Carbon Sequestering: Banking on the Future
Vidler, S. 1998

Abstract

Carbon Sequestering - a band-aid solution or an industry of the 21st century with real environmental benefits? The anthropocentric release of carbon dioxide into the atmosphere is causing worldwide environmental and economic problems. In Western Australia’s salinity affected wheatbelt area 1500 farmers together with the Western Australian government and various private companies are seeking to invest in the intangible product of carbon credits.

Keywords: Carbon Sequester, Kyoto, CO₂, Western Australia Wheatbelt

Introduction

The anthropogenic release of greenhouse gases into the earth’s atmosphere has begun to change the way we think, live, do business, and plan for the future. Of particular concern is the amount of carbon dioxide (CO₂) released through the burning of fossil fuels and the clearing of forests, which is believed to be affecting the world’s climate. At last governments appear to be taking the issue of global warming seriously and thus we find ourselves debating the viability, versatility, benefits and disadvantages of sequestering ‘carbon credits’ to offset the ‘carbon debits’ produced by our way of life. However, the question arises, how will this global trading of a seemingly intangible commodity operate, and is it just another band-aid solution, avoiding the real issues? By examining preliminary work taking place in the Western Australian wheat belt this report will explore the possibilities of successful carbon sequestering.

Conception

The Framework Convention for Climate Change (FCCC) was announced at the 1992 Rio Earth Summit and signed by more than 150 countries as a declaration to stabilise greenhouse gas emissions (Babiker et al. 1997, p. 3). The declaration went further setting the target of reducing CO₂ emissions equal to 1990 levels by the year 2000, yet no details on how this would happen were specified (Babiker et al. 1997, p. 4).

The 1997 Kyoto Climate Change Conference resulted in an agreement to not only legally limit greenhouse gas emissions to five per cent below 1990 emissions collectively, but to allow countries to trade their ‘carbon credits’ and offset emissions by large-scale tree planting (Kyoto Protocol 1998; Shea 1998). In contrast, Prime Minister John Howard fought for and won an eight per cent increase in 1990 levels for Australia (Shea 1998).

What on Earth is Carbon Sequestering?
Carbon is found naturally in all aspects of the environment. The carbon cycle, as shown in figure 1, is necessary for life (Montgomery 1997, p. 416). Humans have dramatically increased the amount of CO\textsubscript{2} mobilised in the carbon cycle by fifteen percent in the last century (Montgomery 1997, p. 416). **Carbon sequestration is when this carbon can be taken out of the atmosphere or absorbed and stored in a terrestrial or aquatic body** (Carbon Offset Glossary 1998). Such bodies can be classified as carbon sinks, but only in their absorption years (Loh n.d.). Old growth forests, for example, are in equilibrium with the atmosphere, naturally releasing as much CO\textsubscript{2} in death as they absorb during growth (Loh n.d.). This distinction is vital in the accurate calculation of carbon credits (Carbon Offset Glossary 1998; Loh n.d.).

**Figure 1: The Carbon Cycle.**

Anthropogenic input into the carbon cycle has resulted in an imbalance.

*Source: Montgomery (1997, p. 414).*

**When? Who? How? What is it Worth?**

A telephone interview with John Bartel, an environmental research scientist at Como’s Conservation and Land Management department (CALM) on 21 September 1998, confirmed that to date very few guidelines concerning carbon sequestration and trading have been established. The legalities of who owns the sequestration rights, how credits will be traded and what they will be worth are currently in debate. It is hoped that the next conference on Climate Change to be held in Buenos Aires in November this year will help to make this process workable (Kyoto Protocol 1998).

Carbon content is measurable, but the quantity sequestered is interdependent on the species of trees planted, the trees survival rates, soil characteristics, climatic conditions, and the final use of the tree and how it is managed during its growth.
To calculate this value Shea (1998) states it is important to first consider:

- the total biomass of the tree has worth, that is the trunk, leaves, roots, branches and even the soil;
- by weighing each part of the tree and establishing its dry weight a relationship between height and diameter can be defined;
- carbon fixed in woody tissue is equal to about half the weight of the dry biomass; and
- an average annual carbon fix can be calculated by evaluating total yearly biomass accumulation per hectare and dividing it by the rotation age of the tree.

Thus the worth of each tree varies both ecologically and economically. There have been many fiscal estimates of this carbon value ranging from $100 to $300 per hectare of forest, yet until trading takes place these estimates are purely speculative (Carbon Credits 1998).

As contributors of CO$_2$ to the atmosphere, companies such as BP, Toyota and Pacific Power, have already ventured into the unknown and invested their money into sequestering carbon in areas such as south western Western Australia (Carbon Credits 1998). As outlined below the wheatbelt area of Western Australia is particularly interesting as it is not only one of the first areas gearing up for carbon trading, but it has many land degradation problems that can be readily addressed by tree planting.

**What is Going on in the Western Australian Wheatbelt?**

The approximate area defined as the Western Australian wheatbelt is the agricultural land that receives between 275 and 600mm of rainfall per annum (Lefroy et al. 1992, p. 44). This area, as show in figure 2, has become synonymous with salinity, erosion, waterlogging and extinction (Lefroy et al. 1992, p. 45). Some of the problems faced in this area include:

- more than 93 per cent of the natural vegetation has been cleared (MacGregor & Pilgrim 1998, p.4);
- one third of the agricultural land will be lost to dryland salinity if nothing is done (Carbon Credits 1998);
- the water table is rising an average of 20 cm per year (Carbon Credits 1998);
- one of the most biodiverse environments in Australia now has the largest number of extinction rates. Amongst flora for example; 70 presumed extinct; 91 endangered; 363 vulnerable; 573 poorly represented (Conacher 1995, p. 26);
- total annual economic cost of land degradation in the area is $517 million (MacGregor & Pilgrim 1998, p. 4).

CALM, along with other groups such as Landcare, have been attempting to remedy some of these ecological problems through tree planting and, most importantly, through changing farmer’s attitudes towards farming practices (Carbon Credits 1998; Bartel 1998, pers. comm., 21 Sept.).
According to Bartel (pers. comm., 21 Sept.), the Carbon Sequestering program is seen as a bonus to CALM giving its tree planting programs an added economic value. Shelterbelts, agroforestry, rotation crops and water management all involve the establishment of plants - plants that can now be earning farmers money each year just by being there (Bartel 1998, pers. comm., 21 Sept.).

**Figure 2: South West Western Australia**
Source: Australian Surveying and Land Information Group 1994, pp. 212-213
Farmers, Government and Industry

CALM projects that by 2020, around 800 000 hectares of trees will be planted in the area by 1500 farmers already involved with an Asian paper company (Carbon Credits 1998). While this project started out growing bluegums for paper pulp, those trees planted since 1990 will also provide farmers with carbon credit sales, encouraging more and more farmers to become involved in agroforestry (Carbon Credits 1998).

Rod Lukatelick, Environmental Manager of British Petroleum’s (BP) Kwinina Refinery confirmed in a telephone interview on 14 September 1998 that BP is one of the companies working with the help of CALM’s ‘tree crop sharefarming’ scheme to plant trees as carbon offsets in strategic areas. BP is paying for the establishment of trees within the 400-600mm rainfall areas (Figure 1), where salinity is at its worst.

According to Lukatelick (1998, pers. comm., 14 Sept.) BP has paid for the establishment of about 40 hectares of maritime pine (Pinus pinaster) trees on each of eight properties; two in the Lake Toolibin Catchment, six in the Katanning Shire (Figure 1). The company will pay for establishment and ongoing management costs and in turn take half the net profit of the sale of the trees after harvest, which should include carbon credits. Farmers will receive a management allowance, half the net profit from the trees, and hopefully a lowering of the water table and thus improved land conditions. Note that the farmer’s land title is secured as is the company’s investment, by the ‘profit a prendre’ legal contract - which means that the farmers control the land, but the company has access to, and ownership of, the trees at all times (Shea 1998). Ten per cent of the trees planted are natives and will be left as permanent shelterbelts (Lukatelick 1998, pers. comm., 14 Sept.). Shelterbelts will not only help native fauna, but will improve on farm climatic conditions.

This is just the beginning for BP as it plans to plant between 25 000 and 60 000 hectares in Western Australia alone (Carbon Credits 1998). BP’s ultimate goal is to ensure that CO₂ output from its worldwide operations are offset by CO₂ sequestering in its own worldwide plantations (Carbon Credits 1998; Lukatelick 1998, pers. comm., 14 Sept.).

What are the Benefits?

The water table

CALM has recorded an average 60 centimetre drop in the water table under bluegum, maritime pine and shelterbelts (Carbon Credits 1998). This seems consistent with other studies that show that a drop of between 10 and 80 centimetres can be expected under such plantations (Agriculture Western Australia et al 1996a, p. 7). Figure 3 illustrates the nature of the water table under bluegums planted in a close-spaced belt of 450 trees per hectare (Agriculture Western Australia et al. 1996a).

Figure 3: Water Table Level Under Newly Planted Bluegums.
The farm environment

There have been three basic species chosen for plantings in the area; mallee in dry marginal land; maritime pine (*Pinus pinaster*) in the 400-600 mm area; bluegum (*Eucalyptus globulus*) in the areas of highest rainfall (Carbon Credits 1998; Agriculture Western Australia *et al.* 1996b, p. 13). Where trees have been skilfully integrated onto farms as shelterbelts and recharge consumers there has been no loss of other farm production (Carbon Credits 1998). Instead, production has improved as the trees have slowed wind, decreased soil erosion, and improved soil structure (Carbon Credits 1998; Schofieldt 1991). Shelterbelts can also assist in the re-establishment of native flora and fauna if plant species and location are chosen carefully (Oates 1995). Not only is this morally important, but native species can, among other things, help to fend off existing crop predators such as insects.

The cash incentive

While many farmers are struggling with degraded land it is sometimes surprisingly difficult to encourage them to introduce agroforestry or other forms of diversification onto their properties. If, on the other hand, farmers are aware that they can be making money while their trees are growing, it may at least make tree planting seem more viable (Oates 1995, p.34; Bartel 1998, pers. comm., 21 Sept.). Farmers will have a commodity to sell locally, nationally or internationally.

The carbon sink

The last obvious benefit of carbon sequestering in the Western Australian wheatbelt, or anywhere for that matter, is that growing trees and plants are soaking up excess CO$_2$ in the atmosphere (Carbon Credits 1998).

What’s the Catch?

Forgetting the issue
If companies can offset their carbon emissions, is this a disincentive to keep trying to reduce them? The satirical cartoon in figure 4 (ReNew 1998, p. 13) reflects the concerns of many environmentalists that the carbon sequestering program is merely a band aid solution to the problems of CO₂ emissions. Many companies may reject implementing energy saving technologies that are capable of repaying themselves within two years, yet may invest in carbon credits to avoid the perceived high costs of energy efficiency (ReNew 1998, p.26).

Rod Lukatelick of BP’s Kwinana Refinery (1998, pers. comm., 14 Sept.) claims that there is only so much that can be done (to prevent CO₂ emissions) within the walls of refinery, hence ‘offsetting’ alternatives must be explored.

**Figure 4: Forgetting the real issue**

![Figure 4: Forgetting the real issue](image)

*Source: ReNew (1998, p. 26)*

**Carbon release**

Another problem is the final use of the timber. Some carbon is released when the tree is first cut down, then more depending on its final use (Pearce 1991, p. 3). For example, if the timber is used to make furniture then carbon release is much slower than if it is turned into paper (Pearce 1991, p. 3). Dr Syd Shea (1998) from CALM suggests that, where possible, timber should be used more than steel, aluminium and cement. Timber is the only one of these materials capable of storing carbon, while the others actually release large amounts by the energy it takes to produce them as shown in Table 1 (Shea 1998, p.6). The table also shows the amount of fossil fuel energy needed to produce each product, a cycle which releases CO₂ into the atmosphere.

**Table 1: Carbon Released and Stored and Fossil Fuel Energy Used in the Manufacture of Building Materials.**

<table>
<thead>
<tr>
<th>Material</th>
<th>Carbon released (kg/t)</th>
<th>Carbon released (kg/m³)</th>
<th>Carbon stored (kg/m³)</th>
<th>Fossil fuel energy (MJ/kg)</th>
<th>Fossil fuel energy (MJ/M³)</th>
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</thead>
<tbody>
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<td></td>
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</tr>
<tr>
<td>Material</td>
<td>Rough sawn timber</td>
<td>Steel</td>
<td>Concrete</td>
<td>Aluminium</td>
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<tr>
<td>30</td>
<td>15</td>
<td>250</td>
<td>1.5</td>
<td>750</td>
<td></td>
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<tr>
<td>700</td>
<td>5320</td>
<td>0</td>
<td>3.5</td>
<td>266 000</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>120</td>
<td>0</td>
<td>2</td>
<td>4800</td>
<td></td>
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<tr>
<td>8700</td>
<td>22 000</td>
<td>0</td>
<td>435</td>
<td>1 100 000</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Shea (1998, p. 6).*

**Keeping control**

It is recommended that carbon credits are issued at intervals during the trees growth, remain only temporarily valid, and are monitored closely (Swart 1992, pp. 158-159). The Bureau of Resource Sciences and Environment Australia are working on a framework to ensure Australia’s creditation standards will be internationally tradeable (Response to Climate Change 1997). Satellite monitoring and on-the-ground auditing will be used to ensure standards are upheld (Response to Climate Change 1997).

**New environmental problems**

While some plantings are rightly addressing local needs, emissions trading schemes will increasingly encourage large-scale commercial plantation projects that are not necessarily aligned with local needs (Swart 1992, p. 158). Large-scale planting also indicates that preferred species are likely to be the most cost efficient varieties, which are not always natives (Loh n.d.). Native eucalypts are fast growing and can absorb more carbon in the first 10 - 12 years, but in the long term (20-30 years) pines are superior (Francis 1998, p. 76). The thirty year rotation cycle is the most commonly adopted (Carbon Credits 1998). Large monocultures therefore generate other ecological issues such as reduced biodiversity (Loh n.d.). John Bartel from CALM admitted that maritime pine was the preferred species for most of the larger scale investments taking place as it was proven to be the most cost effective species to plant. This is an exotic species (1998, pers. comm., 21 Sept.).

**The spaceship earth**

The area of land necessary to balance carbon credits with carbon debits is staggering (Loh n.d.). CALM suggests that Western Australia has the potential to sequester 200 million tonnes of carbon over the next thirty years (Shea 1998). In contrast, the removal of the 3.2 billion tonnes of excess CO₂ released into the earth’s atmosphere each year, would require the planting of a temperate rainforest the same size as Western Australia (Loh n.d.). Then, after the first one hundred years more forest would have to be planted, yet none of it could be harvested (Loh n.d.).
Critics of carbon sequestering point out that it will not reduce the emission of other equally harmful atmospheric pollutants (Loh n.d.; Swart 1992, p. 155).

**Conclusion**

It is clear then that carbon sequestration is not a solution to global warming or CO₂ emissions, but the program will buy some time to investigate other measures and technologies that can physically reduce CO₂ output (Pearce 1991, p. 9). Carbon sequestering is not about the creation of a new tradeable commodity; the objective of the project is to abate climate change.

Carbon storage and sinks are limited by time and space and can themselves create other environmental problems (Francis 1998, p. 76). However, the benefits of the carbon sequestering project are many. The planting of trees will:

- lower the water table;
- decrease salinity;
- decrease wind speed and water runoff;
- improve soil conditions;
- absorb CO₂ emissions.

Admittedly the rewards would be even greater if farmers were planting endemic species with no plans to harvest the trees in the future.

Many of the benefits of the carbon sequestering program are questionable, however, there is solace in the fact that people are beginning to look to nature for solutions. Even if the Carbon Sequestering program does not eventuate, some of the farmers of Western Australia will still be doing their land a great favour by planting trees.

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School of Geography, Population and Environmental Management
Flinders University, Adelaide, Australia