A Discussion Paper on the Feasibility of Funding Riparian Restoration with Revenue Sourced from Carbon Credits

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Acknowledgements

Offsetters is pleased to present this discussion paper on the feasibility of funding riparian restoration with revenue sourced from carbon credits for the Fraser Salmon & Watersheds Program.

Due to the dynamic nature of this sector and the short timeline to research this paper, many of the individuals interviewed for this discussion paper preferred neither to be quoted nor to reveal the name of the organization for which they work. The authors have therefore decided that it would be fair to keep all names anonymous, with organizational names only mentioned in the text where authorized and purposeful. Grateful thanks are offered to all interview subjects that gave so generously of their time to provide input into this subject.

List of Abbreviations

CCAR	California Climate Action Registry
CDM	Clean Development Mechanism
CER	Certified Emissions Reduction
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
lCER	Long Term Certified Emission Reduction
tCER	Temporary Emission Reduction
ERA	Ecosystem Restoration Associates
FAO	Food and Agriculture Organization
GHG	Greenhouse Gas Emissions
IETA	International Emissions Trading Association
IIED	Int'l Institute for Environment and Development
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
OTC	Over-The-Counter
REDD	Reduced Emissions
tCO2e	Tonnes of Carbon Dioxide Equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VER	Verified Emission Reduction
VCU	Voluntary Carbon Unit
WBCSD	World Business Council for Sustainable Development
WCI	Western Climate Initiative
WRI	World Resources Institute

EXECUTIVE SUMMARY

The debate around the issue of climate change has moved from the question of "is it really happening?" to "how can humans best reduce their greenhouse gas emissions to minimize their impact on Earth's climate?" Without question, the primary factor in anthropogenic climate change is humanity's heavy reliance on fossil fuels while increasing the uptake of renewable and efficient energy technologies is essential in combating this threat.

Forests also play a central role in the climate change debate. Forests are among the largest stores of carbon on the planet. When plants grow, they remove carbon dioxide from the air like no other mechanism; when they die, however, these carbon stores are released back into the atmosphere. Today, deforestation is one of the largest sources of greenhouse gas emissions into the atmosphere. Tools to combat it – via reforestation, afforestation, and avoided deforestation - are among those commonly discussed in avoiding climate change.

The pros and cons, opportunities and challenges in using the carbon markets to promote riparian restoration are the focus of this report. There are many good reasons to restore riparian habitat. These systems provide food and habitat and a whole variety of ecosystem services for countless species, including humans. However, finding the funding to restore this habitat is not easy, and financing the restoration with carbon credits is an attractive option.

The global carbon market is growing rapidly. By putting a carbon value on both existing and future forests, we are able to pay the price to either maintain or replant these forests. The Province of British Columbia is also moving in this direction and plans to release regulations on forest-based carbon mechanisms in 2009.

The devil however, as always, is in the details. With standards in flux, and protocols yet to be determined, this document provides a general overview of the carbon markets, their central concepts and trends, and the role of forest-based carbon projects within them. This paper will also examine the risks and rewards associated with funding reforestation with carbon credits. In particular, it provides an examination of the carbon metrics here such as baseline, additionality, and permanence as well as other complicating factors such as land ownership and governance.

In order to conduct this research a review of the current literature was conducted, along with interviews with experts from the fields of forestry, finance, ecological restoration, and both government and non-governmental organizations.

INTRODUCTION

British Columbia is taking its place among the continental leaders in climate policy. Ranging from committing the provincial public sector to carbon neutrality by 2010, to its participation in a multi-state and multi-provincial cap and trade platform, to incentive programs and a carbon tax, British Columbia is part of a new regime in climate governance.

Years of debate are now coalescing into an emerging consensus around the urgent need to reduce global CO2e emissions. Even those parts of the planet that were formerly considered relatively immune to the effects of increased greenhouse gas (GHG) concentrations are revealing their vulnerability. Recent studies have shown that even Antarctica is demonstrating a warming trend with some ice shelves "hanging by a thread" (BBC website, January 22, 2009). Closer to home, current research is suggesting that the arctic may be completely free of summer ice not by the "worst case scenario" of 2050 but rather by the much more alarming 2015. And closer yet, the pine beetle epidemic of British Columbia is now the pine beetle epidemic of North America, as a succession of warm winters enable the onward march of a species that seems impervious to all but the traditional cold Canadian winter.

The carbon market boasts several mechanisms that are designed to address the goals of reduced GHGs. However, the landscape of the carbon market is dynamic at all levels of governance and the potential impacts that new mechanisms may have on the environment, communities, and economy are significant. Therefore British Columbia must craft an innovative approach that weds global standards and best practices with solutions that suit local requirements.

The Bali Action Plan (UNFCCC website, January 19, 2009) calls for "new and additional resources" and "innovative finance mechanisms" to address urgent climate mitigation and adaptation needs. Forestry produces approximately 17 per cent of global emissions, making it the third largest source of GHGs – larger than the entire global transport sector (Eliasch Review).[1] The inclusion of the forest sector in global carbon markets, according to the Eliasch Review, must be a central element in creating new mechanisms. In doing so, the cost of lowering atmospheric GHG concentrations will be reduced substantially, and lower costs will mean that a more ambitious overall emissions target will be possible.

While international efforts are focused largely on tropical forests, parallel discussions are taking place in BC where the Provincial Government is in the process of drawing up regulations around the offsets market. As with any emerging market, there are

[1] The Eliasch Review is an independent report to the UK government, commissioned by the Prime Minister and prepared by Johan Eliasch with the support of the Office of Climate Change. The Review aims to provide a comprehensive analysis of international financing to reduce forest loss and its associated impacts on climate change. It does so with particular reference to the international efforts to achieve a new global climate change agreement in Copenhagen at the end of 2009. The Review focuses on the scale of finance required to produce significant reductions in forest carbon emissions, and the mechanisms that, if designed well, can achieve this effectively to help meet a global climate stabilisation target. It also examines how mechanisms to address forest loss can contribute to poverty reduction, as well as the importance of preserving other ecosystem services such as biodiversity and water services.

dilemmas and debates around this system and what precisely constitutes a high quality carbon credit and transaction platform. Some of the questions that need to be addressed include

- Are carbon credit markets in general a valid and effective means to address climate change?
- Assuming that reforestation is indeed a valid and effective way to combat climate change, are carbon credits a well-founded means to promote this or are different mechanisms needed?
- How can we ensure that projects do not trade off climate benefit against local social and environmental detriment?
- Are there international standards/protocols/methodologies that should be employed in BC or do we need made-at-home solutions?

Explicit to this discussion is the fact that riparian systems are often overlooked in current regulation discussions but must be independently recognized as part of this forestry debate as integral components of the landscape. Forming a fundamental transition zone that connects land and water, the processes that occur in these areas provide critical services to both wildlife and human society. Therefore, there are increased risks as well as rewards associated with earning carbon credits by altering these systems.

There are myriad approaches to both mitigate against and adapt to anthropogenic climate change. This paper is focused on the role that forests, specifically riparian zones, can play in affecting climate change. In particular, the purpose of this discussion paper is to assess whether the funding of riparian restoration through carbon credits will further the Fraser Salmon & Watershed Program's stated goals around watershed habitat restoration and stewardship.

Utilizing the most current research and expert opinion, it will scrutinize this issue via the following approach

1. An evaluation of the carbon trading market, both internationally and within British Columbia's borders
2. An identification and assessment of the risks and benefits associated with earning carbon credits by restoring riparian areas
3. An assessment of the potential economic and practical feasibility of funding riparian restoration with carbon credits

CARBON TRADING

To suggest that the carbon market is growing rapidly would be an understatement. In 2008, 4.9 billion tonnes of carbon dioxide equivalent ($CO2e^2$) was monetized and traded, an 83% increase over 2007 (Point Carbon, January 14, 2009). To put this into a financial context, the carbon market's total value for 2008 was estimated at US$92bn, more than double what it was worth in 2007 (ibid).

Compliance vs. Voluntary

Carbon markets can be broadly broken down into two segments: compliance and voluntary.

In the **compliance** market, companies, governments or other entities buy carbon credits and/or emissions allowances in order to comply with caps on the total amount of GHG emissions that they are allowed to emit. Emissions trading, otherwise known as 'cap and trade', has emerged as a popular method of approaching emissions reductions. This is an administrative approach used to control pollution by means of providing economic incentives to achieve reductions of those pollutants.

Under this system a central body sets a limit or cap on the total amount of a pollutant to be emitted. Companies or groups are issued emission permits and hold an equivalent number of credits (or allowances) that represent their right to emit a specific amount. The total amount of allowances in the economy must not exceed the cap, thereby limiting emissions to that specific level. Inefficient companies that pollute more than their allocated amount are forced to buy credits from those that pollute less than their allocation. The transfer of these allowances is referred to as a trade. The intention of this is therefore to ensure that a polluter pays a penalty to emit, while the seller is rewarded for having reduced their emissions beyond their required amount (Montgomery, 1972).

The ultimate goal of such an emissions trading plan is to reduce emissions. Therefore the cap is customarily lowered over a given period of time with a specific overall emissions reduction target. While the cap is normally set through a political process, individual companies are free to choose how or if they will reduce their emissions. In theory, firms will choose the least costly way to comply with the emissions regulation, thereby creating incentives that reduce the cost of achieving a given pollution reduction goal (Wikipedia, January 18, 2009).

[2] Carbon dioxide equivalency is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO2 that would have the same global warming potential (GWP), when measured over a specified timescale (generally, 100 years).

Example of Cap & Trade: Likely the most successful example of a cap and trade system in the past is that which was brought about as a response to acid rain. Emissions of sulphur dioxide (SO2) and nitrogen oxides (NOx) have increased since the industrial revolution but it was not recognized until the 1960s that this was having a deleterious environmental impact. The principle cause of acid rain is sulphur and nitrogen compounds from human sources, such as electricity generation, factories, and motor vehicles. Coal power plants are one of the most polluting. The gases can be carried hundreds of kilometres in the atmosphere before they are converted to acids and deposited. Acid rain has been shown to have adverse impacts on forests, freshwater lakes, rivers, and soils as well as damaging buildings and having negative impacts on human health (Wikipedia).

The first emissions trading market was established in the United States by enactment of the Clean Air Act Amendments of 1990. The overall goal of the Acid Rain Program established by the Act was to achieve significant environmental and public health benefits through reductions in emissions of SO2 and NOx. In this regulatory scheme, every current polluting facility is given or may purchase on an open market an emissions allowance for each unit of a designated pollutant it emits. Operators can then install pollution control equipment and sell portions of their emissions allowances that they no longer need for their own operations, thereby recovering some of the capital cost of their investment in such equipment. The overall intention is therefore to provide operators an economic incentive to install pollution controls.

Through actions such as Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the Reduction of Sulphur Emissions and the U.S. Clean Air Act Amendments of 1990, by any objective measurement these have been a tremendous success. The air is cleaner and public health has improved most regions. Remarkably, U.S. emissions of SO2 have dropped by 35 per cent while the GDP has more than doubled since its debut (Clean Air Trust, 2009).

As an extension of this system, and under international protocols, are parallel processes called the Clean Development Mechanism (CDM) and Joint Implementation (JI). These provisions of the Kyoto Protocol [3] allow flexibility for developed countries within a trading scheme to invest in carbon reduction projects in other countries as a way of generating tradable carbon credits. These provisions will be mentioned again later in the discussion around forestry.

In the smaller **voluntary** market, individuals, companies, or governments purchase carbon offsets to mitigate their own GHG emissions, normally from those areas of their business that they can't reduce by other means. These often include emissions from transportation, utilities, paper, and other goods and services. A carbon offset is a project that reduces net emissions of greenhouse gas into the atmosphere relative to what these emissions would have been in the absence of the carbon markets. Offsets are commonly generated from installations of technologies such as biomass energy,

[3] The Kyoto Protocol is a 1997 international treaty which came into force in 2005, which binds most developed nations to a cap and trade system for the six major greenhouse gases.[20] (The United States is the only industrialized nation under Annex I which has not ratified and therefore is not bound by it.) Emission quotas were agreed by each participating country, with the intention of reducing their overall emissions by 5.2% of their 1990 levels by the end of 2012. Under the treaty, for the 5-year compliance period from 2008 until 2012,[21] nations that emit less than their quota will be able to sell emissions credits to nations that exceed their quota (Wikipedia).

hydroelectric dams, and wind farms in place of conventional heat and power systems with higher emissions profiles, or from creation or maintenance of carbon "sinks" such as forests. In the event that a project can be proven by a qualified third party verifier, using an objective standard, to generate real, quantifiable, additional, and permanent climate benefit, the project can qualify as an offset.

While the voluntary carbon markets may not currently be as large as their regulated counterparts, voluntary markets have, according to the State of the Voluntary Carbon Market (2008), shown themselves to be innovative, nimble, as well as controversial. There is significant misunderstanding around the voluntary carbon market. However, voluntary markets tend to represent and echo consumer demand for action on climate change (ibid). In this way they are reflective of the public's attitude toward climate change and have the potential to be an immediate resource as the struggle continues to implement a fully effective international climate change framework.

The voluntary carbon market can be further divided into two distinctive components: the Chicago Climate Exchange (CCX) and a more disaggregated over the counter (OTC) market. CCX is North America's only cap and trade system (CCX website) that organizations can voluntarily join. Outside of this formalized structure there are a wide range of voluntary transactions that are not guided by an emissions cap, and are largely found outside of any formal exchange.

The description of the voluntary markets as being smaller is a relative term as a comparison to the compliance market. However, as mentioned earlier, in terms of dollar value and tonnes traded, this is no insignificant market. While the voluntary carbon market was once likened to a 'wild west' by many analysts and writers, by 2007 market trends highlighted that "this frontier had become a settlement zone" (Hamilton et. al 2007). Customers in this area have become far more savvy about the opportunities and pitfalls in the carbon offset domain and stakeholders are working diligently to forge the rules of the game as well as structures to ensure smooth transactions (ibid).

Carbon offsets (offsets) are financial instruments representing a reduction in GHGs. One carbon offset represents the reduction of one metric tonne of carbon dioxide, or its equivalent in other greenhouse gases. Common offset projects are energy efficiency-based or fuel switching and can thus help to expedite and deepen investment in new and emerging low or no-emissions technologies.

Certification

A variety of methodologies are used for measuring and verifying emissions reductions, depending on project size, type, and location. In the voluntary market a diversity of industry standards including the Voluntary Carbon Standard (VCS), Green-e Climate, Gold Standard and others are emerging to provide verification and quality assurance. Third-party standards provide buyers with the assurance that a given carbon offset is real and authorized by other organizations and experts (Wikipedia). Different standards are best used for different types of projects. For example the California Climate Action

Registry (CCAR) has one of the most extensive methodologies specifically designed for forestry projects.

The emergence of standards and registries was a remarkable trend in 2007. Articles in the mainstream press highlighted various quality issues about offsets (the question of additionality – more on this later in the paper) in the market. In response, suppliers embraced an array of tools to produce high quality credits, ensuring their legitimacy (State of the Voluntary Carbon Markets, 2008).

This paper will not engage in philosophical questions pertaining to the commoditization and capitalization of nature – this point is moot as this type of valuing already exists as it has in resource allocation decisions for millennia. Instead, when examining this subject it is critical to address opportunity, challenge, and trade-off. There is a certain amount of risk in any market as demonstrated by the current crisis that is being witnessed in all credit markets today. In short, does the system demonstrate a clear potential to work?

Trends - Impact of the Obama Administration

It's very early in the Obama Administration but it is clear that this President intends to make substantial changes in the United States' approach to energy. While specific details are forthcoming, the Obama-Biden administration has laid out a comprehensive new energy plan that includes

- Help create five million new jobs by strategically investing $150 billion over the next ten years to catalyze private efforts to build a clean energy future
- Within 10 years save more oil than the US currently imports from the Middle East and Venezuela combined
- Put 1 million Plug-in Hybrid cars on the road by 2015
- Ensure that 10 percent of US electricity comes from renewable sources by 2012, and 25 percent by 2025
- Implement an economy-wide cap and trade program to reduce greenhouse gas emissions 80 percent by 2050

(White House Website)

While all of the above actions will impact the carbon markets, the cap and trade initiative all but ensures that the growth of these markets will continue to be rapid.

Carbon Trading in BC

"Effectively dealing with climate change will require a different approach – an approach where we collaborate with our partners to develop a market-based mechanism that will help us achieve regional goals while realizing economic opportunities."

BC Premier Gordon Campbell, April 2007

British Columbia has established targets for greenhouse gas (GHG) reduction, and enshrined these in law through the Greenhouse Gas Reduction Targets Act (BC Gov't website):

- By 2020, B.C. will reduce its greenhouse gas emissions by 33 per cent, compared to 2007 levels. In addition, legally binding targets for 2012 and 2016 will be set in 2009
- By 2050, GHG emissions in the Province will be reduced by at least 80 per cent below 2007 levels
- By 2010, the B.C. public sector will be carbon neutral

In order to achieve these reductions, British Columbia will employ a number of mechanisms, among them the purchase of carbon offsets. The drive to achieve the Province's greenhouse gas emission targets is led by the B.C. Climate Action Secretariat. Under this banner reside the other key areas that this government has identified as the pillars of their plan. This includes membership in the Western Climate Initiative (WCI) and a carbon neutral public sector initiative to be achieved through GHG management and reduction strategies introduced via the Ministry of Labour and Consumer Services and carbon offsets provided via the Pacific Carbon Trust (PCT).

The WCI, launched in February 2007, is a collaboration among seven US Governors and four Canadian Premiers. This enterprise was created to identify, evaluate, and implement collective and cooperative ways to reduce GHGs in the region, focusing on a market-based cap-and-trade system (WCI website).

The Pacific Carbon Trust is a provincial Crown Corporation set up by the B.C. government to acquire credible GHG offsets on its behalf and meet its carbon-neutral government sector target. The PCT, acting on behalf of the Province, will only acquire offsets from projects that are located in B.C. and that meet provincial eligibility criteria as defined by the Ministry of Environment (LiveSmart BC website).

FORESTS AND CLIMATE CHANGE

Before one can evaluate the various impacts of forest carbon, it is important to establish definitions and a baseline.

What is a "Forest"?

A number of issues can arise when defining what constitutes a "forest" in relation to forestry carbon project. For one, depending upon what definition one uses it can impact the amount of area that is deemed eligible for projects. The way that forest is defined can have impacts on the way that carbon accounting is conducted, as well as on what is meant by its associated terms **afforestation, reforestation** and **deforestation** (Watson et al, 2000).

As an example, the Intergovernmental Panel on Climate Change (IPCC) Special Report on Land Use, Land Use Change, and Forestry (LULUCF) states a method of defining a forest by setting a minimum percentage of tree canopy cover (ex: must have > 70% tree canopy cover). Thresholds must be chosen carefully as high/low levels can negatively affect carbon accounting (more on this later in deforestation/reforestation definitions) (Watson et al, 2000).

Forestry Projects

There are three types of forest carbon projects that are currently recognized by different offset standards. Each standard has its own specific name and definition for each project type, but the general areas are

- Afforestation and Reforestation/Restoration Projects
- Forest Management Practices Projects
- Avoided Deforestation/Reduced Emissions from Deforestation and Degradation (REDD)

Afforestation and reforestation projects

According to the Food and Agriculture Organization (FAO), both *afforestation* and *reforestation* involve the "artificial establishment of forest" on lands that were previously non-forested. The FAO distinguishes between project types in that afforestation occurs on lands that were not historically forested (ex: agricultural lands), while reforestation occurs on lands that used to be forests, but have been without cover for some time (Watson et al, 2000). The FAO defines a forest as >10 percent tree cover but it is easy to see how variations in this definition can affect whether a project is actually considered afforestation or reforestation.

The IPCC's definitions are very similar, but instead describe a change in land-use from non-forest to forest, again distinguishing the two based on historical forest cover or not (Watson et al, 2000). **Restoration** projects are simply another term describing reforestation. None of these projects apply to the regeneration of forest cover post-harvest. Each offset standard uses a specific term and definition to describe their

accepted project type. For example, under the California Climate Action Registry (CCAR) standard, reforestation projects are defined as the re-establishment of forest cover on lands that have been non-forested (less than 10% tree cover) for over 10 years (California Climate Action Registry, 2007).

Forest management practices

These are projects that incorporate carbon management into forest practices by reducing harvest levels or extending rotation ages. These changes allow for continued carbon storage and additional carbon sequestration, in essence allowing the forest to continue to play its natural role in sequestering and storing carbon from the atmosphere. Forest management projects allow for continued timber harvesting, but at a lower yield.

Avoided deforestation practices

The third type of forestry carbon project is **avoided deforestation**, which is often referred to as **Reduced Emissions from Deforestation and Degradation** (**REDD**). Deforestation, as defined by both the IPCC and FAO refers to the change or conversion of land cover from forested to non-forested (Watson, Noble, Bolin, Ravindranath, Verardo, & Dokken, 2000). Again, the threshold of what is considered a forest has implications in this definition. If a dense forest is heavily harvested, but left with tree coverage higher than the threshold, it may not be considered deforestation. Many offset standards further define deforestation to specify a change in land-use from forest to something else, such as agricultural or commercial development (California Climate Action Registry, 2007).

"Downstream" Carbon Storage vs. Forest Storage

A common question in forest carbon management is whether or not disturbance – in this case harvesting and replanting trees – results in an increase or decrease in carbon storage. To address this, we need a short discussion on how carbon flows function in a forest.

Carbon stored in a forest can be separated into a number of carbon "pools" that describe where it is kept. The major pools include trees, understory, woody debris, forest floor and soil. The total carbon in a forest system can then be further divided into "stable" and "liable" carbon. In a typical temperate forest, approximately 50 percent of the total carbon is stored in a stable soil pool and is very slow changing. The other 50 percent is made up of the other pools and can be released through decay and disturbance. Carbon can also be transferred out of a forest system through the harvesting of trees. When these trees are cut down, up to 65 percent of a forest's liable carbon can be removed. The remaining 35 percent - comprised of understory, shrubs and woody debris - is left in the forest where a large portion of this carbon is released as debris decays. During milling and processing, 50 percent of the removed carbon can subsequently be released, leaving 20-33 percent of the total liable carbon stored in wood products depending on harvesting and milling efficiency (Wayburn et al, 2007).

Carbon is then released from wood products through slow decay, at an average of 2 per cent per year (Wayburn, Franklin, Gordon, Binkley, Mladenoff, & Christensen Jr., 2007). This rate can vary depending on the product (Ximenes, 2006):

• Very Short-Term	Paper, formboard	(decayed in 3 yrs)
• Short-Term	Fencing, particleboard	(decayed in 10 yrs)
• Medium-Term	Treated pine, plywood	(decayed in 30 yrs)
• Long-Term	Softwood furniture, poles	(decayed in 50 yrs)
• Very Long-Term	House construction material	(decayed in 90 yrs)

A study in Australia found that wood products placed in landfills decay slower than lab experiments suggest. Excavation of three landfills found that wood products of 19, 29 and 46 years buried had only lost around 3.5 percent of their stored carbon (Ximenes, 2006).

Notably, according to Wayburn et al. (2007), repeated short rotation harvests will not produce a higher net carbon sequestration than a single long-term rotation (i.e. a single 90-year rotation stores more carbon than three 30-year rotations). Frequent harvesting causes on-site decay of forest carbon that can continue for up to 30 years. In order to achieve a net gain in sequestration, the carbon lost through decay must be replenished before harvesting occurs again (Wayburn et al, 2007).

While carbon may be continually stored in wood products after trees are cut down, carbon stored within the wood products pool is currently not accounted for under Kyoto or most other offset certification standards. However, it may receive consideration under the post-2012 climate regime. The IPCC Guidelines for accounting of wood product carbon is to assume "all C removed in wood and other biomass from forests is emitted in the year of harvest" (IPCC 1997 Vol 3 p5.17). However, this simplistic model does not reflect reality and it has significant implications for the use and effectiveness of carbon credits in the forestry sector. This challenge invites another: who will design a better system and when will it be ready to use?

Forestry in the current carbon market

As discussed earlier, carbon markets can be divided into two broad categories: compliance (regulatory) markets and voluntary markets. Regulatory markets involve parties under emissions reduction requirements, such as the Kyoto Protocol. Under "cap-and-trade" systems, participants can buy and sell emissions credits through allowance-based transactions (Taiyab, 2006). Forest projects have, so far, only played a limited role in regulatory markets. For example, the Clean Development Mechanism (CDM - an offset standard used with projects under Kyoto), had 827 projects registered as of 2007, with only 1 of these projects being forestry related.

While forest projects are more common amid the voluntary markets, from 2006 to 2007, afforestation and reforestation projects made up only around 2 per cent of the total transaction volumes of the over the counter voluntary markets. Most of this total volume came from "micro projects" of < 5,000 tCO2e/year (Ecosystem Marketplace, 2008).

International standards vs. made-at-home solutions

There are a host of carbon management standards ranging from the international to the regional level. It is this variety of standards that must be harmonized to achieve the best outcomes for B.C. To put the Province's position in context it is important to first understand the international regulatory regime.

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty that was produced at the United Nations Conference on Environment and Development in June 1992. The treaty is aimed at stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the global climate system.

The treaty as originally framed set no mandatory limits on GHG for individual nations and contained no enforcement provisions. These actions were aimed primarily at industrialized countries, with the intention of stabilizing their GHG emissions at 1990 levels by the year 2000. The Kyoto Protocol was adopted in December 1997 and entered into force on February 16, 2005. Under Kyoto, industrialized countries agreed to reduce their collective GHG emissions by 5.2 percent compared to the baseline year, 1990.

It is Kyoto that defines "flexible mechanisms" such as the Clean Development Mechanism (CDM), Emissions Trading, and Joint Implementation (JI) to allow Annex 1[4] economies to meet their GHG targets by purchasing emission reduction credits from elsewhere, through financial exchanges. These are projects that reduce emissions in non-Annex 1 economies, from other Annex 1 countries, or from Annex 1 countries with excess allowances (Wikipedia, January 25, 2009). As Kyoto runs out the Bali Action Plan comes into play with an expected binding agreement to be signed in Denmark in late 2009. Some of the key decisions and supporting activities will be

- Forests – Policy approaches and positive incentives to protect forests, reducing emissions from deforestation in developing countries
- Adaptation – Measures to protect poorer countries against the impacts of climate change
- Technology Transfer – Facilitate transfer of clean technologies from industrialized nations to developing countries

As indicated in the list above, forests play a key role under the Bali program. One powerful tool designed to reduce global emissions due to deforestation is the Reduced Emissions from Deforestation and Degradation (REDD) program mentioned earlier in this paper. REDD presents a strong tool to developing countries to protect and preserve their forests. One challenge to generating offsets in British Columbia is that, due to Canada's status as an Annex 1 (developed) country, domestic projects are not subject to all of the possible benefits of international initiatives around carbon management. For example, in the current scenario Canadian projects cannot qualify as

[4] Under the United Nations Framework Convention on Climate Change Annex 1 countries are those signatory nations defined as being industrialized.

Gold Standard for Voluntary Offsets (VER), as this is applicable only to countries that do not have emission reduction targets under the Kyoto Protocol ("Differences Between the Gold Standard for CDM Projects and the Gold Standard for Voluntary Offsets"). Nor do Canadian projects meet the requirements of the CDM (the projects themselves must take place in developing countries). Thus, while REDD will play an important role for forests globally, in its current form it will have no specific impact upon forests in B.C.

The CDM issues Certified Emission Reductions (CERs), carbon credits for emission reductions achieved by CDM projects. Annex 1 countries can use CERs to comply with their emission limitation targets. CERs can be held by governmental and private entities. CERs are considered either long-term (lCER) or temporary (tCER), depending upon the likely duration of their benefit. Both types of CER can be purchased from the primary (original party making the reduction) or secondary market (resold in the marketplace).

Under the CDM, there is broad consensus that emission permits created through afforestation and reforestation (AR) projects are not necessarily a permanent offset to industrial emissions of GHGs. Taking a position that might be instructive for B.C., the Parties to the UNFCCC agree largely that CERs from AR projects should reflect the temporary nature of carbon and therefore have a limited validity (Dutschke and Schlamadinger, 2003).

A consideration therefore is that tCERs are a new type of carbon credit that is not fungible[5] with any other emission permits. While other emission permits offset GHG emissions once and forever, tCERs only allow for a break in liability for emissions. The effect of the break is that in the second commitment period the liability for emissions compensated through tCERs used in the first commitment period will arise anew (ibid).

One of the most recognized of the voluntary standards is the Voluntary Carbon Standard (VCS). Founded by The Climate Group, the International Emissions Trading Association (IETA) and the World Business Council for Sustainable Development, the VCS is a global standard for voluntary offset projects and establishes criteria around validating, measuring, and monitoring. To recognize credible work that has gone into developing GHG Programs around the world, the VCS program has a process for recognizing GHG Programs that meet VCS criteria. GHG Programs must pass a gap analysis against the VCS in order to be approved. The following programs are approved under the VCS (VCS Website).

- UNFCCC Clean Development Mechanism
- UNFCCC Joint Implementation
- California Climate Action Registry

[5] Fungibility is the property of a good or a commodity whose individual units are capable of mutual substitution. Examples of highly fungible commodities are crude oil, wheat, orange juice, precious metals, and currencies. Fungibility has nothing to do with the ability to exchange one commodity for another different commodity. It refers only to the ease of exchanging one unit of a commodity with another unit of the same commodity (Wikipedia).

An advantage of the VCS program is that the projects can take place anywhere, including developed countries; so B.C.-based projects and credits can carry this quality label.

Impacting BC directly will be a North American emissions reduction cap-and-trade initiative called the Western Climate Initiative (WCI) that was mentioned earlier in the paper. It is this initiative that will dictate how the rules and regulations of the carbon market will play out in BC. The first phase of this plan will be implemented in 2012, followed by a broader cap on carbon emissions in 2015. The WCI has set a goal of reducing GHGs by 15 percent from 2005 levels by 2020.

Specific to this discussion, a North-America wide standard is currently being developed between the Canadian Institute of Forestry and the Society of American Foresters. The new consensus standards will bring together existing and emerging protocols from state, provincial, regional, and national climate policies and programs to create a single set of forest carbon accounting rules that can be broadly applied in sustainably managed forests and long-term forest products in the US and Canada. One UBC-based expert has suggested that this may become the forestry standard for North America.

IDENTIFICATION AND ASSESSMENT OF RISK

Riparian systems are essential parts of the landscape and the processes that occur in these areas provide critical services to both wildlife and human society. In addition to their broader role in regulating Earth's climate, forest systems deliver a host of ecosystem services such as maintaining soil stability, regulating local rainfall, flood control, and supporting high levels of biodiversity. Therefore there are potential risks and rewards associated with earning carbon credits by altering these areas.

There are additional social and economic risks associated with engaging in a carbon credit program that will take several decades to realize the promised carbon benefit and will require perpetual land allocation and monitoring to ensure the viability of these carbon stores.

Ecological Risks and Rewards

"This is without a doubt the most significant natural disaster to ever hit British Columbia's forests. We expect that by 2013, about 80 per cent of our mature natural pine will have been infested by the mountain pine beetle, ... This requires all of us to take unprecedented actions and to think in unprecedented ways."

- BC Premier Gordon Campbell -

The global ecological stakes around deforestation couldn't be higher. According to the Eliasch Review, if the international community does nothing to reduce deforestation, modelling estimates that the global economic cost of climate change caused by deforestation could reach $1 trillion per year by 2100. This is additional impact to that of industrial emissions. The Review goes on to point out that, without tackling forest loss, it is highly unlikely that we could achieve stabilization of GHG concentrations in the atmosphere at a level that avoids the worst effects of climate change.

Common concerns and questions arose from all interview respondents when questioned about the risks of this type of project

- What is the baseline?
- Define the additionality case
- What are the biodiversity and hydrologic implications?

Healthy forests are vital, and increasingly rare. BC's forests are under stress – the mountain pine beetle has changed over 130,000 km2 of pine forest from a carbon sink to a carbon source, as these dying trees release their stored carbon back into the atmosphere. Recent studies have shown that even undisturbed old-growth forests are reacting poorly to climate change (more on this later). There are a host of good reasons to restore disturbed riparian habitat, but the question here is whether it can and should be funded with carbon credits.

For the purposes of this paper, certain assumptions about the site and restoration process are made in order to clarify and simplify the analysis:

- The selected site is already disturbed – having been logged and/or degraded, and likely containing a mix of non-climax species, including invasive
- The site remediation is conducted in an ecologically appropriate and sensitive manner
    - Only identified individual trees and shrubs removed
    - Entry and exit is done sensitively (non-mechanically) in order to reduce disturbance and soil compaction
    - Use of chemical herbicide is minimized or eliminated entirely
- Appropriate site-specific species are utilized
- Appropriate maintenance is performed to ensure the growth and uptake of those species

Respondents interviewed for this paper were unanimous in their support for riparian restoration when it was undertaken for reasons of ecosystem services and biodiversity and when it could be demonstrated to enable rather than hinder healthy forest development. This type of restoration, if done correctly, can speed natural processes up and improve habitat, particularly when invasive species are interfering. Ecologically speaking, riparian restoration provides many benefits.

An additional concern with any type of ecological restoration is a temporal one - climate change is already impacting and changing ecosystems, often displacing the traditional regimes. In order to plant the most appropriate species, one must consider any imminent changes to the local climate. A recently published study of undisturbed old-growth forests in Western North America in the journal Science has demonstrated that tree mortality rates in that area have "more than doubled since 1955" (Harmon 2008). The researchers were able to identify a rise in regional temperatures as the most likely culprit in their demise after ruling out other "possible suspects such as air pollution and forest management practices" (ibid).

Attributing the mortality rates to climate change, researchers pointed out that the loss of old growth trees could have implications for the ecology of the area and, more particularly, for the carbon storage of those forests. It was further highlighted that though the average regional temperature was a mere 0.6 degree Celsius warmer, this translated into "less snow, longer dry seasons, and increased soil evaporation, which stress out trees, making them more vulnerable to destructive insects and disease." At the same time, as Kenneth Raffa a professor of forest entomology from the University of Wisconsin pointed out "bugs and pathogens, which thrive in hotter temperatures grow stronger, making them an even bigger threat to the fading forests" (ibid).

Old-growth forests currently help to mitigate climate change by absorbing CO2, but if these trends continue then these carbon sinks may "actually become a net source of carbon in the atmosphere, a phenomenon that has already been observed in tropical climates" (ibid).

In short, on the understanding that the process, species selection, and maintenance are the same whether one is restoring habitats for carbon sequestration as for other ecological priorities, the same positive benefits are to be expected. Therefore these areas should be expected to provide better habitat, increased nutrient values, and reduced sedimentation to benefit salmonids and other native species.

Carbon storage vs. biodiversity?

Riparian restoration has strong triple bottom line potential. According to many of the respondents to this research, the corollary benefits of this type of restoration far outstrip those of CO2 sequestration. Indeed, as one respondent put it "we're so caught up in climate change that we're not testing to see if people will pay for other ecosystem services." Furthermore, if there's any risk of reversal around the carbon credits associated with these projects then perhaps those dollars should be put into more reliable emissions reduction projects.

The concept of paying for environmental services (PES) is being explored on several fronts. Biodiversity markets have been established in the U.S. and Australia to internalize the public cost of biodiversity destruction into private decision making. Like the carbon market, there are both regulated and voluntary markets for biodiversity. Based on the premise that the loss of biodiversity is, at least in part, due to economic forces, these "programs allow actors to restore land and sell the associated conservation benefits, biodiversity markets better inform economic decision making around land use options. In effect, markets for biodiversity conservation provide a price signal that presents conservation as an economically rational land use option in high biodiversity areas" (TZ1 website).

Canadian policy makers may wish to look to the NSW (Australia) Department of Primary Industries, who have established commercially planted forests for timber and carbon that can be supplemented by a range of non-commercial benefits. Plantings of this kind on Kyoto-compatible sites will generate carbon rights, and some forests are planted with no expectation of a commercial harvest. Salinity credits and carbon rights, combined with enhanced biodiversity, may be sufficient to underpin the investment (Government of NSW website).

Whether restoring degraded riparian zones for ecosystem health or carbon as the top priority, the process is the same. Vancouver-based Ecosystem Restoration Associates (ERA) maintains that it has a 95 percent confidence level, complete with a third-party validation and certification under the ISO 14064-2, with regard to its assessment of the carbon sequestration values of the projects it oversees. Its projects are registered under the Canadian Standards Association GHG CleanProjects Registry (http://www.ghgregistries.ca/cleanprojects/index_e.cfm). In addition to this, it holds back 25 percent of the possible credits in reserve in case of any unexpected reversal.

In theory, representatives of the BC Ministry of Forests and Range supported this approach to riparian restoration. While cautious to point out that ecological restoration is highly case-specific, if done properly then this work can add real value, including from the point of view of carbon. Where they did offer some resistance, however, was around the idea that biometrics[6] can provide highly accurate sequestration figures. These Ministry officials suggested that the growth curves involved in such calculations depend on too many factors to be highly accurate. They also pointed out that, while

[6] Forest biometrics is the science of forest measurement – in this case measuring carbon sequestration

riparian zones are indeed highly productive sites, they are also correspondingly difficult to repair and maintain.

This would appear to be an area of some contention as support for the accuracy of carbon measurement in forest systems was communicated by a member of the UBC faculty who mentioned that accurate models of growth and yield curves do exist. This is something that must be clearly built into any forestry carbon standard.

The notion of a portfolio approach, that the myriad of ecosystem services performed by riparian systems ought to be valued over a carbon isolation approach, is one that often arose with stakeholders. This kind of thinking around combining ecosystem services and regulation is still an interesting idea that has already begun to take root (as per above) and worth investigating further and as this might be a way forward for something as complex as riparian zones.

Additionality

One key question that must be asked is what are the economic risks associated with planting trees today for the carbon values that will develop over the next decades? This calls into play two critical features of any carbon offset, additionality and permanence. There is also the question of opportunity cost: If atmospheric CO2 concentrations need to be reduced now, what opportunities are we passing up by investing time, money, and human resources into these projects that will not generate any significant climate benefit for the next 10-20 years?

In order for any type of carbon project to produce marketable credits, the project designers must prove that the carbon reductions claimed would not have occurred had the project not taken place (Nabuurs, 2007). A project's *additionality* is therefore proven by showing that actions undertaken overcome the "business-as-usual (BAU)" scenario (Sheehan, 2007).

There are a number of different methods used to test a project's additionality. Each offset standard has their own specific requirements, however, some commonly used tests include (Kollmuss, Zink, & Polycarp, 2008):

- Regulatory Surplus Test
    - Project activities are compared with what is required by law/regulation
    - Additional = must not be required by law; must exceed regulation
- Investment Test
    - Financial test of the returns associated with a project
    - Additional = carbon revenues required to make the project activities financially viable
- Barrier Test
    - Analysis of technology, labor, and risk of project
        - *Typically only used if a project fails the Investment Test*
    - Additional = project must demonstrate that some sort of barrier exists preventing project implementation
- Common Practice Test

- Project activities compared with other projects in the region that lack carbon finance, to ensure they're not common practice

Proving additionality of restoration projects can be, and will continue to be, difficult in that project designers must demonstrate that the restoration efforts would not have taken place anyway for reasons other than sequestration of carbon. For example, the Haida Gwaii Climate Forest Pilot Project aims to restore 5,000-10,000 ha of riparian habitat by replacing red alder with a mixed-conifer forest, more representative of the pre-harvest conditions that existed there. The Haida also aim to generate revenue through the sale of carbon credits sequestered by these new forests. According to one analyst, because the fundamental project aim is to restore old-growth forests on Haida Gwaii for cultural purposes, the additionality of this project is difficult to prove (van Kooten, 2008). That said, van Kooten appears to seek too much of the additionality mechanism.

Additionality is not designed to assure the buyer of carbon credits that there are *no other values* – social or environmental – that would prompt an interest in reforestation; instead, the additionality mechanism serves to clarify that these other interests would *not themselves be sufficient* to promote the same level of reforestation even in the absence of the carbon market. In other words, if the reforestation project goes ahead because funds are raised through the carbon markets then the project is additional, even if the Haida secretly – or not so secretly – wanted the planting done for other reasons.

Another aspect of additionality that has been a source of controversy is the establishment of baselines. A baseline refers to the level of carbon emissions/sequestration that would occur under the business-as-usual scenario (Sheehan, 2007). It is used in comparison to a project's projected carbon reductions to measure additionality, as well as determine the quantity of carbon credits produced. However, estimation of baselines can vary significantly depending on a number of assumptions including start date and included carbon pools (soil, shrubs, humus layers, etc) (Nabuurs, 2007). Each offset standard typically has it's own methodologies for estimating baselines. Also, as baselines are future predictions, they cannot be absolutely confirmed. Instead, they can only be credible cases, which leave room for disagreement. The BC Government is gathering and developing their own protocols and baseline criteria for various offset project types, possibly including forestry. However, according to one UBC expert, anything approaching a specific methodology for carbon forestry projects is a long way off.

Permanence

One of the major technical issues involved with developing a forest carbon project is addressing the question of permanence (Aukland & Moura Costa). Permanence refers to the length of time stored carbon will remain in a carbon sink. Terrestrial sinks such as trees and forests are subject to disturbances, which can release sequestered carbon back into the atmosphere. Forest disturbances can be both natural (fires, insect damage, windthrow, etc.) and human-caused (harvesting, land-use changes, and some forest fires) (Aukland & Moura Costa). While effects of disturbances can be addressed

in the project design and mitigated through directed management, there is no way to guarantee the continued existence of terrestrial carbon sinks (Aukland & Moura Costa).

This uncertainty has implications in the sale of forest carbon credits in both risk and liability. Forest credits carry more risk for both the buyer and seller than credits produced by other types of projects (van Kooten, 2008). As a result, many buyers do not trust these credits enough to purchase them (VanderKlippe, 2009). Also, if terrestrial sinks are destroyed prematurely, there remains the question of who is liable to replace them. This is particularly important if the buyer is applying these credits towards an emissions reduction requirement.

Ex-Ante and Ex-post

One way to better insure against carbon losses from disturbances is to sell credits *ex-post* instead of *ex-ante*. Ex-post credits are those sold after the sequestration has already taken place, while ex-ante credits are sold ahead of time with the assumption that the sequestration will take occur. Ex-post credits delay any economic returns and carry more risk to the seller in that the large initial investment is made without any guaranteed knowledge of potential market demand or price at the time of sale (Kollmuss, Zink, & Polycarp, 2008). However, given the sequestration has already occurred, there is less buyer's risk making them more attractive for purchase (Kollmuss, Zink, & Polycarp, 2008). By their very nature forestry carbon credits can't be guaranteed infinite permanence. Any credits can only be guaranteed for a determined amount of time. Furthermore, it is unlikely that a proponent would be able to finance ex-post credits for their buyers, waiting decades after investing time and money into the initial project activity before being able to sell.

There are also forms of ex-ante credits that reduce buyer's risk from loss. In order to insure against any possible reversal, companies will often hold back a percentage of the credits available to them. Sellers can use this "buffer approach," whereby a portion of a project's sequestered carbon is kept from sale and made available to replace any credits lost due to unexpected causes (Kollmuss, Zink, & Polycarp, 2008). This assigns liability to the seller, reducing risk on that part of the buyer.

In order to insure against any possible reversal, companies will often hold back a percentage of the credits available to them. Indeed this is how the private restoration firm, ERA, runs its carbon business. It holds back 25 percent of its carbon credits as a buffer against any kind of reversal (forest failure).

When considering forest credits one ex-forester and current consultant echoed this and outlined how the "advance selling of carbon is risky – it's a heavily discounted product. These projects could possibly be carbon emitters for the first 20 years before any sequestration begins to occur. Therefore you could be selling carbon that is 20-50 years in the future. The benefit of restoration in part eases this, because it's a good thing to do. But the question remains "is this additionality?" This same forester suggested "it certainly seems to push a triple bottom line by accelerating the natural processes, but not immediately."

Land Ownership and Governance

A crucial building block combines strong governance and effective mechanisms for the distribution of finance to reduce forest loss. Eliasch (2008) points out that sovereign nations need to take the lead in implementing a successful system to tackle deforestation. Key areas of reform include clarifying and securing land tenure rights and strengthening the institutional capacity of national, regional and local institutions. The full participation of forest-based communities will make reforms more likely to succeed and benefit the local population.

According to one ex-forester that now does consulting in this area: "Ownership – this is the lynchpin! If this is private land it's easy. Crown land, however, is a different matter. Who's going to own the carbon, and who's going to be able to claim the stumpage[7]? One risk is that you take all the value away from stumpage."

Carbon ownership on Crown land is currently being disputed within the Federal and Provincial governments. The Federal Government states that "…forest sinks are a 'national treasure' and as the Federal Government is the 'Party' to the Kyoto agreement; it owns the rights to forest credits" (Sheehan, 2007). At the same time, the Provincial Government claims it is has jurisdiction. To add to the confusion, the nature of forest licenses on Crown land, as well as aboriginal land claims add additional complications within B.C. The Province and the WCI must work out these types of details before any of these issues can be solved.

This point was echoed by nearly all of the respondents in this research. One respondent with two decades experience as a forester and who now consults on riparian restoration went further and stated "terms of reference for riparian-based carbon sequestration projects have yet to be articulated by WCI and have yet to be explicitly recognized by PCT eligibility criteria. I am not aware of any risk assessment analysis of Riparian-derived carbon credits. Explicit recognition of Riparian-based carbon sequestration projects will likely require special lobby to the BC Climate Action Secretariat."

Credit ownership has been an issue surrounding forest carbon projects all around the world. In 2002, Australia aimed to settle this problem by enacting the Carbon Rights Bill of 2002. This bill created "carbon rights" and "carbon covenants." Carbon rights are legal interests in the carbon sequestered on a piece of land, separate from the ownership of the land. The carbon covenants are the agreements between landowners and owner of carbon rights. Once a carbon right is registered in a State registry, the owner of that right is entitled to any benefits of sequestration (Stevenson).

A similar system could be established in Canada. Legal Scholar Stewart Elgie believes similar legislation could be passed by the Provincial Government, defining what rights exists, who owns them and how they can be transferred (Sheehan, 2007). Elgie says these rights will likely go to those that own or have rights to the trees, being the government, First Nations groups or forest licensees.

[7] Stumpage is the price charged by a land owner to companies or operators for the right to harvest timber on that land. Stumpage used to be calculated on a "per stump" basis (hence the name). It is now usually charged by board feet or by cubic metres (Wikipedia).

Job creation opportunities

If properly designed, forest carbon projects have the potential to generate new sources of employment for nearby rural communities (Sheehan, 2007). All forest sector activities are labour intensive and can provide a number of skilled/non-skilled labour positions (Binkley, et al., 2002). The overall number of positions generated depends on the scale and type of project. Restoration projects involve reforestation activities, including removal of invasive species, seeding and planting of saplings, as well as fertilization and other silvicultural treatments. Forest carbon projects can also indirectly generate employment by stimulating other ecosystem services such as harvesting of non-timber forest products. Projects in delicate riparian zones may require increased labour due to the decreased reliance on mechanization in these circumstances.

Monitoring and maintenance

One of the major milestones of any effective forest carbon management is the transparent and accurate measurement and monitoring of forest emissions reductions. Emission inventories need to be comprehensive and internationally consistent to enable verification of emissions reductions. Using appropriate techniques, forest emissions can be estimated with similar confidence to emissions estimates in other sectors. However, this will require substantial capacity building (Eliasch Review, p 3).

Most carbon offset standards currently available require carbon projects to be monitored and verified. Monitoring and verification serves as an ex-post confirmation that the project is performing as expected (Kollmuss, Zink, & Polycarp, 2008). The specific requirements vary between the different standards, but generally involve the development of a monitoring plan and regularly scheduled reporting. The CDM standard leaves the timeframe of these reports open-ended, while other standards such as the California Climate Action Registry (CCAR) require reports to be made annually (Kollmuss, Zink, & Polycarp, 2008). Forestry projects are typically more expensive to monitor than other types of carbon projects due to the difficulty in obtaining accurate measurements (Antinori & Sathaye, 2006).

In addition to monitoring reports, many (but not all) standards require regular verification of projects by 3rd party auditors as a further means to ensure project quality. Verifiers review these project monitoring reports and make sure the methodologies developed in the project design are being carried out. These verifiers are often certified by individual offset standards to ensure accurate verification. While not all standards require a 3rd party auditor, it is increasingly called for by credit buyers (Ecosystem Marketplace, 2008). B.C. private restoration firms like ERA will sign a 100 year agreement with a municipality to ensure that appropriate maintenance is being performed on these sites.

COSTS OF CARBON FORESTRY

The costs associated with a carbon project can be broken down into Project Preparation Costs, Project Implementation Costs, and Monitoring and Verification Costs.

Project Preparation Costs

The project preparation costs are the expense associated with project design and registration. Transaction costs refer generally to costs of trade beyond the materials costs of the product, such as the costs of searching for projects, project partners, negotiation, monitoring, and regulatory approval (Antinori and Sathaye, 2007). Forestry project transaction costs are often less expensive than with other carbon project types, however, they still make up a large portion of the overall costs. These costs or design steps include

1. Initial project assessment
2. Preparation of project design document (PDD)
3. Contract negotiation
4. Validation by 3rd party auditor
5. Registration with offset standard

Initial project assessment involves search costs as well a checking a project's eligibility and feasibility before further project development begins (CCPO, 2005). This includes economic, environmental, and engineering feasibility studies (Andrasko, Sathaye and Antinori). Search costs may increase in the future as the "easy" projects are used up (Antinori & Sathaye, 2006).

Preparation of the project design document (PDD) can be one of the largest costs involved in project development as it involves extensive analysis. The PDD is the document presented to the offset standard agency in order to apply for registration (ibid). The PDD typically includes analysis such as baseline establishment and demonstrating additionality. Preparation of PDDs for standard CDM projects can cost between $6,500 and $86,000 depending on the project scale (ibid).

Offset standards will often require projects to be validated by a 3rd party before registration (ex: CCAR, CDM). This validation can be expensive: standard CDM projects cost from $6,300 to $24,000 (ibid).

Each offset standard typically has project submission and registration fees. Submission fees are usually a flat rate (ex: CDM charges $1,000 with project document submission). Registration fees vary with project size and some standards have a minimum size under which no fee is applied.

Contract negotiation includes the legal and contractual costs associated with drafting contracts over credit for owners and risk mitigation. This stage can often be the second most expensive to complete, next to preparing the PDD (ibid). Developing an Emission Reduction Purchase Agreement (ERPA) for a CDM project can cost between $4,800 and $55,000 depending on project size (ibid).

Project Implementation Costs

Project implementation costs are all expenses associated with getting the project going after registration, including silvicultural costs and measurement. Most standards dictate a monitoring plan to ensure regular checks and maintenance. Restoration projects typically include removal of invasive/unwanted species, planting and seeding of new trees, biodiversity treatments (topping, girdling, etc.), and fertilization (Stavins & Richards, 2005). The following costs were gathered from previous project reports around Coastal BC, but prices vary with the available stock and labour rates

- Felling/removal of old overstory (alder) $2,500-2,800/ha
- Alder girdling (alternative to felling) ~$1,550/ha
- Brushing and planting (volunteers) $3,000/ha

Some level of planting failure is likely to occur requiring subsequent planting and fertilization treatments to ensure the expected carbon densities are achieved.

Monitoring and Verification Costs

Forestry projects have higher than average monitoring costs (so as carbon to ensure that trees are growing at the rate and size as the model suggested) and verification costs because of the difficulty of measurements and high amount of risk from longer project timeframes (Antinori & Sathaye, 2006). Monitoring methodologies can range from estimations to full field measurements, resulting in variable costs (Antinori & Sathaye, 2006). Typical CDM projects can range from $4,800 to $16,000 in annual monitoring costs (CCPO, 2005).

ECONOMIC AND PRACTICAL FEASIBILITY

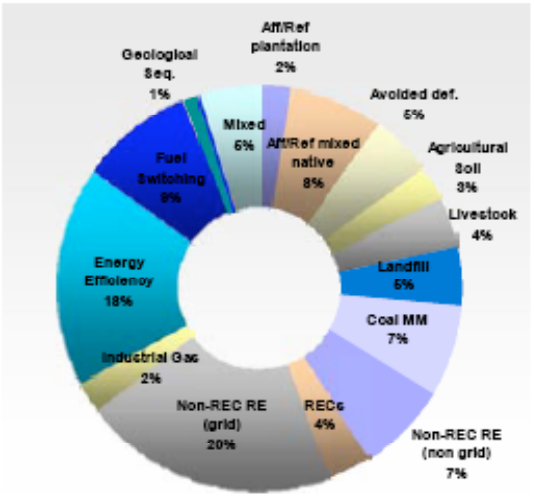
Ultimately, after the broader climate, ecological, and social implications of riparian restoration on this model have been assessed, the viability of a program such as this will come down to some basic issues of practical feasibility; does the expertise and regulatory environment exist to do this properly, and can this be achieved for a price that the market will value?

Will the market pay?

In part the proof is in the practice. Carbon credits are already being sold for municipal riparian restoration projects in the Lower Mainland. For the time being, however, this is a fairly limited program in scale and before many other organizations get involved, the market awaits the announcement of rules, regulations, and standards. As is demonstrated by Figure 1, however, the voluntary carbon market is broad in terms of type and location.

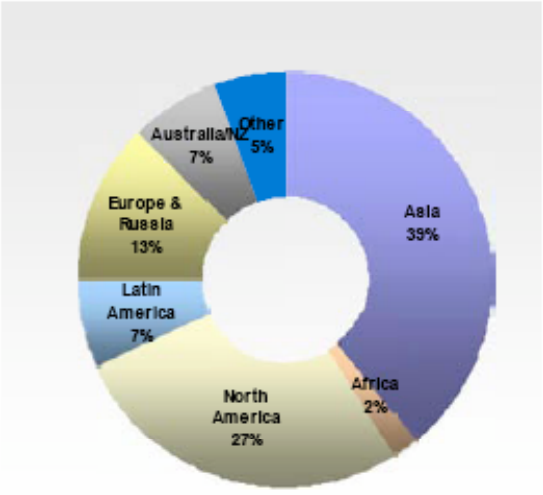
Figure 1: Pricing by Type

Transaction Volume by Project Type, OTC 2007



Source: Ecosystem Marketplace, New Carbon Finance

Transaction Volume by Project Location, OTC 2007

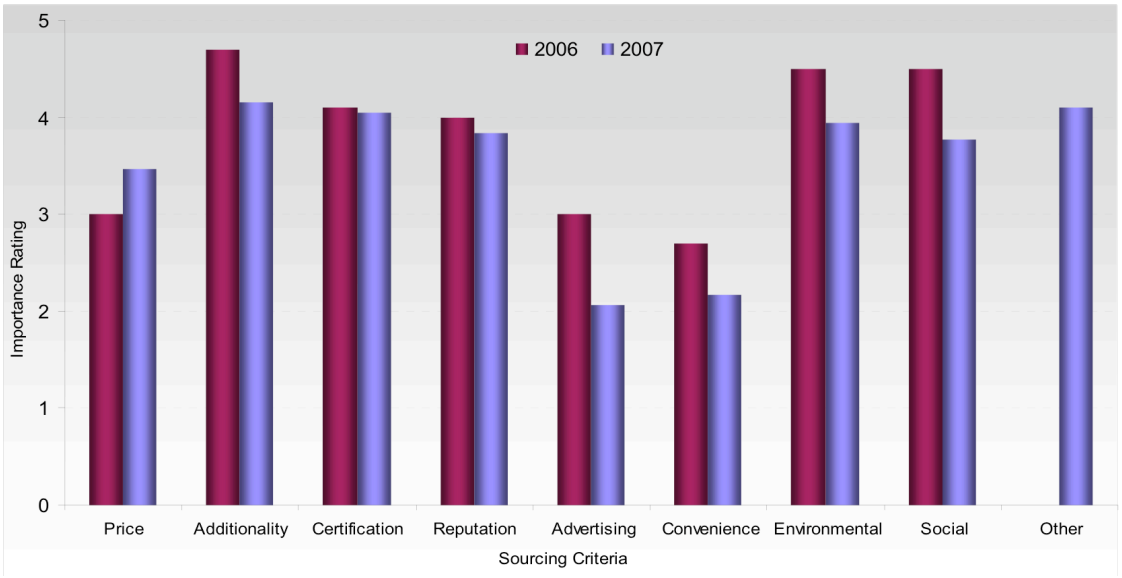


Source: Ecosystem Marketplace, New Carbon Finance

As discussed earlier, some buyers do not trust forest carbon credits because of the increased risk associated with terrestrial carbon sinks. Indeed when this question was posed to a representative from a top professional services firm, their reply was “We have serious questions about permanence, governance, and additionality.” They went on to reflect on what much of the research says, “forestry offsets are not considered by us to be significant. We recognize that 20% of global GHG emissions come from deforestation and clearly it must be addressed – but additionality is the issue for these types of offset – we’re not convinced.”

The Katoomba Group did a carbon buyers study in 2008 to analyze what carbon customers look for when purchasing credits. Their results demonstrated knowledge of the carbon market, with quality assurance (additionality, certification) as the most important aspect, even outweighing price (see Figure 2: The Katoomba Group Buyers Study - Important Project Criteria (Ecosystem Marketplace, 2008). Therefore, buyers may be willing to pay a premium for high quality forest credits if the issues of additionality and permanence can be addressed. Also, well-designed forestry projects provide the additional environmental and social benefits, that also outweighed price in customer importance.

Figure 2: The Katoomba Group Buyers Study - Important Project Criteria (Ecosystem Marketplace, 2008)



Current expertise and regulatory environment in BC

Regulations are not yet clear in British Columbia and businesses are taking a cautious approach toward the carbon market. Indeed when asked what kind of advice they are providing their clients around the coming regulatory regime, one Professional Services Specialist responded that "companies are building massive infrastructure around trying to accommodate expensive regulation. Both the companies as well as consulting firms like ours have spent a great deal of money looking at all of this, and all we can tell them is that it's very hard to predict. There are pockets of deep understanding in the private sector, but companies are struggling to understand these issues and the associated regulations."

There are tested and active standards that B.C. can and will draw upon to base its regulations. The Province is moving quickly to catch up to a market that's maturing rapidly around the world.

CONCLUSION

"Deforestation is progressing rapidly, particularly in the tropics. Firm and urgent action is needed. If not, it is highly unlikely that we can achieve a CO2 stabilization target that avoids the worst effects of climate change."

(Eliasch Review, p. 2)

Crucial questions linger about the future of B.C.'s forests. Climate change is taking place far more rapidly than most models had predicted and even B.C.'s old-growth forests are beginning to suffer as well. Rising temperatures and the associated changes in hydrology and increased pestilence are taking their toll on our oldest and most robust forest systems. The complexity of this issue can't be overstated and forestry is a major part of both the cause of climate change, as well as the solution.

A sea change is required in the way land is used and commodities produced. "A shift to more sustainable production will be complex and challenging, but not impossible if the international community acts together effectively" (Eliasch Review, p. 12). The valuation of carbon is already bringing about considerable change in the structure and standards of the market and promises to grow in importance in the months and years to come.

An international approach to deforestation and the preservation of ecosystem services will be decided through negotiations in Copenhagen in late 2009. The B.C. Government is due to release its regulations around carbon management later this year, with forestry as a part of it. Riparian restoration is an activity that has been proven to provide a host of positive benefits. However, serious questions remain about the appropriateness of carbon being the dominant metric in riparian restoration.

The discussion here is about funding riparian restoration through revenue for carbon credits and whether it furthers the key program areas of the Fraser Salmon & Watersheds Program, particularly Habitat Watershed Restoration and Stewardship. Indeed, the precedent for this funding model has already been set and organizations in B.C. are already earning carbon credits through riparian restoration. However, this discussion paper has outlined some of the dilemmas and trade-offs, standards and principles that carbon-funded riparian restoration projects must follow in order to be rigorous.

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