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ABCA Land Stewardship Initiatives:
An Assessment of Carbon Sequestration and Future Funding Opportunities

***Submitted to*:**
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ABCA Land Stewardship Initiatives:

An Assessment of Carbon Sequestration and Future Funding Opportunities

FINAL

A report prepared for the Ausable Bayfield Conservation Authority

by

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1. INTRODUCTION

For decades, the Ausable Bayfield Conservation Authority (ABCA) has been an advocate of responsible management of land and water resources in the watersheds of the Ausable and Bayfield Rivers in southern Ontario. Long before climate change brought increased attention to the environment, ABCA has utilized a range of tools to initiate stewardship projects that protect and restore natural vegetative cover on both private and public lands. These projects have resulted in numerous ecological benefits and ecosystem services, including biodiversity enhancement, wildlife habitat, recreational opportunities, nutrient cycling, erosion control, and water quality improvement.

Another one of the ecosystem services provided by forests and other vegetative cover is sequestration (storage) of atmospheric carbon dioxide in both the soils and the biomass of the plants. It is recognized that carbon storage is only one of many ecosystem services provided by natural lands. However, it can be argued that in this era of increased carbon awareness, carbon storage is the ecosystem service that provides the most opportunity for generating awareness and potential funding from key ABCA stakeholders in the public and private sector. Concerns about climate change have made greenhouse gas (GHG) emissions one of the most high-profile and complex issues of our time. In this low carbon economy, the emission of GHG is associated with increasing energy costs and sometimes punitive actions. Conversely, the reduction or storage of carbon can bring about a number of financial and promotional opportunities in a society where 'carbon messaging' has a very high impact.

ABCA is in a unique position to potentially take advantage of this growing interest in reducing GHG emissions. Historically the ABCA has influenced an increase of natural vegetation in the watershed through the following methods:

- Land acquisitions through purchase or donation – the ABCA owns approximately 10,000 acres of land, the majority of which is forested;

- Through a close partnership with the Ausable Bayfield Conservation Foundation (ABCF), a non-profit charitable organization with a mandate to promote conservation initiatives in the watershed. Recently the ABCF and ABCA partnered to launch the Huron Tract Land Trust Conservancy (HTLTC) to provide another avenue for preservation of natural land cover in the region;
- Through incentive and education programs that encourage implementation of stewardship projects amongst private landowners in the watershed.

The interest in carbon amongst ABCA's key stakeholders is at an all-time high. The goal of this project was to provide ABCA and its conservation partners (ABCF, HTLTC) with the necessary information to take advantage of emerging opportunities that are based upon the carbon sequestration benefits of conservation initiatives. This innovative approach may provide ABCA with additional options to increase the establishment of forest and other natural vegetation in the watershed, including:

- Corporate sponsorships from businesses that are interested in aligning themselves with projects that increase carbon sequestration to improve their corporate responsibility profile
- Opportunities for private landowners and ABCA to participate in the potential cap and trade carbon offset market
- Increased awareness from a general public that comprehends and responds positively to 'carbon messaging' (e.g. *x* number of trees planted is like taking *y* cars off the road for a year)

This report is a description of efforts made to quantify the carbon sequestration benefits of ABCA's land stewardship initiatives and recommendations on how ABCA and its partner organizations can utilize this information to leverage future opportunities.

Section 2 describes the carbon sequestration characteristics of forests typical to those found within the ABCA watershed. **Section 3** provides recommendations on strategies and approaches for ABCA to obtain corporate sponsorships based on the carbon sequestration benefits of land stewardship projects. Section 3 also provides recommendations on strategies that can be used by the ABCA to utilize 'carbon messages' to increase awareness (and potentially donations) from the general public. **Section 4** provides an overview of the cap and trade carbon market that *may* be introduced in Ontario in the near future and the opportunities that could potentially arise for ABCA and private landowners within the watershed.

2. CARBON SEQUESTRATION IN ABCA FORESTS

The watersheds that comprise the ABCA area are largely rural, with the majority of the land having been cleared of native vegetation for croplands around 150 years ago. Today, agriculture is the dominant land use (85%) of the Ausable and Bayfield watersheds, with forests representing only 13% of the land cover. The majority of forest cover in the ABCA watershed is on privately owned land. Most of the ABCA watershed lies within the 'Deciduous Forest' region (sometimes referred to as Carolinian forest), although the northern edge of the watershed does extend into the 'Great Lakes – St. Lawrence' forest region (OMNR, 2006). A general description of the Deciduous and Great Lakes – St. Lawrence forest regions is provided in Section 2.1. An overview of carbon storage in forest ecosystems is provided in Section 2.2. The methodology used to derive carbon sequestration values for ABCA forests are described in Section 2.3. The carbon storage rates and cumulative totals are discussed in Section 2.4 for both hardwood and softwood forest ecosystems.

2.1 FOREST REGIONS REPRESENTED IN ABCA WATERSHED

The ABCA watershed is located in a transition zone between the northern limits of the 'Deciduous Forest' and the southern portion of the 'Great Lakes – St. Lawrence Forest'.

While a detailed description of the ecosystems of these two forest regions is beyond the scope of this report, a brief overview of both forest regions have been provided here (adapted from *Forest Resources of Ontario 2006*).

2.1.1 Great Lakes – St. Lawrence Forest

The Great Lakes – St. Lawrence forest is a hardwood / mixed-wood zone that extends from the edges of Lake Superior in the north to the counties of mid-western Ontario in the south. Common species that are found in this forest include sugar maple, white pine, poplar, white spruce, yellow birch, red pine, red maple, red oak, eastern white cedar, Canadian hemlock, black cherry, beech, and basswood. Much of the forest in this region is uneven aged, with a range of tree ages and growth stages found within the same stand.

2.1.2 Deciduous (Carolinian) Forest

The Deciduous Forest of southwestern Ontario is the northernmost extension of the dominant forest ecosystem of the eastern United States. The geographic range of the Deciduous Forest coincides with some of Canada's most productive agricultural land, and as a result the remaining forest cover is largely restricted to pockets of land with marginal agricultural productivity. In southwestern Ontario (and the ABCA watershed) the Deciduous Forest is very fragmented, consisting of smaller woodlots that are adjacent to productive farmland. Most of the hardwoods found in the Great Lakes – St. Lawrence forest are also common here, but the region also features a number of other species including tulip tree, sassafrass, white elm, hickory, walnut, and several varieties of oak. The Deciduous Forest is recognized as having one of the most diverse concentrations of flora and fauna in Canada.

2.2 CARBON SEQUESTRATION IN FOREST ECOSYSTEMS

Forests ecosystems store a significant amount of carbon in the living biomass of the vegetation, debris (litter), and soil. The main pools of carbon in forest ecosystems and the primary carbon flux pathways are shown in Figure 1.

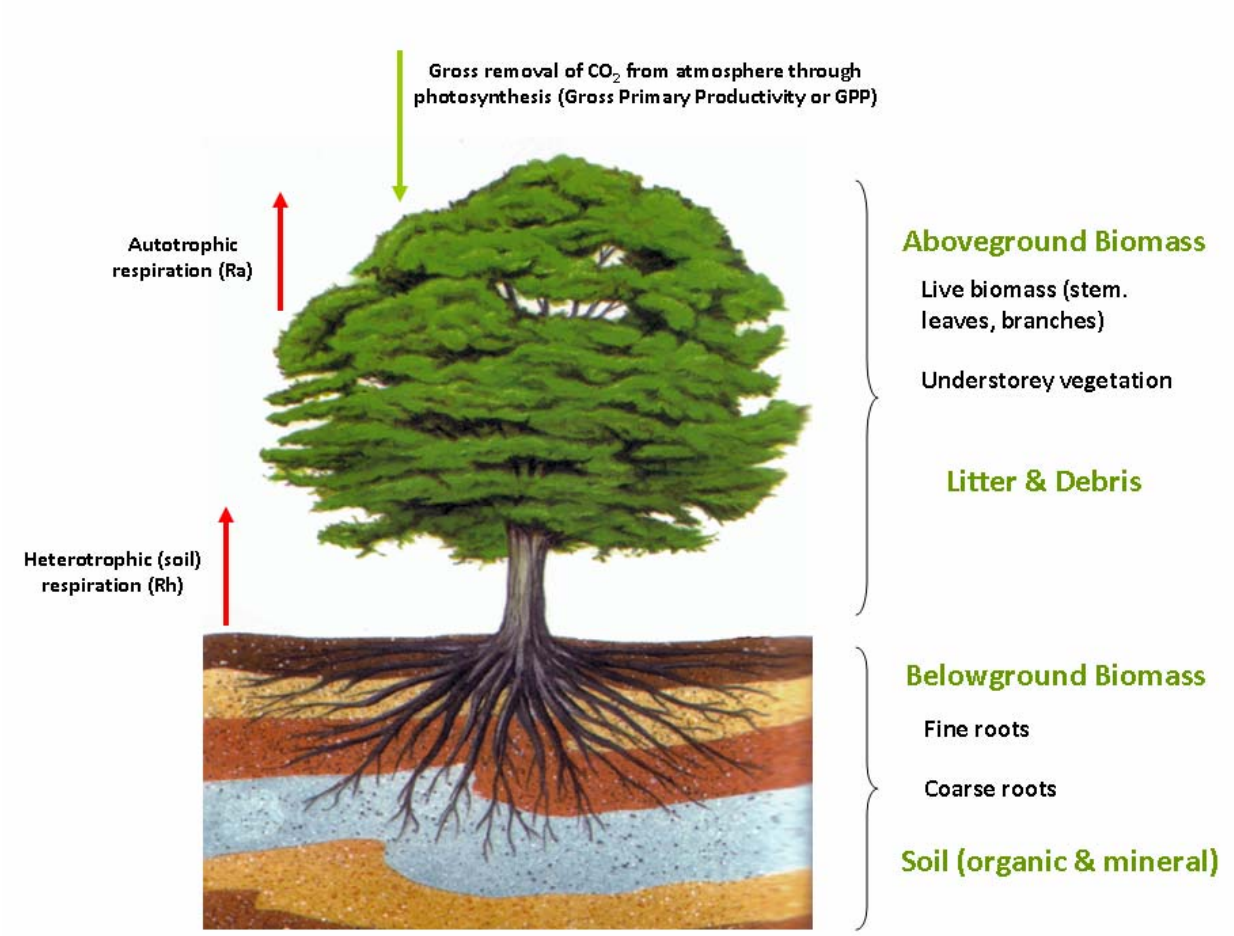

Figure 1: The forest carbon cycle, with the main carbon pools labeled in green. Primary carbon flux pathways are indicated with arrows. Net carbon gains through photosynthesis are shown as a green arrow; net carbon losses from respiration are shown as red arrows.

The overall amount and rate of accumulation of carbon in a forest ecosystem is driven by the processes of photosynthesis and respiration. Photosynthesis is the process within plants that converts atmospheric carbon dioxide into carbohydrate food compounds using energy from the sun. Respiration is essentially the opposite of photosynthesis,

whereby the carbohydrate compounds are converted to energy, releasing carbon dioxide in the process. There are two types of respiration that are relevant to the forest carbon cycle (Figure 1). Autotrophic respiration occurs in the biomass of the live vegetation, including aboveground (leaf, stem) and belowground (root) components. Heterotrophic respiration occurs in the micro-organisms of forest soils.

A number of terms are used to describe the storage of carbon in forest ecosystems. The amount of carbon dioxide that is removed by a forest ecosystem through photosynthesis is also called *Gross Primary Productivity (GPP)*, and is usually expressed as a mass per area per unit time (e.g. tonnes C ha^{-1} $year^{-1}$). *Net Primary Productivity (NPP)* is total biomass accumulated within a forest ecosystem (aboveground + belowground) and is calculated by subtracting autotrophic respiration from GPP. *Net Ecosystem Productivity (NEP)* is the net gain or loss of carbon from an ecosystem and is calculated by subtracting heterotrophic respiration from NPP. *Net Ecosystem Exchange (NEE)* is conceptually similar to NEP, but is a singular measurement of carbon fluxes (usually using eddy covariance techniques) whereas NEP is an annual total.

The rate of accumulation of carbon in a forest ecosystem is largely dependent on tree age (Figure 2, top panel) and the successional stage of the forest. For early succession pioneer species, NPP and NEP increase rapidly in the first few decades of after forest establishment and reach a plateau at the intermediate life stage. The NPP and NEP of early succession species then begin a near linear decline over the remainder of their life cycle. At this point the replacement trees in the successional sequence begin to establish themselves and undergo the rapid increase of NPP and NEP that was experienced by pioneer species decades before. A large amount of variability exists between different tree species in the rate of increase / decrease of NPP and NEP and the age at which the plateau is reached. GPP also exhibits a rapid increase over the first few decades after stand establishment before reaching a level of saturation, the point where decreasing levels of NPP are counterbalanced by increasing rates of autotrophic

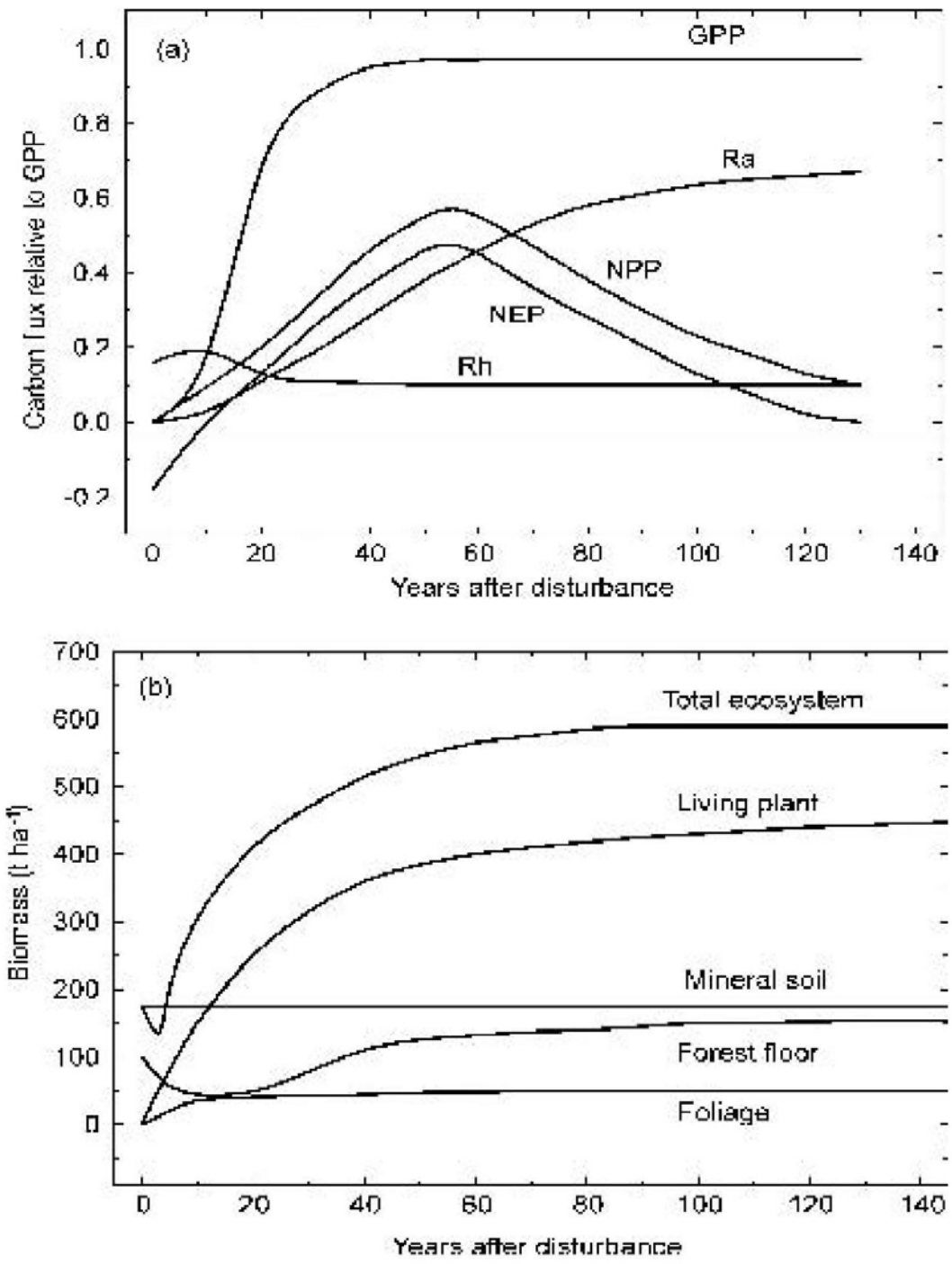

Figure 2: Typical carbon accumulation patterns relative to tree age. The top panel shows the major carbon indicators over the lifetime of a typical tree. The bottom panel shows the allocation of carbon amongst major forest components over the lifetime of a typical tree. Graphic courtesy of Columbo et al. (2005).

respiration. The partitioning of carbon within forest components is also dependent on stand age (Figure 2, bottom panel). Immediately following stand establishment, the soil and litter components contain the majority of the forest carbon. However, after the first few years the living vegetation has become the primary carbon sink. In mature forests the vegetation component contains approximately 70% of the total carbon.

2.3 ABCA FOREST CARBON SEQUESTRATION METHODOLOGY

A literature review was conducted to identify data sources for carbon sequestration estimates of forest ecosystems similar to those that are present in the ABCA watershed. A range of peer-reviewed journal articles and government research reports were obtained for forest carbon sequestration assessments in Ontario, Quebec, and the northeastern USA. A report that estimates the carbon storage of present and future forests in Credit Valley Conservation watershed (Bird and Williams, 2010) was also used. All documents that are referenced in this report have been provided in PDF format on an accompanying compact disc.

The objective of this part of the project was to define net annual carbon accumulation rates and total cumulative carbon storage for forests typical of the ABCA watershed. A challenge of using the literature for this application is that a number of methods exist to estimate and report forest carbon sequestration. Here we describe the assumptions that have been made to ensure that the values reported are consistent and comparable, regardless of the methods used by the original researchers. One method that is used to estimate forest carbon sequestration is through field-based techniques. Field studies can be further subdivided into those using traditional on-the-ground biometric approaches and those that estimate annual carbon storage from eddy flux meteorological data. Ground-based field studies usually report net annual carbon sequestration as NEP while projects using eddy flux techniques report NEE extrapolated over an annual time period. For this project, both NEP and NEE will be assumed to be

equal and representative of net annual carbon accumulation within a forest ecosystem (Goulden et al., 1996).

The other main method that is used to estimate forest carbon sequestration is forest carbon models. Models provide estimates of the annual carbon accumulation rates and cumulative carbon storage according to tree species, geographic region, and individual tree components. This report references three data sources that are based on forest carbon models (Bird and Williams, 2010; Smith et al., 2006; Woodrising 2001). The carbon accumulation and storage values that are reported from these model-derived studies are a total of all non-soil components of the forest ecosystem (above- and below-ground living biomass, litter, coarse woody debris). While soils are a significant portion of total carbon storage in a forest ecosystem, studies have shown that the amount of soil carbon remains relatively stable over time and the majority of net carbon gains occur in non-soil components (Columbo et al. 2005). Therefore it was assumed that the carbon accumulation in the non-soil components are a reasonable comparison to the NEP values reported in the field studies.

2.4 FOREST CARBON SEQUESTRATION

Carbon sequestration values for forests typical of the ABCA watershed are presented in this subsection. Results have been separated according to two major tree physiological groupings, hardwoods and softwoods. Annual carbon storage rates and total cumulative stored carbon are provided at periodic intervals throughout the forest life cycle. Annual carbon storage rates will be useful for predicting the carbon storage potential of new stewardship projects. Total cumulative stored carbon will be advantageous for determining the impact of established stewardship projects or new conservation projects that are used to protect existing forest from land conversion. Both annual carbon storage rates and total stored carbon will be useful in estimating carbon offset and revenue generation potential in future carbon trading markets that may be established in Ontario.

Note that the values reported here are an assessment of the best information available, and are only indicative of the carbon storage characteristics of the major ABCA forest species for which data could be obtained. There are dozens of forest species in the ABCA watershed for which carbon storage data could not be found. It is possible that the carbon storage characteristics of hardwood and softwood species discussed in Sections 2.4.1 and 2.4.2 would be altered if information about additional ABCA forest species were available to be included in this analysis.

2.4.1 Hardwood Forests

The annual carbon storage rates for hardwood forests typical of the ABCA watershed are presented in Table 1. All species exhibit a steady increase in carbon accumulation rates following stand establishment, with an average peak at 30 years of 3.13 tonnes hectare^{-1} year^{-1}. Carbon accumulation rates then decline over the following decades, reaching a point of minimal net carbon accumulation in mature forests. The carbon accumulation rate for hardwood forests averaged over all years is 1.64 tonnes hectare^{-1} year^{-1}.

Significant differences exist in the patterns of carbon accumulation between individual hardwood forest species (Figure 3). Trees that are established earlier in the succession sequence (aspen and birch) are fast-growing, have an earlier peak carbon accumulation point, and have higher peak carbon accumulation rates than other more shade tolerant species. Aspen and birch also more rapidly approach a point of minimal annual carbon accumulation, with very low annual accumulation rates occurring after 75 years as the establishment of late succession forests impacts these shade-intolerant species. Sugar maple is an example of a late succession slower-growing shade-tolerant species that doesn't reach peak carbon accumulation rates until years 40-50. The peak carbon accumulation rate is much lower than that of aspen and birch (Figure 3). Sugar maple exhibits a much more gradual decline in carbon accumulation rates than aspen/birch forests and remains productive (in terms of carbon storage) into its mature years.

The cumulative carbon storage for hardwood forests typical of the ABCA watershed are presented in Table 2. The total carbon storage at year 100 averaged over all species is 189 tonnes hectare^{-1}. The highest carbon storage occurs in the Carolinian ecosystem of oak-hickory forests, which has approximately 30 – 50 % more carbon per hectare than other Ontario forest species (aspen, birch, maple) at year 100.

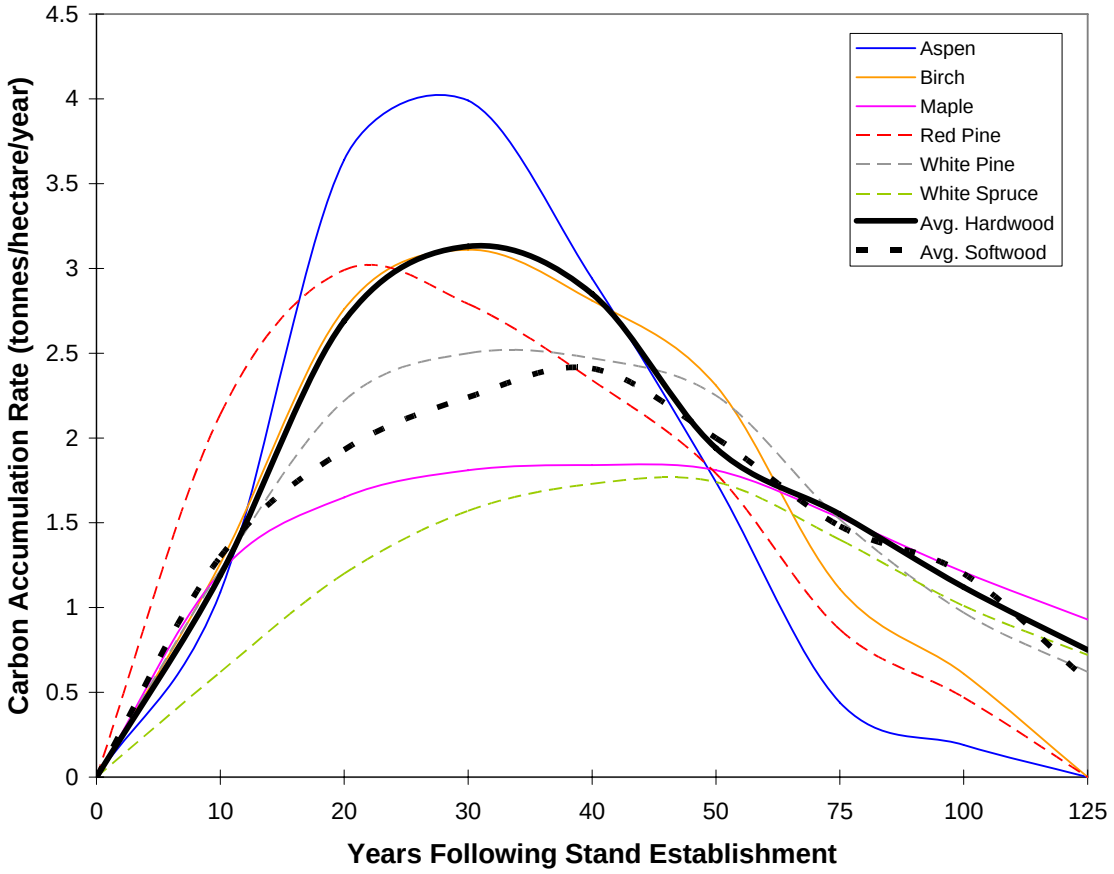

Figure 3: Typical forest carbon accumulation patterns for a selection of hardwood and softwood species found in the ABCA watershed. Hardwood species are shown with a solid line and softwood species are shown with a dashed line. The average carbon accumulation rates for all hardwood and softwood species are displayed using a thick black line. Note the uneven time periods in the X axis.

Site Characteristics		*Forest Age (years)*									
SPECIES	**LOCATION**	**10**	**20**	**30**	**40**	**50**	**75**	**100**	**125**	**Avg. All Years**	**Refs.**
Aspen	Ontario	1.09	3.64	3.99	2.94	1.74	0.44	0.19	0.14	1.34	9
Aspen	Minnesota				2.5						13
White Birch	Ontario	1.26	2.76	3.11	2.81	2.31	1.11	0.61	0.36	1.56	9
Aspen / Maple	N Michigan							1.52			5, 6, 8
Sugar Maple	Ontario	1.21	1.65	1.81	1.84	1.81	1.53	1.21	0.93	1.50	9
Maple / Beech / Birch	NE USA		2.98	3.09	2.88	1.73	1.36	0.95	0.71	1.75	12
Red Oak / Red Maple	Massachusetts					1.95					1, 2, 3, 5
Oak / Hickory	NE USA		3.26	3.34	3.16	2.1	1.84	1.51	1.31	2.19	12
Mixed Hardwoods	Minnesota					2.4					13
Mixed Hardwoods	Indiana						3.04				4,5
Mixed Hardwoods	N Wisconsin						1.63				5
Mixed Hardwoods	Barrie, ON							1.5			7
Poplar	Ontario	2.3									10
Willow	New York	3.4									10
Average All Hardwoods		**1.19**	**2.69**	**3.13**	**2.85**	**1.94**	**1.55**	**1.12**	**0.75**	**1.67**	

Table 1: Annual net carbon storage rates (tonnes C ha^{-1} $year^{-1}$) for hardwood forest ecosystems and species typical of the ABCA watershed. Net carbon storage rates have been provided for a time series throughout the life cycle of a forest ecosystem. A net carbon storage rate for each time period averaged over all hardwood species/ecosystems is provided on the bottom line of the table. The right-hand column ('Refs.') is a key to identify the journal article or report from which the values were obtained in Section 6.

Stand Characteristics		*Forest Age (years)*									*Refs.*
SPECIES	**LOCATION**	**10**	**20**	**30**	**40**	**50**	**75**	**100**	**125**	**150**	
Aspen	Ontario	14	39	79	113	135	159	164	168		9
Aspen	Minnesota				100						13
White Birch	Ontario	17	39	68	98	122	164	184	195		9
Maple / Beech / Birch	NE USA		65	92	115	134	171	199	219		12
Sugar Maple	Ontario	17	32	50	68	87	126	161	188		9
Oak / Hickory	NE USA		70	100	126	149	198	239	274		12
Mixed Hardwoods	Minnesota					96					13
Mixed Hardwoods	Credit Valley, Ontario									245	19
Average All Hardwoods		**16**	**49**	**78**	**103**	**121**	**164**	**189**	**227**		

Table 2: Total cumulative carbon storage (tonnes C ha^{-1}) for hardwood forest ecosystems and species typical of the ABCA watershed. Total carbon storage values have been provided for a time series throughout the life cycle of a forest ecosystem. The total carbon storage for each time period averaged over all hardwood species/ecosystems is provided on the bottom line of the table. The right-hand column ('Refs.') is a key to identify the journal article or report from which the values were obtained in Section 6.

2.4.2 Softwood Forests

The annual carbon storage rates for softwood forests typical of the ABCA watershed are presented in Table 3. All species exhibit a steady increase in carbon accumulation rates following stand establishment, with an average peak at 40 years of 2.41 tonnes hectare^{-1} year^{-1}. Carbon accumulation rates then decline over the following decades, reaching a point of minimal net carbon accumulation in mature forests. The carbon accumulation rate for softwood forests averaged over all years is 1.43 tonnes hectare^{-1} year^{-1}.

Significant differences exist in the patterns of carbon accumulation between individual softwood forest species (Figure 3). Trees that are established earlier in the succession sequence like red pine are fast-growing, have an earlier peak carbon accumulation point (20 years), and have a higher peak carbon accumulation rate (2.99 tonnes hectare^{-1} year^{-1}) than other more shade tolerant species. Red pine also more rapidly approach a point of minimal annual carbon accumulation, with very low annual accumulation rates occurring after 75 years. White spruce is an example of a late succession slower-growing shade-tolerant species that doesn't reach peak carbon accumulation rates until year 50. The peak carbon accumulation rate (1.74 tonnes hectare^{-1} year^{-1}) is much lower than that of red pine (Figure 3). White spruce exhibits a much more gradual decline in carbon accumulation rates than red pine forests and remains productive (in terms of carbon storage) into its mature years.

The total cumulative carbon storage for softwood forests typical of the ABCA watershed are presented in Table 4. The total carbon storage at year 100 averaged over all species is 174 tonnes hectare^{-1}. The highest carbon storage occurs in the white pine ecosystems, which has approximately 30 % more carbon per hectare than white spruce forests at year 100.

When comparing the cumulative carbon storage of hardwood forests to softwood forests in the ABCA watershed, the average total carbon storage in hardwoods is

consistently greater than softwoods throughout the forest life cycle (Tables 2 and 4). This is not a recommendation that preference should be given to planting of hardwoods or specific faster-growing species in new forest projects in the interest of increased carbon sequestration. The priorities in planning forest projects should continue to be optimal matching of site conditions with suitable tree species. However, the differences in carbon storage between hardwoods and softwoods identified in this report could be useful in forecasting the potential carbon offset generation of forest projects should a carbon trading market be established in Ontario (discussed in more detail in Section 4).

2.4.3 Conversion to Atmospheric CO_2 Uptake

The goal of this project was to provide ABCA and its landowners with the information required to take advantage of emerging opportunities that pertain to the reduction of atmospheric greenhouse gases. Thus it is necessary to convert the rates of forest carbon accumulation and total carbon stored into equivalent values of CO_2 (carbon dioxide) removed from the atmosphere using the following conversion factor:

1 tonne sequestered carbon = 3.667 tonnes CO_2 uptake from atmosphere

The equivalent values of CO_2 removed from the atmosphere will be a critical factor in utilizing the information from this report in the future. Any communication materials that are developed in the interest of obtaining sponsorship or increasing awareness of the ABCA's stewardship initiatives should use the atmospheric CO_2 uptake values, as these are closely aligned with private sector interests in reducing GHG emissions. The atmospheric CO_2 uptake values will also be important in determining the potential carbon offset generation of stewardship projects, as the base unit for calculating carbon offset credits is CO_2 emission reductions. The conversion of key carbon sequestration variables for both hardwood and softwood forest ecosystems is provided in Table 5. Some examples of household and travel carbon impacts that can be used by ABCA in its sponsorship promotional materials is provided in Table 6.

Site Characteristics		*Forest Age (years)*									
SPECIES	**LOCATION**	**10**	**20**	**30**	**40**	**50**	**75**	**100**	**125**	**Avg. All Years**	**Refs.**
Red Pine	Ontario	2.14	2.99	2.79	2.34	1.79	0.87	0.47	0.29	1.43	9
Red Pine	Ontario			2.6							15
Red Pine / White Pine	NE USA	1.21	1.79	2.3	2.46	2.22	1.67	1.18	0.94	1.83	12
White Pine	Ontario	1.22	2.22	2.5	2.47	2.25	1.52	0.97	0.62	1.62	9
White Pine	Turkey Point, ON						1.96				14
White Pine / White Spruce	Ontario		1.44								16
White Spruce	Ontario	0.62	1.2	1.57	1.73	1.74	1.4	1.01	0.72	1.30	9
White Spruce	Ontario			1.7							15
Red Spruce / Eastern Hemlock	Maine							2.37			14
Mixed Softwoods	Minnesota				3.04						13
Average All Softwoods		**1.3**	**1.93**	**2.24**	**2.41**	**2**	**1.48**	**1.2**	**0.57**	**1.55**	

Table 3: Annual net carbon storage rates (tonnes C ha^{-1} $year^{-1}$) for softwood forest ecosystems and species typical of the ABCA watershed. Net carbon storage rates have been provided for a time series throughout the life cycle of a forest ecosystem. A net carbon storage rate for each time period averaged over all softwood species/ecosystems is provided on the bottom line of the table. The right-hand column ('Refs.') is a key to identify the journal article or report from which the values were obtained in Section 6.

Stand Characteristics		*Forest Age (years)*									Refs.
SPECIES	**LOCATION**	**10**	**20**	**30**	**40**	**50**	**75**	**100**	**125**	**150**	
Red Pine	Ontario	6	48	78	103	122	154	169	178		9
Red Pine	Ontario				91						15
Red Pine	Ontario								172		11
Red Pine / White Pine	NE USA	12	36	69	99	123	170	203	229		12
White Pine	Ontario								196		11
White Pine	Ontario	17	34	58	82	106	153	182	202		9
White Pine / White Spruce	Ontario		29								16
White Spruce	Ontario	12	23	36	54	70	111	140	162		9
White Spruce	Ontario				64						15
White Spruce	Ontario								161		11
Mixed Softwoods	Minnesota				137						13
Mixed Softwoods	Credit Valley, Ontario									229	
Average All Softwoods		**12**	**34**	**60**	**90**	**105**	**147**	**174**	**187**		

Table 4: Total cumulative carbon storage (tonnes C ha^{-1}) for softwood forest ecosystems and species typical of the ABCA watershed. Total carbon storage values have been provided for a time series throughout the life cycle of a forest ecosystem. The total carbon storage for each time period averaged over all softwood species/ecosystems is provided on the bottom line of the table. The right-hand column ('Refs.') is a key to identify the journal article or report from which the values were obtained in Section 6.

Forest Type	Carbon Storage @ 100 years ($t\ ha^{-1}$)	Total CO_2 Uptake @ 100 years ($t\ CO_2\ ha^{-1}$)	Avg. Annual Carbon Accum. Rate ($t\ ha^{-1}\ year^{-1}$)	Avg. Annual CO_2 Uptake ($t\ ha^{-1}\ year^{-1}$)	Single Tree Lifetime Carbon Storage (t)	Single Tree Lifetime CO_2 Uptake (t)
Hardwood	189	693	1.69	6.2	0.108	0.40
Softwood	174	638	1.55	5.68	0.1	0.36

Table 5: Summary of forest ecosystem carbon sequestration and atmospheric CO_2 uptake for both hardwood and softwood forests typical of the ABCA watershed. Ecosystem carbon storage (at 100 year age), annual ecosystem carbon accumulation rates, and single tree lifetime carbon storage (at 100 year age) are shown. Single tree lifetime carbon storage rates are calculated assuming a stem density of 1750 per hectare.

Carbon Impact	Assumptions	CO_2 emissions (tonnes)	Number of Trees
Ontario single-family annual household energy use	10,000 kWh electricity 30,000 kWh natural gas	8.5	21
Average Ontario resident (annual)	Per Capita share of provincial GHG emissions	15.4	39
Annual Car Usage	Mid-size sedan (e.g. Taurus) 20,000 km driven	4.5	11
Round-trip flight – short	1 hour each way Non-stop	0.12	0.3
Round-trip flight – cross-country	5 hours each way Non-stop	1	3
Round-trip flight – international	10 hours each way Non-stop	2	5

Table 6: The carbon impact (tonnes of atmospheric CO_2 emitted) and the number of equivalent trees planted (hardwood presented) for a selection of household and travel examples. These examples can be used by ABCA in its promotional materials that are used to obtain sponsorship revenue for stewardship projects. For example, the annual carbon footprint from an average-sized car (4.5 tonnes CO_2) is counterbalanced by the planting of 11 hardwood trees (0.4 tonnes CO_2).

3. SPONSORSHIP AND AWARENESS OPPORTUNITIES

The forest carbon accumulation and storage information presented in Section 2 will provide the ABCA with a set of defensible and locally relevant values that they can use to communicate the 'carbon benefits' of the projects that they manage and initiate. This section of the report will review opportunities that are available to the ABCA to take advantage of their 'carbon benefits' information to generate funding and awareness for their stewardship projects. Section 3.1 is a review of different forms of corporate sponsorships that are available and recommendations on steps the ABCA could take to capture some of these opportunities. Section 3.2 is a review of funding and awareness programs that focus on smaller donations, often from the general public.

3.1 CORPORATE SPONSORSHIPS

A range of corporate sponsorship opportunities are available to organizations that manage land stewardship projects. One of the main driving factors for these sponsorship opportunities is the carbon sequestration benefits of land stewardship projects. Businesses are interested in aligning themselves with organizations and projects that increase carbon sequestration and mitigate climate change. Marketing strategies that utilize 'carbon jargon' (e.g. carbon footprint, carbon neutral) have become very effective as the public has developed a greater understanding of these concepts relative to other environmental issues. Thus the fact that land stewardship projects can be communicated through 'carbon jargon' makes them a strong candidate for obtaining sponsorship funding.

3.1.1 Corporate Sponsorship Options

A review was conducted of corporate sponsorship options that are available to land stewardship organizations in Ontario. Specific examples of some innovative partnerships between the private sector and land stewardship organizations are provided. Sponsorship examples have been subdivided into the following categories:

- On-going (continuous) funding programs
- Specific single-event promotions
- Generation of carbon offset credits
- Other sponsorship models

3.1.1.1 On-going (continuous) funding programs

These opportunities are the result of significant multi-year funding commitments by some of Canada's largest corporations that have identified environmental protection as a cornerstone of their corporate social responsibility efforts. Three examples of on-going environmental funding programs are provided below.

RBC Blue Water Project

From 2007 - 2016 the Royal Bank of Canada (RBC) has committed a total of $50 million that will be granted to not-for-profit organizations that protect watersheds and provide access to clean drinking water. The Ausable Bayfield Conservation Foundation received a $100,000 grant from the RBC Blue Water Project in 2011 to support the Healthy Headwaters Wetlands Initiative, a project that is restoring and enhancing important wetlands for the benefit of water quality and quantity in Huron and Middlesex counties.

TD Friends of the Environment Foundation

The TD Friends of the Environment Foundation (TD FEF) was formed by TD Bank Financial Group to fund local projects led by charitable organizations that are dedicated to preserving the environment. Since 1990 the TD FEF has provided more than $53 million to support over 19,000 environmental projects in communities across Canada. Every year TD Bank Financial Group contributes an additional $1 million to TD FEF.

Shell Canada Fuelling Change Program

Fuelling Change is a revised version of the long-running Shell Environmental Fund. In the Fuelling Change program, Shell will grant a total of $1 million per year to projects that

improve and restore Canada's environment, with the decisions on project funding to be decided by on-line votes. Canadians will have the opportunity to vote for their favourite projects from three focus areas – Land, Air and Water. The projects with the most votes at the end of each cycle will receive grants in the amounts of $25,000, $50,000 or $100,000. The program is open to Canadian-based charitable and not-for-profit organizations, educational institutions, community groups, and municipalities.

3.1.1.2 Specific single-event promotions

Single-event promotions are typically limited-time partnerships that are established between a land stewardship organization and a sponsoring business. During this time, the business will provide financial contributions to the land stewardship organization as part of a promotional campaign for a new product or to celebrate a corporate event, such as a milestone anniversary. In product-specific campaigns the donation to the stewardship organization is usually based on the amount of sales of a product (e.g. one tree planted for every product sold). Given the number of single-event promotions that have been established in Ontario and the rest of Canada recently it is clear that this is a promotional vehicle that is attractive to corporate sponsors, and is a key opportunity for the ABCA and its partners to take advantage of in the future. A number of examples of single-event promotions are provided in Table 7.

3.1.1.3 Generation of carbon offset credits

Some potential opportunities exist for ABCA to obtain funding from organizations that will retain the associated carbon credits that are generated from stewardship projects. These are separate from opportunities that may be available in the future for ABCA or individual landowners in the watershed to generate *their own carbon credits* in the emerging carbon trading market that Ontario may participate in (this opportunity is described in Section 4).

SPONSOR	AMOUNT	PROGRAM DESCRIPTION	RECIPIENT
CAA	Not disclosed	One tree will be planted (to a maximum of 20,000) for each southern Ontario customer that participates in CAA's Autogreen program	Trees Ontario
Sansin Stains	Not disclosed	One tree will be planted for each gallon of Sansin's Enviro-Stain sold in May 2011	Trees Ontario
Union Gas	$10,000	Donation to plant 3300 trees in London and Sarnia as part of their 100th anniversary celebration	Trees Ontario
Active Green & Ross	Not disclosed	One tree planted for every EcoPower oil change that was purchased in early 2011 (2500 trees total)	Trees Ontario
Canadian Tire	$250,000	For the launch of Blue Planet enviro light bulbs, Canadian Tire donated $2 for every package of bulbs bought in Canada	Trees Ontario
Libro Financial Group	$20,000	Donation to plant 8000 trees to celebrate paperless statements	Trees Ontario
Latornell Symposium	Not disclosed	Funds the planting of 4000 trees annually to offset the GHG impacts of the annual meeting	Trees Ontario
Fed Ex	Not disclosed	Funded the greening of over 50 schools since 2007 and contributed to the reforestation of lands affected by BC wildfires in 2009	Tree Canada
Golder Associates	$85,000	Donation to greening schools program to celebrate their 50th anniversary	Tree Canada
3M	Not disclosed	Through their 'Plant it Forward' program will provide funding for the planting of 10,000 trees in 2011 through no-cost customer dedications	Tree Canada
Paper Mate	$20,000	Donation to tree planting efforts to celebrate the launch of new biodegradable pens	Tree Canada
Northland Firelogs	Not disclosed	For the launch of their green firelog product are funding the planting of a tree for every unit sold	Tree Canada
Molson	Not disclosed	Funding the planting of 100,000 trees throughout Canada in 2011 in their Red	Tree Canada

		Leaf Program	
Majesta Tissue	Not disclosed	Funding the planting of 37,000 trees per year in vulnerable shoreline areas in Canada in support of their sustainable paper commitment	Tree Canada
Loblaws	Not disclosed	Provided funding for the planting of 80,000 trees to counterbalance the trees harvested for their flyers	Tree Canada
Staples	Not disclosed	Charges a $5 fee for every on-line delivery order under $50, half of which is donated to Tree Canada for the planting of one tree – this is intended to counterbalance the inefficient travel impacts of small deliveries	Tree Canada
Deloitte	Not disclosed	Provided funding for the planting of 50,000 trees to celebrate their corporate Impact Day for social responsibility	Tree Canada
Enbridge	Not disclosed	Provided funding to plant 50,000 trees along pipeline right-of-ways	Tree Canada
IKEA	Not disclosed	Donate a portion of Christmas tree sales to fund 'Pick a Tree Plant a Tree' program	Tree Canada
Allied Van Lines	Not disclosed	Fund the planting of one tree for every 3000 miles of driving (6000 trees total)	Tree Canada
Air Miles	Not disclosed	175 miles can be reimbursed by customers to fund tree planting projects	Tree Canada
Miss Vickie's Chips	Not disclosed	Provided funding to plant 40,000 trees in a promotional program with specially marked bags of chips	Tree Canada
Talisman Energy	$500,000	Donated funds to support wetland education initiatives	Ducks Unlimited Canada
Mountain Equipment Co-op	$15,000	Donation to support conservation initiatives	Grand River Foundation
Several corporate sponsors	> $100,000	Donations to support conservation initiatives	Toronto Living City Foundation

Table 7: A sample of recent single-event corporate sponsorships of land stewardship projects in Ontario and the rest of Canada. Shown are the sponsoring company, the dollar value of the donation (if known), the land stewardship organization that received the sponsorship funding, and a brief description of the single-event project.

It is important to note that stewardship projects that are funded for the purpose of generating carbon offset credits must be documented and monitored to a higher level of rigour than those funded through other sponsorship methods. A description of the issues that must be addressed in the planning, management, and monitoring of these projects is provided in Section 4. Two examples of potential opportunities from the generation of carbon offsets to be retained by the sponsoring organization are provided below.

Ontario Power Generation (OPG) Tree Planting Program

OPG is a large emitter of GHGs that must report GHG emissions annually to Ontario's Ministry of the Environment and may face mandatory reductions in the near future if Ontario agrees to participate in the Western Climate Initiative cap and trade program. Since 2000 OPG has invested in a tree planting program as a credit (GHG sink) to reduce its overall carbon footprint. This program has resulted in the planting of almost 4 million trees in southern Ontario, with funding allocated through a competitive RFP process. Project proponents must address carbon offset principles including additionality, leakage, permanence, and on-going monitoring to ensure the carbon sequestration that results from the project will be applicable as a credit against OPG's carbon footprint.

Greening Canada Fund

The Greening Canada Fund (GCF) was launched in 2009 with a cash investment from TD Bank and BMO. This program generates high-quality carbon offset credits by investing in GHG emission reduction projects across Canada. GCF focuses on investing in projects led by social and non-profit organizations. Carbon offsets that are generated from GCF projects are marketed and sold to companies that are interested in reducing their carbon footprint. It is uncertain whether GCF invests in land stewardship projects to generate carbon offset credits.

3.1.1.3 Other sponsorship models

A number of other models have been identified for obtaining corporate sponsorship for land stewardship projects that do not fit into the previous categories. Several examples are provided below:

Trees In Trust (www.treesintrust.com)

This is a program whereby financial donations are made to a land trust organization that manages a plot of protected woodland in the donor's name. Donations can also be made as a gift with the plot of woodland protected in the recipient's name.

Canadian Land Trust Alliance LEED Credit Program

This program allows projects that are striving for LEED (Leadership in Energy and Environmental Design) certification to receive credit for certain LEED requirements by donating funds to a recognized CLTA land trust organization with managed lands that are within 800 km of the LEED project location. This program is available to applicants for the LEED 'Existing Buildings' and 'Neighbourhood Development' options. Credits are awarded at a rate of $2000 per protected acre.

Ducks Unlimited Branded Merchandise

Ducks Unlimited Canada has a number of corporate partners (including Giant Tiger, Russell Stover candies, MBNA credit card) that are licensed to sell merchandise branded with the DU logo. A portion of the sales of these products is donated to DU.

3.1.2 Recommendations to ABCA

In this subsection a number of recommendations are provided on actions the ABCA and its partner organizations can take to capture corporate sponsorship opportunities. The recommendations are not listed in any particular order of importance.

1. **ABCA is encouraged to provide continued staffing and promotional support to its charitable partner organizations (e.g. Ausable Bayfield Conservation Foundation) as the avenue for receiving and soliciting corporate sponsorships.** The review of land stewardship corporate sponsorship examples for this report revealed a clear preference for the majority of sponsorship dollars to be donated to charitable organizations. However, the lack of marketing and promotional staffing resources at the ABCF severely restricts its capacity to pursue these sponsorship opportunities. The ABCA could provide increased support to ABCF through the provision of a staff resource whose role is fully or partially dedicated to promotion of the ABCF in the interest of generating corporate sponsorships.
2. **ABCA is encouraged to invest in an upgrade of the ABCF page on the ABCA website.** A review of several other charitable foundations associated with other Ontario conservation authorities revealed some key features that are lacking on the current ABCF webpage. One such feature is a listing of major donors to the foundation. Given the fact that a primary objective of many corporate donors is the recognition that they receive for their gift, an enhancement of the ABCF website to provide this recognition is strongly encouraged. Another feature of the ABCF website that is lacking is an interface whereby interested parties can directly donate to the foundation through an on-line payment gateway (also discussed in Section 3.2). A number of other conservation foundations use an organization called 'Canada Helps' as the mechanism for their on-line donations.
3. **ABCA should consider engaging with other stewardship organizations in southwestern Ontario to discuss the establishment of partnerships that would increase marketing opportunities and geographic coverage.** The fiscal challenges faced by many Ontario conservation authorities, including the ABCA, could make it difficult for any one organization to implement a cohesive and consistent program to target corporate sponsorships. One potential solution to this challenge might be a regional partnership of numerous conservation authorities to address this opportunity. A regional partnership would reduce the

burden on any single conservation authority to finance a dedicated corporate sponsorship program, and it would expand the geographic scope of potential donors. ABCA is encouraged to initiate dialogue with other conservation authorities in southwestern Ontario to explore a potential partnership agreement.

4. **ABCA is encouraged to develop a list of potential corporate sponsors for whom a relationship with ABCA would be a 'good fit' with their community focus and corporate social responsibility mandate.** While ABCA is not geographically restricted in seeking corporate sponsorship, there is likely to be a much greater probability that companies with a local presence will be interested in engaging in partnerships with the ABCA. For this reason ABCA is encouraged to focus its initial sponsorship efforts on companies that have their headquarters or significant operations in the ABCA watershed and surrounding area. A list of candidate companies that could be considered as part of an initial sponsorship campaign is provided in Appendix A.

5. **ABCA and its partners are encouraged to identify innovative methods to receive corporate sponsorship.** Traditional cash donations are only one form of corporate sponsorship that should be pursued. The research conducted for this report revealed that a popular form of corporate sponsorship is the single-event donations that are often used for product promotion (see Table 6). ABCA is encouraged to initiate dialogue with prospective sponsors about developing single-event programs in support of stewardship projects in the ABCA watershed. Another innovative sponsorship approach could be the provision of non-cash gifts such as services or equipment. This could reduce the financial burden on ABCA to purchase these services or materials and could be an avenue for the sponsor to promote the services or products that are being donated.

6. **ABCA is encouraged to develop a formal communications strategy tailored for corporate sponsorships.** The main reason that corporate sponsors provide donations to organizations like ABCA is to generate publicity and promotional

opportunities that shed their business in a positive light. Marketing experts state that businesses expect a 3:1 payback in revenue from the funds that they donate. Therefore ABCA should invest in a professional and comprehensive communications strategy that can be presented to potential sponsors to explain how they will receive a return on their investment. This strategy should include details on the various media channels (traditional and social) that will be used for promoting the sponsorship and the estimated audience that will be reached.

7. **ABCA is encouraged to establish a goal or target pertaining to watershed forest cover against which corporate sponsorships will be applied.** A goal pertaining to forest cover in the ABCA watershed (e.g. 10% increase in forest cover by 2015, increase of 5000 forested hectares) would show corporate sponsors that their donations are going towards a specific ABCA initiative that has the potential to become a high-profile promotional piece. The use of targets can be an effective method to generate interest, enthusiasm, and publicity in an initiative.

8. **ABCA is encouraged to assign a staff position dedicated to obtaining corporate sponsorships and donations.** Given the potential of sponsorships to bring new sources of revenue to ABCA and its partner organizations, a dedicated staff member should be assigned to develop the communication strategies and to cultivate relationships with targeted businesses. The acquisition of sponsorship dollars is very competitive, and ABCA cannot expect that sponsoring businesses will approach them on their own. ABCA has to be aggressive in promoting itself as a credible and viable organization in which to invest sponsorship dollars. A dedicated staff member would help ABCA to present itself as a professional and prepared organization that is worthy of sponsorship. Should ABCA be successful in establishing a partnership with other stewardship organizations in the region to pursue corporate sponsorships (see Recommendation 3) the costs of having a dedicated staff member could be shared.

3.2 SMALL DONATIONS

Another opportunity for additional revenue for ABCA and its charitable partner organizations to support land stewardship initiatives is small donations ($5 - $500) from individuals or small businesses. While this revenue source is not expected to provide the volume of funds as a targeted and organized corporate sponsorship campaign, it is nevertheless an additional opportunity for the ABCA to generate increased funding with a minimal amount of effort. The following recommendations are provided on actions the ABCA and its partner organizations can take to capture small donations. The recommendations are not listed in any particular order of importance.

1. **ABCA is encouraged to update the ABCF page on its website to provide the opportunity for individuals and small businesses to donate directly through an online payment gateway.** A number of charitable organizations provide an on-line option for small donations to be made[1] in recognition of the growing preference by individuals to conduct financial transaction over the internet. An organization called Canada Helps (www.canadahelps.org) has been established to facilitate on-line donations for charitable organizations. Canada Helps provides a ready-made e-payment gateway that can be embedded in the charitable organization's website. A service charge of 3.9% is deducted from all on-line donations made through Canada Helps e-payment gateway to cover the costs of credit card transaction fees (this service charge is universal for on-line credit card transactions and would apply to any e-payment gateway service).
2. **ABCA is encouraged to take advantage of social media tools to promote its land stewardship initiatives and encourage donations.** Social media tools like Twitter and Facebook have an incredible reach and low cost if used properly. ABCA should utilize the tools to increase its profile within the community, raise awareness for its stewardship initiatives, and solicit small donations.

[1] Conservation Halton Foundation is one example: http://www.conservationhalton.ca/ShowCategory.cfm?maincategory=1&subCatID=999

3. **ABCA is encouraged to communicate the benefits of its land stewardship initiatives using carbon-based themes.** Carbon-based themes have become a very effective marketing and promotional tool. One reason is because the general public has an understanding of carbon concepts like 'carbon footprint' and 'carbon neutral'. The other reason is because GHG emissions are caused by many of our everyday actions and needs (home heating, electricity, driving), making the issue of climate change one that has a personal connection. When communicating the benefits of its land stewardship initiatives through various promotional channels, ABCA is encouraged to utilize carbon-based themes to do so. For example: "Each year, one acre of forest cancels out the carbon footprint of an average Ontario citizen".

4. POTENTIAL OPPORTUNITIES IN CARBON OFFSETS

In cap and trade carbon markets large emitters of GHG over 25,000 tonnes per year (e.g. power plants) will be required to reduce their GHG emissions below a specified 'cap'. One method for these large emitters to meet their reduction targets will be purchasing carbon offsets from GHG reduction projects that have been verified and approved by the cap and trade authority. Because the overall cap of GHG will be reduced on an annual basis, demand for carbon offsets is expected to increase amongst the large emitters, thus driving up the price of carbon offsets over time. Section 4.1 is a brief description of the cap and trade market that is relevant to Ontario. Section 4.2 reviews key issues specific to carbon offset projects that must be addressed by landowners who are considering participating in cap and trade programs. Section 4.3 provides some recommendations on actions that can be taken by ABCA and its partner organizations to prepare for future carbon offset opportunities. Section 4.4 provides some rough estimates of potential offset-based funding for three scenarios of forest projects that may be applicable to the ABCA watershed.

4.1 THE WESTERN CLIMATE INITIATIVE

Cap and trade markets currently exist in Europe, the northeastern United States, and the province of Alberta. Although cap and trade markets are not yet active in Ontario, the provincial government[2] has embraced cap and trade mechanisms as a key method to meet their GHG reduction targets of 15% below 2005 levels by the year 2020. Ontario is a participant in the Western Climate Initiative[3] (WCI), a regional cap and trade market comprising four Canadian provinces and several US states that is scheduled to begin in 2013. Several key aspects of WCI have yet to be finalized, including key decisions that affect carbon offset project developers such as the offset pricing structure and the percentage of a large emitter's GHG reduction requirement that will be able to be met through offset purchases. Although Ontario has not yet defined a firm date to begin active participation in the WCI, this is expected to occur in the near future given the recent re-election of the provincial Liberal government which is a strong supporter of Ontario's involvement in cap and trade markets. Through Ontario's participation in WCI, managers of Ontario-based offset projects will have the flexibility to engage in transactions with an increased selection of buyers that are located throughout participating WCI states and provinces.

While WCI has yet to announce its approved list of project types and associated protocols for the generation of carbon offsets, forest-based offsets are expected to play a major role in meeting emission reduction targets. The broad group of forest-based offsets might include the following project categories:

- **Afforestation**: the conversion of land that was not recently forested back into natural forest cover. Afforestation has been designated as a priority offset project type by the Ontario government and has been the subject of

[2] http://www.ene.gov.on.ca/en/air/climatechange/capAndTrade.php
[3] http://www.westernclimateinitiative.org/index.php

extensive research by the Ontario Ministry of Natural Resources (Gleeson et al., 2009; Parker et al., 2009).

- **Forest Conservation** is the permanent protection of existing forests (through designations like easements) to avoid potential harvest or land conversion that would otherwise release much of the forest's stored carbon
- **Sustainable Forest Management** is the adoption of recognized management practices that maintain the diversity, health, and carbon stocks of a forest

Given the large number of unknowns regarding program-specific details about the WCI (offset project types, offset usage limits by large emitters, offset pricing), it is impossible to provide a detailed projection of the potential revenue that could be expected from forest-based offset projects in the ABCA region, however some rough estimates have been provided in Section 4.4.

4.2 CARBON OFFSET CRITERIA

Even though the specific types of forest carbon projects and offset quantification protocols haven't been finalized by WCI, it is important to review the main criteria that universally apply to all offset projects. These criteria are defined by ISO 14064-2, the leading standard that defines the characteristics of offset projects to ensure that real reductions in GHGs are achieved and that the interests of both buyers and sellers of offsets are protected. The main criteria that are used to assess eligibility of offset projects are tests for permanence, additionality, and leakage avoidance.

4.2.1 Permanence

Carbon offset projects must generate permanent reductions of GHG emissions. Of the several forest carbon offset protocols that the WCI is reviewing for adoption (in part or full), there are some common approaches to addressing the issue of permanence:

- Project proponents must commit to maintaining the forest stand or sustainable management practices that are responsible for carbon storage for a specified period of time (e.g. 100 years). Project proponents are required to enter into legally binding agreements that contain repayment provisions should they be responsible for their project experiencing a reversal of carbon sequestration that has been previously credited as a carbon offset;
- Project proponents must adhere to a long-term monitoring plan, including regular site inspections by the project proponent, reporting of monitoring results to the carbon offset program, and periodic site visits by third-party verifiers and/or program officials;
- Project proponents must contribute a portion of their offsets (usually 10 – 20%) to a 'buffer account' of offset credits that cannot be sold. This buffer account acts as insurance against unforeseen losses of accumulated carbon from events like fire, pest infestations, or disease outbreaks. This maintains the integrity of the carbon offset program by ensuring that the GHG emissions reductions that have been quantified remains valid even though individual projects may lose all or part of their accumulated carbon.

4.2.2 Additionality

Additionality requires that an offset project be dependent on the offset funding in order for it to occur. GHG reductions from offset projects are deemed additional if they would not have otherwise occurred in a 'business as usual' scenario and if they were not initiated from a regulatory/legislative requirement.

The current 'business as usual' at ABCA uses a variety of funding sources to implement various stewardship initiatives including tree planting programs, land conservation, and responsible land management incentives. Should ABCA or private landowners in the watershed choose to generate carbon offsets in the future, it will be necessary to take proper steps to manage offset projects separately from stewardship projects funded

through other means. This separation of offset projects from ABCA's existing programs will address the additionality requirements and will also make it easier to conduct the stringent monitoring and verification demands of offset projects.

4.2.3 Leakage

Leakage occurs when the establishment of a carbon offset project in one location leads to an increase in GHG emissions at another location, thereby negating the GHG reduction benefits of the offset project. One example of leakage is with forest conservation projects, where harvesting activities can simply shift from within the boundaries of an offset project to outside of the protected areas. Another example of leakage is with afforestation projects from the conversion of marginal farmland. In this case leakage can occur if a landowner converts another parcel of land from natural cover to cropland to compensate for the cropland that was retired for the purpose of offset generation. Leakage avoidance can be a challenging concept to accurately quantify, but several of the existing forest carbon offset protocols provide guidance and decision tools to guide project proponents in assessing this issue.

4.3 RECOMMENDATIONS

In this subsection a number of recommendations are provided on actions that the ABCA can take to prepare for its participation in a potential future cap and trade market. The recommendations are not listed in any particular order of importance.

1. **ABCA is encouraged to initiate dialogue with other Ontario conservation organizations that could be future partners in delivering services to the carbon offset industry.** In the event that the Ontario government gives the final green light to its participation in the WCI cap and trade market, a new infrastructure of services centred on the carbon offset industry will arise. This new offset service industry will encompass the entire process from project planning and

implementation expertise through offset listing and brokerage services. Given their existing network of relationships with landowners and their expertise in implementing and managing stewardship projects, ABCA and other conservation authorities (CAs) could have a significant and strategic role to play in Ontario's carbon offset services industry. There will be a demand amongst carbon offset project developers for unbiased, trusted, and experienced professionals to work with individual landowners to ensure that offset projects are implemented according to protocol. Conservation Ontario has been monitoring the progression of Ontario's cap and trade stance and the potential role of the province's CAs in the offset services industry. ABCA is encouraged to engage in dialogue with Conservation Ontario and other Ontario CAs to develop a unified and comprehensive plan that will guide the involvement of Ontario's CAs in this new industry.

2. **ABCA is encouraged to educate staff about forest-based carbon offsets.** Given the potential major impact that the carbon offset industry could have on ABCA and future land stewardship practices in the watershed, ABCA staff should be educated about the structure and function of carbon offset projects and how they differ from existing stewardship initiatives. The staff engagement should include a discussion about the logistics of managing and monitoring offset projects separately from other stewardship initiatives.

3. **ABCA is encouraged to get feedback from watershed landowners** about whether they are interested in participating in potential carbon offset programs in the future and if they would like to work with ABCA as one of the service providers in an offset program.

4. **ABCA and its charitable partner organizations (ABCF, Huron Tract Land Trust) are encouraged to include carbon offsets as one of the tools to secure conservation lands in the watershed.** This recommendation is contingent upon both the provincial government finalizing Ontario's participation in cap and trade and the approval of forest conservation as an allowable offset project.

4.4 OFFSET REVENUE SCENARIOS

In this subsection potential revenue projections are provided for three carbon offset scenarios that may be applicable to the ABCA or its partner organizations in the future. Given the lack of defined protocols at this time for forest-based carbon offsets in Ontario, these revenue projections are largely speculative and are at best a **rough estimate** of what might be expected should carbon offset financing be sought in the future. ABCA should not publicize these projections or make decisions based on them until further guidance on the structure and function of Ontario's carbon offset market is released, at which time more accurate projections can be made. The three carbon offset scenarios and their revenue projections are described in the following subsections.

4.4.1 New Forest – Compliance Carbon Market

Although Ontario has not yet defined a firm date to begin active participation in the compliance WCI carbon trading market, this is expected to occur in the near future given the recent re-election of the provincial Liberal government which is a strong supporter of Ontario's involvement in cap and trade markets. Forest-based offsets are expected to play a key role in the WCI carbon trading market. It is almost certain that the protocol that is adopted by the WCI for new forests will only allow carbon offsets to be generated ***ex-post***, which means that the carbon sequestration has to occur before the offsets can be approved and sold. Given the fact that forest carbon sequestration is minimal for the first couple of decades following stand establishment, the financing from new forest projects in the compliance carbon markets will not reach their full potential for many years.

Our revenue projections for this compliance-market new forest offset project are based on the following assumptions:

- The **project size** is 20 hectares of new forest established as a result of carbon financing

- The **carbon sequestration rates** are an average of the hardwood and softwood annual rates shown in Table 1 and Table 3 (literature-based) and therefore have not been developed using a specific offset protocol
- A 20% reduction of the carbon storage has been applied for **risk management** purposes as is common for forest-based offsets (see bullet 3 of Section 4.2.1)
- The assumed **time period** for which carbon offsets are generated is 100 years, which is typical of many new forest projects
- Estimates of the **price of carbon offsets over the next 20 years** are based on reported opinions of carbon finance experts. A conservative price of $10 tonne^{-1} has been used at the start of the projection, which increases by $1 per tonne until year 20 (to $30 tonne^{-1})
- Estimates of the **price of carbon offsets beyond the next twenty years** are difficult to find – in this projection we have assumed the price at year 20 ($30 tonne^{-1}) remains constant thereafter
- All carbon offsets are generated **ex-post**, meaning they cannot be verified and sold until the actual carbon sequestration has taken place

Using the assumptions listed above, the potential revenues generated from a 20 hectare project of new forest to be sold in the compliance carbon markets are shown in Figure 4. The total value of the project over its 100-year lifetime would be approximately $300,000 from the sale of approximately 11,000 tonnes of carbon offsets. While this is significantly greater than the initial project establishment costs (estimated at $70,000 using a cost of $2 / seedling), some significant challenges exist that must be addressed.

First, for new forest carbon projects for sale in the compliance market (whose carbon credits must be generated *ex-post*) there is a long period of time that must elapse before the carbon sequestration levels allow for the project to generate enough carbon

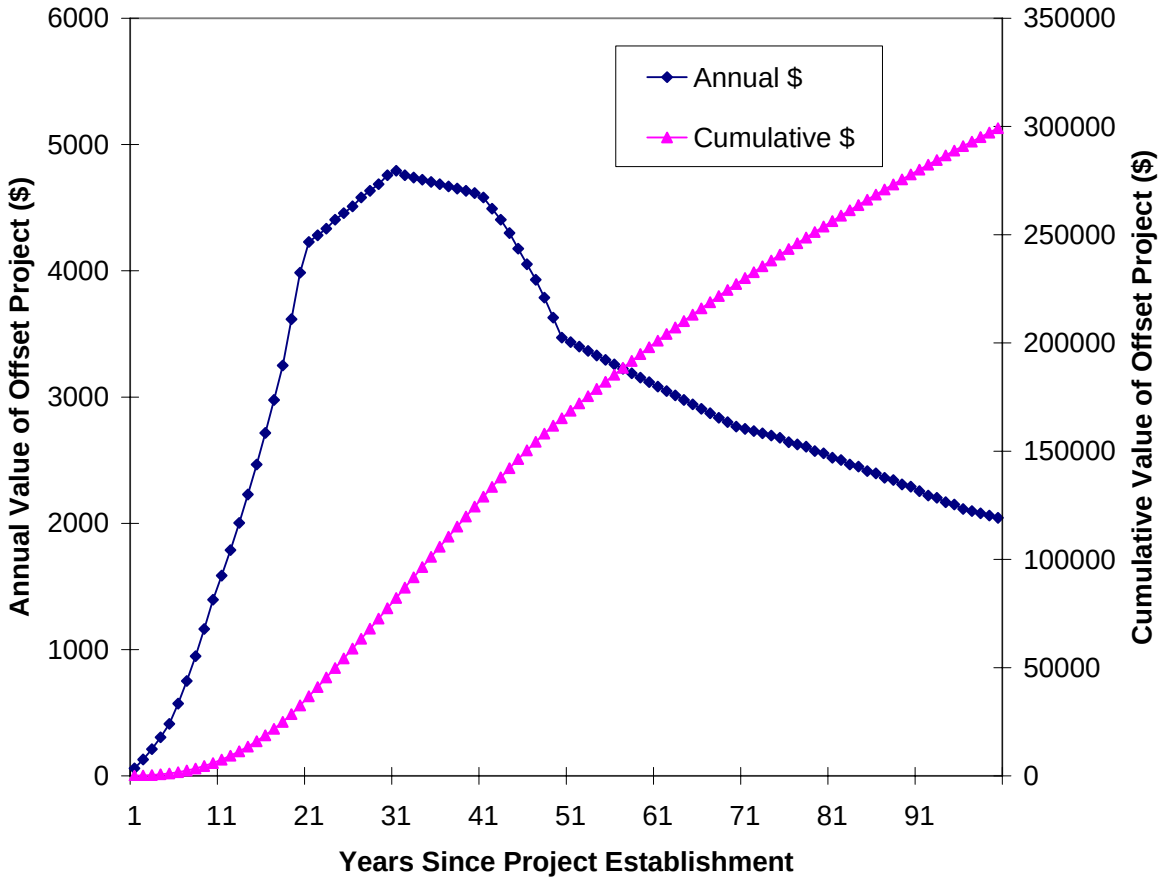

Figure 4: Projected value of a 20-hectare carbon offset project of new forest for sale in the compliance carbon market. Note the different Y-axis that are used for both annual value and cumulative value of the carbon offset project.

offsets to recover the project costs. In this scenario the 'break-even' point where the initial costs have been recovered does not occur until year 28 after establishment.

Second, the expenses that are incurred to develop and maintain carbon offset projects can be significant. These expenses include program fees to list the project, third-party verification, project design expertise, legal fees (especially to develop landowner contracts), and on-going monitoring.

Third, the economies of scale in the evolving carbon markets are likely going to dictate that the minimum size for any listed project would have to be around 10,000 tonnes of

carbon in order for it to be cost-effective with the various expenses that are involved. Given the geographic realities of land ownership and stewardship projects in southern Ontario, a pooling of smaller projects will be required to generate enough carbon sequestration to meet the minimum sizes that are going to be required for listing.

With these challenges in place, an **aggregator** is going to have to emerge that will collectively represent the interests of many private landowners in the development and sale of carbon offset projects in the compliance market. The level of involvement of an aggregator can vary, but usually they take care of all project design documentation, third-party verification, legal issues, and project listing requirements. Aggregators may also secure additional sources of start-up financing to alleviate the financial strain that can be imposed during the initial years of *ex-post* projects before significant carbon offset revenues are generated. In return the aggregator retains a portion of the project's carbon revenues, usually between 20-30%. In Ontario the conservation authorities may have a role to play as an aggregator or as a contract service to an aggregator given their existing tree planting expertise, knowledge of the land, and relationships with landowners.

4.4.2 New Forest – Voluntary Carbon Market

In addition to the emerging compliance carbon market, a voluntary carbon offset market is already in existence today. The voluntary carbon market is primarily supported by businesses that want to invest in carbon offsets to counterbalance all or part of their corporate carbon footprint. This is almost always done for marketing or promotional reasons to enhance a company's sustainability profile. To a lesser extent the voluntary carbon market is supported by individuals or families that purchase carbon offsets to counterbalance their personal GHG emissions from travel, automobile use, or home energy consumption. There are some positive and negative aspects about the voluntary carbon market in terms of new forest projects. On a positive note, in the voluntary market the use of ***ex-ante*** carbon generation is common. This allows a project

to forward-sell the offsets that are going to occur in the future before the carbon has actually been sequestered, greatly reducing the financing burdens described in Section 4.4.1 for *ex-post* projects. On a negative note, the voluntary market does not have the pool of forced offset buyers that exists in the compliance market. The voluntary market is dependent on the marketing ability of the project proponents, which is an additional expense and challenge that must be addressed.

Our revenue projections for this voluntary market new forest offset project are based on the following assumptions:

- The **project size** is 20 hectares of new forest established as a result of carbon financing
- The **carbon sequestration rates** are an average of the hardwood and softwood annual rates shown in Table 1 and Table 3 (literature-based) and therefore have not been developed using a specific offset protocol
- A 20% reduction of the carbon storage has been applied for **risk management** purposes as is common for forest-based offsets
- The assumed **time period** for which carbon offsets are generated is 100 years, which is typical of many new forest projects
- The price of carbon offsets are assumed to be \$20 tonne^{-1} which is an average price on the voluntary market
- All carbon offsets are generated **ex-ante**, meaning they can be verified and sold before the actual carbon sequestration has taken place

Using the assumptions listed above, the potential revenues generated from a 20 hectare project of new forest in the voluntary carbon markets are approximately \$200,000 from the sale of approximately 11,000 tonnes of carbon offsets. Since this scenario has used the *ex-ante* method, the carbon offsets from the project could be sold at anytime after project establishment, although the project would still have to be established with the

same level of rigour and quality control as is expected in the compliance market. Expenses that could be expected to develop and maintain a new forest offset project for the voluntary market are as follows: expertise to assist in project design documentation, third-party verification, legal fees, on-going monitoring, and marketing/promotion.

4.4.3 Existing Forest – Compliance and Voluntary Carbon Markets

Another option that may be available to generate carbon offsets is through the long-term preservation of existing forest lands through the establishment of conservation easements or some other protective instrument. In order for these projects to be deemed additional, it must be shown that the carbon offset financing was a key factor in securing the preservation of the lands and that the alternative scenario would have been the loss of that forest. Going forward this financial incentive may be an option for the ABCA, ABCF, or HTLTA to secure tracts of land that otherwise may have been unattainable.

Our revenue projections for this existing forest offset project (for the voluntary or compliance market) are based on the following assumptions:

- The **project size** is 20 hectares of existing forest that is under threat of land-use conversion and is protected as a result of carbon financing
- The **carbon sequestration totals** are an average of the hardwood and softwood cumulative totals shown in Table 2 and Table 4 (literature-based) and therefore have not been developed using a specific offset protocol
- A 20% reduction of the carbon storage has been applied for **risk management** purposes as is common for forest-based offsets
- The price of carbon offsets are assumed to be \$20 tonne^{-1} which is an average price on the voluntary market (note that the price for carbon offsets in the compliance market will be much more variable)

- All carbon offsets are generated **ex-post** as the actual carbon sequestration has taken place in the existing forest

Using the assumptions listed above, the potential revenues generated from a 20 hectare project of existing forest are approximately $200,000 from the sale of approximately 11,000 tonnes of carbon offsets. This scenario has used the *ex-post* method for carbon offset generation as the existing forest has already sequestered the carbon from the atmosphere. Since *ex-post* was used, offsets from this project could be sold at anytime after project establishment in either the compliance market or the voluntary market. Expenses that could be expected to develop and maintain an existing forest offset project are as follows: expertise to assist in project design documentation, third-party verification, legal fees, on-going monitoring, project listing fees (for compliance market offsets), and marketing/promotion (for voluntary market offsets).

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APPENDIX A

A list of candidate businesses (in no particular order) that could be considered as part of a ABCA corporate sponsorship campaign. Shown are the business name, the corporate headquarters of the business, and the reasoning for its inclusion in the list.

COMPANY	CORPORATE HQ	JUSTIFICATION FOR CONSIDERATION AS A POTENTIAL SPONSOR
United Communities Credit Union	Essex, ON	• Strong presence in SW Ontario • History of supporting local organizations (e.g. Huron Manufacturing Assoc. awards show) • Dedicated corporate community investment program
Sifto Canada	Mississauga, ON	• One of the largest private sector employers in the region • Subsidiary of Compass Minerals, a large US mining firm that has a corporate environmental protection program
BM Ross	Goderich, ON	• Local headquarters • Support for environmental stewardship is a good fit with several of the company's core environmental engineering services • Company has an existing community involvement program
Huron Tractor	Exeter, ON	• Local headquarters • The parent company (John Deere) is a global leader in corporate environmental stewardship

NextEra Energy	Florida	• Company has a very strong focus on renewable energy and mitigation of GHG emissions • Company is a new arrival in Huron County and is working hard to solidify community relations
Union Gas	Chatham, ON	• Company has a dedicated corporate responsibility and environmental stewardship program • Company has a history of supporting land stewardship projects (supported Trees Ontario in 2011)
Ellison Travel	Exeter, ON	• One of Canada's largest travel agencies with HQ in ABCA region • Dedicated company sustainability mandate, including promotion of carbon neutral travel through the use of carbon offsets • A member of the Carlson Wagonlit travel group, one of the world's largest travel organizations which also has a strong corporate social responsibility program
Hensall District Co-op	Hensall, ON	• Local headquarters in ABCA region
Thompsons	Blenheim, ON	• SW Ontario headquarters with a facility in the ABCA region
Bluewater Recycling	Huron Park, ON	• Local headquarters in ABCA region • Support for stewardship projects is a good fit with the company's core recycling and environmental services

Metroland Media	Mississauga, ON	• Publisher of several newspapers in ABCA region • Parent company (Toronto Star) is implementing a corporate sustainability program to become recognized as the leader in this field amongst Canada's publishing sector
Home Hardware	St. Jacobs, ON	• Company has several locations in ABCA region • Parent company has a relationship with Tree Canada – over $540,000 donated through special sales
Moffatt & Powell	London, ON	• Company has several locations in ABCA region • Company is a member of the RONA family, one of Canada's largest home improvement chains with a strong corporate responsibility mandate
TSC Stores	London, ON	• Company has several locations in ABCA region • Company has existing partnerships with several land-based organizations, including OFA, Ontario Fed. of Anglers and Hunters, and 4H
Car Dealerships (Eric Campbell Ford, HMP, Exeter Chrysler)		• The parent companies of each car dealer have strong sustainability mandates