flurry of activity. We now have a Minister and a Department for Climate Change (DCC), and everyone's priorities now include what does an ETS mean for me? There is, as this article goes to press, little to show for that activity but that's all about to change. Professor Garnaut released his report at the Press Club on July 4, followed closely (July 16) by Climate Change Minister Wong releasing the Government's green paper on emissions trading at the same venue. Australian Forest Growers, the peak body for private forest growers, has been closely involved in the consultation process to develop the green paper.

It is anticipated that the green paper will be very broad - describing issues and options. Responses to the green paper will be open until early September. The current thinking is this will allow Government to make considered decisions and prepare draft legislation by year's end - all necessary if the Government timetable of having an Emissions Trading Scheme (ETS) legislated and running by 2010 is to be met.

During this time the forest and wood products industry has developed a single agreed position on emissions trading which has been provided to Government and others as a starting point for negotiations. In parallel, but hopefully not in isolation, DCC officials have been finalising the content of the green paper under the guidance of Cabinet.

Perhaps not surprisingly, close engagement with politicians has been difficult during this period given the newness of the government and the 'cabinet cones of silence' that will prevail until the green paper is released. That said, The Hon.

How will agriculture and forestry be accommodated within the national emissions trading scheme?

Tony Burke, Minister for Agriculture, Fisheries and Forestry, in particular has shown a keen interest in understanding the forestry industry position.

The rubber will really hit the road when the green paper is released and we will then have a much clearer picture of the Government's thinking. There will be opportunities for consultation both in the context of the green paper responses (July to September) and then again when the exposure draft legislation is released (December to February).

The industry-agreed position can be seen at www.afg.asn.au/news/. In summary, it seeks that forestry is recognised within an emissions trading scheme. Priority areas are the inclusion of post 1990 reforestation (Kyoto forests) at the growers' option; recognition of the trade exposure of some of the down-stream processors such as paper manufacturing; recognition of carbon stored in harvested wood products as early as possible; equitable and sensible treatment of bioenergy; and recognition of the neutrality of pre 1990 forests. There has been excellent feedback on this position and we anticipate that its content will get good recognition in the green paper, at least adequate to continue more detailed discussion on the priorities.

It's kind of exciting and terrifying at the same time. There is little doubt that we are about to enter major structural reform and we fully intend to ensure forestry's unique position as carbon positive is well understood and recognised.

Warwick Ragg

Chief Executive, Australian Forest Growers

If you go out in the woods today you are in for a big surprise…

The world of climate change and carbon emissions trading has many new words. A few are:

Carbon	A naturally occurring element in coal, oil, wood, charcoal and gases such as carbon dioxide and methane.
Carbon calculator	A scientifically-based model used to calculate the amount of greenhouse gas emitted or sequestered and/or stored.
Carbon credit	An amount of carbon stored in a carbon sink used to offset greenhouse gas emissions.
Carbon dioxide	CO_2 is one of six greenhouse gases emitted from burning fossil fuels.
Carbon pool	Where carbon sequestration for a number of projects is pooled together and managed on a pooled basis.
Carbon sink	A way of storing carbon, for example in trees.
Carbon trading	A system where polluters buy carbon credits in lieu of taxes or quota restrictions.
Climate change	A term used to describe changes in climate, for example those caused by the greenhouse effect.
Greenhouse effect	Greenhouse gases such as carbon dioxide and methane warm the earth by trapping infrared radiation in the atmosphere. Increasing concentrations of these gases, due mainly to the burning of fossil fuels, is believed to be causing dramatic change in the world's climate.
Greenhouse gas emissions	Release of greenhouse gasses into the atmosphere.
Kyoto Protocol	An international agreement, in 1997, which sets targets for future emissions for developed countries.
Emissions Trading Scheme	A market-based mechanism that assigns tradeable rights/allowances to emitters who can buy and sell emission rights from each other.
Offset	Activities, such as tree growing, to reduce net emissions.
Sequestration	The process by which carbon is removed from the atmosphere, such as the absorption and storage of carbon by trees.
3.67	The magic figure used to convert tonnes of carbon to tonnes of carbon dioxide. 1.0 tonne C = 3.67 tonnes of CO_2.

Further information

Web sites for further information on climate change, greenhouse effect and carbon trading are:

http://www.greenhouse.gov.au

The Department of Climate Change site has much information on climate change, greenhouse effect, carbon trading, Greenhouse Friendly program, using trees as greenhouse sinks and carbon sequestration schemes. The fact sheets, publications and the search facility are excellent.

http://www.brs.gov.au

Search for 'climate change' and access numerous reports on the impact of climate change on agriculture and forestry.

http://www.climatechangeinaustralia.gov.au/index.php

A range of reports on how climate change may affect climatic factors and conditions across regional Australia.

Check out *Animations* to see projected temperature and rainfall change in Australia for 2000 – 2100.

http://www.carbonfarming.org.nz

The Carbon Farming Group's online calculator enables farmers to identify how the New Zealand Emissions Trading Scheme may affect them. You can calculate livestock emissions and forest sequestration using data averaged across New Zealand conditions. (Parts of Tasmania are akin to New Zealand).

http://www.afg.asn.au

Carbon trading and its relevance to plantations and farm forestry, Sue Salvin, 2007 is an 8-page, well-illustrated paper written for private forest growers. Published in Australian Forest Grower, Vol 30 No1. 2007. Contact http://www.afg@asn.au for a copy.

Harvesting trees and using wood saves Carbon

Forestry is Australia's only industry sector that stores more greenhouse gases than it emits. Many think that when forests are felled the carbon is lost. Nothing could be further from the truth. This view may exist because carbon emissions trading operates under accounting rules that deem when trees are harvested the carbon is released into the atmosphere. Failure to recognise the carbon stored in wood products (such as timber and paper) may have overestimated global carbon dioxide emissions by at least 10%.

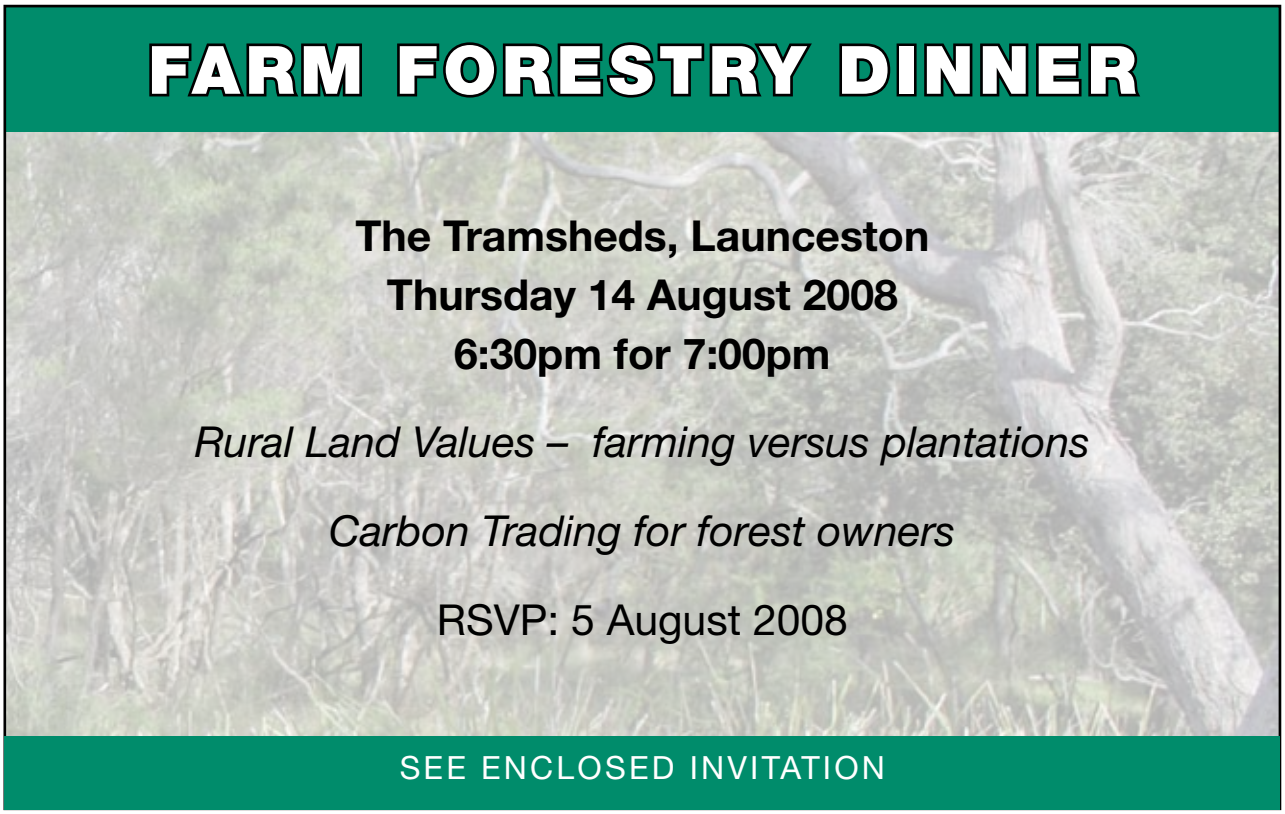
The Cooperative Research Centre for Greenhouse Accounting and the Forest and Wood Products Research and Development Corporation (FWPRDC) have investigated the carbon cycle in forests and wood products. See http://www.fwrdc.org.au. Their research (which excludes carbon storage in the soil or emissions from logging slash) shows that after 200 years:

- **Unharvested forests** store about 230t C /ha.
- **Harvested forests**, harvested and regenerated every 35 years, store about 50t C /ha or 10% of the carbon stored by forests and their wood products.
- **Harvested forests and their wood products** store about 500t C /ha, or more than twice the carbon, stored in unharvested forests.

(Source: Forests. Wood and Australia's Carbon Balance, FWRDC)

Arthur Lyons

Regional Private Forester
Private Forests Tasmania



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