US CARBON MARKETS AND OPPORTUNITIES FOR AUSTRALIAN FOREST MANAGERS

JAMES BULINSKI

2011 GOTTSTEIN FELLOWSHIP REPORT

JOSEPH WILLIAM GOTTSTEIN MEMORIAL TRUST FUND

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Bill Gottstein was an outstanding forest products research scientist working with the Division of Forest Products of the Commonwealth Scientific Industrial Research Organization (CSIRO) when tragically he was killed in 1971 photographing a tree-felling operation in New Guinea. He was held in such high esteem by the industry that he had assisted for many years that substantial financial support to establish an Educational Trust Fund to perpetuate his name was promptly forthcoming.

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About the author

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Executive summary

This report details outcomes of a study tour undertaken within the United States of America (US) during February 2011, that was generously supported by the Gottstein Trust Fellowship Program. Broadly, the aim was to better understand US carbon markets and develop a 'road-map' that could be used by Australian practitioners to better navigate this space. More specifically, the objectives were to:

i. provide an analysis of existing and developing markets for forest sequestered carbon in the US, including trading mechanisms, potential market size and value, likely timeframes for market development and key market risks;
ii. identify pathways for Australian practitioners to deliver carbon into these markets; and
iii. improve the capacity for Australian practitioners to favourably position themselves to capture opportunities arising from emerging US markets.

The study centered on a series of face-to-face interviews with individuals representing 28 organisations with strong interests in emissions trading programs.

During 2009-2010, prospects for a national carbon trading program in the US were promising, with two key Bills, referred to as the Waxman-Marky and Kerry-Boxer Bills, introduced into the House of Representatives and Senate (respectively) that would potentially pave the way to a cap-and-trade program. Unfortunately, neither succeeded in the Senate and the impetus for a national carbon trading program faltered during 2010. At the time this study was undertaken, it was clear that this had resulted in a broad contraction of the carbon sector within the US.

While these Bills failed, the cap-and-trade design features that they outline provide some interesting signals as to the form of future programs. Both set ambitious emissions reduction targets (>80% reduction against 2005 levels by 2050) and allow for the recognition of at least two billion tonnes of grenhouse emissions 'offsets' per annum. Key eligibility considerations include additionality (typically to be considered additional projects must be able to demonstrate they deliver emissions reductions over and above what would have occurred under the 'business as usual', or baseline, scenario), permanence, and ability to verify. International Offsets are restricted to projects in developing countries that have entered agreement with the US. Forestry projects are mentioned directly, suggesting these would be accepted.

In the absence of a federal program, a range of regional initiatives have been developed, including the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program operating across 10 US states since 2009. The value of the RGGI market is around $400 million per annum and certain offset types can be recognised, including re-forestation. However, emissions allowances are readily available, allowance prices are low ($1.89 per tonne CO2e) and compliance hurdles for forest projects are high. To date, no offset projects have been delivered into RGGI and there is little commercial interest in this program among US project developers.

Of greater interest, is the proposal by the state of California to introduce a cap-and-trade program from 2011. Under this program, the target is to achieve annual emissions equivalent to 1990 levels by 2020 (a 12% reduction as compared with 2008 levels). Emissions allowances

will be auctioned, with a reserve price starting at $10 tonne CO2e in the initial year and escalating at over 5% per annum to 2020, implying a value of over $4 billion from 2015-2020.

Eligible Offsets are recognised under the Californian Cap-and-Trade, although emitters are limited to meeting no more than 8% of their emissions profile with Offsets. This suggests Offsets will trade at a slight discount to allowances and implies an annual market for Offsets of at least $330 million from 2013. Offsets derived from international projects are potentially allowable, but this is likely to be limited to a small number of developing countries. Domestic offset projects must meet the requirements of protocols approved by the Californian Air Resources Board.

A protocol relating to forestry projects has already been drafted. Key features include: reductions must be additional; minimum crediting period of 25 years; sequestration must be retained for 100 years after credits are issued; a proportion of credits will be retained in a 'buffer' account; carbon stocks to be verified including through on-ground measurement; and projects must predominantly utilise native tree species.

Outside of the mandatory compliance market, a voluntary market exists within the US that, in recent times, has seen over $70 million worth of verified Offsets traded annually. The value achieved for on-market Offset sales in the US averaged around $4.90 per tonne CO2e in 2010, which is slightly below the global average. With the demise of the Chicago Climate Exchange during 2010, three verification standards now dominate: the American Carbon Registry, Climate Action Reserve and Verified Carbon Standard.

Outside of the relatively small voluntary-market, there presently appears little opportunity for Australian-based forest projects to trade directly into the US. Establishing projects within the US itself is the more transparent and immediate pathway to participation. Approaches that have achieved recognition and acceptance within the US can be broadly categorised as improved forest management, reforestation and avoided conversion (or deforestation). Of these, avoided deforestation appears unlikely to deliver large volumes of Offsets. Improved forest management appears to be the favoured strategy at lower carbon prices, while re-forestation is potentially a larger source of supply at carbon prices exceeding $15 per tonne CO2e.

Table of contents

About the author iii
Acknowledgements iii
Executive summary iv
1. Introduction 1
2. Model for a national program 4
3. Regional initiatives 7
4. Regional Greenhouse Gas Initiative 9
5. Californian Cap-and-Trade 15
6. Voluntary markets 25
7. US-based projects 31
8. Conclusion 36
9. References 37
Appendix 1: Organisations interviewed 41
Appendix 2: State agencies administering the RGGI 44
Appendix 3: ARB schedule around Cap-and-Trade 45
Appendix 4: Operational forest carbon projects (US) 46
Appendix 5: Dominant carbon standards in the US 48

1. Introduction

After almost two decades of scientific, public and political debate around climate change and the policy tools best suited to dealing with it, there is now a global trend toward the adoption of greenhouse gas reduction targets, or caps, and the use of market-based mechanisms to drive the behavioral change required to achieve these. A number of governments have instituted mandatory compliance programs that attach a price to greenhouse gas emissions. This includes, for example, the European Union Emissions Trading Scheme (EU ETS), the Regional Greenhouse Gas Initiative (RGGI) operated by a collection of states within the United States of America (US), the New South Wales Greenhouse Gas Reduction Scheme, (NSW GGAS) and the New Zealand Emissions Trading Scheme (NZ ETS).

With the introduction of such policies, a large global market-place for the trade of emissions units, often referred to as carbon-credits, has emerged. In 2005, the global carbon market was valued at around [1]$11 billion. In the five years to 2010 (Fig. 1), that market size increased by more than ten-fold, to close to $142 billion (Linacre *et al.* 2011), making it one of the fastest growing commodity markets in the world. This rapid increase is all the more surprising when it is considered that around 85% of the total market value is driven by just one program, the EU ETS, and that some of the world's largest emitters, such as the United States and China, collectively responsible for around 40% of global emissions (United Nations Statistics Division, 2010), are yet to formalise nation-wide compliance programs.

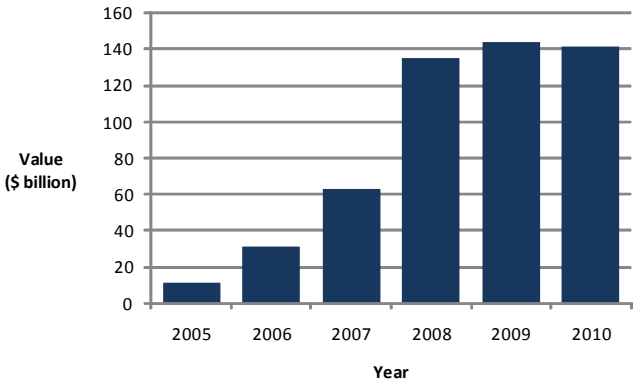

Figure 1. Value of the global carbon market.

Forests are an important carbon sink, estimated to store over 280 gigatonnes globally (FAO, 2005). This is increasingly recognised within emissions reduction and trading programs. The Clean Development Mechanism (CDM), NSW GGAS, NZ ETS, RGGI and a range of voluntary markets, for example, all allow recognition, via the issue of carbon credits or verified 'Offsets[2]', of carbon sequestered by eligible forest management activities. These can include establishing new forests (Reforestation, or afforestation), avoiding removal of forests subject to some threatening process (Avoided Deforestation), or altering management regimes to allow for increased sequestration (Improved Forest Management).

This represents a fundamental shift in the way forests are valued. For the first time, a tangible, tradable 'product' with a monetary value has been created around one of the environmental services that forests provide. This new forest product is changing the way that the business of doing forestry is viewed, with a range of novel carbon focused ventures emerging in the last ten years that are not solely reliant on traditional wood products. It is also changing the way that

[1] All currency amounts in this report are expressed as US dollars.

[2] Throughout this report, Offset is used as a generic term to describe verified greenhouse gas reduction units under various mandatory and voluntary compliance programs. One Offset is equivalent to an amount of greenhouse gas abated, or avoided, that has a global warming potential equivalent to one tonne of carbon dioxide (1 t CO_2e).

forestry is practiced, with new silvicultural and harvesting regimes being applied, and landscapes previously thought uneconomic now being opened up to forestry activities.

Realising the opportunities arising from the growing demand for forest carbon is not without challenges. While the global carbon market is substantial, the market for forest carbon remains a relatively small and complex niche. The larger 'mandatory-compliance' market is wholly dependent on the vagaries of policy imposed by multiple governments around the world, from federal to state level, often with little consistency between jurisdictions. History has shown these are subject to change on relatively short-notice, which makes this is a dynamic and uncertain market within which to operate.

The smaller 'voluntary market' is still in early stages of development. Transparency within this market is low. Understanding who the buyers are, what influences their purchasing decisions, what the scale of demand is and what price point the market can bear is difficult. On top of this, the process for realising the 'product', carbon credits, is technically complex, with a range of legislation, standards and verification processes to be navigated before the first credit is created.

Nevertheless, this emerging market is creating some exciting commercial possibilities and, by virtue of their long history of engagement with emissions reduction programs, Australian forest managers are comparatively well placed to realise them (Box 1).

Box 1. Australian managers have a long history of engaging with emissions programs

- The first public discussion papers around a national trading scheme were released by the Australian government in 1999 (Australian Greenhouse Office, 1999).
- From 1999-2006, the Cooperative Research Centre for Greenhouse Gas Accounting provided an important forum for developing the science around forest carbon accounting.
- In 2004, the NSW Greenhouse Gas Abatement Scheme (NSWGGAS) was introduced, making it one of the world's earliest mandatory compliance programs.
- Tree plantings targeting carbon outcomes began to be established within Australia from the late 1990's (Beder, 1999) and the world's first on-registry trade of forest carbon took place in Australia in 2005 (NSWGGAS).
- The Greenhouse Friendly Program, operating from 2001-2010, provided a valuable proving ground for forest carbon projects and verification standards.
- This experience has been further refined through the ongoing debate around design features of proposed emissions reduction programs, including the Carbon Pollution Reduction Scheme and the Carbon Farming Initiative.

In recent times, policy initiatives have been introduced into the US that have the potential to create an enormous market for forest carbon, including from international sources. As with carbon markets everywhere, however, finding pathways into this market is not easy, particularly if you are situated on the other side of the globe. This report details the outcomes of a study tour to the US that was generously supported by the Gottstein Trust Fellowship Program.

Broadly, my aim was to better understand the US market-place and develop a 'road-map' that could be used by Australian practitioners to better navigate this complex space. More specifically, the objectives were to:

i. provide an analysis of existing and developing markets for forest sequestered carbon in the US, including trading mechanisms, potential market size and value, likely timeframes for market development and key market risks;

ii. identify pathways for Australian practitioners to deliver carbon into these markets; and

iii. improve the capacity for Australian practitioners to favourably position themselves to capture opportunities arising from emerging US markets.

The study centered on a series of face-to-face interviews with individuals representing 28 organisations (Appendix 1) with strong interests in emissions trading programs[3]. This included a cross-section of stakeholders, from Non Government Organisations (NGO's), government agencies, emitters, forestry agencies, specialist forest carbon firms, carbon trading agencies, registries and carbon standards. The four-week itinerary included visits to California, Colorado, Illinois, New York, Pennsylvania and Washington. Further research was conducted through reviewing relevant Bills, legislation, regulations, standards, protocols and publications.

1.1. Setting the scene

The US emits around six billion tonnes[4] of greenhouse gases per annum, representing close to 20% of total global emissions and making it the second largest emitter behind China (United Nations Statistics Division, 2010). Since 1990, annual emissions have increased by an average of 0.4%, with the majority arising from combustion of fossil fuels for energy (US Environmental Protection Agency, 2011).

Due in part to its global prominence as an emitter, as well as its absence from international initiatives such as the Kyoto framework, US emissions reduction policy has been the subject of intense debate, both internally and internationally. Often criticized for moving too slowly on addressing greenhouse emissions, the US is yet to introduce a comprehensive national approach and recent research suggest its efforts are "mid-range" with respect to the global effort on tackling the issue (Australian Productivity Commission, 2011).

During 2009 and into 2010, the prospects for the introduction of a national emissions trading program were promising. To date, more than 10 Bills have been proposed by members of the US congress that seek to implement a cap-and-trade approach to emissions reduction (Charnley *et al.*, 2010). In June 2009, one of these Bills, referred to as The American Clean Energy and Security Act or the Waxman-Markey Bill, was approved by the US House of Representatives. In November 2009, the Clean Energy Jobs and American Power Act, also known as the Kerry-Boxer Bill, was introduced to the Senate. Both Bills proposed setting firm emissions reduction targets and the introduction of a cap-and-trade program, commencing from as early as 2012.

[3] People that participated in interviews are generally referred to collectively in this report as 'Participants'.

[4] Amounts of greenhouse gas emissions and carbon sequestration are expressed as tonnes of carbon dioxide equivalents (t CO2e) throughout this report, unless otherwise indicated.

The use of Offsets as a permissible emissions reduction activity was a feature of both Bills. Offsets created internationally were acceptable and the potential market for Offsets well exceeded a billion tonnes per annum. Not surprisingly, this caused considerable excitement amongst existing and aspiring Offset providers, with a number of new US firms created during this time and existing firms expanding their capacity in the expectation of massively increased demand. The mood was optimistic, with many believing the world's largest Offset market, valued at hundreds of millions of dollars, was soon to come into effect.

Unfortunately, both Bills failed during mid-2010, with neither proceeding to a vote by the Senate. There now appears little likelihood that either will be revived, at least in the short term. In response, the US Offsets and carbon trading sector contracted significantly:

> "*The year of 2010 was a bumpy ride for suppliers in the US, where the federal governments inability to reach a climate solution hastened the closure of the Chicago Climate Exchange (CCX) as well as several state-side trading desks*". (Peters-Stanley *et al.*, 2011)

When this study was undertaken during early 2011, themes that regularly featured in conversations around the state of the market-place were re-structures, down-sizing and re-direction of business models so as to reduce the reliance on carbon- derived revenue. As one of the people who took part in this study (Participants) phrased it, "*there are a lot of carbon refugees in the US at the moment*".

The general consensus amongst Participants was that federal climate change policy was no longer a priority issue that was capturing public attention and generating political debate. Nearly all participants considered a national emissions trading program, or indeed any other form of federally administered mandatory reduction program, was highly unlikely to be implemented over the next several years. The earliest date suggested was 2015, with some participants suggesting later than 2020, or "*never*" in a couple of instances.

Balanced against this was cautious optimism around policy developments in California, which has passed legislation that will likely see the introduction of a state-level program from 2012. As well as potentially creating the world's second largest carbon-market, the Californian Cap-and-Trade program is seen as a potential driver for the development of a federal program, possibly including through linkages to other state-level initiatives like the Western Climate Initiative and cap-and-trade programs emerging in Canadian provinces. To paraphrase one participant:

> "*All eyes are now on California. If that program is a success, other states may follow, but if it fails, a national program will be set back by at least five years*".

Given their state of development, more attention is paid in this report to the regional programs than proposed federal initiatives.

2. Model for a national program

While the Waxman-Marky and Kerry-Boxer Bills ultimately failed in the Senate, they are worth some consideration here as pre-cursors to a possible future US emissions trading program

administered at the federal level. The two Bills share many similarities and, for reasons of brevity, this report focuses on Waxman-Marky[5].

Central to the Bill, which references a range of emissions reduction activities, is the introduction of a cap-and-trade program to drive a 17% reduction in emissions against 2005 levels by 2020 and an 83% reduction by 2050. The cap-and-trade would cover around 85% of emissions sources. Electricity generators, oil refineries, natural gas suppliers, and energy intensive industrials exceeding certain emissions thresholds would be mandatory participants.

Each year, an amount of emissions Allowances[6] will be created equal to the emissions budget for that year, this being set according to the emissions reduction targets described above. Mandatory participants are required to acquit one Allowance for every tonne of greenhouse gas emitted, or incur a fine that is two times the 'fair market value' of the allowance deficit.

At program commencement, the majority (85%) of Allowances would be made available free of charge. Most of the remainder would be auctioned with a $10 (per Allowance) reserve, or floor, price[7]. Over time, the proportion of Allowances available via auction would increase, with no free allocation beyond 2030. The reserve price would increase at 5% per year plus inflation.

The Bill proposes a number of 'cost-containment' mechanisms, including unlimited banking of Allowances, borrowing against future allocations and set-price purchases from a comparatively small (≤3% of emissions budget) 'strategic reserve' (starting price of $28). Eligible Offsets can be used in place of Allowances for a proportion of a participants emissions profile and the Administrator may allow for the use of Allowances generated under other trading programs, provided they are "*at least as stringent*" as the US program.

2.1 Treatment of Offsets

The Bill allows for offsetting of up to a total of 2 billion tonnes of emissions each year using eligible Offsets. Up to half of the Offsets can come from international sources, with provisions to increase this should domestic Offset supplies fall below 0.9 billion tonnes. At around five years from commencement, international Offsets are discounted as compared with Allowances, so that 1.25 Offsets must be acquitted to account for one tonne of emissions liability. This suggests on-market trades of international Offsets will likely achieve a price at least 25% below that of auctioned Allowances.

The Bill is not prescriptive with respect to the type of Offset projects that may be eligible. In the case of international projects, however, the Bill stipulates that Offsets will only be recognised where the project is located in a developing country and the US has entered an agreement with that country. General eligibility principles for projects are:

[5] Readers interested in further detail are encouraged to view reports prepared by the PEW Centre on Global Climate Change. Kerry-Boxer: http://www.pewclimate.org/short-summary/clean-energy-jobs-american-power-act-chairmans-mark Waxman-Marky: http://www.pewclimate.org/acesa

[6] The term Allowance is used through this report as a generic reference to various emissions units made available to emitters, either freely, or via auction, under mandatory compliance programs within the US. One Allowance is equivalent to 1 t CO2e.

[7] All carbon prices, whether for Allowances, Offsets or non-specified carbon units, are expressed as US dollars per t CO2e.

- Activity is additional – must not have been required by law and must deliver reductions over and above what would have occurred under a 'business as usual' scenario.
- Reductions are verifiable –must be possible to quantify reduction amounts and an independent verifier is required to confirm these amounts.
- Reductions are 'permanent' – references are made within the Bill to establishment of 'reversal' buffers to insure against reversal events.

Two offsetting activities mentioned directly within the Bill are forestry and agricultural projects, suggesting these would be readily accepted. The proposed crediting period for forestry is 20 years, with five years for agricultural projects and 10 years for 'other' project activities. Crediting period renewals will typically be unlimited for most project types.

The US Environmental Protection Agency (EPA) is the administrator of international Offsets and project types other than domestic agriculture and forestry (Fig. 2). The Secretary of Agriculture will oversee domestic agriculture and forestry projects. An independent Offsets Integrity Advisory Board will provide technical guidance to the EPA. In addition, a separate US Department of Agriculture Greenhouse Gas Emission Reduction and Sequestration advisory committee will provide advice around domestic agriculture and forestry offset projects.

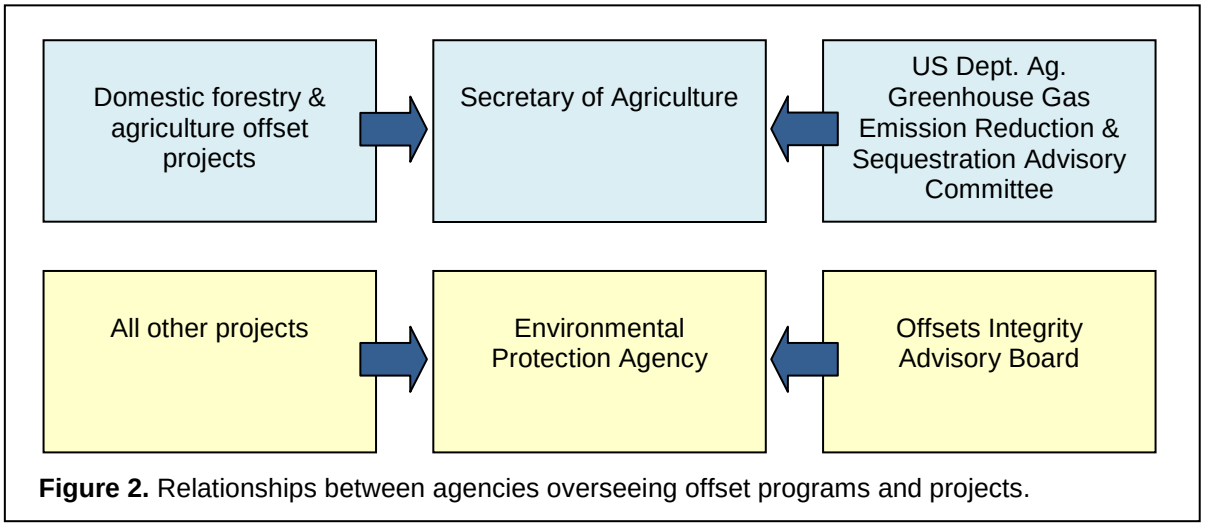

Figure 2. Relationships between agencies overseeing offset programs and projects.

The Bill includes provision for encouraging early action, in advance of the implementation of a cap-and-trade program, by allowing recognition of certain Offsets issued under a government established, or administrator approved, program prior to the cap-and-trade commencing.

2.2. Prospects for Offsets

Since the Waxman-Marky and Kerry-Boxer Bills have not been voted into law by the US senate, there are no immediate prospects for supplying Offsets into a national mandatory compliance market. However, the treatment of Offsets under these Bills is encouraging with respect to the form of future markets. At two billion tonnes per annum, the potential demand for Offsets is enormous and would represent the largest market of its kind. A wide range of Offsets are potentially allowable, with forestry projects specifically mentioned under both Bills. Offsets

generated outside of the US can be recognised, although the offset activity must be conducted in developing countries. Finally, the auction reserve price for Allowances suggest a minimum starting price of $7.50 rising to over $12 within five years.

With regards opportunities for Australian practitioners, the mechanisms detailed within the Bills would provide a number of pathways to market, including developing projects within the US itself, or within developing countries. It appears unlikely that carbon sequestered by projects within Australia could trade directly into such a program. However, the Administrator may "*issue credits in exchange for credits issued by an international body established by the UNFCCC or a protocol to such convention*" (American Clean Energy and Security Act 2009, Section 743, pg. 810). This is significant as the Australian government's recently proposed Carbon Farming Initiative (CFI) proposes to allow Australian-based forest projects to retire CFI units for Australian Allowance Units (AAU's), which in turn might be retired in exchange for US credits (Fig. 3).

Figure. 3. A possible pathway to realising US Offsets, or Allowances, where mechanisms proposed under the American Clean Energy and Security Act 2009 prevail.

3. Regional initiatives

In the absence of a federal initiative, several regional programs have emerged in the US over the past five years (Fig. 4). These include a fully functioning cap-and-trade program referred to as the Regional Greenhouse Gas Initiative (RGGI). The state of California now also has well advanced plans for the introduction of a cap-and-trade, scheduled for commencement during 2012. Both are described in detail under separate sections that follow.

Outside of RGGI and the Californian Cap-and-Trade, there are other initiatives that have been established around emissions reduction objectives. These include the Western Climate Initiative, the Mid-west Greenhouse Reduction Accord and sector specific individual state programs. These programs, which are either relatively small scale, or as yet not as advanced as the RGGI and Californian Cap-and-Trade, are described briefly below.

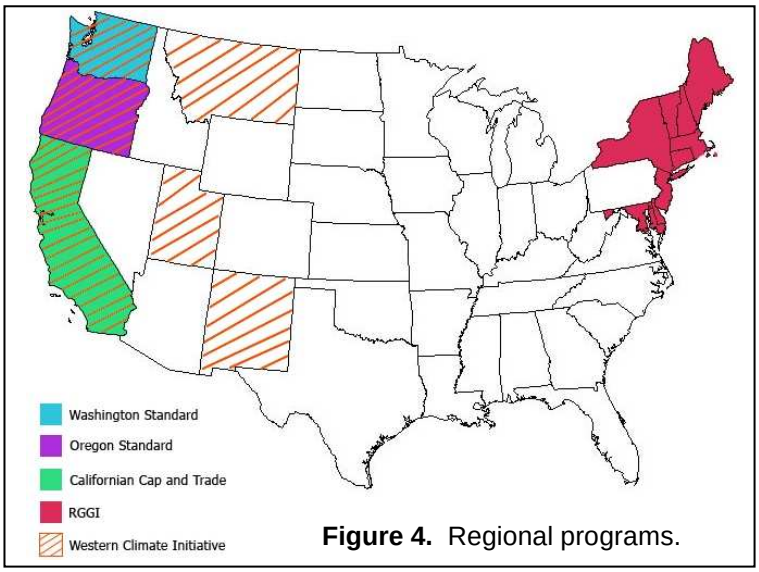

Figure 4. Regional programs.

3.1. Western Climate Initiative

Formed in 2007, the Western Climate Initiative (WCI) includes a number of US states (California, Montana, New Mexico, Oregon, Utah and Washington) and Canadian provinces (British Columbia, Manitoba, Ontario and Quebec). The intent is to develop a regional target for emissions reductions and then to implement programs that will help meet this target. The target that has been agreed is a 15% reduction against 2005 levels by 2020. One of the key platforms for meeting this is the intended establishment of a series of linked cap-and-trade programs.

Unfortunately, the future of the WCI, at least in terms of breadth of geographic coverage, is looking uncertain as a number of states appear to be withdrawing, including Arizona and Utah. Other participating states, including Montana and New Mexico, appear to be having difficulties securing, or retaining, the political mandate to introduce cap-and-trade programs.

Despite these difficulties, a number of states including California, Oregon and Washington appear committed to the WCI. Additionally, three participating Canadian provinces (British Columbia, Ontario and Quebec) have already passed cap-and-trade legislation and appear ready to link to the Californian Cap-and-Trade, via the WCI, from as early as 2012. Work around designing the WCI is continuing, with a number of stakeholder discussion papers released in recent times, including relating to the treatment of Offsets (Western Climate Initiative, 2011).

The design of the WCI allows for the use of Offsets as a means "*to reduce compliance costs*" and it is intended that the partner states will "*leverage existing protocols*" (Western Climate Initiative, 2010a). Although no final decision appears to have been made as to the range of emissions reduction activities that may be eligible for Offset creation, reviews of existing protocols around agricultural, forestry and waste management activities have been conducted (Western Climate Initiative, 2010b), suggesting these are likely to be recognised.

3.2. Midwest Greenhouse Gas Reduction Accord

The Midwest Greenhouse Gas Reduction Accord (MGGRA) is a commitment from six states in America's Midwest (Illinois, Iowa, Kansas, Michigan, Minnesota and Wisconsin) and one Canadian Provence (Manitoba) to reduce emissions through a regional cap-and-trade. Despite the Accord being agreed in 2007, with commitments to complete the design of the cap-and-trade by 2009, there appears to have been little progress towards implementation. According to Linacre *et al.* (2011): "*MGGRA appears no longer functional with cap-and-trade off the agenda*".

3.3. Emissions standards – Oregon & Washington

Both Oregon and Washington[8] have introduced compliance programs that set emissions performance standards for stationary energy facilities (i.e. power-plants) operating within their own state boundaries. Oregon first introduced related legislation in 1997 (updated 2003),

[8] Massachusetts operated a similar program from 2006, but this has been wound down with the commencement of the RGGI in 2009 (Massachusetts is a RGGI participant). While operating fully, the Massachusetts program allowed for the use of Offsets created from forestry projects located in Massachusetts, or New England, provided they were verified under the Verified Carbon Standard or Climate Action Reserve.

making it one of the first legislative instruments of its kind to be introduced globally and the first to be introduced in the US. Under Oregon's standard, which is administered by the Energy Facility Siting Council[9], energy facilities must meet an emissions standard that is 17% better than the most efficient base-load gas plant operating in the US. This can be met through efficiency improvements, or through the use of eligible Offsets.

While the Oregon program allows emitters to develop their own offset projects, all have so far opted to pay a fee to the Climate Trust[10] to source Offsets on their behalf. The Climate Trust is a not-for-profit established in 1997 to facilitate the acquisition of Offsets on behalf of emitters captured under the program. The fees paid to date equate to $1.40 per tonne (CORE, n.d), with total Offsets under the program to 2009 exceeding 2.3 million tonnes (Climate Trust, 2009).

The portfolio maintained by the Climate Trust includes Offsets derived from a wide range of emissions reduction activities, such as energy efficiency projects, fuel switching, use of co-generation facilities, use of low emissions building materials and forest sequestration. Offset projects, which are verified by the Climate Trust themselves, have been predominantly US-based. To date, three forest related projects are included within the portfolio, including two reforestation projects, one US based and one based in Ecuador, and one US based avoided deforestation project. The scale is relatively small, with a total forest area of less than 1,500 hectares and expected Offsets of less than 400,000 tonnes over the life of the projects.

The Washington program, which was initiated in 2003 and now administered by the Energy Facility Site Evaluation Council[11], establishes a mitigation plan that requires new, or upgrading, energy facilities[12] to offset 20% of their emissions over a 30 year period. According to Potter & Jones (2011), the program targets projects that can be certified under the Climate Action Reserve (CAR), or Verified Carbon Standard (VCS). To date, however, essentially no offsetting activity, or purchase of Offsets, appears to have taken place under this program (CORE, n.d.).

4. Regional Greenhouse Gas Initiative

The RGGI is a cap-and-trade program, operational from 2009, that is founded around a Memorandum of Understanding (MOU) agreed by ten US states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont. In agreeing to the MOU, participating states have committed to a regional emissions cap that seeks to reduce emissions from the electricity generating sector by 10% at 2018. The target is to 'stabilise' emissions at 188 million tonnes for the period 2009-2014, then to reduce emissions by 2.5% per annum through until 2018 (Fig. 5).

Each state receives an allocation of Allowances[13] equivalent to its total emissions budget for the year. Around 86% of Allowances are sold via an open auction, with a further 4% offered for sale at a fixed price (RGGI, 2011). The main purchasers are around 200 large (>25 Mega Watt)

[9] http://www.oregon.gov/ENERGY/SITING/index.shtml

[10] http://www.climatetrust.org/

[11] http://www.efsec.wa.gov/default.shtm

[12] The threshold for inclusion is 25 megawatts.

[13] Each Allowance is equivalent to one tonne of carbon dioxide (1 tonne CO2e).

fossil fuel based electricity generators that have a mandatory compliance obligation under RGGI. Mandatory participants are required to acquit one Allowance, or eligible Offset, for every tonne of emissions and failure to do so results in non-compliance penalties.

The value of Allowances traded annually has been around $400 million. To the end of 2010, being the end of the second compliance year, some $789 million in government revenue has been raised through Allowance sales (RGGI, 2011). In the main, this revenue has been used to invest in emissions reduction initiatives, particularly energy efficiency and renewable energy.

To date, states have been readily able to meet their compliance obligations, with total emissions from the electricity generation sector for 2009-10 being well below 150 million tonnes. This has meant that Allowances have generally traded close to the auction reserve price (Fig. 6) of $1.89 (Potomac Economics, 2008-2011).

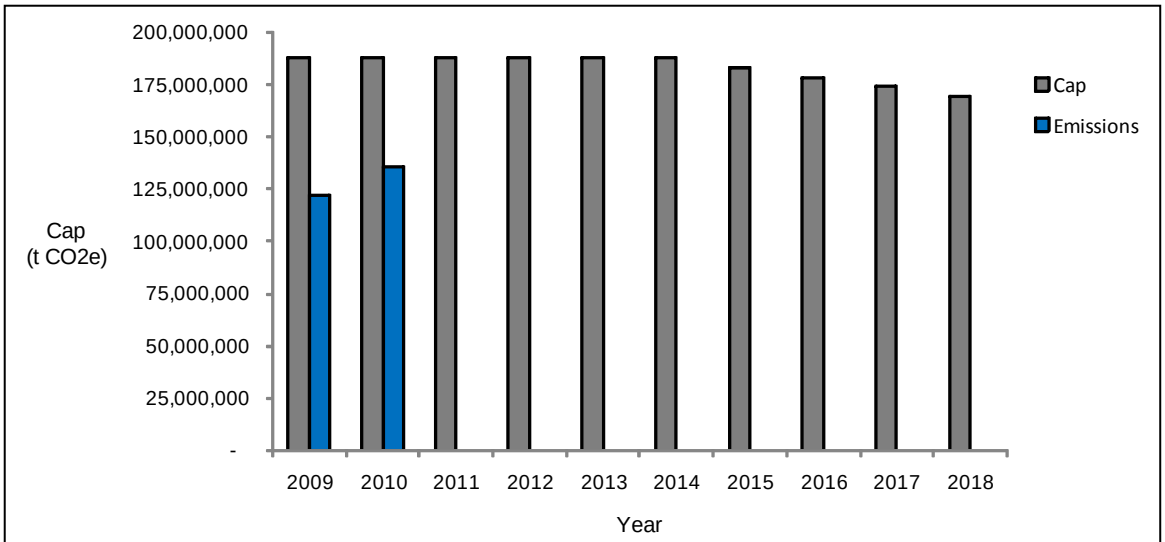

Figure 5. Annual emissions cap under the RGGI, with actual emissions for the first two compliance years (data source: RGGI Allowance Tracking System).

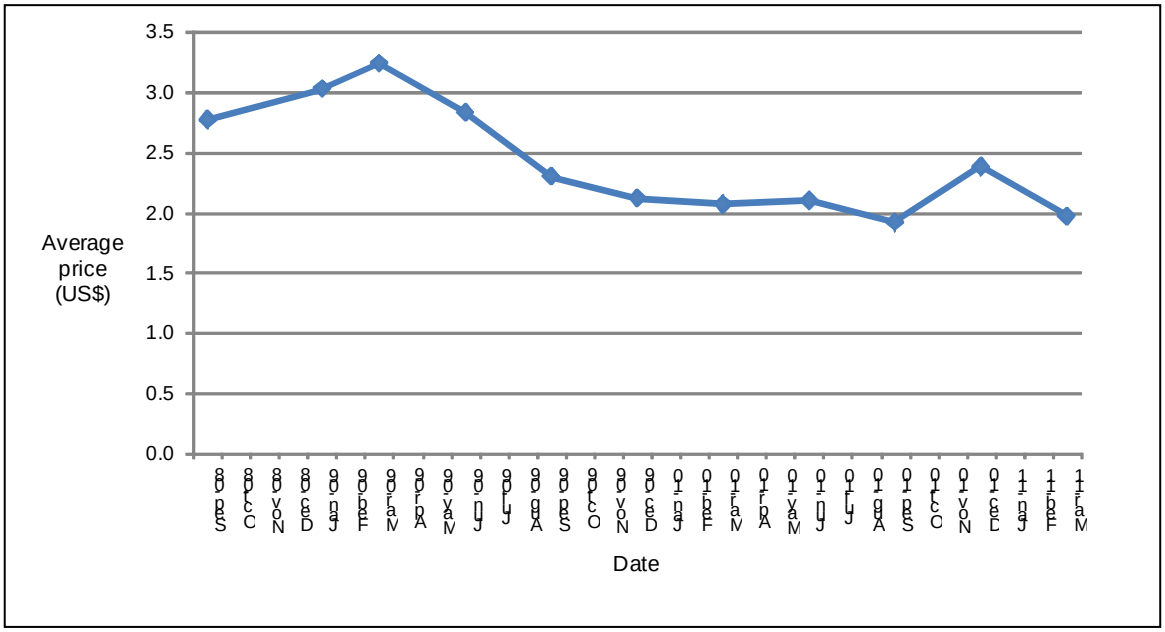

Figure 6. Average price at auction for RGGI Allowances.

4.1. Treatment of Offsets

Certain types of emissions reduction activities may be considered for the creation of Offsets:

- capture or destruction of methane from landfills;
- methane avoidance through livestock manure management;
- energy efficiency projects; and
- sequestration of carbon through afforestation activities

Activities are only eligible for Offset creation where they take place within the RGGI states. There are also limits to the amount of Offsets that can be used to meet RGGI obligations. These increase in line with increases in spot-market prices for Allowances (Table 1).

Table 1. Offset limits by percentage and volume at various Allowance prices (on-market auctions).

Price	Allowance	Allowance (tonnes CO2e)*				
($/t CO2e)	(% emissions)	2011	2012	2013	2014	2015
<7	3.3	6,206,540	6,206,540	6,206,540	6,206,540	6,051,377
7-10	5.0	9,403,849	9,403,849	9,403,849	9,403,849	9,168,753
>10	10.0	18,807,698	18,807,698	18,807,698	18,807,698	18,337,505

* As calculated against the annual cap set for all 10 participating states (data sourced from the RGGI COATS system: http://www.rggi.org/historical_emission)

This implies a potential Offset market value to 2015 of around $20 million per annum at a spot-price of $3.50 (assuming Offsets traded equivalent to spot), $65 million at $7 and $188 million at $10. However, as detailed in the following sections, there are significant impediments that have served to exclude Offsets from playing a part in the RGGI market-place, to the extent that not a single Offset project has yet been registered[14].

Offset project registration and verification is administered within the state where the project, or majority of offsetting activity, is located (Appendix 2).

Forest carbon Offsets

Afforestation of cleared lands is potentially eligible for recognition where these criteria are met:

i. The afforestation is undertaken within RGGI participating states.

ii. The land on which the project is to be located has been clear of forest for at least 10 years prior to project commencement.

iii. The project is additional, in that it is not required to be undertaken by law and does not receive non-RGGI related incentives from state funded programs.

iv. A ‘permanent conservation easement’ is in place confirming land within the project boundary will be maintained in a forested state.

v. ‘Forest management plan’ in place committing to use native species in 75% of plantings.

[14] Data sourced from the RGGI CO_2 Allowance Tracking System (RGGI COATS).

The process for registering a project involves submitting an 'Offset Project Consistency Application' (Box 2) to the relevant state agency and having this independently verified[15]. Verifiers need to be registered with the relevant state agency (Appendix 2).

Assuming the application is successful, the project proponent[16] (Proponent) is qualified to create Offsets[17]. To do this, the Proponent submits a 'Monitoring and Verification Report' and, if this is accepted by the regulatory agency, Offsets are created. Following the first verification, Projects are registered on the RGGI CO2 Allowance Tracking System (RGGI COATS[18]) and details relating to the project are made publicly available, including Monitoring and Verification Reports.

Afforestation projects must have an allocation period of >20 years, with Monitoring and Verification Reports submitted no less frequently than every five years (RGGI, 2010). Carbon sequestration claims under these reports must be substantiated by in-field measurements.

Box 2. Requirements for applications to register forest-carbon projects under RGGI	
Project description	• Land ownership arrangements • Project boundary – forest maps • Plant species utilised in the Project • Forest Management Plan
Demonstration of eligibility	• Not forested for at least 10 years prior to commencing the Project • Forest Management Plan consistent with sustainable forest practices
Sequestration baseline	• Description of baseline scenario and carbon pools • Estimates of sequestration under baseline scenario, including through reference to in-field measurement
Monitoring and verification plan	• Forest strata identification and mapping • Methodology for sample plot establishment and assessment • Expansion factors, allometric functions and carbon fraction values used to convert forest measures to estimates of carbon content • Harvesting regimes and associated accounting approaches • Data quality assurance procedures and practices
Carbon sequestration permanence	• Permanent conservation easement • Details of any 'forest-replacement' insurance policies (optional)

Many of these requirements, as well as registration, verification and reporting processes will be familiar to Australian practitioners as they are similar to our domestic programs. However, RGGI does include some relatively unique features that are expanded upon in following sections.

[15] Referred to by the RGGI as obtaining a 'Completeness Determination'.

[16] Referred to by the RGGI as a 'Project Sponsor'.

[17] Referred to by the RGGI as 'CO2 Offset Allowances'.

[18] https://rggi-coats.org/eats/rggi/index.cfm?fuseaction=home.home&clearfuseattribs=true

Conservation easements

A permanent conservation easement is required to be in place in relation to the forested land to be included in the carbon project. Conservation easements are a legal instrument that appear widely used within the US as a means of restricting land uses so as to promote conservation objectives (Anderson, 2005; Merenlender *et al.* 2004). Conservation easements are strongly promoted by NGO's, including the Nature Conservancy (The Nature Conservancy 2003) and Pacific Forest Trust[19].

A conservation easement is a legally enforceable contract attached to a land title which survives even where land ownership arrangements change. Typically, the parties to a conservation easement are the landowner and the holder of the easement. There is no prescribed form, with parties largely free to agree content and terms. Typically, each easement is unique, however, those applied to forest typically address: the rights of the Grantor; the rights of the Grantee; forest management requirements and restrictions; land development and subdivision restrictions; land use and access restrictions; and enforcement provisions (Zinkhan, 2008).

The RGGI requires that a "permanent" conservation easement be in place that:

> "*…requires that the land within the offset project boundary be maintained in a forested state in perpetuity, that the carbon density within the offset project boundary be maintained at long-term levels at or above that achieved as of the end of the final CO2 offset allocation period, and that the land be managed in accordance with environmentally sustainable forestry practices*". (RGGI 2009, pg12)

The requirement to maintain forest in perpetuity goes beyond Australian-based programs and many international programs, which generally reference defined time scales of <150 years.

Baseline carbon pools

In common with a number of carbon verification programs, RGGI requires that Proponents detail the sequestration baseline associated with a 'business as usual' management scenario (i.e. the sequestration that would have occurred in the absence of the afforestation activity). In a departure from Australian programs (implemented and proposed), RGGI requires that Proponents include field measurements, collected prior to planting, to support baseline claims:

> "*…sequestration must be measured before offset project commencement, using measurements made no more than 12 months prior to project commencement*" (RGGI 2009, pg15).

The carbon pools that must be considered are live above and below-ground tree biomass, as well as soil carbon. Dead organic matter[20], woody debris and non-tree biomass are optional.

The measurement process includes plot-based assessments of requisite carbon pools, with a sampling intensity (i.e. number of plots) sufficient to meet a targeted 95% confidence interval of ±10% around the mean carbon estimate calculated across plots. Methodologies for plot

[19] See for example: http://www.pacificforest.org/working-forest-conservation-easements.html
[20] Where dead matter and woody debris are not at, or near, zero then these also need to considered.

establishment and assessment must be consistent with Pearson *et al* (2007). In the case of soil carbon, this requires in-field collection and subsequent lab analysis of soil samples.

As a general comment, these processes appear more onerous and costly than the minimum baseline data requirements for Australian and many international verification programs. In particular, the requirement to collect field data rather than reference established standards, or modeled data, the high precision targets (95% confidence interval of ±10%) as well as the requirement to consider soil carbon, which can be prohibitively expensive to measure, appears to create some significant barriers to entry for project proponents.

Forest management plan and species mix

A key eligibility requirement that a Proponent must meet is to put a documented 'Forest Management Plan' (FMP) in place. The FMP needs to demonstrate that forest management:

> "*…is consistent with widely accepted environmentally sustainable forestry practices and designed to promote the restoration of native forests by using mainly native species …*" (RGGI 2009, pg14).

In relation to the latter, the FMP must commit the Proponent to ensuring >75% of the forest area is composed of native species "…*consistent with the forest types and forest soils native to the area*". This is considerably more prescriptive than many other programs.

Treatment of harvest events

Forest harvesting is allowed provided the land is maintained in forest over the long-term (refer commentary around conservation easements). However, where harvesting is to take place:

> "…*certification must be obtained prior to harvest activities through the Forest Stewardship Council (FSC), Sustainable Forest Initiative (SFI), American Tree Farm System (ATFS), or another similar organization approved by the regulatory agency*" (RGGI, 2010 pg 10).

Additionally, it appears RGGI requires that the effect of harvest events be captured through field-based accounting, including assessing carbon stocks from sample plots located within harvest areas. Effectively, this means carbon accounting would require an ongoing field measurement program from initial forest establishment, through harvest event, to forest re-growth (or re-planting). Any drop in carbon stocks that occur following harvest would presumably require the Proponent to either acquit Allowances, or make-good the carbon debit through bringing other forest areas forward. It does not appear that carbon stored in harvested wood products can be recognised under RGGI. This limits prospects for harvested forests considerably.

4.2. Prospects for Offsets

Under current and foreseeable settings, the potential for offset projects to participate in the RGGI market is very limited. Compliance hurdles for participants have been readily met to date, with total emissions across 2009 and 2010 compliance years falling some 50 million tonnes below the Allowance budget. Although the Allowance cap declines from 2014, current

emissions levels suggest a low likelihood that Allowance demand will exceed supply across the life of RGGI. As a consequence, Allowances are currently trading at around $1.89.

It was widely agreed amongst Participants that Offsets would likely trade at a discount to Allowances, since the cap on Offset use (<10% total emissions) means they are a more limited compliance instrument than Allowances. In other words, for Offsets to be attractive in the RGGI market-place, they would presently need to be priced at less than $1.89 t CO2e.

At this price, it is unlikely that forestry projects, or indeed any Offset project focused on the RGGI market, will be commercially viable. While the price-point for Offset sale is low, the cost of meeting eligibility and compliance requirements is high. In particular, the need to establish conservation easements, the emphasis on field based measurement including around baselines, and the geographic limits (participating states only) add substantially to production costs. Likely due to these constraints, no projects of any type appear to have been registered[21]. Additionally, very few Offset verifiers are registered, suggesting little demand for verification services.

Prospects for Offsets might be improved if emissions from the covered sector increase, coverage is broadened to include other emitters, or the Allowance cap is adjusted downwards at a faster rate. However, all of these appear unlikely. Indeed, there has been recent coverage of moves by the New Hampshire House of Representatives to exit the RGGI (e.g. Goodman 2011). While many Participants considered it unlikely RGGI would be wound back, they also considered it unlikely that there would be a further tightening of emissions targets.

Due to the low pricing, high compliance hurdles, limited program lifespan, and apparent lack of political drivers for reform, none of the Participants were seriously considering RGGI as a market-place for forest carbon. Their viewpoint is supported by independent analysis that also suggests there is insufficient incentive for participation (e.g. Point Carbon 2010).

5. Californian Cap-and-Trade

California is the US' most heavily populated state and, with a gross domestic product of over $1.8 trillion, has the eighth largest economy in the world (Taylor, 2011). In 2008, 484 million tonnes of greenhouse gases were emitted, representing a 4% increase against 2000 levels (Californian Air Resources Board, 2010a). Transportation is the largest source, accounting for 37% of emissions in 2008, followed by electricity generation (24%) and industrial sources (20%) (Californian Air Resources Board, 2010a). Forests and rangelands, which collectively cover over 130,000 square kilometers (Brown *et al.*, 2004), are a carbon sink estimated to achieve net-sequestration of some four million tonnes per annum (Californian Air Resources Board, 2010b).

In the absence of control measures, emissions are forecast to grow to 507 million tonnes by 2020, representing an increase of around 5% on 2008 levels. To help avoid this, the California state government has adopted the Global Warming Solutions Act of 2006, often referred to as Assembly Bill 32, or AB 32. Under AB 32, the Californian Air Resources Board (the ARB) is tasked with developing a plan for the state to define emissions reduction targets and establish

[21] As determined through a project search on the RGGI CO2 Allowance Tracking System (30th May 2011): https://rggi-coats.org/eats/rggi/index.cfm?hc=IStQICAK

programs for meeting these. The target that has now been set as emissions equivalent to 1990 levels by 2020, which represents a 12% reduction as compared with 2008 levels and 16% against forecast emissions to 2020 under a business as usual scenario.

In October 2010, the ARB issued draft regulations around an 'economy-wide' greenhouse gas Cap-and-Trade program intended to commence January 1st 2012. These draft regulations were subsequently approved to proceed to finalisation by the ARB in December 2010 (Californian Air Resources Board, 2010c). The ARB now have an ambitious target for developing and implementing the regulations, with finalisation expected in December 2011 (Appendix 3).

The Cap-and-Trade includes three compliance periods, being 2012-2104, 2015-2017, and 2018-2020. Under the first compliance period, large industrials and electricity generators that have an emissions profile exceeding 25,000 tonnes will have compliance obligations. In the second compliance period, fuel distributors with emissions exceeding 25,000 tonnes will be included.

There are a number of emissions sources specifically excluded from coverage, including combustion of biomass, ethanol, or bio-diesel and methane destruction activities. Forestry and the land use sector more broadly (e.g. agriculture) is not covered under the Program, meaning that forestry activities are not subject to emissions reporting and Allowance acquittal obligations. Forestry is, however, able to participate in the Program through the provision of 'offset credits'.

Each year, the ARB will create an amount of Allowances equal to the state's emissions budget for that year. Each Allowance is equivalent to one tonne of carbon dioxide. The Allowance budget starts at 166 million tonnes at 2012, declining to 160 million tonnes at 2014. In 2015, when fuel distributors are included, the Allowance budget steps up to 395 million tonnes, then declines at around 3% per annum to 334 million tonnes at 2020 (Fig. 7).

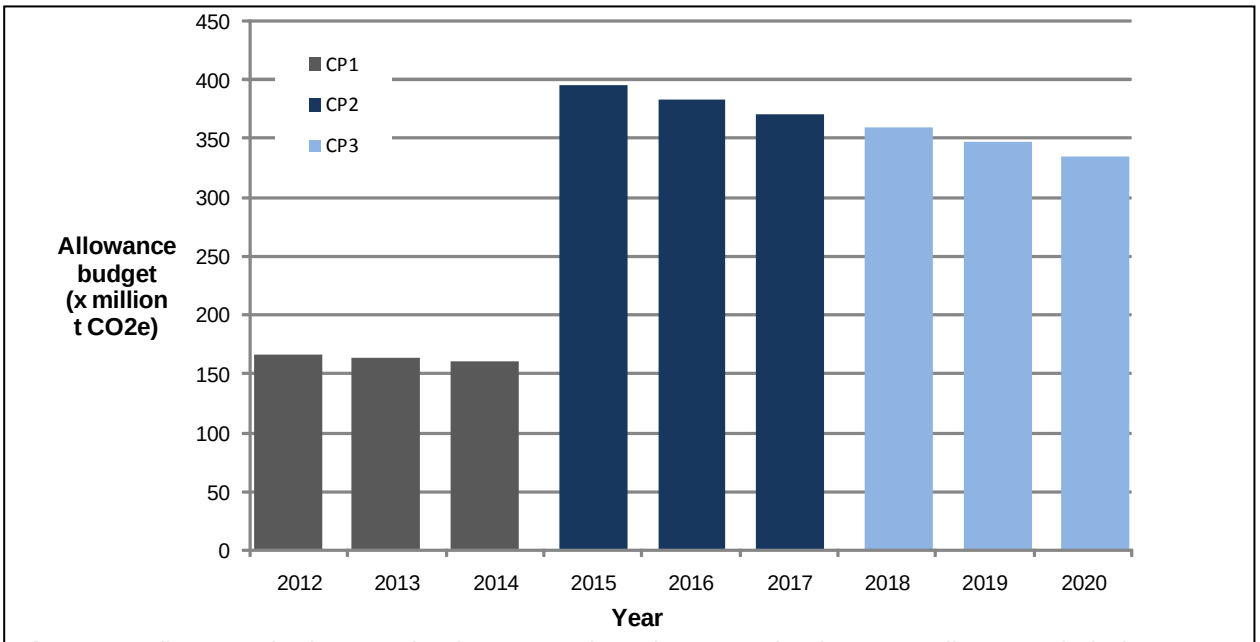

Figure 7. Allowance budgets under the Cap-and-Trade across the three compliance periods (CP1-CP3) to 2020. Allowances decline by around 2% from 2012-2014. The increase at 2015 relates to introduction of further sectors, after which Allowances decrease by around 3% per annum (data source: Californian Office of Administrative Law, 2011).

A large proportion of Allowances will be distributed free-of-charge to mandatory participants based on sector-specific performance benchmarks that will decline over time. During the first compliance period, Allowances equivalent to the full bench-mark emissions amount will be made available. From 2015, certain sectors will be issued Allowances that cover only a portion (50-75%) of bench-mark emissions. The overall effect is for allocated 'free' Allowances, and the number of Allowances introduced into the market, to decline over time.

At the end of each three year compliance period, parties with obligations under the Program will have been required to surrender Allowances equal to their emissions profile[22], or face government imposed penalties[23]. Participants that have achieved emissions lower than their Allowance allocation will have spare Allowances that can be sold to another party, or banked for future use[24]. Participants set to exceed their allocation will have to purchase additional Allowances by the end of the compliance period in order to avoid penalties.

Allowances can be purchased through a variety of mechanisms. Firstly, the ARB will retain at least 2% of the annual Allowance budget and make these available for purchase through quarterly auctions, commencing February 2012. Critically, a reserve price for Allowances is set at $10 in the initial year, escalating at 5% per annum[25] to $15 at 2020.

The ARB will also retain a small percentage of the annual Allowance budget for use as an 'Allowance Price Containment Reserve' (Containment Reserve). The proportion of Allowances retained within the Containment Reserve will increase with each compliance period, with 1% retained for years 2012-2014, 4% retained for 2015-2017, and 7% retained for 2018-2020. The intent of the Containment Reserve is to create a price ceiling by providing a fixed price source of Allowances available for purchase by participants. In 2012, Allowances can be purchased from the Reserve at $40-50. The Reserve releases Allowances in a series of three tiers, with the purchase price increasing with each subsequent tier (2012: tier I $40, tier II $45, and tier III $50). Beyond 2012, these prices are inflated by 5% per annum to 2020, at which time Allowances will be priced in the range $59-74.

Finally, it is anticipated that a secondary market will emerge, wherein participants purchase Allowances from other participants, including emitters that have excess Allowances, specialist trading firms, and providers of Offsets.

The auction reserve price and the Containment Reserve create, to some extent, an upper and lower bound around trading prices (Fig. 8). The prices that Allowances will actually trade around into the future is a subject of intense speculation. One of the more detailed analyses is provided by Point Carbon (Henderson, 2011), who suggest trades will be close to the auction reserve at commencement ($13), rising to close to the Containment Reserve by 2020 ($75).

[22] The Cap-and-Trade references both annual and tri-annual compliance requirements. Each year, covered entities must surrender Allowances equivalent to 30% of their total emissions for the previous year. Every three years, Allowances equivalent to the total emissions across those three years must be surrendered.

[23] This includes imposing a further requirement to surrender Allowances equivalent to four times the 'excess' emissions amount within 30 days of the original surrender deadline.

[24] Allowances do not 'expire' and can be banked. Some holding limits apply: see Sub-Article 11 of 'California's Cap and Trade Proposed Regulation', as approved for finalisation by the California Air Resources Board on December 16, 2010.

[25] Inflation will also be applied on top of this percentage increment.

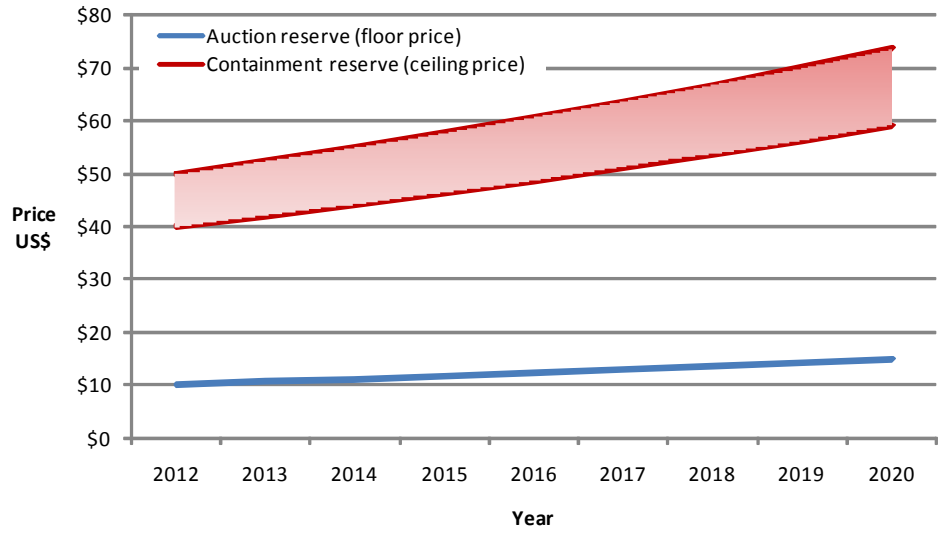

Figure 8. The price range for Allowances, as defined by the auction reserve price and the set price for Allowances made available through the Price Containment Reserve (data source: Californian Office of Administrative Law, 2011).

Assuming demand for Allowances tracks close to the annual Allowance budget, the total value of the market will be at least $4-5 billion from 2015-2020 (based on Allowance reserve prices). In terms of market size, the Californian Program will be around one fifth that of the EU's emissions trading program, making it the second largest carbon market in the world.

5.1. Treatment of Offsets

It is proposed that certain types of greenhouse gas abatement and reduction activities will be eligible for the creation of Offsets. There are limits to the amount of Offsets that can be utilised by compliant parties in order to meet their obligations under the Program. Covered entities are able to meet up to 8% of their compliance obligation using Offsets. This cap makes Offsets a more limited compliance instrument than Allowances. For this reason, Participants generally felt Offsets would trade at a slight discount to prices paid for Allowances.

Assuming actual emissions track close to Allowance budgets, and emitters elect to use Offsets in lieu of Allowances for 8% of their emissions profile, there is a potential market for close to 30 million Offsets per annum from 2015 (Table 2). Assuming a $1 discount to the Allowance auction reserve, this implies an annual Offset market value of at least $330 million from 2013.

Principles for Offset eligibility are that the greenhouse gas reductions must be real, additional, quantifiable, verifiable, permanent and enforceable. For Offsets projects to be recognised, they must comply with an approved Compliance Offset Protocol. Protocols are reviewed and approved by the ARB[26]. Protocols must establish minimum standards around:

i. establishing project baselines;

[26] All proposed Protocols are made available for public comment prior to any approval.

ii. accounting for leakage;
iii. quantifying uncertainty in estimating Offset amounts;
iv. ensuring the permanence of the Offsetting activity;
v. establishing the length of the crediting period; and
vi. data collection and project monitoring.

Table 2. Offset cap and potential market value where actual emissions are equivalent to the total annual Allowance budget and emitters elect to use Offsets for 8% of their obligation (data sources: Californian Office of Administrative Law, 2011).

Compliance period	Year	Offset cap (t CO2e)	Value* ($)
1	2012	13,264,000	119,376,000
	2011	13,020,000	123,690,000
	2012	12,776,000	128,079,400
2	2013	31,560,000	333,786,450
	2014	30,596,000	341,300,292
	2015	29,632,000	348,555,753
3	2016	28,664,000	355,461,014
	2017	28,666,444	374,699,205
	2018	26,736,000	368,276,487

* Where Offsets trade at a $1 discount to the auction reserve price.

Activities for which Protocols are presently being developed by the ARB include forestry and urban forestry; livestock manure and methane management; and destruction of ozone depleting substances. Historically, ARB has had a close relationship with the Climate Action Reserve (CAR), a Californian based not-for-profit with a strong focus on development of Offset standards for US based projects (Section 7, Appendix 5). It is proposed that existing protocols developed by the CAR will form the basis for protocols adopted by the ARB.

While nothing has yet been formally announced, it was generally felt by Participants that the CAR would provide Offset registry services to the Californian Cap-and-Trade. The ARB has indicated, however, that it may also accept Offsets from other registries, provided that they have successfully applied to the ARB to provide registry services (Californian Air Resources Board, 2010d). In this case, Offset registries will be required to use the Compliance Offset Protocols approved by the ARB and the ARB will review the eligibility of all Offset credits issued before transitioning them into 'compliance' grade Offset credits recognised by the Cap-and-Trade.

During the early stages of the Program, it is likely that only offset activities that take place within the US will be considered. The draft rules (Californian Air Resources Board, 2010c – Section 14) do, however, point toward future consideration of international Offset generating activities, specifically compliant activities in Canada and Mexico, as well as Reducing Emissions from Deforestation and Degradation (REDD) projects established in developing countries.

The draft rules also suggest other types of offsetting activities may be considered into the future, pending the adoption of approved protocols. Certainly there was an expectation held by many Participants that further protocols would be adopted by ARB, with soil carbon management projects a likely contender for future recognition.

Forest carbon Offsets

Draft rules around the treatment of Offsets, including a draft Compliance Offset Protocol for Forest Projects, are detailed in the ARB's "Compliance Offset protocol for forest projects" (Californian Air Resources Board 2010d). The ARB has recommended four Offset protocols be adopted, including a Forest Offset Protocol and a protocol relating to 'Urban Forest' projects[27].

Box 3. Project types recognised by the Forest Offset Protocol

Type and description	Activity-specific requirements
Reforestation Restoration of tree cover on land that is not at "optimal stocking levels" and which has limited commercial opportunities over the coming 30 years. Restoration can involve direct methods, such as tree planting, or indirect methods, such as removing impediments to natural reforestation (e.g. grazing exclusion).	• land must have had <10% tree canopy cover for at least the 10 years preceding project commencement, or have been subject to a disturbance event that has removed at least 20% of the live biomass in the area • no commercial harvesting can have occurred within the project area for at least 10 years prior to project start • no, or very limited, harvesting to take place during the first 30 years following project start • must account for carbon contained in shrubs and under-storey
Improved Forest Management This project type involves undertaking forest management activities that maintain or increase carbon stocks on already forested lands relative to a project baseline.	• land must have >10% tree canopy cover • the project must employ 'natural' forest management practices, which includes emphasis on use of native forest species and the creation of habitat and age class complexity within the forest
Avoided Conversion This project type involves preventing the removal of forest, or any other conversion to a non-forested (cleared) state.	• must be able to demonstrate that there is 'a significant threat of conversion' from forest to non-forest • must be able to demonstrate the project will result in the land being maintained in a forested state, which is achieved through establishing a 'perpetual' conservation easement, or transferring land into public ownership (e.g. public trusts)

To a large extent, these have been based on CAR's 'Forest Project Protocol, Version 3.2'[28] (Climate Action Reserve 2010a) and 'Urban Forest Project Protocol v1.1' (Climate Action

[27] Projects based on reducing methane emissions associated with livestock production and destruction of ozone depleting substances have also been accepted by the ARB as eligible offset activities.
[28] Available at: http://www.climateactionreserve.org/how/protocols/adopted/forest/current/

Reserve 2010b). However, in transitioning from a voluntary to mandatory program, the ARB have made some amendments:

> "*The most significant modifications relate to the enforcement of projects through regulation rather than through legal contracts, and modification of the project crediting period to align with the cap-and-trade regulation.*" (Californian Air Resources Board 2010d, pg 10).

Importantly, Offsets generated under CAR's existing protocol are potentially eligible for recognition under the Cap-and-Trade (see the 'Incentives for early action' section).

To simplify further discussion, CAR's existing Forest Protocol and ARB's proposed Protocol are largely treated interchangeably throughout the remainder of this report and are referred to collectively as 'the Forest Offset Protocol'. Where there is conflict between the two protocols, the processes proposed by ARB have been deferred to.

Under the Forest Offset Protocol three project types are recognised: Reforestation, Improved Forest Management and Avoided Conversion (Box 3). Compliance requirements that apply to all project types are described in the sections that follow. Activity-specific considerations are summarised in Box 3. Urban Forest projects, which are likely to only ever play a small part in US markets, are dealt with briefly in a later section.

Ownership structures and compliance responsibilities

The Forest Offset Protocol does not allow for separation of forest and land ownership. A Forest Owner is defined as the owner of an interest in property involved in the Forest Project. Where the land owner has vested an interest in the ownership of the forest to another party, both the land owner and the party with the interest in the forest are collectively considered to be the Forest Owners. All Forest Owners are ultimately responsible for project commitments. However, a Project Operator must be clearly identified who will take responsibility for monitoring, reporting, retaining records and facilitating verification activities.

Project location and longevity

The project activity must be based in the United States. While the proposed regulations do make reference to limited future consideration of international projects, only US based projects will be recognised during the early stages.

Greenhouse gas reductions must be additional. This eligibility requirement is considered to have been met where the reduction activity is not required by law or regulation, and the reduction is greater than that which would have occurred under a business as usual scenario.

The minimum crediting period for the project must be 25 years and sequestration must be maintained for at least 100 years after credits are issued. The Project Operator must commit to monitoring the forest for 100 years beyond the date of the last Offset issue. This includes submitting annual reports to ARB. There is no limitation to renewal of the crediting period, although the Project Operator must comply with the latest Forest Offset Protocol at renewal.

A proportion of credits will be maintained in a 'Forest Buffer Account'. The amount of credits is calculated in line with the outcomes of a Project-specific risk evaluation. Where an

unintentional sequestration reversal occurs (e.g. fire), credits will be retired from the account and the project will be automatically terminate where carbon stocks are reduced below the project baseline. If the reversal event is intentional (e.g. forest clearing), the Project Operator must surrender Allowances equivalent to the size of the reversal.

Carbon accounting and verification

Changes in carbon stocks to be quantified, including through on-ground measurement. Carbon contained in live biomass (above and below ground), standing dead wood and harvested wood products must be accounted. Where site preparation disturbs soil in more than 25% of the project area, soil carbon must also be accounted. Accounting must be reference field-based measurements, with forest inventory sample plots measured at least once every 12 years. Approved growth models can be used to forecast carbon changes between field measures.

Undergo regular third party verification. A third-party verifier is required to review claims made under project reports at least once every six years across the life of the project. The verification process must include 'site visits'. All verifiers must be accredited by ARB and the same verifier cannot be used for more than six years in a row.

Box 4. Requirements of an Offset Protocol compliant carbon inventory program

- A defined project boundary (e.g. forest mapping).
- Documented procedures describing forest stratification and sampling methodologies.
- Documented procedures for the collection of field measurements.
- Documented procedures for the measurement of parameters used to estimate biomass.
- Documented analytical methods and biomass equations.
- A quality assurance & quality control plan, including around data collection.
- Documented data and records management systems and processes.
- A 'change log' that records any changes over time to methods or analytical approaches.

Forest management

As with the RGGI, the Forest Offset Protocol places considerable emphasis on sustainability issues and prescribes the use of native species. The Forest Offset Protocol requires that "Natural Forest Management" practices are adopted. To comply, Project Operators must:

> "*… promote and maintain a diversity of native species and utilize management practices that promote and maintain native forests comprised of multiple ages and mixed native species within the Project Area and at multiple landscape scales*" (page 17, Californian Air Resources Board, 2010e).

Native forests are defined as "*those forests occurring naturally in an area, as neither a direct nor indirect consequence of human activity post-dating European settlement*". The Forest Offset Protocol further requires that:

"*Forest Projects must manage the distribution of habitat/age classes and structural elements to support functional habitat for locally native plant and wildlife species naturally occurring in the Project Area…*" (page 17, Californian Air Resources Board, 2010e).

Where harvesting is to be conducted (e.g. as part of an Improved Forest Management Project), a number of onerous obligations are imposed, including that the Project Operator must:

"…*demonstrate that the Forest Owner(s) employ and demonstrate sustainable long-term harvesting practices on all of its forest landholdings, including the Project Area..*" (page 17, Californian Air Resources Board, 2010e)

These sustainable harvesting practices can be demonstrated where the Forest Owner is either:

- certified under the Forest Stewardship Council, Sustainable Forestry Initiative, or Tree Farm System programs; or
- is able to demonstrate they will adhere to a renewable long-term management plan, endorsed and monitored by a state or federal agency, which establishes that harvest levels can be permanently sustained; or
- able to demonstrate they employ uneven-aged silviculture and will maintain canopy cover averaging at least 40% across the forestland owned by the Forest Owner within, and near to[29], the Project area.

Where 'even-aged' management practices are employed:

"*harvesting must be limited to stands no greater than 40 acres. Stands adjacent to recently harvested stands must not be harvested using an even-aged harvest until the average age of the adjacent stands is at least 5 years old, or the average height in the adjacent stand is at least 5 feet*". (page 17, Californian Air Resources Board, 2010e)

Urban Forest Offsets

In addition to reforestation/afforestation, improved forest management and avoided deforestation projects, the ARB has also indicated that urban tree planting projects may be eligible for consideration under the Cap-and-Trade program. Based on the CAR's Urban Forest Project Protocol v1.1, eligible activities include tree planting under-taken in urban municipalities, on educational campuses and by utilities. Eligible tree plantings typically occur as small (<40 hectares) scattered areas. The management units considered are referred to as 'tree sites':

"*A tree site contains one tree at a time, however, the tree may be replaced over time and the site itself may be moved*". (page 3, Climate Action Reserve, 2010b).

As with Forestry projects, Urban Forest projects must be carried out in the US and projects need to demonstrate they meet additionality criteria. Project Operators are required to provide annual reports detailing carbon stocks, including the number of tree sites in the Project. Wherever the number of tree sites declines (i.e. there is a reversal), the Project Operator must retire Allowance units equivalent to any claimed Offsets. Regular in-field tree assessment and measurement is

[29] The Forest Offset Protocol refers to 'Assessment Areas' as the boundary for this requirement. Assessment areas are defined as "*a forest vegetation community that shares common environmental, economical and regulatory attributes*".

required. Allometric functions are used to convert tree measures to carbon estimates. Annual reports and carbon inventory outcomes are subject to third-party verification.

Whilst Urban Forest projects are an interesting approach to greenhouse gas reduction, it seems highly unlikely they will play a significant part in generating Offsets. Scale is limited and the practicalities involved in monitoring a large number of tree sites across many decades (project life is 100 years) will likely mean Urban Forest Offsets will be a comparatively expensive option. None of the Participants were considering this project type as a serious commercial opportunity. Notably, no Urban Forest projects are registered, or 'listed' for registration, by the CAR registry.

5.2. Supply dynamics

In advance of the Cap-and-Trade, the ARB has sought to incentivise early action and to create some forward price setting and trading activity. One initiative has been to announce that eligible Offsets will be recognised in advance of the Program commencing in 2012, so that mandatory participants may be able to use these early action Offsets to meet compliance obligations from 2012 (Californian Air Resources Board 2010c). The ARB will accept early action Offsets generated from eligible Offset activities, which appear likely to include projects based on forestry, livestock methane management and destruction of ozone depleting substances, provided that:

i. the emissions reduction activity took place between Jan. 1st 2005 and Dec. 31st 2014;
ii. the offset project commenced prior to Jan. 1st 2012;
iii. the activity is based in the US;
iv. the CAR Protocols have been applied to estimate Offset amounts; and
v. all Offset claims have been verified by an ARB-accredited verification body.

This initiative has driven an increase in trading of CAR recognised Offsets, referred to as Climate Reserve Tonnes (CRT's). This has seen the price for CRT's rise, with trades during early 2011 approaching $10 per tonne, representing a 60% increase on values observed during 2010 (Volcovici & Carroll, 2011). This is a promising early price signal.

The linkage to the Cap-and-Trade appears to have created significant interest in CAR from project developers. Across its ten year history, CAR has registered 95 projects. Currently, a further 199 are listed, including 63 forestry related projects, the majority of which are presumably intended to proceed to full registration (Table 3).

Despite this apparent 'rush' of projects to CAR and the Californian Cap-and-Trade, at least some market analysts are suggesting Offset demand will well outstrip supply, particularly during the second and third compliance phases. As an example, Point Carbon (see Henderson 2011) predicts that, if demand tracks close to the Offset allowance (8% of emissions budget), there will be a shortfall against demand of some 68 million tonnes to 2020 (see also Linacre *et al.*, 2011). Significantly, this forecast includes some arguably optimistic assumptions around the speed and scale at which international projects will enter the Cap-and-Trade. Supply projections developed by the CAR support Point Carbon's analyses, with the supply of Cap-and-Trade eligible early

action Offsets delivered by 2015 estimated at around 25 million (Climate Action Reserve, 2010c).

Based on these sources, there would appear to be a ready market for some eight million Offsets per annum, over and above the existing supply pipeline.

Table 3. Summary of projects and Offsets issued under the Climate Action Reserve.

Type	Projects listed	Projects registered	Offsets issued
Avoided deforestation*	14	1	1,807,035
Improved forest management*	38	1	11,708
Afforestation/reforestation*	11	0	0
Coal mine methane combustion	4	1	25,931
Landfill gas capture/combustion	74	64	5,398,640
Livestock gas capture/combustion*	45	15	297,817
Organic waste compost/digestion	5	1	44,457
Ozone depleting substances*	7	9	4,163,638
Other	1	3	1,200,022
Total	**199**	**95**	**12,949,248**

* These activities are likely to be eligible for creation of Offsets that will be recognised by the Californian Cap-and-Trade from program commencement.

5.3. Opportunities for Australian forest managers

Unfortunately, it appears Australian-based projects will not be able to participate directly in the Cap-and-Trade. While it is proposed to allow international Offsets, this appears highly likely to be limited to projects in developing countries with which California has entered bilateral agreements. Participants suggested that, whilst there was a 'place-marker' within the legislation for international projects, it remained unclear as to how this might be implemented. Those who commented felt that "*it will be a long time before international projects materialise, if ever*".

At this stage, then, the clearest and most immediate pathway into the Californian market appears to be to develop projects within the US itself (Section 7).

6. Voluntary markets

Outside of the mandatory compliance markets that have been the focus of previous sections of this report, a market exists for 'voluntary Offsets'[30] within the US. Whilst this market is dwarfed by the volume and value of allowances presently traded under the RGGI (>125 million tonnes per annum) and proposed to be traded under the Californian Cap-and-Trade (>150 million tonnes), the US voluntary market is nevertheless worthy of some consideration as a potential

[30] In the context of this report, the term voluntary market refers to purchases and sales of independently verified greenhouse gas units occurring outside of a mandatory compliance market.

opportunity to realise value from forest ecosystem services. Importantly, segments of the voluntary market are essentially borderless, so that there is potential for Australian forest managers to trade directly into these segments from Australian-based projects.

In 2009, some 19.4 million tonnes of voluntary Offsets were bought and sold in the US, equating to some $74 million in value (Point Carbon, 2010). The volume of trade remained steady into 2010, with 19.2 million tonnes traded. This makes the US market-place significant on the global stage. Over the two years 2009 and 2010, some 229 million tonnes of voluntary Offsets were traded globally (Peters-Stanley *et al.* 2011), meaning that US trades represented close to 17% of the total global market (by volume) during this period.

The value achieved for on-market Offset sales in the US averaged around $5.30 per Offset in 2009 and $4.90 in 2010 (Peters-Stanley *et al.* 2011). By way of bench-marking, the global volume weighted average price for on-market sales during 2009 and 2010 is estimated (Peters-Stanley *et al.* 2011) at around $6.50 and $6.00, meaning that over the past two years at least, carbon typically sells for a lower value in the US than the global average.

Within the US, as elsewhere, there has been wide variation around average sales price, with on-market sales during 2009 ranging from as little as $0.15 per tonne, up to $8.30 (Point Carbon, 2010). Forestry derived Offsets have tended to trade at the higher end of this range, possibly as a result of the wider environmental co-benefits associated with forest projects and a market-place perception that forestry Offsets are more likely to be recognised under a mandatory compliance regime than other Offset types.

Analyses provided by Point Carbon (2010), indicates there are a range of parties purchasing Offsets in the US, including large emitters, traders, financial institutions, project developers, project aggregators and retail buyers, such as small organisations and individuals (Fig. 9). Surprisingly, retail buyers and larger emitters accounted for only 31% of all Offset purchases during 2009, while project developers and project aggregators accounted for some 39% of purchases. This suggests that much of the 2009 trading arose from developers and aggregators seeking to grow their portfolio of saleable Offsets.

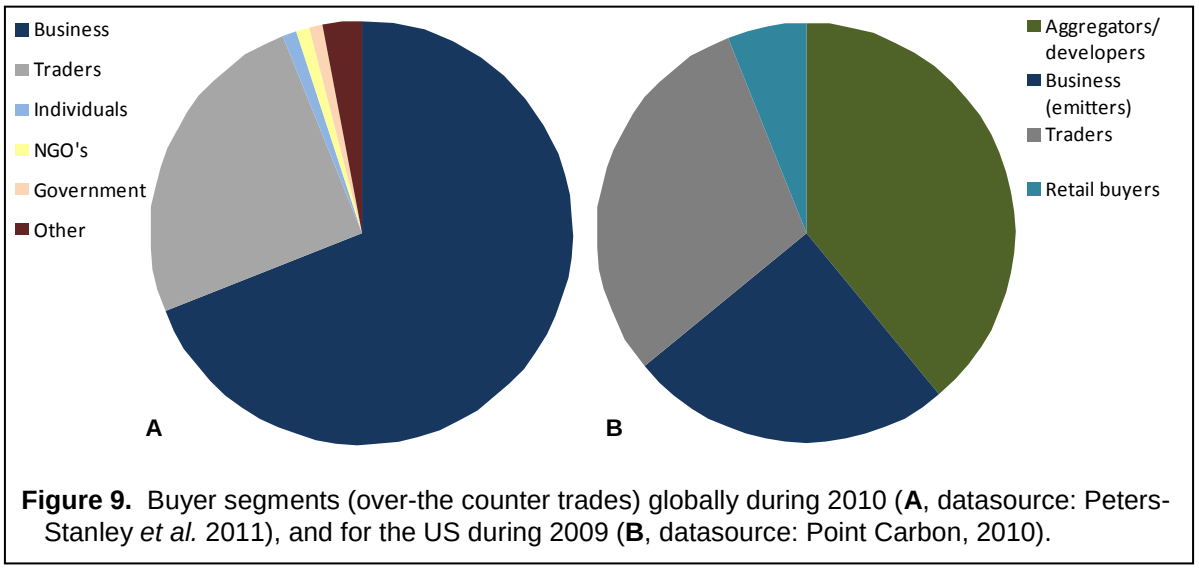

Figure 9. Buyer segments (over-the counter trades) globally during 2010 (**A**, datasource: Peters-Stanley *et al.* 2011), and for the US during 2009 (**B**, datasource: Point Carbon, 2010).

Charnley *et al.* (2010) report that as many as half of the voluntary purchases in the US arise from so-called "pre-compliance" speculation, wherein market players buy voluntary Offsets in the expectation that these may be traded into developing compliance markets. In the case of the Californian Cap-and-Trade, this strategy appears to have been at least partially successful.

6.1. Projects, standards and registries

Ecosystem market-place maintains an inventory of 'operational' projects, defined as those projects that have transacted Offsets and/or which have undergone validation against a standard. This inventory lists 226 operational forest-based projects globally, relating to some 2.1 million hectares of forested, or to be forested, land. Within the US, 25 forest-based projects are listed. Of these, 14 involve reforestation, seven are avoided deforestation projects and the remaining four are improved forest management projects (Appendix 4).

There are four dominant Offset standards that have achieved a high level of recognition within the US. These are the American Carbon Registry (ACR), the Climate Action Reserve (CAR), the Voluntary Carbon Standard (VCS) and the Chicago Climate Exchange (CCX), each of which have their own verification standards, registries and links to trading platforms (Appendix 5).

In terms of number of projects registered and anticipated Offset volumes, the VCS has achieved the highest uptake by project developers globally (Table 4). However, whilst widely recognised within the US, the VCS is yet to register a US-based forestry project and, to date, the CCX and CAR have been preferred by US-based developers.

Table 4. Registered projects and issued Offsets for the American Carbon Registry (ACR), Climate Action Reserve (CAR) and Verified Carbon Standard (VCS) &CCX.

	ACR	CAR	CCX	VCS
Projects (global)				
Projects registered	29	95	336	616
Offsets registered	31,494,078	12,949,248	?	62,789,169
Forest projects (global)				
Projects registered	3	2	32	7
Offsets registered	?	1,818,743	11,682,700	208,070
US-based projects				
Projects registered	23	95	222	27
Offsets registered	?	12,949,248		4,896,048
US-based forest projects				
Projects registered	1	2	24	0
Offsets registered	1,119	1,818,743	4,591,800	0

Based on Participant feedback, this did not appear set to change in the near future, with a number of individuals suggesting VCS Offset prices were less attractive to project developers than for other standards. Additionally, some participants suggested Offset supply from VCS projects was likely to well outpace demand over the next several years, with some anticipating a significant supply increase arising from South American projects (avoided deforestation).

During its seven years of operation, the CCX was particularly successful at attracting projects, with some 24 US-based forest projects registered and generating some 4.6 million forest derived Offsets. This is likely to have been partly driven by the high level of involvement of emitters within the CCX program who submitted to annual emissions audits and Offset obligations, providing a ready market for CCX Offsets. However, following a buy-out by Intercontinental Exchange during 2010, the CCX's Offset program has effectively been wound up. Project proponents that realised carbon units (Carbon Financial Instruments) under the CCX, now find themselves with essentially no market for those units and are presumably faced with the challenge of abandoning projects, or transitioning them into an alternate market-place.

The CAR, which has a very strong focus on US-based projects[31], has so far registered two forestry projects, one around improved forest management and one around avoided deforestation. The popularity of the CAR amongst US-based project developers has been boosted by its alignment with the Californian Cap-and-Trade program. In particular, announcements by the ARB indicating that certain CAR Offsets would be recognised under the Cap-and-Trade has generated considerable interest around CAR projects, with some 95 new projects presently listed for consideration. A number of Participants also suggested that CAR was attractive because it has a comparatively high level of local relevance, since it has been developed specifically for US-based projects.

The ACR has a relatively small number of offset projects registered (29 from various activities), although a significant volume of Offsets are associated with these (31 million tonnes). To date, only one forestry related project has been registered within the US (reforestation). Despite these statistics, the ACR appears relatively popular amongst project developers, at least partly due to a perception that the ACR takes a more 'flexible' approach to setting project requirements.

In particular, the ACR has allowed for reduced project durations, at least as compared with the CAR, and has considered options other than conservation easements 'in perpetuity' for managing sequestration reversal risk. As an example, an approved Methodology[32] developed by Finite Carbon around improved forest management activities refers to a minimum project duration of 40 years and a range of risk mitigation measures, including contributing to the ACR buffer pool and the use of insurance instruments (American Carbon Registry 2010).

While the ACR does not presently share the linkages to developed, or developing, mandatory compliance programs to the same extent that CAR does, market commentators suggest that there is reasonably strong interest in ACR from large corporate buyers, with 'contractual offers' reportedly in place for some 3.4 million ACR Emissions Reduction Tonnes (ERT's) over the next four years (Potter & Jones, 2011).

6.2. Prospects for Offsets

Globally, the voluntary carbon market remains relatively small, representing just 0.3% of all trades, by volume (Linacre *et al.*, 2011). It is also a volatile and difficult to navigate market-

[31] Activities based within Mexico are now being increasingly considered and included.

[32] Improved forest management methodology for quantifying GHG removals and emissions reductions through increased forest carbon sequestration on U.S. timberlands (September 2010).

place, with competing standards, protocols, programs and registries, and buyer demand waxing and waning depending on financial conditions and developments in government climate policy. This is no less the case for the US voluntary market, where several dominant standards operate, there is no strong signal for a national trading program but regional policy developments such as the Californian Cap-and-Trade are influencing demand and supply, and the economy is still recovering from the global financial crisis which is placing pressure on discretionary spending.

During 2010, this volatility and uncertainty saw the Chicago Climate Exchange, the world's largest voluntary carbon market, all but collapse. Nevertheless, the US market remained roughly stable from 2009-2010, with around 19 million Offsets traded[33], which is in line with the global trend for the same period (Peters-Stanley *et al.*, 2011).

Looking forward, there are a range of opinions around how the voluntary market may develop, both within the US and globally. In a recent market survey, Peters-Stanley *et al.* (2011) report:

> "*Suppliers are cautiously optimistic that this demand will remain strong as the economy recovers and the market continues to mature in its efforts to synthesize buyer motivations and market scale*" (pg. vii).

This statement aligns reasonably well with opinions expressed by Participants. However, a number did suggest that, with federal action stalled and the high-profile collapse of the CCX program, the appetite for Offsets within corporate America had been considerably diminished during 2010. Several felt that a number of players had been investing in pilot projects with a view to 'learning by doing' in advance of a federal mandatory program and that this type of investment behavior was now likely to fall away. Many suggested early movers now felt "*burned*" and were not eager to rush back into Offsets.

With regards to supply dynamics, several Participants expressed the view that, without increased preferential purchasing of domestically generated Offsets, the US voluntary market was likely to be well over-supplied over the coming years. In particular, it was thought that large volumes of Offsets were soon to enter the market from forest projects in south America and developing countries. This is a view that is supported to some extent by the recent surge in Offset credits generated from Reduced Emissions from Deforestation and Forest Degradation (REDD) projects, with a >500% increase reported from 2009-2010 (Linacre *et al.*, 2011).

On balance, those commercial operators interviewed during this study that had an interest in the voluntary market appeared to view it largely as a 'proving up ground' for the development of business models, project activities, and verification standards that would ultimately feed into a mandatory compliance market, rather than as a significant opportunity in its own right. This positioning is supported by recent developments around the Californian Cap-and-Trade program, where CAR generated Offsets appear likely to be recognised.

6.3. Opportunities for Australian forest managers

One of the appealing aspects of the voluntary market is that it is global and sales of Offsets are not necessarily constrained by the location of the purchaser, or Offset origination activity.

[33] A speculative, once-off trade of 54 million CCX CFI's at $0.02/tonne is excluded from these figures.

Trades in the voluntary market also take place through a wide variety of mechanisms, from small-scale retail (e.g. web-based sales) to large-scale wholesale, from spot-market purchases to forward supply contracts, and from independently verified units to a 'promise' that abatement activities will be undertaken. This flexibility means that, unlike existing and emerging compliance programs, it is possible to trade carbon sequestered within Australian forests, directly into the US voluntary market. Achieving market penetration is, however, not without challenges.

Overall, as a market for an Australian forest product, the US voluntary market is small by volume (19 million tonnes), and very small by value (ca. $70 million). To put this in context, Australia exported some 5.3 million tonnes of woodchip alone during 2008-2009, for a total value approaching $1 billion (ABARE, 2009).

Competing within this relatively small market-place are a number of already well established project developers, aggregators and trading intermediaries with the capacity to pull large portfolios of Offsets together from a range of sources. Some of these operators are based in developing countries, where the costs of producing verified carbon units is low due to cheap labor and the availability of larger tracts of forests subject to threatening processes that potentially make them eligible for REDD style projects.

For this reason, Australian-based operators are unlikely to be able to compete on price in the wholesale market. In the retail market, however, there is considerably less transparency and consumer understanding around carbon pricing and it may be possible for Australian-based operators to carve themselves a niche in this area. Achieving this would no doubt require significant marketing effort aimed at raising the profile of Australian projects and positively differentiating Australian originated Offsets from the wide range of other Offset types available. Potential points of differentiation include the co-benefits associated with forestry projects within Australia (e.g. reduced land salinisation, enhanced biodiversity value, reduced soil erosion), as well as the relatively transparent carbon property ownership legal structures and relatively low risk of sequestration reversals arising from illegal logging, or land ownership changes.

One of the key challenges in generating Offsets recognised under an independent standard is that Australian operators presently have few options for realising this. There is currently no domestic Offset verification program in place, with the Greenhouse Friendly Program having been wound up during 2010 and its replacement, the Carbon Farming Initiative, yet to be passed into legislation. With respect to the international standards widely recognised in the US, only the VCS is applicable to Australian-based projects. The range of projects that can participate in VCS is considerably restricted as a result of the Australian government reporting carbon sequestration from Australian forests as part of its international obligations under the Kyoto protocol. For many projects that would otherwise be eligible, this creates a 'double-counting' issue, whereby sequestration is effectively already claimed by the Australian government. Forest activities that do not meet Kyoto eligibility requirements, such as reforestation of lands cleared after 1st January 1990, are less likely to have to contend with this issue.

7. US-based projects

Outside of the voluntary-market, there presently appears little opportunity for Australian-based projects to trade directly into the US, with existing and proposed programs specifying that whilst international projects are allowable, they must be located in developing countries. The pathway to market for international projects of any kind, however, appears unclear since a requirement for 'bilateral agreements' between governments is a common feature of US programs. Few examples of these agreements exist at this point. All of this suggests the most transparent and immediate pathway to participating in US markets is to establish projects within the US itself.

A number of studies point toward considerable opportunities for greenhouse gas abatement through forest projects. Stavins & Richards (2005), for example, suggest that in terms of cost of emissions reduction, forest projects are highly competitive as compared with other options and that abatement programs of 100 million tonne CO2e per annum is achievable, even at modest carbon pricing. Murray *et al.* (2005), who modeled a range of pricing and abatement scenarios, report that forest projects could abate over 400 million tonnes of emissions each year, representing the equivalent of over 5% of total emissions for the US (US Environmental Protection Agency 2011).

Around this broad opportunity for creating a supply of forest-derived abatement, many questions arise, such as what are the most commercially attractive projects, is the market already crowded with suppliers, what is the realistic cost of abatement and where are the best locations for projects? While a detailed analyses of these is beyond the scope of a short study like this, some commentary is included in the sections that follow that provides an introduction to these topics.

7.1 Overview of US forests and existing carbon projects

Forests cover around 300 million hectares of land in the US, representing roughly a third of all land area (Wayburn *et al.*, 2007). Forests are already a major contributor to emissions reduction, with analyses suggesting as much as 10% of the total annual emissions for the US are being sequestered by forests (e.g. Murray *et al.*, 2005; Woodbury *et al.*, 2007). Nevertheless, there has been a historic trend for forest clearing, with cover estimated to have been reduced by over 50% since European settlement (Wayburn *et al.*, 2007). While most of this occurred in the 1800's, some threatening processes, such as clearing for agriculture and property development remain (Wayburn *et al.*, 2007).

Since around the 1950's, the area of reserved forest within the US has increased considerably, with around 7% of the total forest area (20 million hectares) now being managed as reserves. Of the non-reserved forest, around half is publicly owned and government controlled, the other half is privately owned (Butler 2008). Of the privately owned forest areas, a relatively large amount (35%) is owned by smaller individual landholders, with the remainder predominantly owned and managed by commercial forestry operators.

Of the 25 'operational' forest projects on Ecosystem Marketplace's project inventory, 14 involve Reforestation, seven are Avoided Conversion projects and the remaining four are based on Improved Forest Management. Some concentration of projects is evident in the west, especially California, and in the southeast, including Arkansas, Louisiana and Mississippi (Fig. 10). This

pattern is likely to reflect the state of development of regional emissions programs, as well as availability of cheaper land. California has the most well developed trading program outside of the RGGI states, and an extended history of NGO involvement in developing 'pilot' projects.

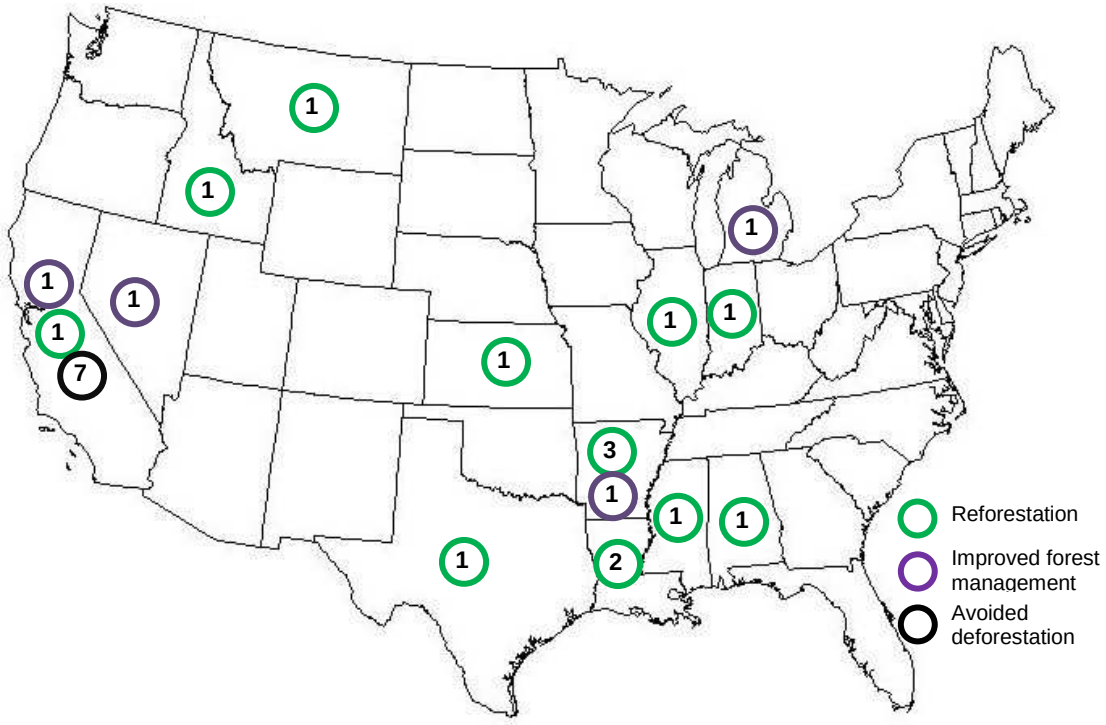

Figure 10. Location of 'operational' forest carbon projects by type (data source: Ecosystem Market-Place, project inventory).

There have been a number of studies published that attempt to model the costs of producing forest abatement within the US. Stavins & Richards (2005) developed a marginalized cost model relating the costs of abatement under differing Offset supply scenarios. Based on their model, which essentially assumes that least cost abatement opportunities are exploited first and highest cost opportunities last, the average cost-base for a 100 million tonne CO2e per annum abatement program is around $5.50 per tonne, rising to around $12.50 at 300 million tonnes.

This roughly aligns with analyses conducted by Murray *et al.* (2005), who suggest that significant volumes of abatement could start to be achieved at carbon pricing as low as $5 t CO2e. Wayburn *et al.* (2007) report that the price of carbon needs to be at least $5.50 t CO2e before it starts to incentivise forest and land owners to alter management practices:

> "*This enables carbon to provide some incremental value to landowners, resulting in either retention of land for forest, or retention of trees during harvest*" (pg. 2).

At prices exceeding $27 t CO2e, Wayburn *et al.* (2007) predict that carbon forestry will begin to compete with traditional wood product based business models.

While the above cost and pricing figures provide some useful benchmarks, it should be noted that these all rely heavily on modeled outcomes. In reality, there is little transparency around the full costs associated with project development and delivery within the US. This is due in part to the limited number of commercial, non-subsidised, projects that have actually been delivered to date, as well as the commercial sensitivities that surround cost information. As a consequence, the figures cited here should be treated with caution.

7.2 Improved Forest Management

Under this approach, the forest management regime being applied to existing forested areas is altered, so as to increase the amount of carbon sequestered over time as compared against a 'business as usual' baseline. This could include, for example, reducing harvest frequency so as to allow for an increase in average stand age, increasing forest growth rates through management inputs, or increasing stocking levels in under-stocked forest areas.

A number of studies suggest that at lower carbon prices (<$15 t CO2e), Improved Forest Management projects are the most commercially competitive of the forest-carbon options, primarily due to the lower up-front costs associated with this project type. Murray *et al.* (2005) suggests that significant volumes of abatement could start to be achieved through these project types at carbon pricing as low as $5. At $15, as much as 200 million tonnes of abatement could be achieved annually. This is supported by Gorte & Ramseur (2010), who suggest that improved forest management will deliver more abatement than reforestation projects to prices of around $15-20 per tonne.

The views of Participants align well with these published studies. The main focus of project developers, at this stage, appears to be on delivery of Improved Forest Management projects. Notably, of the 63 forest related projects recently 'listed' for consideration by the CAR, 38 are based on Improved Forest Management. There appear to be two main approaches that project developers are using to identify and deliver projects of this type:

i. Partnership strategy - a number of project developers have sought to develop relationships with existing commercial forest managers whose business model is focused on wood products, with a view to jointly monetising carbon stored in production forests. Under this approach, the developer seeks to leverage off their specialist knowledge of standards and markets, which may not be well developed within the production forest 'partner'.

ii. Aggregation strategy - a large area of US forest, including considerable areas subject to harvesting, is owned by smaller individual landholders (sometimes referred to as 'family owned' forest). Some developers are seeking to connect with these landowners and work with them to realise carbon outcomes from their forests. Since there are economies of scale with this type of project, developers typically target larger forest areas and seek to aggregate multiple forest parcels into a single project, or carbon pool. Profit share arrangements appear common, wherein the developer covers most, or all, of the up-front costs in return for a share of the revenue derived from the carbon.

With respect to the partnership strategy, one of the key challenges faced by project developers is convincing forest managers to alter management practices for improved carbon outcomes,

since this typically comes either as a cost impost (e.g. apply a silvicultural input that increases sequestration potential), or foregone wood product based revenue (e.g. extend average harvest age). To paraphrase one Participant, "*it's a hard sell because at today's carbon prices we are often basically asking the forest manager to accept a lesser commercial outcome*".

For the aggregation strategy, Charnley *et al.* (2010) suggest that family forest owners may be more receptive to carbon projects than commercial operators, because family owners do not always focus on harvest revenues as a primary driver of forest management. This means Improved Forest Management practices, such as extending rotation length, may align well with the motivations of family forest owners (Bliss and Kelly 2008). Nevertheless, promoting this project type to individual landowners is difficult, since it requires entering long-term undertakings that can restrict land management options into the future. The practicalities of engaging with scattered forest owners can also be difficult to resolve. To paraphrase one Participant "*you can spend a lot time on the road and at information sessions to turn up just a handful of acres*".

Another challenge with the aggregation model is that management complexity, and therefore costs, increases with increasing fragmentation of the forest. This dynamic favours selectively targeting larger forest areas. Across the US, the average size of a privately owned forest parcel is only 10 hectares (Butler 2008). However, over half of all privately owned forest occurs in parcels larger than 40 hectares and owners of these larger tracts are most likely to have some of the mechanisms in place that would allow for transition into an Improved Forest Management project, such as forest management plans and certification (Butler 2008).

7.3 Reforestation & afforestation

Under this approach, cleared land is converted to forest, either through partial conversion within a landowners holdings under a lease, land right purchase, or profit share arrangement; or through whole-of-property conversion following a land purchase by the project proponent. There is some evidence to suggest that uptake for the partial conversion approach would be relatively high (Butler 2008, Alig 2003), although based on the views of Participants, the drivers for doing so are less likely to be related to amelioration of land degradation processes than is often the case within Australia (see also Butler, 2008; Charnley *et al.*, 2010).

Feedback from Participants suggested reforestation projects were widely considered less commercially attractive than Improved Forest Management projects, primarily because of the significant up-front capital costs required. One Participant expressed the view that, in many cases, existing and planned Reforestation projects were being driven by NGO's with a view to demonstrating 'proof of concept' and encouraging uptake by commercial operators. This is supported by the Ecosystem Marketplace project registry (Appendix 4), which shows most operational projects are relatively small-scale NGO delivered programs.

As reported by other studies, including Gorte (2009), fine detail on the costs associated with reforestation are "… *not widely available*", presumably due to the commercial sensitivities around releasing cost-base details. Gorte (2009) reports a 'low end' cost of around $500 and a 'high-end' close to $5,000 per hectare. Bair & Alig (2006), report site establishment and planting

costs ranging from around $500-950 per hectare, with ongoing management costs of $6-20 per hectare per year[34].

A preliminary web-based review of rural land prices in regions marginal for forest establishment suggests purchase prices start from around $1,500 per plantable hectare. Combining these with the estimates of establishment above, the cost of carbon forest establishment and early management is likely to well exceed $2,000 per hectare. Based on this very coarse analysis, and assuming a cumulative sequestration of 300 tonnes per hectare (Birdsey 1996) is achievable over the life of a project in cheaper, more marginal landscapes, delivery of carbon 'at cost' seems unlikely to be achievable for anything less than around $9 a tonne (CO2e).

In a detailed review of forestry and agricultural carbon sequestration opportunities, Murray *et al.* (2005), identify a threshold carbon price at which reforestation projects become more commercially attractive than improved forest management projects:

> "*At relatively low GHG prices (≤$5/t CO2 Eq.) and in early years, carbon sequestration in agricultural soils and carbon sequestration in forest management (i.e. harvest and regrowth practices) are the dominant mitigation strategies. Afforestation becomes the leading strategy at middle to higher prices (≥ $15/t CO2 Eq.)…"* (pg. ES-3)

One of the challenges for reforestation projects that was not considered in detail by this study, however, is that high up-front costs are coupled with an extended abatement delivery timeframe. For most temperate forests, it can take five years or more before large volumes of carbon start to be sequestered on an annual basis. This timeframe is significant when it is considered that RGGI, the only existing cap-and-trade program in the US, runs to 2018 and the Californian Cap-and-Trade is proposed to run until 2020. In effect, a reforestation project will have less than ten years to generate a return under the two lead trading initiatives that presently exist.

With respect to preferred locations for Reforestation projects, several Participants suggested states in the south-east were most attractive as larger tracts of relatively cheap land were available. One Participant suggested land in these states was also the most likely to be marginal with respect to agricultural production, so landowners might be favourably disposed to some level of conversion to forest. These views are supported by various studies, including Murray *et al.* (2005), who identify the South-Central (Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee & Texas) and Corn Belt (Illinois, Indiana, Iowa, Missouri, Ohio) regions as having high potential for Reforestation (see also Wayburn *et al.*, 2007; Charnley *et al.*, 2010).

7.4 Avoided deforestation

Under this approach, areas of forest subject to threatening processes are protected, resulting in avoiding an emissions release. Typically, this project type requires establishment of a conservation easement, or other land instrument, that prevents the forest from being cleared. This project type has been popular with NGO's, who have widely promoted the benefits to landowners. However, these projects appear less popular with commercial developers.

[34] Includes no treatments for wood product values (e.g. thinning/pruning) and no harvest related costs.

Of the close to 1.7 million tonnes of Offsets transacted in over-the-counter trades in the US in 2008, only around 2% arose from US Avoided Deforestation projects. None of the commercially oriented Participants appeared to be seriously resourcing the development of US-based avoided deforestation projects. One of the reasons cited was that the opportunities for cost-effective delivery of this project type in the US were considerably lower than in developing countries, where costs were lower and, perhaps more critically, the volumes of Offsets that could be created were far greater than could be achieved in the US.

Charnley *et al.* (2010) report that a major barrier to Avoided Deforestation projects in the US has been the difficulty of reliably estimating the real threat of future conversion. One of the key eligibility criteria around this project type is that the developer must be able to establish that the forest is subject to some threatening process and, in the absence of the project, the forest is likely to be removed. Another eligibility criteria relates to leakage, wherein the developer must demonstrate that preventing forest conversion in one location, does not result in conversion taking place elsewhere. Establishing points of proof around these requirements can be difficult.

8. Conclusion

From the many conversations I had with people while travelling through the US, as well as reviews of a range of recent market commentary, it seems unlikely that an all-encompassing national carbon trading program will be introduced within the US during the next five years. Federal initiatives that were so promising during 2009-2010, including the Waxman-Marky and Kerry-Boxer Bills, appear stalled indefinitely and it will now take some completely new initiative to reinvigorate the emissions reduction policy agenda.

In the absence of a federal program, and with the RGGI largely being perceived as a 'toothless tiger', the Californian Cap-and-Trade program represents the most significant policy development, offering the greatest prospects for Offsets. A lot seems to be riding on the success of the Californian program, with many Participants believing it could serve either as the catalyst for delivery of a federal program, or set it back indefinitely.

Presently, there is some scope for Australian forest managers to participate in US voluntary carbon markets, particularly through projects validated under the VCS. The main game, however, will always be the mandatory compliance market and participating in this will likely require delivering projects in a limited number of developing countries, or more immediately, delivering projects within the US itself.

With over a decade of experience in engaging with emissions programs and delivering forest projects into carbon markets, Australian forest managers are potentially well placed to develop US-based projects. Several project types are possible, including avoided conversion, improved forest management and reforestation. Forestry-based projects appear well received in the US, are apparently generally accepted by regulators as a legitimate approach to emissions abatement and, with respect to cost of abatement, are likely to prove highly competitive.

While real opportunities are starting to emerge, particularly around the Californian Cap-and-Trade, and many of the technical barriers around realisation of verified carbon units appear

readily met, the commercial challenges involved in delivering projects into the US should not be underestimated. This study has provided only a brief introduction to these and more detailed analyses would be required in order to evaluate the business case for pursuing US projects.

9. References

ABARE. (2009). Australian commodity statistics. Available at: http://www.abare.gov.au/publications_html/data/data/data.html

Alig, R.J. (2003). US landowner behavior, land use and land cover changes, and climate change mitigation. *Silva Fennica* **37** (4): 511-527.

American Carbon Registry. (2010). Improved forest management methodology for quantifying GHG removals and emissions reductions through increased forest carbon sequestration on U.S. timberlands. Developed by Finite Carbon, approved & released September 2010. Available at: http://www.americancarbonregistry.org/carbon-accounting/improved-forest-management-methodology-for-increased-forest-carbon-sequestration-on-u.s.-timberlands

Australian Greenhouse Office. (1999). National emissions trading: Establishing the boundaries: Discussion paper 1. Australian Greenhouse Office, Canberra.

Anderson, E.R. (2005). Conservation easements: a tool to preserve land, wealth, and silvicultural practices. *Forest Landowner* **64**(1): 28-29.

Australian Productivity Commission. (2011). Carbon emission policies in key economies. Research Report, May 2011.

Bair, L.S. & Alig, R.J. (2006). Regional cost information for private timberland conversion and management. United States Department of Agriculture – Forest Service Pacific Northwest Research Station, General Technical Report PNW-GTR-684.

Beder, S. (1999). Emissions trading – A vehicle for achieving greenhouse targets. *Engineers Australia*, August 199, pp. 28-29.

Birdsey, R.A. (1996). Regional estimates of timber volume and forest carbon for fully stocked timberland, average management after final clearcut harvest. In: Forests and global change, Vol. 2 – Forest management opportunities for mitigating carbon emissions. R.N. Sampson and D. Hair (eds.), pp309-334, American Forests, Washington DC.

Bliss, J.C. & Kelly, E.C. (2008). Comparitive advantages of small-scale forestry among emerging forestland tenures. *Small-scale Forestry* **7**(1): 95-104.

Brown, S., Pearson, T., Dushku, A., Kadyzewski, J., & Qi, Y. (2004). Baseline greenhouse gas emissions for forest, range, and agricultural lands in California. Winrock International, Report 500-04-069F, March 2004.

Butler, B.J. (2008). Family forest owners of the United States, 2006: A technical document supporting the Forest Service 2010 RPA Assessment. US Department of Agriculture, Forest Service, Northern Research Station, June 2008.

Californian Air Resources Board. (2010a). Trends in California greenhouse gas emissions for 2000 to 2008 - by category as defined in the scoping plan. May 28, 2010. Available at: http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_trends_00-08_2010-05-12.pdf

Californian Air Resources Board. (2010b). Forested lands and wood products biodegradable carbon emissions and sinks. May 12, 2010.

Californian Air Resources Board. (2010c). Rulemaking to consider the adoption of a proposed California cap on greenhouse gas emissions and market-based compliance mechanisms regulation, including compliance offset protocols. December 16, 2010. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm

Californian Air Resources Board. (2010d). Proposed regulation to implement the California Cap-and-Trade Program. October 28, 2010. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm

Californian Air Resources Board. (2010e). Compliance offset protocol for forest projects. Draft version, October 28, 2010. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm

Californian Office of Administrative Law (2011). Final regulation order – Article 5: California cap on greenhouse gas emissions and market-based compliance mechanisms. California Code of Regulations, 21st December 2011. Available at: http://www.arb.ca.gov/regact/2010/capandtrade10/capandtrade10.htm

Charnley, S., Diaz, D., and Gosnell, H. (2010). Mitigating climate change through small-scale forestry in the USA: Opportunities and challenges. *Small-scale Forestry* **9**, 445-462.

Climate Action Reserve (2010a). Forest project protocol – Version 3.2, 31 August, 2010. Available at: http://www.climateactionreserve.org/how/protocols/

Climate Action Reserve. (2010b). Urban forest project protocol – Version 1.1, March 10, 2010. Available at: http://www.climateactionreserve.org/how/protocols/

Climate Action Reserve. (2010c). Projections of future CRT issuance. November 5, 2010.

Climate Trust. (2009). The Climate Trust 2009 annual report. Available at: http://www.climatetrust.org/annualRep.html

CORE. (n.d.). State power plant rules of Oregon, Washington and Massachusetts. Available at: http://www.co2offsetresearch.org/policy/PowerPlantRules.html

FAO. (2005). Global forest resources assessment 2005 – Progress towards sustainable forest management. FAO Forestry Paper 147. Available at: http://www.fao.org/forestry/fra/fra2005/en/

Goodman, J. (2011). New Hampshire house votes to quit RGGI. Stateline report, 4th March 2011. Available at: http://www.stateline.org/live/details/story?contentId=555695

Gorte, R.W. (2009). Carbon sequestration in forests. Congressional Research Service Report for Congress 6 August 2009.

Gorte, R.W., & Ramseur, J.L. (2010). Forest carbon markets: Potential and drawbacks. Congressional Research Service, Report for Congress, 24 May 2010.

Henderson, P. (2011). The Californian carbon rush. Reuters, Special report Feb 17, 2011.

Linacre, N., Kossoy, A., Ambrosi, P., Sahlia, M.A., Bishop, V., Bosquet, B., de Gouvello, C., Matsuki, T., & Randade, M. (2011). State and trends of the carbon market 2011. Report, Carbon Finance at the World Bank.

Merenlender, A. M., Huntsinger, L., Guthey, G., & Fairfax, S.K. (2004). Land trusts and conservation easements: Who is conserving what for whom? *Conservation Biology*, **18**: 65-75.

Murray, B.C., Sohngen, B., Sommer, A.J., Depro, B., Jones, K., McCarl, B., Gillig, D, DeAngelo, B., Andrasko, K. (2005). Greenhouse gas mitigation potential in US forestry and agriculture. US Environmental Protection Agency Office of Atmospheric Programs, Report 430-R-05-006.

Pearson, T.R.H., Brown, S.L., and Birdsey, R.A. (2007). Measurement guidelines for the sequestration of forest carbon. United States Department of Agriculture Forest Service Northern Research Station, General technical report NRS-18, March 2007. Available at: (http://nrs.fs.fed.us/pubs/gtr/gtr_nrs18.pdf)

Peters-Stanley, M., Hamilton, K., Marcello, T. & Sjardin, M. (2011). Back to the future – State of the voluntary carbon markets 2011. Ecosystem Marketplace & Bloomberg New Energy Finance, report, 2nd June 2011.

Point Carbon. (2010). US offset markets in 2010: The road not yet taken. Carbon Market Analyst North America, Point Carbon, 1st March 2010.

Potter, T.M. & Jones, M. (2011). Forest carbon emerging as an asset class in sequestration. Natural gas & electricity, June 2011, pg. 14-19.

Potomac Economics. (2008-2011). Market monitor report for auction 1-11. Potomac Economics report series, October 2008 – March 2011. Available at: (http://www.rggi.org/docs/Auction_1_MM_Report.pdf)

RGGI. (2009). Regional Greenhouse Gas Initiative CO_2 budget trading program: Draft model offset project consistency application – Afforestation (Version 1.0). Regional Greenhouse Gas Initiative Inc. report, February 2009.

RGGI. (2010). Offset handbook for Regional Greenhouse Gas Initiative (RGGI) model rule offset subpart XX-10 and model offset consistency applications and model monitoring and verification reports – Version 1.0. Regional Greenhouse Gas Initiative Inc. report, May 2010.

RGGI. (2011). Investment of proceeds from RGGI CO2 Allowances: Benefits of Regional Greenhouse Gas Initiative (RGGI)- funded programs in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Regional Greenhouse Gas Initiative Inc. report, February 2011.

Stavins, R.N. & Richards, K.R. (2005). The cost of US forest-based carbon sequestration. Pew Center for Global Climate Change, January 2005.

Taylor, M. (2011). CAL Facts. Californian Legislative Analysts Office, January 2011. Available at: http://www.lao.ca.gov/reports/2011/calfacts/calfacts_010511.pdf

The Nature Conservancy. (2003). Conservation easements - Conserving land, water and a way of life.

United Nations Statistics Division. (2010). Millennium development goals indicators. Updated 23rd June 2010. Available at: http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749

US Environmental Protection Agency. (2011). Inventory of greenhouse gas emissions and sinks: 1990-2009. US EPA report, 15th April 2011. Available at: http://epa.gov/climatechange/emissions/usinventoryreport.html

Volcovici, V. & Carroll, R. (2011). California trading awakens after CARB vote. Point Carbon, research report, 6 January 2011.

Wayburn, L.A., Franklin, J.F., Gordon, J.C., Binkley, C.S., Mladenoff, D.J., Christensen, N.L. (2007). Forest carbon in the United States: Opportunities and options for private lands. Pacific Forest Trust.

Western Climate Initiative. (2010a). Design for the WCI regional program. 27th July, 2010. Available at: http://www.westernclimateinitiative.org/component/remository/general/

Western Climate Initiative. (2010b). Offset system essential elements draft recommendations paper. April, 2010. Available at: http://www.westernclimateinitiative.org/document-archives/Offsets-Committee-Documents/

Western Climate Initiative. (2011). Draft recommendations offset system process (Offset committee task 1.3). 7th June 2011. Available at: http://www.westernclimateinitiative.org/document-archives/Offsets-Committee-Documents/

Woodbury, P.B., Smith, J.E., Heath, L.S. (2007). Carbon sequestration in the US forest sector from 1990 to 2010. Forest Ecology & Management, **241** (1): 14-27.

Zinkhan, C. (2008). Conservation easements. Forests and forestry in the Americas: An encyclopedia. Society of American Foresters and International Society of Tropical Foresters. Available at: http://www.encyclopediaofforestry.org/index.php/Conservation_Easements.

Appendix 1: Organisations interviewed

Name	Sector/Type	Description
Avoided Deforestation Partners	NGO/ Conservation	Seeks to influence development of US and international climate policy. Focus on reducing deforestation activities, particularly in tropical forests. Supportive of the development of market mechanisms, including for forest carbon. http://www.adpartners.org/
Baker & Mckenzie	Private/ Advisory	Legal firm with a strong presence in the emissions trading area, including within the US. Close relationships into regulators dealing with emissions and climate change issues. http://www.bakermckenzie.com/
BP	Private/ Emitter	Large energy and fuel producer with extensive global operations and large US presence. Significant emissions profile. Likely to have liabilities under any regional (California) or federal mandatory emissions reduction compliance programs that may be introduced. http://www.bp.com/bodycopyarticle.do?categoryId=1&contentId=7052055
Californian Air Resources Board	Government/ Regulator	Californian state government agency responsible for designing, implementing and administering the California cap-and-trade. http://www.arb.ca.gov/homepage.htm
Camco	Private/ Project Developer & Advisory	Advisory firm experienced in development of carbon, emissions reduction and energy efficiency projects. Joint venture announced in 2010 around developing large methane reduction projects. http://www.camcoglobal.com/
Carbon Verde	Private/ Advisory	Consultancy with experience in forest management, carbon project design, carbon accounting, REDD project development, and the development and application of carbon standards and protocols. http://www.carbonverde.com/
CCB Standards	NGO/ Standards	Not-for-profit partnership established around the development of standards relating to carbon projects, particularly in regards independent verification of claims around co-benefits of forest carbon projects (e.g. biodiversity and socio-economic impacts). http://www.climate-standards.org/index.html
Chicago Climate Exchange	Private/ Exchange	A trading platform established in 2003 focused on voluntary Offsets. Activity and presence in this space has been considerably reduced following a buy-out by Intercontinental Exchange in 2010. http://www.chicagoclimatex.com/
Climate Action Reserve	NGO/ Standards	An Offsets program focused on the development of standards, or 'Protocols', for US based projects. Closely aligned with the Californian Air Resources Board and development of Offset protocols under the Californian Cap-and-Trade Program. http://www.climateactionreserve.org/

Climate Trust	NGO/ Offset services & policy	A not-for-profit seeking to influence climate change policy and regulation, particularly in relation to Offset projects, and to provide Offset services to government agencies and businesses. Administers the Colorado Carbon Fund. http://www.climatetrust.org/index.html
Delta Institute (Delta Offsets)	NGO/ Project developer	A not-for-profit focused on encouraging implementation of offset projects, including through undertaking projects of their own and providing advisory services. Has historically maintained strong links to the CCX, including creation and retirement of Offsets. http://deltacarbon.org/offsets
Dirk Forrester	Private/ Advisory	Independent consultant with experience in carbon funds management and investment models for offset and abatement projects.
Forest Trends - Ecosystem Marketplace	NGO/ Advisory & development	Not-for-profit seeking to promote sustainable forest management, primarily through development of markets for ecosystem services. Provides regular analyses and coverage of market trends, including through The Katoomba Group's 'Ecosystem Marketplace'. http://www.forest-trends.org/
Environmental Credit Corp	Private/ Project developer	A US-based for-profit firm seeking to develop a supply of carbon credits, including through developing their own offset projects. Pursuing a range of activities, including methane destruction, forestry and energy efficiency projects. http://www.envcc.com/
Environmental Financial Products	Private/ Advisory & Financing	An advisory services firm focusing on monetising emissions reduction and carbon sequestration projects, as well as project funding models. Includes principals previously intimately involved in the development of the Chicago Climate Exchange. http://envifi.com/wordpress/?page_id=3
Equator LLC	Private/ Project developer	A for-profit firm with a presence in the US and South America. Active in developing forest carbon projects and monetising forest carbon assets. Also has strong interests in forest asset development and management. http://www.equatorllc.com/
Finite Carbon	Private/ Project developer, Financial	A for-profit firm focused on development of forest carbon projects and monetising forest carbon assets. Has a focus on aggregation and improved forest management, as well as project financing. http://www.finitecarbon.com/
Garten Rothkopf	Private/ Advisory	Advisory services firm focused on policy development and policy related research. Maintains a close interest in climate policy and a diverse range of clients from private sector to government agencies. http://www.gartenrothkopf.com/
International Emissions Trading	NGO/ Peak body	Not-for-profit seeking to facilitate development of emissions trading around the world. Membership is predominantly comprised of private sector companies, with partnerships into various emissions

Association (IETA)		reduction and clean energy agencies. http://www.ieta.org/
Newmont Mining	Private/ Emitter	Large mining company with operations in the US, Australia, New Zealand, Africa, south-east Asia and south America. Significant emissions profile. Likely to have liabilities under any federal mandatory program that may be introduced. http://www.newmont.com
Noble Group	Private/ Trader	Large firm with offices around the globe. Focus is on supply chain management for agricultural, industrial and energy products. Active in trade of various carbon units, including under CDM and JI programs. Maintains an active carbon trading presence in the US. http://www.thisisnoble.com/index.php?option=com_content&task=view&id=74&Itemid=98
Pacific Forest Trust	NGO/ Forest conservation	A well established NGO focused on forest conservation. Promotes recognition of ecosystem services, including through market-based mechanisms. Maintains a strong interest in policy development, the evolution of carbon standards and forest management practices. http://www.pacificforest.org/
Point Carbon (Thompson Reuters)	Private/ Analyst, Advisory	With seven international offices, Point Carbon is a subscription-based advisory firm offering market research services around carbon, energy and renewables trading. Regularly publishes research, analyses and commentary relating to US markets. http://www.pointcarbon.com/
Scientific Certification Systems	Private/ Verifier, Advisory	Advisory and consulting firm with 25 year track-record in certification and verification around environment, sustainability, stewardship, and food quality/ safety. Previous audit experience includes FSC, VCS, CAR and CCBA. claimshttp://www.scscertified.com/
US Forest Service	Government/ Forest manager	A US Department of Agriculture agency founded in 1905 and which now manages close to 80 million hectares of forested public lands. Their Ecosystem Management program includes a focus on climate change adaptation. http://www.fs.fed.us/
Verified Carbon Standard	NGO/ Standard	The VCS has grown to become a dominant voluntary carbon standard and registry operator. Based in Washington, the VCS has served to register and verify carbon projects from around the globe, amounting to an estimated 52 million Offsets. http://www.v-c-s.org/
Winrock International	NGO/ Standards, Verifier, Advisory	A not-for-profit that includes projects around the globe. Focuses on economic development and capacity building in disadvantaged countries, with a view to improving welfare and sustainability. Manages the American Carbon Registry and active in project methodology and policy development. http://winrock.org/

Appendix 2: State agencies administering the RGGI

State	Agency	Contact details
Connecticut	Department of Environmental Protection	Paula Gomez paula.gomez@ct.gov (860) 424-3088 http://www.ct.gov/dep/cwp/view.asp?a=2684&Q=440696&depNav_GID=1619
Delaware	Division of Air Quality	Valerie Gray valerie.gray@state.de.us (302) 739-9402 http://www.awm.delaware.gov/AQM/Pages/Offsets.aspx
Maine	Bureau of Air Quality	Eric Kennedy eric.kennedy@maine.gov (207) 287-5412 http://www.maine.gov/dep/air/greenhouse/co2off.htm
Maryland	The Department of the Environment	Renee Fizer rfizer@mde.state.md.us (410) 537-4219 http://www.mde.state.md.us/Pages/Home.aspx
Massachusetts	Department of Environmental Protection	William Space william.space@state.ma.us (617) 292-5610 http://www.mass.gov/dep/air/approvals/aqforms.htm#rggi
New Hampshire	Department of Environmental Services	Joseph T. Fontaine joseph.fontaine@des.nh.gov (603) 271-6794 http://des.nh.gov/organization/divisions/air/tsb/tps/climate/rggi/index.htm
New Jersey	Department of Environmental Protection	Christopher Sherry christopher.sherry@dep.state.nj.us (609) 292-6818 http://www.state.nj.us/dep/
New York	Department of Environmental Conservation	John Marschilok jxmarsch@gw.dec.state.ny.us (518) 402-8448 http://www.dec.ny.gov/energy/53449.html
Rhode Island	Department of Environmental Management	Barbara Cesaro barbara.cesaro@dem.ri.gov (401) 222-2808 http://www.dem.ri.gov/pubs/forms.htm#offsets
Vermont	Air Pollution Control Division	Dick Valentinetti dick.valentinetti@state.vt.us (802) 241-3840 http://www.anr.state.vt.us/air/htm/RGGI.htm

Appendix 3: ARB schedule around Cap-and-Trade

Cap-and-Trade Program Activities for 2011	
Through Spring	Offset protocols workshop
	Compliance workshop planned topics: compliance cycle, penalties
	Electricity workshop planned topics: reporting requirements for electricity deliverers, voluntary renewable energy, long-term electricity contracts
	Allocation workshop
	Program management workshop planned topics: holding and purchase limits, corporate association reporting requirements, auction design, market oversight, penalties
Late Spring	First regulation change notice package ("15-day changes") released for public comment
Early Summer	WCI Linkage workshop
Mid-Summer	Second regulation change notice package ("15-day changes") released for public comment
Fall	Cap-and-trade regulation finalized Compliance workshop planned topics: registration process, compliance cycle, tracking system training
December	Cap-and-trade regulation goes into effect

* As sourced (23 May 2011) from: http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm

Appendix 4: Operational forest carbon projects (US)

Details of operational forest carbon projects, including activity type, relevant standard and expected Offsets to be generated.

Project	Type	Standard*	Developer	State	Forest area (ha)	Offsets (t CO2e)
Restoring a legacy at Red River National Wildlife Refuge	Reforestation	CCB	Conservation Fund	Louisiana	478	387,105
Restoring a Forest Legacy at Marais des Cygnes National Wildlife Refuge	Reforestation	CCB	Conservation Fund	Kansas	314	
Byron Roach Afforestation/Reforesation Project	Reforestation	CCX	AgraGate	Texas		56,500
AgraGate Afforestation Pool 1	Reforestation	CCX	AgraGate	Mississippi	30,460	473,400
Lompico Headwaters Forest Carbon Project	Improved Forest Management	CAR	Sempervirens Fund	California	82	100,000
Managed Forestry Pool 2	Improved Forest Management	CCX	Delta Institute	Arkansas	12,810	26,600
Mid-Forest Lodge Sustainability Managed Forestry Project	Improved Forest Management	CCX	Delta Institute	Michigan	6,859	81,900
Delta Carbon XFO Pool 2	Reforestation	CCX	Delta Institute	Alabama	2,253	24,000
Delta Carbon XFO Pool 3	Reforestation	CCX	Delta Institute	Arkansas	3,594	7,300
Big River/Salmon Creek	Avoided deforestation	CAR	Conservation Fund	California	6,504	1,805,795
Delta Carbon XFO Pool 1	Reforestation	CCX	Delta Institute	Illinois	1,206	43,800
Garcia River Forest	Avoided deforestation	CAR	Conservation Fund	California	9,628	154,080
Tensas River National Wildlife Refuge Afforestation Project	Reforestation	ACR,CCB VCS	Trust for Public Land	Louisiana	3,430	1,125,040

* CCB: Climate Community & Biodiversity; CCX: Chicago Climate Exchange; CAR: Climate Action Reserve; ACR: American Climate Registry; VCS: Verified Carbon Standard.

Project	Type	Standard*	Developer	State	Forest area (ha)	Offsets (t CO2e)
The van Eck Forest	Avoided deforestation	CAR	Pacific Forest Trust	California	850	525,000
Love Creek Forest	Avoided deforestation	CAR	Pacific Forest Trust	California		
RPH Ranch	Avoided deforestation	CAR	Craig Blencowe	California	120	
US Sustainable Forest Program – Smoke Creek	Improved Forest Management	CCB	ECO2 Forests	Nevada	5,000	900,000
Nez Perce Tribe Afforestation/Reforestation Project	Reforestation	CCX	National Carbon Offset Coalition	Idaho		
Green Trees	Reforestation	ACR	C2I, LLC	Arkansas	2,000	
Delta Carbon XFO Pool 5	Reforestation	CCX	Delta Institute	Arkansas	700	500
Phillips Family Tree Farm	Avoided deforestation	CAR	Phillips Family Tree Farm	California	920	
Lugar Stock Farm Afforestation Offset Project	Reforestation	CCX	Lugar Stock Farm	Indiana		
The Cuyamaca Rancho State Park (CRSP) Reforestation Project	Reforestation	CAR	California State Parks	California	2,500	
McCloud River	Avoided deforestation	CAR	TerraPass; Pacific Forest Trust	California	9,200	1,085,600
Mingo National Wildlife Refuge Forest Restoration Initiative	Reforestation	CCB	Conservation Fund	Montana	367	

* CCB: Climate Community & Biodiversity; CCX: Chicago Climate Exchange; CAR: Climate Action Reserve; ACR: American Climate Registry; VCS: Verified Carbon Standard.

Appendix 5: Dominant carbon standards in the US

American Carbon Registry (ACR)[35]

The genesis of the ACR (GHG Registry) was established in 1996, making the ACR the oldest registry of its kind in the US. Today, the ACR is managed by Winrock International, a large not-for-profit with a strong focus on sustainability and community development. To date, 29 projects and over 31 million Offsets (referred to as Emissions Reduction Tonnes, or ERT's) have been registered. Approved projects include methane destruction activities, energy efficiency projects and fuel switching activities. Only one forest project has been approved.

The ACR requires developers to adhere to approved Standards and Methodologies. Three standards, being the ACR Standard v2.1, Forest Carbon Project Standard v2.1 and Livestock Waste Management Standard v1.0, have been approved. Six Methodologies have been approved, including 'Improved forest management on US timberlands' and 'Afforestation and reforestation of degraded lands'. A further four methodologies are well advanced and three are under development. Project developers can submit their own Methodologies for consideration.

Climate Action Reserve (CAR)[36]

Established in 2008, this not-for-profit has established itself as a dominant Offsets registry and protocol developer within the US. To date, 95 Projects and close to 13 million Offsets (referred to as Climate Reserve Tonnes, or CRT's) have been registered. The CAR requires project developers to adhere to approved Protocols. Eleven Protocols have been developed and adopted, including for Forest, Urban Forest, Livestock (manure/methane), Landfill (methane combustion), Nitric Acid production, Organic waste composting, Organic waste digestion, and destruction of ozone depleting substances. A further four protocols are under development, including Cropland management, Nutrient management and Rice cultivation.

The focus to date has been on US projects, with some recent extension of activities into Mexico. Importantly, the CAR has close links to the Californian Cap-and-Trade and a number of its protocols have been used as the basis for protocols proposed for adoption by the ARB. Additionally, certain offset activities carried out in accordance with CAR protocols, including forestry projects, are likely to be eligible for recognition under the Californian Cap-and-Trade. This has driven strong interest in trade of CAR Offsets and registration of new projects.

Chicago climate exchange (CCX)[37]

The CCX was established in 2003 with a view to creating a platform for voluntary emissions reporting, reduction and offsetting. During mid-2010, following a buy-out by Intercontinental Exchange, the CCX's Offset recognition and trading activities began to be wound back and, at the time of writing, have essentially ceased. In its seven years of operations, the CCX registered 336 Projects, including 32 forestry-related Projects generating some 11.6 million Offsets. Uniquely, the CCX included emitters who committed themselves to binding emissions reduction targets, including through Offset purchases.

[35] http://www.americancarbonregistry.org/carbon-registry
[36] http://www.climateactionreserve.org/
[37] http://www.chicagoclimatex.com/

The CCX considered a range of offsetting activities from around the world, including forestry, methane destruction, soil carbon management, energy efficiency, destruction of ozone depleting substances, renewable energy, and range-lands management. Project developers were required to adhere to CCX protocols. These were, however, not published. From personal experience, this made it difficult for project proponents to engage with the CCX, since no clear guidance on project structure, methodologies and verification processes was available. A number of Participants also suggested this lack of transparency reduced the perceived value of CCX Offsets, as it was difficult to independently assess their integrity.

Climate, Community & Biodiversity Standard (CCB)[38]

The CCB standard, established in 2003, is administered as a partnership between several conservation organisations, including Conservation International, CARE, the Nature Conservancy, Rainforest Alliance and the Wildlife Conservation Society. To date, 37 projects have been validated under the CCB standard, including 32 forest related projects.

Importantly, the CCB standard has not been designed as a tool for independent verification, and recognition, of Offsets. Instead, the focus is on confirming that projects do deliver a net greenhouse gas reduction and confirming claims that co-benefits, such as socio-economic outcomes and environmental benefits, are delivered. Typically, project proponents interested in achieving both CCB standard recognition and verified Offsets will undertake a dual verification process and include a second standard for Offsets recognition (e.g. ACR, CAR, VCS).

Verified Carbon Standard (VCS)[39]

The Verified Carbon Standard (VCS), formerly referred to as the Voluntary Carbon Standard, was founded in 2005, with the first version of the standard published in 2007. Since that time, the VCS has grown to arguably become the dominant, most widely recognised, voluntary standard globally. Some 588 Projects are currently registered from around the world, with anticipated Offsets exceeding 60 million tonnes. Seven of these projects are forestry related.

The VCS requires developers to meet the requirements of the latest version of the standard: 'Verified Carbon Standard Version 3.0'. Additionally, forestry developers must adhere to the latest version of VCS' 'Agriculture, Forestry and Other Land Use Requirements' and have their project-specific methodology approved through a double verification process, or adopt a methodology previously approved by VCS. Presently, nine methodologies have been approved that focus on improved forest management, or avoided deforestation. No methodology is yet available for afforestation/reforestation. The VCS does, however, recognise methodologies approved under the Clean Development Mechanism[40] and the Climate Action Reserve.

[38] http://www.climate-standards.org/index.html

[39] http://www.v-c-s.org

[40] http://cdm.unfccc.int/methodologies/index.html