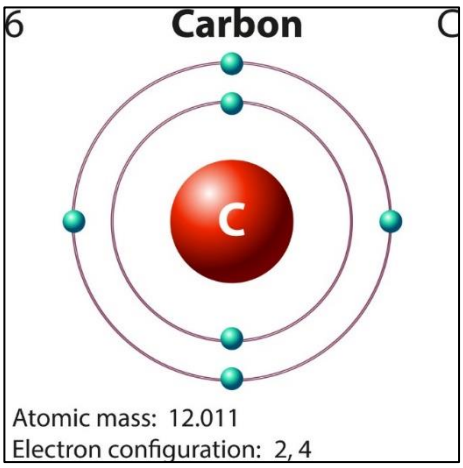
Forest Carbon and Woodlot Licences
WPDC Project 2022WPDC5320-001

October 19, 2023



Prepared for: Woodlot Product Development Council

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Purpose and background of project

This project was initiated by the Cariboo Woodlot Association (CWA), and in particular its current and past presidents, Hugh Flinton, RPF and Gord Chipman, RPF, respectively. At the June 2022 annual general meeting of the CWA the issue of carbon management arose. Hugh became the proponent for the funding application and supported me in preparing an application to the Woodlot Product Development Council (WPDC). WPDC is acknowledged for funding this project.

The goal statement of the project is as follows: to benefit and promote the woodlot industry by informing woodlot licensees about the emerging carbon market and options; to identify opportunities and examine how woodlot licensees could get involved and potential synergies with other forest tenures.

The objectives of this report are to provide the following in an easily accessible/readable format:

1. Summary of the current and emerging carbon situation in terms of standards, methodologies and markets
2. List of carbon opportunities for woodlot licensees – what kinds of things "count" as a forest carbon project on a woodlot licence
3. Synergies with other area-based forest tenure holders such as community forests, and private forest landowners
4. What is currently possible on Schedule B (Crown) lands and what is possible on Schedule A (private) lands, and where things are going

This report serves as a snapshot in time of the current carbon management situation, but it should be noted that this is an evolving regime and things are changing fast. Some elements of this report will likely be out of date as soon as it is finalized.

This report is based on the following: what the author learned when taking the UBC Forest Carbon Management micro-certificate in fall 2022; interviews with many experts in the field; results of having convened multiparty meetings in January, March and June 2023 with MOF, FBCWA, BCCFA, PFLA representatives and more; and lots of review of material from various organizations, programs and websites.

Limitations and Non-Advocacy

There are limitations to this report; none of it is considered as advice to a specific woodlot licensee or private forest landowner. While the author has put in an extensive effort to understand the current state of forest carbon opportunities, as noted above, it's a rapidly changing realm.

To be clear, the author is not advocating that woodlot licensees pursue forest carbon projects. The purpose of the project is to educate woodlot licensees of what the opportunities are.

Measurements and Chemistry Refresher

Before proceeding, it's important to understand the measurements used in carbon and GHG. Internationally, everything related to carbon and GHG is in metric. Some non-metric units are included as there are references to American protocols, standards and methodologies later in this report.

- 1 metric ton = 1 tonne = 1000kg
- 1 US ton = 907.186kg (not used in this report)
- 1 million tonnes = 1 megaton (Mt) = 1 teragram (Tg) = 1 x 10^{12} g
- 1 billion tonnes = 1 gigaton (Gt) = 1 petagram (Pg) = 1 x 10^{15} g

The other key item to understand is the relationship of C to CO_2. The ratio of C to CO_2 is 1:3.67 – in other words, 1 part CO_2 = 3.67 x C. This is based on the atomic mass of each element. The weight of 1 molecule of C (atomic mass of 12) to CO_2 or 1 molecule C (atomic mass of 12) and two of O (atomic mass of 16 each) therefore it's the ratio of 44 (12+16+16 = 44) to 12 or 3.67.

The greenhouse gases (GHGs) that contribute to climate change include CO_2, methane (CH4) and nitrous oxides (NO_x) among others. There are different ratios of each in the atmosphere and that are emitted by different activities. Rather than identifying them all separately, the common practice is to use measurements related to tonnes of CO_2 equivalent (CO_2e).

Carbon in the Forest and the Landscape

Forests are full of carbon, as carbon is the basic building block of life. Managing forests therefore is carbon management. It's important to understand where carbon exists in forests, and the relationship of carbon to tree volume and other biomass in a forest and on the landscape.

Where carbon exists in a forest

Carbon exists in trees (stem/bole, branches, leaves/needles, roots), vegetation (woody and herbaceous), litter, downed woody debris and in the soil.

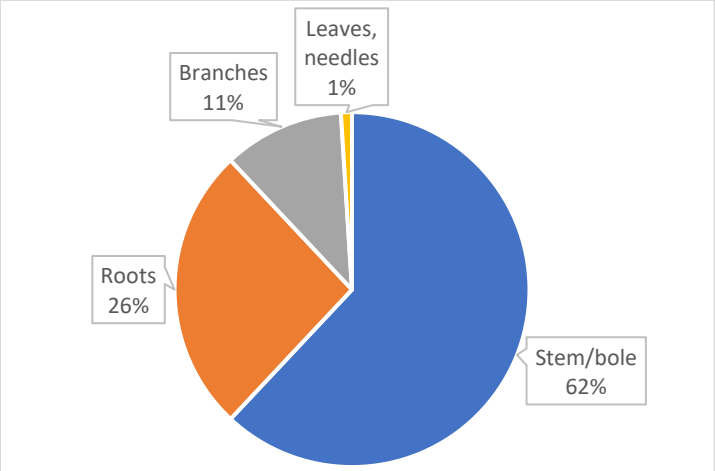


Figure 1: Proportion of carbon in different parts of a tree

Within a tree, approximately 62% of C is in the stem/bole, 26% in roots, 11% in branches, 1% in leaves/needles. This of course varies by species but is a general approximation.

Approximately 50% of a tree is water, roughly 50% of dry mass of a tree is C. The other 50% dry mass is hydrogen, oxygen and trace elements. This of course varies by species but is a general approximation.

Useful fact: 1m^3 of wood is about 1 tonne of CO_2e

One cubic metre (1m^3) of wood weighs approximately 500 kg (dry wood weight, average but again depends on the species). As noted above, half of this is carbon content or about 250 kg C per m^3. Converting C to CO_2 using the multiplier 44/12=3.67 noted above (rounded to 4 for ease of calculation) gives us roughly 1 metric tonne of CO_2. This is approximate but as stated it's easy to remember. In summary 1m^3 of wood is about 1 tonne of CO_2e or 250 kg of pure carbon.

Where carbon exists on the landscape

A McMaster University study (Sothe et al 2022) noted that of all Canadian carbon stocks only 21 Pg of 327 Pg or 6% total is plant and tree biomass and 94% is soil (see Figure 2, graphic credit to World Wildlife Fund).

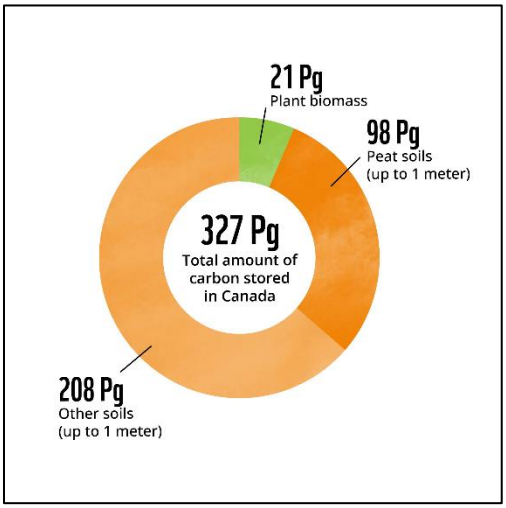


Figure 2: Distribution of carbon in Canadian ecosystems

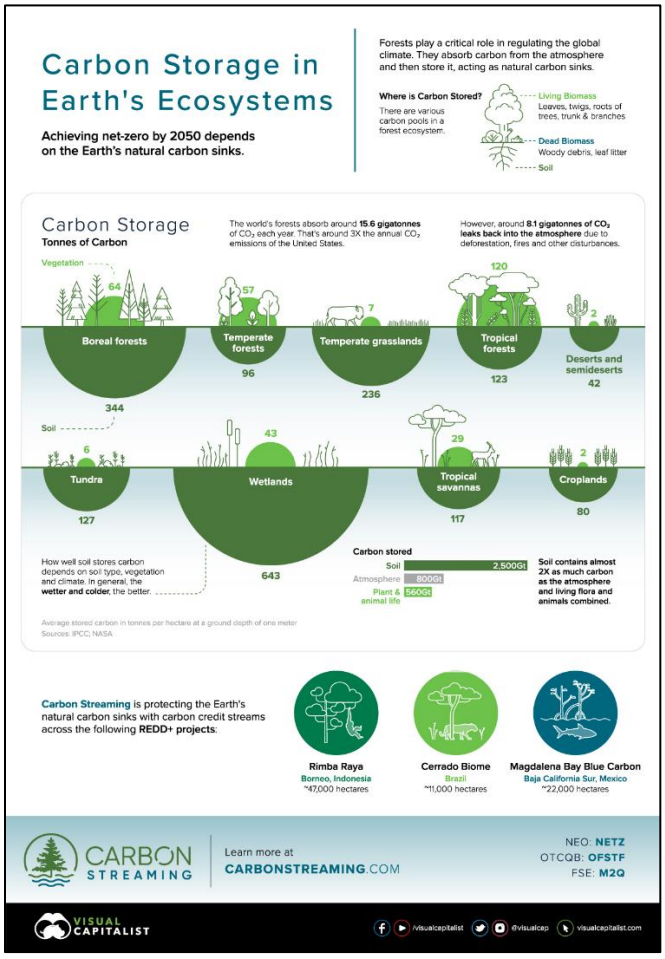


Figure 3: Carbon storage in Earth's ecosystems

Within a forest, most carbon is within soils, especially in boreal forests. Even in temperate forests (which include most forests in BC soils account for over half the carbon. Some have noted that as a general rule, half the carbon in a forest is underground and half is visible above ground. Wetlands also contain significant amounts of carbon in proportion to other ecosystems. To put it in perspective, Figure 3 shows proportions of carbon in wetlands at a global scale (graphic from Visual Capitalist).

Carbon measurements at the forest scale

Many of the measurements that foresters use to measure tree volume and growth rates are convertible to measuring carbon. Basic forest mensuration and growth and yield models and techniques can equate tree volume to carbon by using allometric equations with expansion factor to account for branches, leaves, and root to shoot ratios to estimate biomass below ground in roots. For wood volume alone, for example, if the mean annual increment is $2m^3$/ha/year, this can be calculated as roughly 2 tonnes of CO_2e/ha/year.

Measuring carbon in soil is more difficult and costly, as it involves sampling soils and using different methods in a lab using heat or chemical processes to determine amounts of carbon.

Natural Resource Canada has an operational model to calculate and model different disturbances and effects on carbon, the Carbon Budget Model for Canadian Forest Sector (CBM-CFS 3). This model accounts for all types of carbon on the landscape, including that in the soil and dead organic matter.

Carbon Sources, Sinks, Sequestration and Storage

There four key terms that are useful to be explained here:

- A carbon *source* has a positive emission value; it emits carbon. Examples include industrial activities such as burning fossil fuels, but also natural processes such as wildfires.
- A carbon *sink* has a negative emission value; it absorbs carbon. Examples include natural systems such as plant and vegetation growth, but there are also industrial sinks such as underground storage and evolving technologies to capture carbon from the air. Another important sink in the forest sector is harvested wood products, as long as they remain in use long term.
- Referring to forests, *sequestration* refers to the ability to capture of carbon, and *storage* (or stocks) refers to the amount of carbon in a forest at any point in time. In general, young forests have a high sequestration rate but not much storage, and old forests store a lot of carbon, but sequestration rates are low.

Global and BC context of sources and sinks

A global and BC context is useful to understand the opportunity that forests play in managing carbon. Globally, Werner Kurz of Natural Resources Canada [1]notes carbon sources and sinks in Table 1.

Table 1: Global carbon sources and sinks

Sources	**Sinks**
*Fossil fuel burning • 35.2 Gt CO_2e/yr • 89%	Atmosphere • 19.1 Gt CO_2e/yr • 48%
Land use and land use change • 4.5 Gt CO_2e/yr • 11%	Forests, vegetation, land • 11.4 Gt CO_2e/yr • 29%
	Oceans • 10.5 Gt CO_2e/yr • 26%
Total • 39.7 Gt CO_2e/yr	Total • 41.0 Gt CO_2e/yr
**Budget imbalance -1.3 Gt CO_2e yr or 3%	

*Key point is fossil fuels were in the ground before the industrial revolution; there's sources that are natural from decay, burning biomass was part of a natural cycle, but burning fossil fuels is unnatural and is a one way flux to the atmosphere. Fossil fuel CO_2 is a net addition to natural systems.

**This budget balance seems counterintuitive that if sinks > sources, why do we have a problem? Atmosphere is the default sink, which is causing global warming.

[1] Presentation to Forest Professionals BC, February 10, 2023

To put this in context for BC, missions in BC from all other sectors are approximately 62Mt CO_2e.

Managed, Unmanaged Forests and Natural Disturbances

There is some controversy around how Canada reports emissions in relation to managed forests, unmanaged forests and in particular emissions from wildfires.

Managed forest is defined by Natural Resources Canada as "all forests under direct human influence and is a subset of Canada's total forest area. It includes protected forests, forests managed for harvesting and forests subject to wildland fire or forest insect management." All forests in BC are considered managed forest for emissions reporting. However, it is worth noting that within BC, 22.3M ha is actively managed in the timber harvesting land base (THLB), and 38.8M ha is non-THLB which includes non-operational areas, parks and protected areas.

Canada (and BC) don't count natural disturbances such as wildfires as a contribution to GHG emissions – we only count anthropogenic sources as per international rules. To put this in perspective, emissions from recent BC wildfires were 184, 214 and 145 Mt CO_2e for 2017, 2018 and 2021 wildfire years, respectively (2.34 to 3.45 times BC's emissions from all other sectors).

In summary, our forests may be officially reported as a carbon sink based on anthropogenic activities and excluding natural disturbances such as wildfire. Old forests store a lot of carbon, but if they are at risk of wildfire, (particularly those in the non-managed non-THLB) are increasingly becoming a carbon source.

Basic Principles of Forest Carbon Management

As noted previously, forests are full of carbon. Everything a woodlot licensee does manages carbon in one way or another. Planting trees after harvest, spacing a stand will sequester carbon, increase carbon storage or stocks. Following harvest, fibre from the woodlot licence may become long term storage of carbon in a sink as harvested wood products (i.e., if it's manufactured into lumber) or become a carbon source (i.e., if it's used as a short term product such as biomass burned or becomes pulp and used in short term products such as toilet paper). Additionally, emissions are created through timber harvesting phases such as felling, skidding, trucking and road maintenance.

All of these things are *business as usual* on the woodlot licence. Business as usual is a key term in the carbon management world. Credits are only issued on the carbon market for things done beyond business as usual, that are *additional*. These additional things must be *verified* against existing *standards, methodologies and protocols* to be sold as a *carbon credit* on an existing *market*. (All terms italicized will be defined below.)

There may come a point in the management of a woodlot license that there may be better economic opportunities to pursue revenue opportunities from a forest carbon project, rather than harvesting timber, for a portion of the woodlot licence area.

Terminology

It is necessary to understand the various terms and concepts in the world of carbon management.

- Carbon offset – a removal of GHG emissions from the atmosphere
- Carbon credit – a reduction of GHG emissions into the atmosphere, activities to compensate for emissions elsewhere, often purchased by a third party
- One credit = reduction of 1 metric tonne of CO_2e
- Eligibility conditions – set of eligibility criteria a project must meet, defined by standards or methodologies. Scope or use of methodology established intended applications.
- Applicability criteria determines the methodological eligibility. Step 1 is evaluating methodology options – some are specific, some are broad, some are for certain geographies.
- Baseline (business as usual or BAU) – in absence of the project, would there be any difference in activities.
- Additionality – whether a project will be additional, i.e., would emission reductions have occurred otherwise? Would forest have been conserved otherwise? Would trees have been planted otherwise? This must be demonstrated to support the claim that the carbon benefits are real. There are standards and methodologies to test additionality.
- Leakage – refers to shifting emissions from the project to elsewhere; does the project just shift more emissions elsewhere? Potential impacts are estimated, managed and monitored. There are subcategories: Activity-shifting leakage (does the project just move the activity to another location) and market shifting leakage (change in supply-demand equilibrium).
- Permanence – how long will the intervention actually last, how certain are we? Risk analysis determines the impermanence buffers. Categories: natural, anthropogenic, internal, external.
- Validation – review of project by an independent 3rd party, measurements, calculations, documentation, correct use of a standard or methodology
- Measurement – a plan to monitor carbon stocks, leakage and permanence over time.
- Reporting – actual results of monitoring, summary of carbon benefits during a period of time
- Verification – a confirmation of the actual carbon benefits with the project. Requires review of monitoring results by independent 3rd party. Leads to project registration and credit issuance. When and how a project registered depends on standard and methodology. Verification of reduced or removed emissions leads to carbon credits.
- Initiatives - a coordinated effort, variable scale, comprised of many carbon activities, may involve investment, policy, education, outreach. May not lead to forest carbon projects or credits. An example is BC's Forest Carbon Initiative launched in 2017. Different activity types such as reforestation, fertilization, fibre utilization is funded but these are not forest carbon projects that led to carbon credits being bought and sold.
- Programs – always associated with credits. Established by NGOs and governments. Develop and approve standards, protocols and methodologies. Projects reviewed against these standards. They operate credit registry systems (issue, transfer, retire credit). Programs are distinct from initiatives, but initiatives may use programs.
    - Compliance programs – usually run by governments and address emissions by particular industries.
    - Voluntary programs – usually run by NGOs and aimed at non-regulated activities. Forest carbon projects fall in this realm.
- Carbon pools – where carbon is stored in the forest for the project, such as live biomass, dead organic matter, or the soil
- Carbon projects – a carbon initiative that leads to credits that can be bought and sold.

There are many players involved in forest carbon management. *Proponents* propose, organize, advocate for the project. *Developers* assess, pursue, establish the project. *Stakeholders* include individuals, groups institutions and communities that are positively or negatively impact the project, or in the absence of the project. *Rights holders* are individuals, groups, institutions, communities' benefits and liabilities associated with land use, tenure, carbon. *Participants* are those actively involved in project.

Within the voluntary carbon market, there are many standards, methodologies and protocols, some are applicable to Canada and some are not (there are many others that only apply to developing countries, they were not listed here):

- Forest Carbon Offset Protocol v2.0 (draft) – BC government document
- NCX (Natural Capital Exchange) – American (pilot program done in Canada, not continuing)
- Verra – Verified Carbon Standard, area of focus Agriculture, Forestry and other land use
- Climate Action Reserve – voluntary offset program
- American Carbon Registry – see land use, land use change and forestry standards
- July 2023 – draft federal protocol for private lands Draft Federal Offset Protocol: Improved Forest Management on Private Land - Canada.ca

These different standards, methodologies and protocols have different intervention types, or groupings of activities that are *additional* or changes to *business as usual*. The most relevant ones are as follows:

- General categories: better/different harvesting, protection, growth/productivity
- Specific intervention types:
    - improved forest management (Logged to Protected Forest, extended rotation)
    - avoided deforestation – keeping forest as forest, not a different land use
    - avoided degradation – avoiding degradation of a forest
    - afforestation – reforesting an area of land that was previously forested, but not for several decades

The most relevant or likely intervention type that a woodlot licensee or private forest landowner would pursue would be improved forest management. There is an opportunity to create more specific, more nuanced standards for a new intervention type; for example, wildfire risk reduction treatments that reduce the risk of a stand of trees being burned in a wildfire.

Process

There are many steps to getting a forest carbon project in place before it can be verified and carbon credits issued that can take at least several months to over a year. It is very similar to the forest certification process: a set of standards exist and an independent third party verifies that things are being done according to the standards. These include the following:

- Pre-screening – quick and dirty approach, does it make sense to pursue a project
- Pre-feasibility
- Feasibility
- Design and development
- Baseline, additionality and theory of change
- Spatial boundaries – set the location of the project
- Temporal (time) boundaries – setting the timeframe for the project, when did it start (it can be retroactive) and how long is the commitment (can be up to 100 years)
- Carbon pools – where does the carbon exist in the project area that you're tracking (i.e., trees and live biomass only, soil, litter, dead organic matter)

- Activity data and emission factors, modelling, leakage, permanence, net emissions removals or reductions, legal policy and financial considerations
- Development of project design document and monitoring plan – summarizes everything
- Validation and registration
- Implementation and monitoring
- Verification and issuance of credits
- Finance and markets – sell your credits in the market.

Cost and Economies of Scale

Establishing a forest carbon project from concept and pre-screening to issuance of carbon credits is a lengthy and costly process. Because there have been so few projects done in BC, it's difficult to provide a solid cost estimate. Costs of $50 000 and up to $100 000 have been suggested by numerous sources.

This is where economies of scale come in to play: the costs to establish a forest carbon project are not completely fixed, but the larger the project (both geographically and in terms of reduction of emissions), the more cost effective it will be. Different non-contiguous parcels of forest can be grouped to form a single forest carbon project.

Where and How to Sell Offsets

Carbon credits can be sold to various organizations in different manners. There are financing opportunities that may fund your forest carbon project from inception. These organizations will offer to pay to develop your project, get paid from the eventual carbon revenue, pay you the balance. Other options are to self-fund the development of the forest carbon project, and then go to brokers, retailers or exchanges to sell credits. Buyers of credits purchase offsets through these mechanisms.

Agreements can be set up for a variety of timeframes, with either locking in prices, or building in opportunities to renegotiate if market prices change, like any commodity.

A few market resources are as follows:

- World Bank carbon pricing dashboard – note that these are often compliance market prices
- Climate Impact X exchange and marketplace based in Singapore – a relatively new international carbon market
- Carbon credits.com
- Local community carbon marketplaces

Carbon credits on the voluntary market range from $10 to $60/t$CO_2$e currently but are anticipated to increase to minimum $45/t$CO_2$e. As the market develops, and as the mandatory carbon tax that we all pay increases, this will increase the overall market.

Current BC Legislation, Policy and Constraints

BC's Greenhouse Gas Industrial Reporting and Control Act outlines obligations of B.C. facilities that emit 10 000 tonnes or more of carbon dioxide equivalent (CO_2e) per year – and those that have emitted more than 10 000 tonnes in any of the previous three years – must report their greenhouse gas emissions annually. This act also outlines requirements to manage carbon such as in a forest carbon project. It outlines that there must be clear rights, such as private land tenure or clearly defined rights in an

agreement. BC maintains a carbon registry of various industrial and emissions reduction and forest carbon projects.

Under the authority of GGIRCA, BC drafted its Forest Carbon Offset Protocol (FCOP) back in 2011 and has updated it to version 2.0 in early 2023. It remains in draft format. The purpose of FCOP is to outline the standards and methods to develop a forest carbon project on Crown land in BC.

Currently in BC, forest tenures do not explicitly convey clear rights to manage carbon. This is certainly the case for woodlot licences, and even for community forest agreements (which were designed to enable management of non-timber forest products beyond timber). The other significant complication to granting rights to manage carbon is the fact that forest tenures on Crown land are the unceded territories of Indigenous nations; the majority of BC is not covered by treaties.

An Atmospheric Benefit Agreement (ABA) is the current mechanism to enable rights to manage carbon for an area, but it's not necessarily exclusive rights.

Private land opportunities and constraints

There are 52 757 ha of Schedule A lands associated with woodlot licences, or 9.1% of total area managed as woodlot licences (see Table 2). Note that Schedule A lands may include Indian Reserve land or private fee simple land.

Table 2: Area and AAC of Woodlot Licences in BC

The annual allowable cut (AAC) is the annual amount of timber that can be harvested on a sustainable basis within a defined forest area.

Region	# of WLS	AREA (ha)			AAC (m^3)		
		Private Land	Crown Land	Total	Private Land	Crown Land	Total
Coast	122	4,626	63,616	68,242	24,735	344,184	368,919
N. Interior	400	30,973	249,258	280,231	31,083	559,666	590,749
S. Interior	323	17,158	213,998	231,155	22,286	467,927	490,213
Total	**845**	**52,757**	**526,872**	**579,628**	**78,104**	**1,371,777**	**1,449,881**

Source: FLNRORD List of Woodlot Licensees as of March 7, 2022

There are constraints for Schedule A lands, notably any commitments in the woodlot licence management plan. Schedule A lands contribute to the AAC for the entire woodlot licence.

There is no official policy, but if a woodlot licensee proposes to do a forest carbon project on their Schedule A lands, current thinking by MOF is to remove the area of the forest carbon project from the woodlot licence.

Future directions

The following are the anticipated future directions at the BC and global scales.

British Columbia

The BC government is currently thinking that issuance of a separate "purpose built" tenure to manage carbon on Crown lands, which could overlap other tenures, to manage carbon is the way to go.

Other possibilities are that Forest Landscape Plans could include objectives for forest carbon and/or specify areas for carbon storage and sequestration.

Legislative change, such as to the Forest Act, to clarify forest carbon management in different tenures would be a lengthy process.

Modernizing legislation to be consistent with DRIPA could be a "back door" quicker approach to advance this, based on the assumption that addressing climate change is a First Nations priority.

Until this possible carbon tenure is fleshed out, BC government is working on interim guidance and approaches. ABA is the current approach.

Global

Article 6 of Paris Agreement set the rules for a crediting mechanism to be used by the 193 parties to the Paris Agreement to reach their emission reduction targets, notably making it possible for countries to buy voluntary carbon credits (article link here). Therefore, the voluntary carbon market may grow.

Voluntary carbon markets are anticipated to increase in value in the future. The estimated voluntary carbon market value in 2020 was US$400M and is anticipated to grow to $10-25B by 2030.

Forest carbon standards and their intervention types will likely change and adapt and become more nuanced over time. This means there could be carbon credit benefits for incremental management, such as reducing wildfire risk, or precommercial thinning to make stands more productive and sequester more carbon. To reiterate a key point: these things have to be *additional* to *business as usual*.

Author's Perspective

From the discussions I've had with experts in this field, this is a huge opportunity that could fund the forestry work we want to do on the larger landscape. Some that I spoke to suggest that enabling international investment in voluntary carbon markets will provide the funding that foresters and forest managers could never dream of through either government programs, or just the profit reinvested back from logging. New funding sources could be invested in our forests to make them more resilient to future disturbances and a changing climate, as well as more productive for future timber harvesting.

Examples of Similar Projects

There is a registered forest carbon project in Quebec registered to Verra standards, a mix of improved forest management intervention types: logged to protected forest; extended rotation age. There is also some area with the intervention type afforestation, reforestation and restoration. The project covers 15 000 ha of private forest land and has average annual emissions reduction of 115 409 tCO_2e.

The Chekamus Community Forest has a registered forest carbon project that was created through an ABA and registered to BC Forest Carbon Offset Protocol version 1.0. Annual emissions reductions range from 1195 to 12 460 tCO_2e per year over 100 years. Financial statements show carbon revenue of $226 460 for 2022 and $77 576 for 2021 and $598 826 for 2020. The area of the community forest is 33 018 ha but it is unclear whether the forest carbon project covers the entire community forest.

Darkwoods is a private land conservation area managed by Nature Conservancy of Canada in the Kootenays, covering 54 972 ha. The forest carbon project has annual emissions reductions of 124 847 tCO_2e and the project time period is 100 years. The standard used is with Verra.

Quadra Island Forestlands forest carbon project covers 417.9 ha and has total emission reductions of 91 168 tCO_2e reduction over 25 years. Financing of the carbon paid for BC Parks to purchase the private land. The standard used is BC Forest Carbon Offset Protocol version 1.0.

Mosaic Forest Management launched their Big Coast Forest Climate Initiative in 2022 on a portion of their private forest lands on Vancouver Island and Haida Gwaii. The initiative defers harvest for 30 years on 40 000 ha and has a total emission reduction of 20 million tCO_2e over the life of the project. The standard used is with Verra.

Theoretical example

As noted above, there may come a point in the management of the woodlot license that there may be better economic opportunities to pursue revenue opportunities from a carbon project, rather than harvesting timber, for a portion of the woodlot licence area.

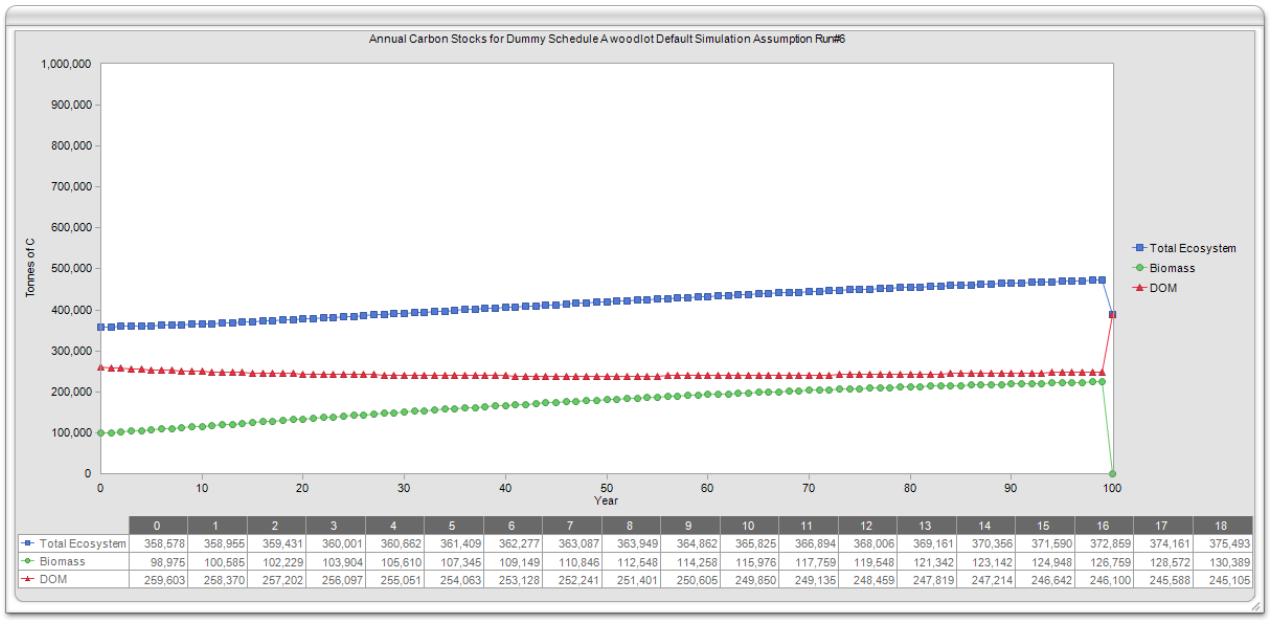
A theoretical example was created using Natural Resource Canada's Carbon Budget Model for the Canadian Forest Sector (CBM-CFS3) to provide some reliable numbers. The following was the input:

- 1000 ha of private Schedule A forest land (note this does not have to be one owner or contiguous parcels)
- General assumption: MAI of $2m^3$/ha/year, rotation age 100yr, therefore AAC $2000m^3$/year
- Cariboo Forest Region, SBPSmk biogeoclimatic subzone, site indices of 20m for Pl, Fd, Sw
- Age-gross volume tables were provided by TIPSY (Table Interpolation Program for Stand Yields)
- 7 stands were created with the species, ages and areas in Table 3
- No disturbances were generated (this is unlikely in reality)

Table 3: Parameters for theoretical example

Stand	Age (years)	Species	Area (ha)
1	10	Pl	200
2	30	Sw	200
3	50	Fd	100
4	70	Sx	100
5	90	Fd	200
6	110	Pl	100
7	130	Fd	100
Totals	-	-	1000

With no timber harvesting proposed, the proposed intervention was improved forest management, logged to protection. Results of the model run for 100 years calculating annual carbon stocks are shown in Figure 4 (note that DOM is dead organic matter).



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Total Ecosystem	358,578	358,955	359,431	360,001	360,662	361,409	362,277	363,087	363,949	364,862	365,825	366,894	368,006	369,161	370,356	371,590	372,859	374,161	375,493
Biomass	98,975	100,585	102,229	103,904	105,610	107,345	109,149	110,846	112,548	114,258	115,976	117,759	119,548	121,342	123,142	124,948	126,759	128,572	130,389
DOM	259,603	258,370	257,202	256,097	255,051	254,063	253,128	252,241	251,401	250,605	249,850	249,135	248,459	247,819	247,214	246,642	246,100	245,588	245,105

Figure 4: Annual carbon stocks for theoretical example

Table 4 shows some very approximate calculations based on the above, compared to *business as usual* of timber harvesting on a regular schedule (very approximate – the calculation methodologies to compare business as usual with a proposed project are very complicated and time consuming). The comparison suggests that there could be higher revenue per unit area per year from forest carbon projects compared to conventional timber harvesting.

Table 4: Business as usual compared to forest carbon projects

Business as usual - worst case scenario		**Comments**
Net profit/m^3	10	
Net profit total $/yr	20000	
Net profit $/ha/yr	20	
Business as usual - best case scenario		**Comments**
Net profit/m^3	50	
Net profit total $/yr	100000	
Net profit $/ha/yr	100	
Carbon project - worst case scenario		**Comments**
Set up costs ($)	100000	
Periodic verification cost ($)	10000	every 5 years
Emission reductions (tCO_2e/yr)	1000	
Market price ($/$tCO_2e$)	10	
Project length (years)	25	
Gross revenue ($)	250000	emission reduction/yr x C price x project length
Less set up cost	100000	
Less periodic verification/5yr	50000	
Net revenue ($)	100000	
Net revenue ($/yr)	4000	
Net revenue ($/ha/yr)	4	
Carbon project - best case scenario		**Comments**
Set up costs ($)	75000	
Periodic verification cost ($)	10000	every 5 years
Emission reductions (tCO_2e/yr)	10000	
Market price ($/$tCO_2e$)	25	
Project length (years)	25	
Gross revenue ($)	6250000	emission reduction/yr x C price x project length
Less set up cost	75000	
Less periodic verification/5yr	50000	
Net revenue ($)	6125000	
Net revenue ($/yr)	245000	
Net revenue ($/ha/yr)	245	

Summary of Forest Carbon Project Opportunities for Woodlot Licensees

General

The key challenge to implement a forest carbon project on a woodlot licence is the small scale, in comparison to other forest carbon projects. This makes it expensive per tCO_2e captured.

Therefore, the key opportunity if a woodlot licensee wants to develop a forest carbon project is to work with others to scale up the project as large as possible by grouping with other forest landowners/tenure holders. Grouping can be different owners and non-contiguous parcels of land.

Document the carbon management intentions for the woodlot licence in current plans with respect to timeframes (needed to establish temporal aspect of projects as per standards).

There are other considerations if a woodlot licensee pursues a forest carbon project:

- Revisions to AAC and management plan – if the management intent is changed for a significant area of the woodlot licence, the AAC and management plan will likely need to be updated
- Implications for cut control

Learn more about forest carbon by taking the UBC Forest Carbon Management micro-certificate, an 8 week online course. There is currently funding available from the Stronger BC Grant for almost any adult to receive up to $3500 to cover the cost of the program.

Download and utilize Natural Resource Canada's Carbon Budget Model for the Canadian Forest Sector (CBM-CFS3) to model different scenarios on the woodlot licence.

Schedule A Specific Opportunities

Since Schedule A lands are mostly private (noting some are Indian Reserve lands), the ownership and therefore rights to the atmospheric benefits of emission reductions are clear. If a woodlot licensee is keen to explore forest carbon markets, this is the most straight forward approach.

While not policy yet, a woodlot licensee may need to remove the area of a forest carbon project from their Schedule A lands of the woodlot licence.

Schedule B Specific Opportunities

Since Schedule B lands are on Crown land, or unceded Indigenous territory, the ownership and therefore rights to the atmospheric benefits of emission reductions are not clear. There are no existing rights to manage atmospheric benefits from forest carbon projects within the tenure granted by a woodlot licence.

Woodlot licensees that are keen to explore a forest carbon project on their Schedule B lands may pursue an ABA or wait for the new anticipated tenure opportunity that MOF is developing. They may also consider grouping forest carbon projects with other area-based tenures, such as community forests or First Nation Woodland Licences.

Summary

Everything a woodlot licensee does is sequestering, storing or releasing carbon – but unless it's beyond business as usual it can't be a forest carbon project and therefore can't be a revenue stream.

Forest carbon on a woodlot licence is more than just the timber – there's more carbon in the soil, in the dead organic matter and in areas such as wetlands.

This is a new and emerging sector, and there will be more opportunities in the future.

Recommendations

- FBCWA should advocate to MOF for forest carbon opportunities to be realized on woodlot licences (both Schedule A and Schedule B lands). Any forest carbon specific tenures that MOF develops should be offered to woodlot licensees where they overlap their tenure areas.
- FBCWA or individual woodlot associations or woodlot licensees should collaborate with other area based tenures and their associations to explore forest carbon opportunities, such as BC Community Forest Association or individual community forests, or First Nation Woodland Licences

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Appendices

Appendix 1 - Acronyms

AAC – annual allowable cut
ABA or ABSA – atmospheric benefit agreement or atmospheric benefit sharing agreement
ARR – afforestation, revegetation and restoration
BAU – business as usual
BCCFA – BC Community Forest Association
CH_4 – methane
CO_2 – carbon dioxide
CO_2e- carbon dioxide equivalent
DOM – dead organic matter
FBCWA – Federation of BC Woodlot Associations
FCOP – Forest Carbon Offset Protocol (BC Government)
FNWL – First Nations woodland licence
GHG – greenhouse gas
IFM – improve forest management
MAI – mean annual increment
MOF – BC Ministry of Forests
NGO – non-governmental organization
NRCan – Natural Resources Canada
PFLA – Private Forest Landowners' Association
THLB – timber harvesting land base
WPDC – Woodlot Product Development Council