



**Feasibility Assessment of Afforestation  
for Carbon Sequestration (FAACS) Initiative**

# **Ontario Pilot**

## *Establishing New Forests to Address Kyoto*

A Report on

**Examining the  
Feasibility of Afforestation for Carbon Sequestration in Ontario:**

**Landowner Interest and Incentives, Policy Barriers and  
Investment and Market Conditions**

Prepared for:

Canadian Forest Service, Great Lakes Forestry Centre  
1219 Queen Street East, Sault Ste. Marie, Ontario, P6A 2E5

Prepared by:

Eastern Ontario Model Forest  
P.O. Bag 2111, Kemptville ON, K0G 1J0

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This report was prepared by the FAACS Ontario Pilot Team at the Eastern Ontario Model Forest. This team is made up of; Sharleen Hawco, Tony Rotherham, and Martha Copestake.

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If you have any questions regarding this report or if you require any further information please contact:

Martha Copestake  
Eastern Ontario Model Forest  
P.O. Bag 21111, Kemptville, ON, K0G 1J0  
(613)258-6567  
[mcopestake@eomf.on.ca](mailto:mcopestake@eomf.on.ca)  
[www.eomf.on.ca](http://www.eomf.on.ca)

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## Executive Summary

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The Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) initiative is a part of the Climate Change Action Plan of the federal government. Led by the Canadian Forest Service, FAACS is a national policy development initiative to determine whether afforestation to create new forest carbon sinks is a viable option for Canada to help meet a portion of its Kyoto commitments. There are three main components of the initiative: firstly, a compilation of records of land afforested from 1990 to 2002, to be used as the “backcast” data; secondly, the development of an afforestation module as a component of the national carbon budget model (CFS-CBM2); and thirdly, the establishment of 5 pilot studies across Canada to assess and test a variety of regionally relevant mechanisms to provide incentives for afforestation on private lands. The Eastern Ontario Model Forest (EOMF) was selected to deliver the FAACS pilot for Ontario. The EOMF is examining landowner attitudes, policy barriers, market influences, and funding and delivery mechanisms related to afforestation on private lands.

This report outlines the findings and recommendations of the Ontario FAACS pilot. The information contained in this report was developed through a series of focus sessions on landowner incentives, policy barriers, and the carbon marketplace, in addition to a series of surveys taken across the province regarding landowner interest in afforestation.

### **Recommendations are given regarding the following:**

- Landowner Incentives and Plantation Establishment Agreements
- Plantation Establishment Agreement & Carbon Ownership and Sales Agreement
- Investor Needs
- Plantation Establishment Costs and Revenues
- Attracting Capital for Afforestation
- Plantation Establishment Objectives and Ongoing Management of the Plantation Estate
- Overcoming Policy Barriers to Afforestation
- Wood and Carbon Measurement
- Record Keeping
- Aggregators and Brokers

### **Potential Business Models are identified as follows:**

- Traditional small business approach with market based offset carbon credit trading
- Financial support from Large Final Emitters with an interest in corporate social responsibility programs
- Government grants
- Preferential tax treatment for investments/expenditures to establish plantations
- A partnership with a forest products company
- Any hybrid incorporating the above model

### **The structure and conditions for a successful afforestation program are as follows:**

- Ensure that managed forest land property tax rates are competitive with farm land tax rates.
- Ensure harmony of land-use policies at the provincial & municipal levels.
- Provide long-term policy commitments to support an afforestation program and the carbon market.
- Determine the long-term ROI that will be high enough to attract landowner investment.
- Provide an attractive income tax write-off allowance to defray the costs of plantation establishment and tending to FTG. This is designed particularly to enable landowners to fund plantation establishment.
- Stimulate the establishment of private sector forest management organizations to deliver all aspects of the afforestation program including landowner information and agreements, plantation establishment, wood growth measurement and calculation of offset carbon credits.
- Provide well designed guidelines for species selection, silvicultural crop planning to achieve wood and carbon sequestration goals. Provide environmental management objectives to ensure eligibility for certification.

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## 1.0 Introduction

Trees provide important social, environmental, and economic benefits. Land clearing by the early settlers resulted in the deforestation of vast tracts of land for agricultural production leaving 10-40% tree cover on these areas. Development pressures are increasing as our population increases and as a higher percentage of the population moves to urban areas. 90% of the provincial population now lives in Southern Ontario (OMNR 2004). Rather than conversion of forests to farmland, the pressure now is for conversion of land (farm, forest, or idle) to developments such as housing subdivisions, business parks, and shopping malls. Associated with these development pressures are increased environmental problems such as poor water quality, reduced air quality, and a lack of connected natural space. Increasing the amount of tree cover through planting trees can aid in alleviating these environmental problems while providing many other important benefits to society. The key benefits provided by planting trees include:

- Conservation of Soil and Water quality.
- Air quality improvement and mitigation of climate change through carbon sequestration.
- Income generation through the supply of forest products and possibly offset carbon credits within a domestic offset trading system.
- Creation of natural spaces for wildlife habitat, ecosystem integrity, recreational use, and visual aesthetics.

Canada's recent ratification of the Kyoto Protocol has played a role in inspiring new national environmental commitments from the government. Specifically, Kyoto has renewed national interest in increasing the amount of forest cover on our landscape through afforestation and reforestation to produce offset carbon credits. Trees use carbon dioxide and sequester carbon as a part of their natural photosynthetic function. Increasing and/or maintaining forest cover is considered to be one of the options for mitigating increases in atmospheric carbon dioxide and climate change. The Kyoto Protocol recognizes several forestry activities; afforestation, reforestation, deforestation, and forest management. Inclusion of forest management in forest carbon accounting is a matter of choice for each signatory country. Canada has yet to make a decision. Deforestation, as defined by the Kyoto Protocol, refers to the permanent conversion of forested land to non-forested land through urban development, road construction, or agricultural expansion and results in a carbon debit for signatory countries (Anon. 2001). Offset credits are obtained through offset mechanisms such as afforestation and reforestation.

Under Kyoto, afforestation is defined as the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding, and/or the human-induced promotion of natural seed sources. Basically, the term refers to the planting of trees on marginal agricultural lands. In turn, reforestation is defined as the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forest land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on December 31<sup>st</sup>, 1989. It should be noted that here forest is defined as a minimum area of land of 0.05 – 1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30% or a tree density of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest. In Canada the term afforestation is used collectively for the activities defined in the Kyoto Protocol as afforestation and reforestation.

Planting trees can contribute to Canada's commitment to reducing atmospheric greenhouse gases (GHGs). Afforestation, forest management and the carbon market brings an opportunity to obtain additional revenues for forest landowners, through the trading of offset credits. In today's society investments are not made without an

expectation of a reasonable return on investment. The signing of the Kyoto Protocol and the global carbon market may provide the needed return to secure investment in activities such as afforestation on private lands.

The Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) initiative is a part of the Climate Change Action Plan of the federal government. Led by the Canadian Forest Service, FAACS is a national policy development initiative to determine whether afforestation to create new forest carbon sinks is a viable option for Canada to help meet a portion of its Kyoto commitments. There are three main components of the initiative: firstly, a compilation of records of land afforested from 1990 to 2002, to be used as the “backcast” data; secondly, the development of an afforestation module as a component of the national carbon budget model (CFS-CBM2); and thirdly, the establishment of 5 pilot studies across Canada to assess and test a variety of regionally relevant mechanisms to provide incentives for afforestation on private lands. The Eastern Ontario Model Forest (EOMF) was selected to deliver the pilot for Ontario. The EOMF is examining landowner attitudes, policy barriers, market influences, and funding and delivery mechanisms related to afforestation on private lands. This report outlines the findings and recommendations of the Ontario FAACS pilot.

## **1.1 The Process of the Development of an Afforestation Program for Carbon Sequestration**

The flow chart on the following page outlines the process of developing an afforestation program for carbon sequestration on private lands in Ontario. The flow chart is intended to put the work outlined and the recommendations given in this report into the context of program development. The components outlined make up the program planning phase. These components must be addressed prior to the development and implementation of any new afforestation program for carbon sequestration. For each component, the corresponding report sections are indicated for reference. The italics indicate components that are outside the scope of the work plan for the Ontario FAACS Pilot and therefore have not been addressed in this report. If these components are being addressed elsewhere, it is indicated.

## **2.0 Methodology**

What follows is a discussion of the methodology used to determine landowner attitudes towards afforestation, planting trends and the incentives they would require to plant trees in the future, and to examine the attitudes of Large Final Emitters (LFEs) toward Offset Credits from afforestation. The information was developed through a series of focus sessions on: landowner incentives, policy barriers in Ontario and the Carbon Marketplace. In addition a series of surveys was undertaken including experts and key stakeholders that allow for an overall understanding of the market place for Offset Credits from afforestation projects. The following information provides a more in-depth look at the different methodologies used in the aforementioned sessions and surveys.

### **2.1 Methodology from Focus Session**

#### ***Overall Session Methodology***

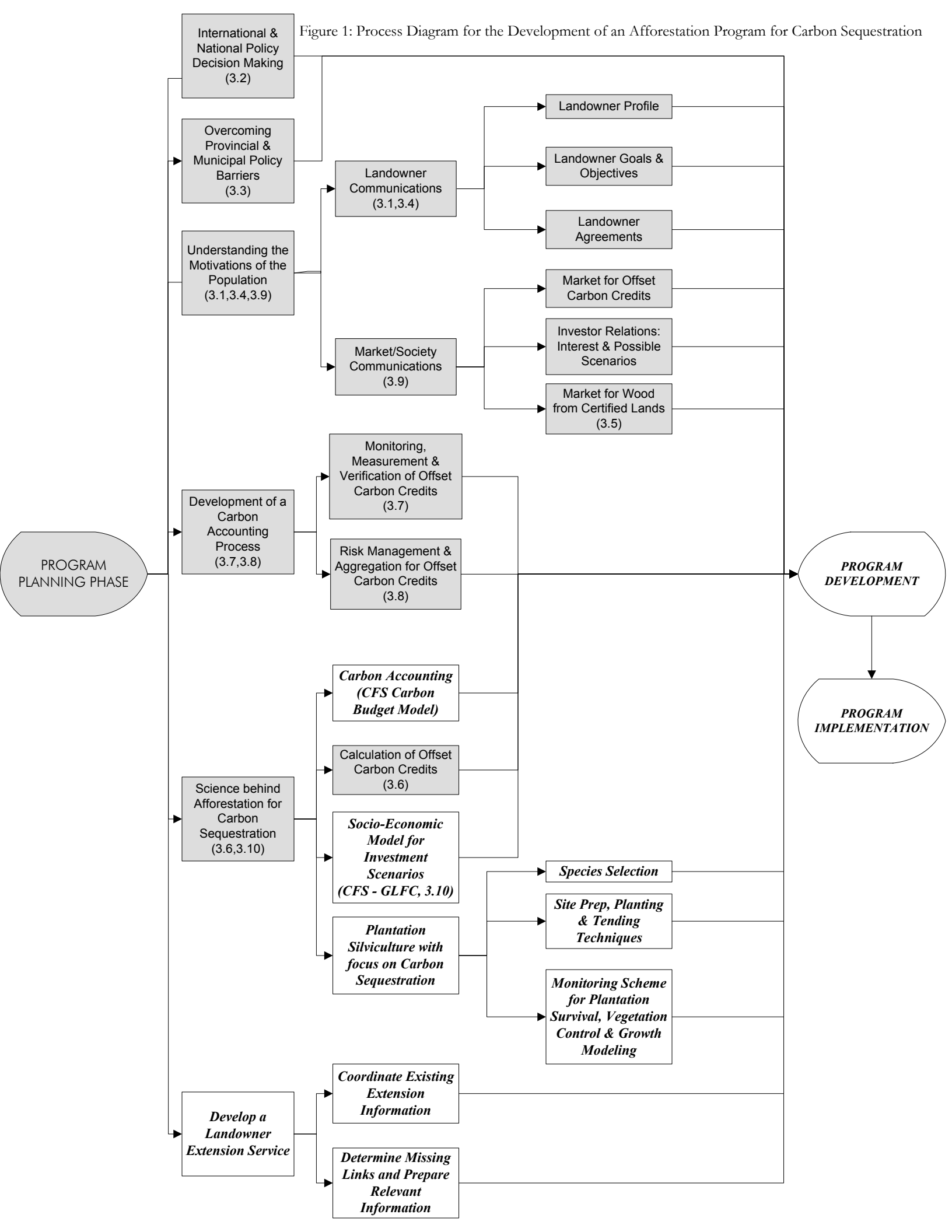
The Eastern Ontario Model Forest and several partners<sup>1</sup>, hosted a series of workshops across southern Ontario in November of 2003. The primary goal of these sessions was to address issues surrounding establishing new forests in Ontario to address Canada’s Kyoto commitments. The Focus Sessions heard from a broad spectrum of rural landowners, forest and agriculture sector, carbon brokers and industry surrounding three broad categories of issues:

- Landowner Incentives - “What Incentives are Required to get Trees in the Ground?”
- Policy Barriers - Overcoming Policy Barriers to Afforestation on Private Lands in Ontario
- Offset Credits from Afforestation, Customers Needs and the Investment Challenge (Ontario)

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<sup>1</sup> Natural Resources Canada (Canadian Forest Service), Ontario Ministry of Agriculture and Rural Affairs, Ontario Ministry of Natural Resources, Ontario Woodlot Association, Ontario Stewardship, Conservation Ontario, Ontario Forestry Association, Trees Ontario Foundation, and the Ontario Soil and Crop Improvement Association.

Figure 1: Process Diagram for the Development of an Afforestation Program for Carbon Sequestration



### ***Landowner Incentives – “What Incentives are required to get Trees in the Ground?”***

The primary goal of these sessions was to hear from a broad spectrum of rural landowners about the type of incentives it would take for them to become involved in a potential afforestation program. In addition, their views on afforestation agreements, offset credits, and opinions on real or perceived issues that may arise by undertaking such an initiative, were also being sought. Utilizing a network of provincial and regional organizations actively involved with rural landowners across southern Ontario, 100 landowners were invited to participate in one of the three workshops held in Kemptville (eastern Ontario), Barrie (south central Ontario) and Woodstock (south western Ontario). Participants were invited based on a criterion of having available open land (agriculture and/or rural vacant lands) and who had an interest in establishing trees on these lands. It should be noted that although individuals from both the farming and forestry communities were invited to attend all sessions, attendees were predominately from the forestry community (i.e. those involved in forestry organizations and/or active in planting). Refer to Section 3.4 for session outcomes. For more detailed information regarding this session please refer to the FAACS Focus Session Document entitled “Landowner Incentive Focus Session: What Incentives are Required to get Trees in the Ground”.

### ***Policy Barriers – Overcoming Policy Barriers to Afforestation on Private Lands in Ontario***

The goal of the session was to identify the most significant barriers to private land afforestation and to determine strategies and actions to overcome these barriers. Throughout the session there was active discussion of the barriers. This session was convened in Cobourg Ontario, Nov 5, 2003, and was attended by 50 individuals from a wide variety of interested groups from both the forestry and agriculture sector involved in private land forestry. Refer to Section 3.3 for session outcomes. For more information regarding this session please refer to the FAACS Focus Session Document entitled “Overcoming Policy Barriers to Afforestation on Private Lands in Ontario”.

### ***Offset Credits from Afforestation, Customers Needs and the Investment Challenge in Ontario***

The purpose of the Carbon Focus Session was to look for common ground, a potential business structure, and key business aspects for landowners, Carbon brokers and Large Final Emitters all interested in afforestation projects for the purposes of carbon sequestration. The session participants were comprised of 50 individuals from the forestry sector, carbon brokers and LFEs. This session was convened November 19, 2003 in Toronto, Ontario. Refer to Section 3.6 – 3.9 for session outcomes. For more information regarding this session please refer to the FAACS Focus Session Document entitled “Offset Carbon Credits from Afforestation, Customer Needs and the Investment Challenge in Ontario”.

## **2.2 Afforestation Survey of Landowners in Eastern, South-Western and South-Central Ontario**

The information obtained from these surveys helped to develop landowner incentives through the Landowners Focus Sessions.

### ***Purpose of the Surveys***

- To gauge interest of rural landowners in a potential tree planting program.
- To provide baseline information on:
  - current and future tree planting activities
  - types and sizes of land holdings

### ***Sample & Method***

- Telephone survey
- 375 rural landowners randomly sampled
- Random Sample of key areas in Ontario with low land opportunity costs: Eastern, South-Central and South Western Ontario
- To qualify, landowners had to own a minimum 10 acres (4 ha) of land.
- Questions were based on those asked in the National Environics surveys in 2000 and 2003.

Refer to Section 3.1 for survey results.



## 2.3 Opinion Survey of Large Final Emitters (LFEs) in the Oil and Gas Industry

The BC FAACS Pilot, with assistance from the Ontario FAACS Pilot, developed a questionnaire designed to find out the views of LFEs on the purchase of Afforestation Offset Credits as a way to meet their GHG emissions reduction target. A group of LFEs, in Alberta, was visited and asked a series of questions. Most of the LFEs questioned were associated with the oil and gas industry. Their answers, together with the views of other LFEs operating in other fields, contacted during the Ontario FAACS Pilot Study are included in Section 3.9.

## 3.0 Results / Outcomes

### 3.1 Summary of Findings Related to Afforestation from Landowner Surveys

Rural landowner profiles indicating demographics, motivation, willingness to participate in an afforestation program. Please refer to the documents “Findings of the Afforestation Survey for Landowners in Eastern Ontario” and “Findings of the Afforestation Survey for Landowners in South Western and South Central Ontario” for the complete surveys. These documents are available from the CFS – GLFC and the EOMF.

#### *Afforestation in Ontario: Afforestation Survey of Landowners in Eastern, South-Western and South-Central Ontario*

Figure 2: Afforestation Trends in Eastern Ontario

<p><b>Average Respondent Age</b></p> <ul style="list-style-type: none"> <li>• 57 yrs</li> </ul> <p><b>Average Area of Land owned</b></p> <ul style="list-style-type: none"> <li>• 160 acres<sup>2</sup> (65 ha)</li> </ul> <p><b>Area of land planted in the past</b></p> <ul style="list-style-type: none"> <li>• 9 acres (4 ha)</li> </ul> <p><b>Area of Land willing to plant in the future</b></p> <ul style="list-style-type: none"> <li>• 4.3 acres (2 ha)</li> </ul> <p><b>Area of Idle Land</b></p> <ul style="list-style-type: none"> <li>• 27 acres (11 ha) (range of 1 - 160 acres)</li> </ul>
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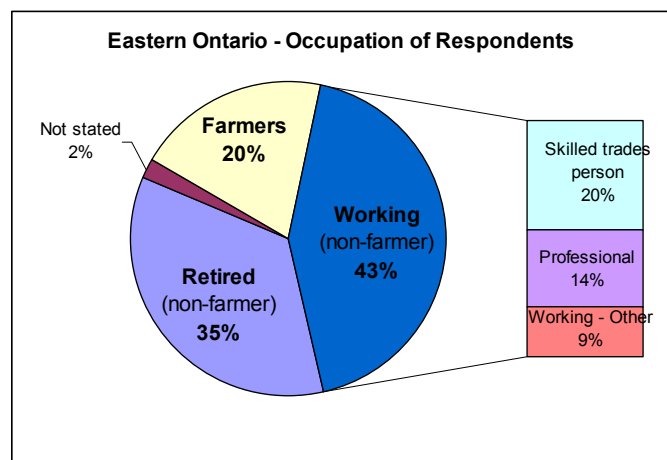
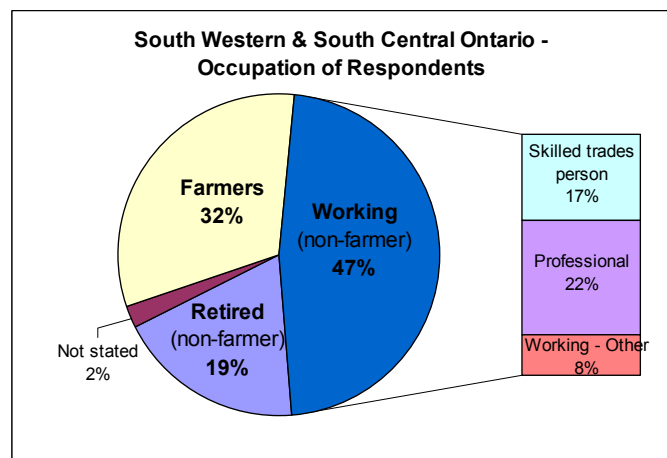


Figure 3: Afforestation Trends in South Western and South Central Ontario

<p><b>Average Respondent Age</b></p> <ul style="list-style-type: none"> <li>• 55 yrs</li> </ul> <p><b>Average Area of Land owned</b></p> <ul style="list-style-type: none"> <li>• 100 acres<sup>3</sup> (41 ha)</li> </ul> <p><b>Area of land planted in the past</b></p> <ul style="list-style-type: none"> <li>• 11 acres (5 ha)</li> </ul> <p><b>Area of Land willing to plant in the future</b></p> <ul style="list-style-type: none"> <li>• 6.8 acres (3 ha)</li> </ul> <p><b>Area of Idle Land</b></p> <ul style="list-style-type: none"> <li>18 acres (7 ha) (range of 1 – 225 acres)</li> </ul>
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<sup>2</sup> Area of Land Owned in Eastern Ontario - It should be noted that the average acres owned per landowner is skewed. The distribution is variable across the landscape with 25% of landowners owning between 11 and 25 acres (5 – 10 ha) and 45% of landowners owning greater than 151 acres (61 ha). Please refer to Figure 3, pg 11 of the “Findings of the Afforestation Survey for Landowners in Eastern Ontario”.

<sup>3</sup> Area of Land Owned in South Western / South Central Ontario - It should be noted that the average acres owned per landowner is skewed, as a small amount of individuals own over 250 acres (101 ha). When those landowners with over 250 acres (101 ha) (n = 18) are excluded from the sample the average amount of land owned drops to 75 acres (30 ha). Please refer to Figure 3, pg 12 of the “Findings of the Afforestation Survey for Landowners in South Western and South Central Ontario”.

### **Woodlot Owners' Objectives (weighted results)**

- Financial 37%
- Environmental 63%

### **Why Do Landowners Plant Trees?**

- Primarily to enjoy their property. (Eastern Ontario)
- Primarily for aesthetic and environmental reasons. (South-Western Ontario & South-Central Ontario)

### **Reforestation/Afforestation**

- Landowners with open areas are interested in planting trees.
- Delivery agent must be local, familiar and trusted.
- Landowner must be involved in decisions.
- A few landowners will lease land to others.
- Plant the right species for the site.

### **Amount of Land willing to plant**

The amount of land willing to plant in Eastern Ontario is 4.3 acres (2 ha), and in South Western Ontario and South Central Ontario 6.8 acres (3 ha), as indicated in Figure 1 and 2. It is important to note that the information received from the survey indicated that landowners are interested in planting relatively small patches, on average 2 - 3 hectares. Although these survey represent a wide sample of rural landowners in eastern and south-western Ontario, when we spoke one on one with landowners during the Landowner Incentive Focus Session we got very different readings on landowner willingness to plant. During the Landowner Incentive Focus Session, once landowners received information and a full explanation of the full nature of program envisaged, landowners indicated that they are prepared to plant larger areas of their land provided reasonable incentives, as outlined in Section 3.4, are part of the overall planting program. Due to the nature of the breakout sessions (they were discussion groups), the exact acreage of land was not determined.

### ***Afforestation in Canada: Summary of Findings Related to Afforestation from Landowner Surveys carried out across Canada from 1993 to the present:***

These findings were supported by information from a study<sup>4</sup> of 10 landowner surveys carried out across Canada between 1993 and 2003.

**Demographics:** The majority of the 450,000 Canadian woodlot owners are men more than 55 years old, many have post secondary education. Farmers, retirees, skilled trades and professionals make up the largest segments of occupations. They have owned their woodlots for at least 20 years. Family income varies from \$40,000 to \$60,000.

**Ownership Motivation:** Personal satisfaction from land ownership, recreation, leaving an inheritance. There is a strong conservation and environmental ethic.

**Land Stewardship and Ownership Rights:** Landowners want to maintain control of their land. They believe more forests need to be replanted.

**Afforestation:** Many landowners would respond positively to monetary incentives to plant trees. Landowners want to plant trees that are native to their regions. They want to own the mature trees. Landowners show a significant level of willingness to participate in an afforestation program and have expectations of financial support, reductions in property tax, income tax deductions, and technical assistance with planting. Landowners express a clear preference to work with woodlot/forestry associations and Conservation Authorities.

There is widespread awareness of the role of trees in improving air quality and reducing global warming, but there is virtually no awareness of their role in carbon sequestration.

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<sup>4</sup> This information is drawn from work done by Victor Brunette et al done under the Model Forest/Canadian Federation of Woodlot Owners program.

NOTE: This shows the importance of the language used to promote tree planting. Language and understanding will be critical in gaining support for the establishment of plantations for carbon sequestration. Landowners will respond to incentives but their concern for flexibility has tended to make them shy away from restrictive long-term deals. Successful afforestation programs will be flexible and respond to differences among landowners with regard to their ownership motivation and management objectives, the size of land holdings, their occupation and their capacity to cost-share or provide in-kind support.

**Sources and Needs for Information:** Brochures, manuals, on-site consultations and demonstration sites are the preferred sources of information. Information given over the phone is the least preferred medium.

**Survey of planting costs:** A confidential survey of planting and tending costs on industrial operations across Canada was carried out to get an idea of the potential costs of a large-scale afforestation program. These costs were inflated to accommodate the increased costs of planting smaller blocks. Costs of \$1200-1500 per hectare are used in this report.

### **3.2 Policy Decisions Essential to a Successful Afforestation Program**

The Canadian government is considering the feasibility of a large-scale Afforestation program to develop offset carbon credits as a component of Canada's Climate Action Plan. Offset carbon credits depend on the Kyoto Protocol and Canada's Climate Change Program for their value. Offset carbon credits are non-fungible commodities that owe all of their value to Canadian Government policy and the structure of Canada's Climate Change Action Plan. A planning horizon and policy stability for 20-50 years is required for afforestation offset credit production. Several policy decisions are essential before any program can be implemented. These decisions are required to establish a solid policy foundation for the Offset Credit production and trading aspects of the program. An adequate level of commercial certainty is also needed for the development of a business case for those considering an investment in afforestation for carbon sequestration.

#### ***International Policy Decisions***

If Russia does not ratify the Kyoto Protocol the Treaty will not enter into force and the international structure for action to reduce GHG emissions will disappear unless rescued by a group of "like minded nations" agreeing to act together. Canada has committed to reducing GHG with or without Kyoto but Canadian policy and GHG emission reduction targets and mechanisms may change if The Kyoto Protocol does not come into force. Capital is nervous in the face of policy uncertainty.

#### ***National Policy Decisions***

Five domestic policy decisions are also required:

##### **1. Beyond 2012; Canadian involvement in a second and subsequent commitment periods**

An afforestation program large enough to make a difference will require the mobilization of efforts to support the establishment of thousands of hectares of plantations on private lands across Canada. This will not take place without firm policy decisions to support the program over a period of at least 25 years. Agreements with landowners and investors will have to be structured to cover any closure of the Offset Credit market caused by government policy decisions after that time. It is unlikely that private capital can be mobilized in the face of such short-term planning horizons that are way too short for a successful large-scale afforestation project. Policy certainty will be required over a period of 30-50 years.

##### **2. Establishment of a 'Start Date' for Afforestation Projects**

The terms of the Kyoto Protocol require that land for afforestation be bare of trees on Dec 31, 1989. It will take about 10 years before any significant amount of Offset Credits are produced by Canadian afforestation projects. Any plantations established before the Start Date will not be eligible under Canada's Offset Program. The government should set the Start Date at Jan 1 1990 and announce it without delay for the following important reasons:

- Uncertainty about the ‘Start Date’ will prevent any planting until the start date is announced.
- An estimated 60,000 ha of old-field planting has been carried out in Canada since 1990 (CFWO ca2000). The landowners can be considered ‘early adopters’. The number of landowners is significant and their support for an afforestation program will be influential.
- These plantations can form the basis of the afforestation database to record data on the afforestation program and determine the wood and Offset Credits produced. See section 3.7
- Offset Credits produced since January 1, 1990 will allow the early establishment of a market in afforestation Offset Credits. This will act as a positive signal to landowners and investors.
- All systems need testing; this is best done on a small scale before the start of a major program.

### **3. The Offset Program**

The objective of Canada’s Offset Program is to provide flexibility in the achievement of GHG emission reduction targets and reduce costs.

### **4. Long-term Commitment**

Landowners and plantation managers across the country have clearly stated that a potential afforestation program should not be started without firm policy commitment to a long-term program. Afforestation programs have operated at a level of approximately 5000 ha per year over the past decade. A national afforestation program on a scale large enough to make a significant contribution to Canada’s GHG emissions reduction targets together with the required mobilization of capital, development of seedling production and plantation delivery, establishment and tending infrastructure will not take place without policy stability for a period of at least 20 years. This period is needed to allow for a ramping-up period and the establishment and tending of plantations to free-to-grow (FTG). Landowners have been disappointed by the abrupt cancellation by governments of private land forestry programs in the past.

### **5. Sources of Funding and Financially Attractive ROI**

The public sector and the private sector are possible sources of funding for an afforestation program. If funding is provided by the public sector, the government can get a return on investment through several types of benefits. These would include: Development or ownership of Offset Credits, an addition to the wood supply, ecological benefits through water, habitat and soil conservation, rural job creation and community stability as well as returns to society and governments from employment creation and economic activity. If funding is provided by the private sector, the government may avoid making direct budgeted investments but will still develop all the other benefits. But all levels of government will have to make policy changes to make possible a return on investment adequate to attract private capital.

ROI based only on revenues from Offset Credit sales are not high enough to attract capital to afforestation projects. Revenues from Offset Credits will have to be supplemented by revenues from the sale of wood and/or by tax write-offs that will effectively reduce the investment needed to establish and tend plantations. Landowners dedicating their land to growing trees for 20-50 years must also benefit.

The long term investment and the domestic and international uncertainties facing the program provide persuasive reasons for offering a significant tax write-off to make possible the achievement of a reasonable ROI over a shorter period of time. From a policy perspective it may be easier to establish a 10-15 year program to allow tax write-offs to effectively reduce the investment required to fund plantation establishment than it will be to fix policy on Climate Change and Offset Programs for a period of 50 years.

### ***The Need for a National Exit Strategy***

International agreements provide less certainty for investors than Canadian domestic legislation based on contract law. If the Kyoto Protocol does not enter into force or is not supported by joint action taken by a group of “like minded nations”, the policy and legal foundation for GHG emissions reductions, Offset Credit markets and the revenues from the sale of Offset Credits will disappear. This is not a normal commercial risk. The basis for the market value of Offset Credits depends on firmly established government policy.

The Canadian government must develop an action plan to protect the private sector and the Canadian economy against the effects of changes in international policy and Canadian Climate Change Programs. For projects which will be completed and amortized by the end of the first commitment period in 2012 this may not be a serious consideration. For projects that extend beyond 2012 (such as afforestation) it is important. For a successful large-scale afforestation program to be implemented over a period of up to 25 years including tending, the implications of significant policy change are clear. Consideration of an Exit Strategy or backup position for investors in afforestation for carbon sequestration is required.

### **3.3 Policy Barriers**

It has been widely accepted that there are barriers to private land afforestation and that these barriers must be overcome to ensure the successful implementation of a new private land afforestation initiative. Presently the province is at a fork in the road with respect to afforestation. Political commitments have been made to the environment, and in turn afforestation on private land, by ratifying the Kyoto Protocol. Positive initiatives have been developed as a result. However, there are deficiencies within government policy that prevent full support of these initiatives. These deficiencies, or policy barriers, act as disincentives to afforestation and will hinder the success of any new afforestation initiative. It is important now to develop methods to overcome these barriers in order to develop an effective afforestation program. Kyoto is providing the positive momentum needed to accomplish this.

Both the significant barriers and the set of relevant action items were determined with input from a wide variety of interested parties and stakeholders involved in private land afforestation through a focus session in late 2003 entitled “Policy Barriers to Afforestation in Ontario”<sup>5</sup>. The intention of the focus session was to get feedback from a wide variety of interested groups and individuals and to develop tangible recommendations. For further details refer to the Policy Barriers Focus Session outcome document; *Overcoming Policy Barriers to Afforestation on Private Lands in Ontario*.

#### ***Barrier 1: Government Commitment***

There is a lack of commitment from the Ontario government towards private land afforestation. This is seen in the halting of the majority of governmental financial support for tree planting in the mid 1990’s in the province. This is affecting the afforestation initiative as the private sector has not picked up the slack left by the government. Support is needed in terms of funding, policy development, and leadership on environmental issues. Environmental problems and the related efforts to resolve them are long term; therefore, government commitments regarding the environment should be long term as well. However, government commitments should not be expected to last longer than 5 years as power changes will undoubtedly bring policy changes. The commitment needed by the government must be long term and mechanisms must be created to reflect this need within the context of the environment. In addition, the commitment that is required by the government is in terms of leadership and support through both policy development and funding.

#### ***Barrier 2: Unfair Taxation***

There is presently an unfair taxation procedure for forested land in comparison with agriculture land. This is acting as a disincentive for afforestation on private lands. The Municipal Property Assessment Corporation (MPAC) has recently changed their land valuation method for forested lands in Ontario. The change in valuation has increased the value of forested lands hence significantly raising the taxes on privately owned forested land in the province. The lowered tax rates that were provided through the Managed Forest Tax Incentive Program (MFTIP) are now not low enough to act as an incentive to maintain or create forest land as originally intended (OFA 2003). MFTIP is a voluntary program that provides lower property taxes to participating landowners that agree to conserve and actively manage their forests (OMNR 2003). Qualifying forested lands (excluding residences) are reassessed, classified as managed forests, and taxed at 25% of the residential tax rate. This provides savings to the landowner on two levels; in the decrease in assessment value and in the decreased tax rate. MFTIP is an important program because it is the only program in the province that provides financial incentive for maintaining and managing forested land. As well, MFTIP should act as one of the incentives to afforest marginal crop land. The most important point of this incentive is that it was intended to act in the same way that the farm tax program works. The forested property was to be

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<sup>5</sup> The “Policy Barriers to Afforestation in Ontario” Focus Session was held on November 5<sup>th</sup>, 2003 in Cobourg, Ontario.

assessed based on the “current use value”. The “current use value” is based, in the agricultural case, on farmer to farmer sales. Therefore, in the managed forest case, it should be based on forest manager to forest manager sales. This method is indicated in the Ministry of Finance’s *Assessment Act, 1990* which stipulates that managed forest properties shall be assessed “based only on the current use of the land and not other uses to which the land could be put” (Ontario Ministry of Finance 1990). Regardless, MPAC is using a “current market value assessment” for forested properties; farmland rates will not be applied to any managed forest property. With this method, the value is based on a sales comparison of the highest valued use for a given tract of land. The resulting increases in land tax diminish and, in some cases, nullify the intended MFTIP incentive.

This assessment method has many repercussions, for instance: it can act as a disincentive to participate in MFTIP; it can act as a disincentive for farmers to convert marginal land to forested land because of the associated tax increase; and it renders current forested land vulnerable to fragmentation and development. Government policy is not connecting on this issue; MFTIP was started by the Ministry of Natural Resources to promote the maintenance of tree cover, the Ministry of Finance’s Assessment Act supports this, but MPAC is operating under a different set of principles. Environmental policy must transcend the boundaries of all government sectors and levels. Taxation procedures for forested lands must be equivalent to those of farm lands in order for landowners to begin considering the conversion of marginal croplands to forest (afforestation).

### ***Barrier 3: Municipal Planning Objectives***

There is a lack of recognition in municipal planning for afforestation, the maintenance of greenspaces, and the associated benefits such as water quality improvement. A current example of this is the Oak Ridges Moraine; the municipalities are supporting development over and above environmental considerations despite the environmental degradation history lesson they have in their own backyard. This issue is also closely related to the taxation problem in that it has been noted that MPAC’s forested lands assessment shift is a result of pressures by the municipalities for more tax dollars (OFA 2003). Development is more attractive to a municipality than forests because of the significant associated return. It is important for municipal planners to show leadership with environmental activities and by using sound environmental methods because of their close association with the public. In addition, the benefits of afforestation will be closely tied to the community providing for community education on the important role of trees in their environment. Municipal Planning objectives must include the further creation of greenspaces through afforestation.

### ***Barrier 4: Seed & Stock Availability***

Presently, in Ontario there is a seed and stock availability issue. The private nurseries do not have the capacity to operate in the same manner as the (now closed) provincial nurseries could. To put this into context; private nurseries are not operating at capacity, and cannot increase their production until they have guaranteed purchasers, which cannot be secured until a tree planting program is underway and long term commitments can be made by a delivery agent to the nurseries (Boysen 2003a). In addition, the government’s Ontario Tree Seed Plant (OTSP) now also operates on a cost recovery basis. Because tree planting efforts are now on a smaller scale than historical levels, the OTSP’s collection and storage capacity is waning. And of course, they too can only increase their capacity with long term commitments from purchasers. This crisis is also related to increased recognition for the need to use zone specific seed to produce stock (Boysen 2003a). A species’ seed production in a certain zone obviously cannot relate to the seed demand in that given zone. Therefore it is difficult to predict seed availability for a given zone. The result of all this is that the province is deficient in appropriate seed and stock for many areas. The CFS is doing work on quantifying the seed and stock deficiencies within the Forest 2020 Plantation Demonstration and Assessment Initiative.

### ***Barrier 5: Compensation for Positive Environmental Externalities***

By increasing the amount of forest cover on their land, the owner is providing an important environmental service to society as a whole. However, the owner is responsible for the full cost of this service. Landowners must be compensated to some degree for the positive environmental services they are providing. It is necessary to determine how society can share the cost of tree establishment with the landowner. Shared costs would act as an incentive for landowner participation in an afforestation initiative. Societal recognition for the important role that trees play in our environment is required. This will result in acceptance of cost sharing for environmental services. An example of how society could share the costs is through lowered taxation rates for forested lands. This method of cost sharing will,

however, only affect rural municipalities. It is necessary to come up with a mechanism to share the cost between rural and urban municipalities.

### ***Barrier 6: Social Values for the Environment***

There is a lack of public civic duty and values with respect to the environment. By rekindling a civic sense of duty with respect to the environment, activities such as afforestation will be highly respected and their importance will be recognized. Benefits of this would include; change in societal values and a resulting change in government values as well as an acceptance to pay for beneficial environmental services. This will require a paradigm shift for not only citizens, but also for municipalities and the provincial government. Barriers 5 and 6 are related in that they refer to lacking public responsibility for their surrounding landscapes and ecosystems.

### ***Action Items***

To overcome each of the significant barriers, a set of action items were developed and are targeted at governments and their relevant policies. This will create awareness, in the government, of the options available and the actions necessary. In turn, policy changes and adaptations can be made in favour of afforestation. The following summarizes the most relevant action items:

- **Public Education:** Social recognition for the important role that trees play on our landscape, as well as the benefits that trees provide in our economy, will aid afforestation initiatives on many different levels. Environmental education should infiltrate society at all levels; from primary school through to our government leaders. The school system should include an environmental component in each year. Successful education would result in a society that places a higher value on natural resources and in turn our government and their decisions would reflect these values. For example, strengthen existing programs, such as Envirothon.
- **Secure a “Champion of the Cause” within government:** A “champion of the cause” should be secured both within each relevant branch of all levels of the government as well as outside of the government. The “champions” can promote important ideas in their branch and push policy changes in favour of these ideas. This will ensure that the benefits, goals, and policy needs of private land afforestation are continuously reiterated in policy making and decision making within the governments.
- **Establish a long term work plan to drive a long term mandate:** This is difficult because when it comes down to it any government funded programs can only be expected to have at maximum a 5 year life. A long term vision for the environment must be developed which includes the importance of increasing tree cover. Ideas discussed involved the creation of crown agency for the environment that could implement and monitor long term work plans. This would provide the continuum that the government has not provided and it would create the pressure needed to operate within a long term vision. Also suggested, was the creation of bilateral agreements between provinces on environmental issues which would ensure a necessary commitment continuation when governments change. Another strategy is to link policies to longer term political issues such as; climate change, economic stability, or clean water.
- **Creation of a centralized agency – Trees Ontario:** There is a need to develop a centralized agency to deliver afforestation programs. A central agency will provide greater capacity to smaller organizations running planting programs, such as Conservation Authorities. This will help by increasing efficiency and allowing the organizations to concentrate on landowner communications and on the ground activities rather than administration type details. In addition, estimating demand, organizing the orders, and providing the needed resources for seed and stock will be facilitated. The Trees Ontario program has been widely accepted as a delivery agent for any new afforestation program.
- **Recognize the value that the resource provides to society and create incentives based on that:** This can be done through the creation of tax and program incentives. Some examples include; tax exemption for purchases related to forest management, per hectare monetary incentives for land planted, and the maintenance and improvement of the Managed Forest Tax Incentive Program (MFTIP).

- **Equitable tax treatment for forest land and farm land:** Forested land must be treated the same as farm land in land value assessments. The assessment procedures must be changed to reflect the assessment act. In addition; coordination should be fostered between the Ministry of Finance, MPAC, the MNR, OMAF, and the municipalities to avoid this type of oversight.

### 3.4 Landowner Incentives and Agreements

#### *Landowner Incentives*

According to the Ontario Land Classification there are 1.2 million hectares of appropriate available land available in Ontario. However, by taking landowner interest into consideration there are between 50,000 and 300,000 hectares presently available for afforestation. The variations in available land are based on different incentive levels, with the low end being full cost to the landowner and the high end being a fully subsidized program (Bird 2002).

Landowner incentives were assessed both by the Afforestation Survey for Landowners, and well as through the Landowner Incentive Focus Session. The survey findings are documented in the “Findings of Afforestation Survey for Landowners in Eastern Ontario” and the “Findings of Afforestation Survey for Landowners in South Western and South Central Ontario”, summarized in Section 3.1.

The importance of incentives in encouraging afforestation on private lands was heard consistently in both the surveys and the focus sessions. The surveys show that in eastern Ontario (Figure 3) and south western / south central Ontario (Figure 4) landowners were most interested in financial incentives with the top 2 incentives being Income Tax Credits and a Reduction in Property Tax. In Eastern Ontario close to 60% indicated that Income Tax Credits and Reduction in Property tax would be important in encouraging them to plant in the future, In South western south central Ontario this was close to 50%. In both areas close to 40% indicated that a subsidy on planting cost as well as information on how to select appropriate sites would be important. Technical assistance incentives were the least important incentives.

**Figure 4: Important of Incentives to Encourage Afforestation Eastern Ontario**

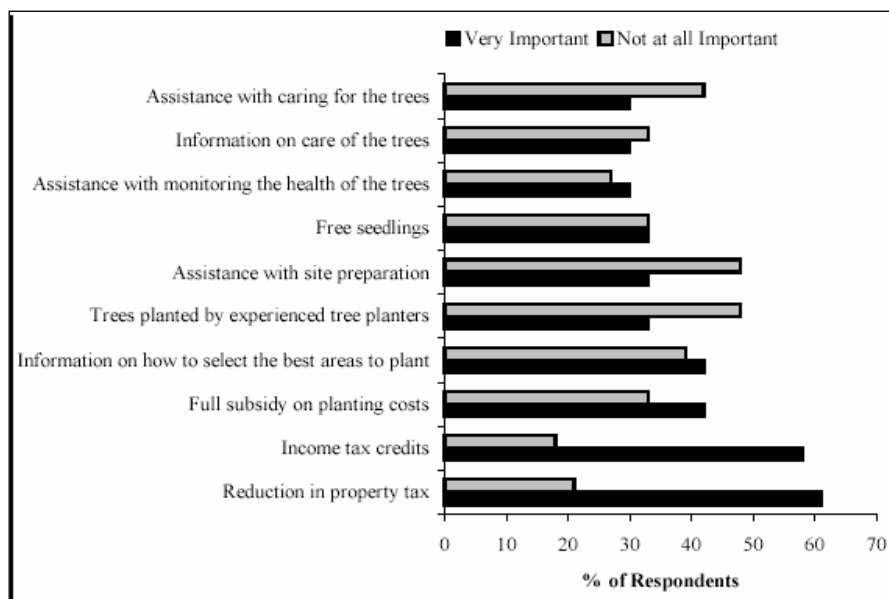
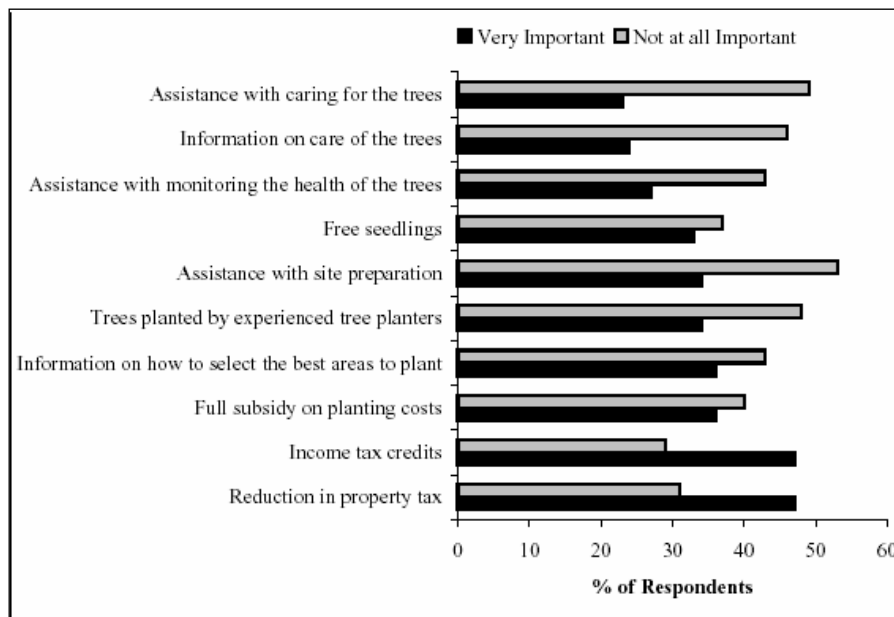




Figure 5: Important of Incentives to Encourage Afforestation in South Western South Central Ontario



#### *Considerations for Developing Incentives for Afforestation*

Landowners indicated there was considerable interest in participating in a potential afforestation program. However, during the Landowner Incentive Focus Sessions, landowners stated that a number of questions would have to be clarified by any program/delivery agency prior to an agreement to participate. These include:

- **Long-term program stability.** The program/delivery agency has to be able to make, and meet, long-term commitments to both participants and program goals throughout the entire term of the agreement.
- **Local delivery.** Any program developed (forest management extension services, technical advice, plantation establishment, tending, etc.) would be best received by landowners if a locally based agency or organization delivered it.
- **Respect.** Respecting landowner’s management objectives (e.g., choice of tree species, silviculture treatments, etc.) and property rights is essential.
- **Financial Assistance.** A flexible incentive package providing landowners, with a series of options based on their objectives and ability to contribute (financial and in-kind) to the program, would be more attractive to landowners than just a “one size fits all” package. Financial assistance is the most attractive to landowners. For example, 70% to 90% of the plantation establishment and associated management costs to at least the “free-to-grow” stage. Financial assistance could also come in the form of a 5 year payment plan in order to overcome problems of limited discretionary capital for the “land rich cash poor” landowner. This presumes an investor would start the program with an initial investment that would get leveraged into a larger program.
- **Competitive Benefits.** The benefits of afforestation for the landowner (e.g., revenues from wood fibre and offset credits, as well as the intangible benefits – personal, social, and environmental) must be competitive with other potential land use opportunities.

- **Ownership.** Long-term success of the program, and specifically the management of the plantations, will be ensured if the landowner adopts a sense of ownership of the initiative. It is recommended that landowners contribute financially to the program. For example: Landowners pay approximately 10% of the establishment costs – to secure and demonstrate commitment. Across Ontario landowners consistently felt that providing their land as part of an afforestation program should be considered as an investment towards the program. Covering 10% of the overall program was also consistent with what the Canadian Federation of Woodlot Owners has found nationally (CFWO 2004). Other examples include: underwrite the cost associated with the field visit during the initial planning stage, etc.).
- **Recognition.** The landowner needs to be recognized for their contribution (e.g., the availability of an attractive gate sign similar to those used to promote participation in the Ontario Ministry of Natural Resources’ Woodland Improvement Agreement program).
- **Favourable Property Taxes.** The creation of a more favourable property assessment and tax environment were noted as one of the most influential matters when considering a change in land use (e.g., converting farmland to forestland).
- **Favourable Policies.** Provincial and municipal government agriculture and forestry policies and programs that effect private landowner’s decisions on land use, need to be reviewed and harmonized.

### ***Landowner Agreements***

Due to the different roles and responsibilities of the parties involved in establishing a plantation to produce both wood and offset carbon credits, it is likely that two separate agreements will be needed. One agreement for the establishment and growing of the trees, and a second agreement covering the sale of offset credits. During the Landowner Incentive Focus Session discussion surrounded other considerations that need to be taken into account in the development of an agreement. These include:

- **Simple.** Landowners will be more receptive to an agreement that is simple, written in plain language, and that doesn’t intrude on their property rights and/or management objectives. The agreements must also be simple to lift at the term of the agreement.
- **Registration on Title.** Having the agreement registered on title caused concern to some landowners. While landowners understood the argument for the inclusion of such a condition, they also thought it might be a deterrent to participation. An agreement that is easy to remove from title upon expiry, may help in alleviating this concern.
- **Clear Roles.** The roles and responsibilities of all parties need to be clearly spelled out in the agreements.
- **Flexible term.** Landowners were apprehensive about long-term agreements. They indicated a preference for a flexible agreement that was shorter in length (e.g., 15-20 year term maximum, with provisions for renewal in 10-year increments).
- **Flexible ownership.** The agreement should offer flexibility in the ownership of the wood and offset credits. In most cases, the wood being retained by the landowner throughout the agreement, and the offset credits contracted to another party (e.g., investor).
- **An Exit Clause.** A landowner’s needs change over time. Land may be sold and landowner ownership and management objectives may change. Regardless of the length of the agreement, an exit clause is required. Reasonable penalties to exit the agreement will be necessary (e.g., repayment of costs and losses pro-rated over the term of the agreement). Care should be taken to ensure they do not deter participation.

- **Flexible packages.** A “one size fits all” type of agreement will not meet the needs and/or objectives of all landowners. A flexible agreement offering an array of different arrangements would be much more attractive to landowners. The arrangements might offer different options such as: the length of the agreement, level of financial assistance in the establishment of the plantation, ownership of the offset credits, opportunity for the landowner to participate in management activities, etc.
- **Management Plan.** The management plan must be harmonized with other plans currently being used by landowners, for example: Managed Forest Tax Incentive Program, Ontario Environmental Farm Plan, etc. The management plan must be simple and based on sustainable forest management. In addition, stand treatment prescriptions must be both harmonized with, and avoid conflict with offset credit development and sales.
- **Penalties.** Carefully structured penalties (e.g., repayment of costs and losses pro-rated over the term of the agreement) to cover failure to perform. It must be designed in a manner that promotes responsible performance and does not become a barrier (perceived or real) to landowner participation. Responsibilities and penalties for both parties must be clearly defined in the agreement.
- **Dispute resolution.** An arbitration process to resolve any disputes as to the meaning and/or implementation of the provisions of the agreement (e.g., penalties, terms of exiting the program, etc.) should be provided.

The workshop participants greeted the concept of an afforestation program linked to carbon sequestration with great interest. Landowners appeared to be receptive and willing to enter into some form of partnership with an agency/organization in a potential afforestation program across southern Ontario.

A well-designed program, that will provide long-term commitment to program objectives, respect landowner’s rights and management objectives, provide a range of attractive incentives, and is based on a landowner ‘friendly’ agreement, should attract large-scale landowner participation.

The challenge that lies ahead is to ensure that landowner’s interests are adequately addressed if an afforestation program is developed under the FAACS initiative or another program.

Throughout all three of the Landowner Incentive Sessions the landowner attitudes towards planting and the economics found to be diverse. This diversity corresponds to the diversity of soil productivity, opportunities for land use and economic pressures over the three regions in Ontario.

### **3.5 The Growing Market for Wood from Certified Forest Lands, and the General Requirements for Certification of these Lands**

There are 3.4 billion ha of forest in the world. The implementation of a Sustainable Forest Management (SFM) standard and certification is expensive. Only the forests that contribute significant volumes of wood to industry are likely to become certified. Perhaps half of the world’s forests (1.7 billion ha) may be certified in the future.

At present there are four well represented forest certification programs, and several smaller ones in operation. These programs all certify sustainable forest management. The programs are: the Programme for the Endorsement of Forest Certification (PEFC) with 52 million ha; the Sustainable Forestry Initiative (SFI) with 42 million; the Forest Stewardship Council (FSC) with 40 million, the Canadian Standards Association (CSA Z809) with 28 million, American Tree Farm System (ATFS) with 11 million and others with 10-20 million ha. The total is about 210 million ha of forest certified to SFM systems world-wide. This is perhaps 12% of the potential.

Currently there is little demand at the retail consumer level for certified forest products. The consumer does not understand certification but supports good forest management. There is demand from large users of paper and large retail chains. There is little or no premium paid for certified products. The main advantage throughout the supply and

demand chain is market access and corporate image. Certification is also being driven by public expectations for improved forest management performance.

Canada is the second largest producer (after the US) and the largest exporter of forest products in the world with approx. 210 million ha of multiple-use forest land that may become certified in the future. At the end of 2003 there were 58 million ha certified to three SFM standards in Canada. The SFM systems in use in Canada are; CSA with 28.4 million ha, SFI with 25.8 million and FSC with 4.2 million. Some forests have been certified to more than one program.

### ***The Challenge of Certifying Small Areas of Forest***

Small areas of forest present challenges for certification. On small properties the cost of certification, per hectare, is very high and the program may involve more paperwork than a woodlot owner is prepared to handle. Two additional SFM programs have recently been developed for private woodlots to overcome these problems. They are:

- The FSC special program for Small and Low Intensity Managed Forests (FSC/SLIMF). The applicable FSC standard will be used but the SLIMF program offers a simplified procedure for audit and certification for single or groups of private woodlots.
- The Canadian Federation of Woodlot Owners (CFWO), representing Canada's 450,000 woodlot owners, have recently completed the development of a standard designed specifically for private woodlots and to complement the CSA, SFI and FSC programs.

### ***Certification Applicable to Plantations***

Wood harvested from plantations take the pressure off of natural forests. The specific certification programs that may be applicable to areas planted under an afforestation program are the CFWO and FSC/SLIMF programs. No certification will be needed for 20-30 years, as certification offers little benefit until the wood is harvested.

### ***The SFM Criteria Observed by most Certification Programs***

All of these SFM certification programs have a common goal; to promote sustainable forest management through the implementation of standards and a third party audit. The criteria also have a great deal in common. The difference is mainly in the emphasis.

If an afforestation program is going to be implemented with one of the objectives being: qualification for certification, there are several criteria that must be respected. These criteria are:

- Conservation of Biodiversity
- Conservation of soil and water quality,
- Maintenance of ecosystem health and productivity,
- Provision of sustainable benefits to society,
- Maintenance of forest ecosystem contributions to global ecological cycles (carbon sequestration),
- Respect for property and tenure rights (legitimate land claims),
- Contributions to community well-being; and
- Protection of natural forest attributes.

### ***Guidelines***

Based both on these criteria and the objective of ensuring eligibility for certification some planning guidelines for an afforestation program on private lands in Ontario must be considered. The key overarching elements for these guidelines are soil and water quality, riparian zones, conservation of biodiversity and respect for property rights.

- Plantations should be established using site-adapted native species capable of competing successfully with the existing ground vegetation on the site; normally grass/hay.
- Where practical, plantations should be planted with a mixture of silviculturally compatible species.
- Treeless riparian zones should be planted in a way that allows both good growth of planted species as well as natural regeneration to native hardwoods and shrubs. This zone should be managed with care.

- Initial spacing and silvicultural stand treatments should be used that will avoid non-commercial thinnings and promote stand stability, good production of wood, high rates of sequestration and natural regeneration/ conversion to the site-adapted natural forest ecosystem.

### 3.6 The Calculation of Offset Credits (tonnes of CO<sub>2</sub>e) in a Tree

Calculation of the Carbon content of wood in the tree, and therefore the weight of Offset Credits, is most practically done through the use of conversion factors.

#### *The Parts of the Tree*

Three parts of the tree are used in this example: **Tree stem** - or **trunk**; **Root mass** - includes the stump; and roots and **Crown** – includes the top and branches. The easiest part of the tree to measure is the merchantable volume of the tree trunk. Measurement systems for the merchantable volume of wood are well established. For practical reasons the conversion factors are based on one (1.0) cubic meter of merchantable wood. This permits easy application of the conversion factors to the volume of single trees, stands of trees or large areas of forest. The amount of carbon in the Crown and the Root mass are calculated using conversion factors based on one (1.0) cubic meter of merchantable wood in the trunk.

#### *Conversion Factors<sup>6</sup>*

Using 1 cubic meter of merchantable wood as the starting point for calculation makes it easy to calculate volumes of wood and carbon content on a per hectare basis.

**Table 1: Conversion Factors<sup>7</sup>**

<p><b>Volume of Wood.</b> Factors to calculate the volume of wood in the three parts of the tree. If the volume of merchantable wood in a tree is 1.0 cubic meter, the remaining parts of the tree are represented by the following factors of full tree volume:</p>	<ul style="list-style-type: none"> <li>• The crown or top and branches contain 0.454 cubic meters of wood.</li> <li>• The stump and below-ground root mass contains 0.396 cubic meters of wood</li> </ul>
<p><b>Dry Solid Matter.</b> The factor to convert 1.0 cubic meter of wood to dry solid matter (dry wood density) is:</p>	<ul style="list-style-type: none"> <li>• 0.37 for Poplar</li> <li>• 0.43 for Canadian Conifers</li> </ul>
<p><b>Carbon Content.</b> The dry solid matter is one half carbon. Factor to determine carbon content:</p>	<ul style="list-style-type: none"> <li>• Multiply by 0.50</li> </ul>
<p><b>Offset Carbon Credits.</b> Offset carbon credits are expressed as tonnes of carbon dioxide equivalent (CO<sub>2</sub>e). The factor to convert 1 tonne of Carbon to tonnes of CO<sub>2</sub>e:</p>	<ul style="list-style-type: none"> <li>• Multiply by 3.667</li> </ul>

<sup>6</sup> Conversion factors are ratios used to determine an unknown value (e.g. the volume of wood in the top and branches of a tree) from a known value (e.g. the merchantable volume of stem wood). For example, for a tree with a known merchantable volume of 0.5m<sup>3</sup> of wood, using the conversion factors noted above, the volume of wood in the crown of that tree is : 0.5m<sup>3</sup> x 0.454 (crown conversion factor) = 0.227m<sup>3</sup>

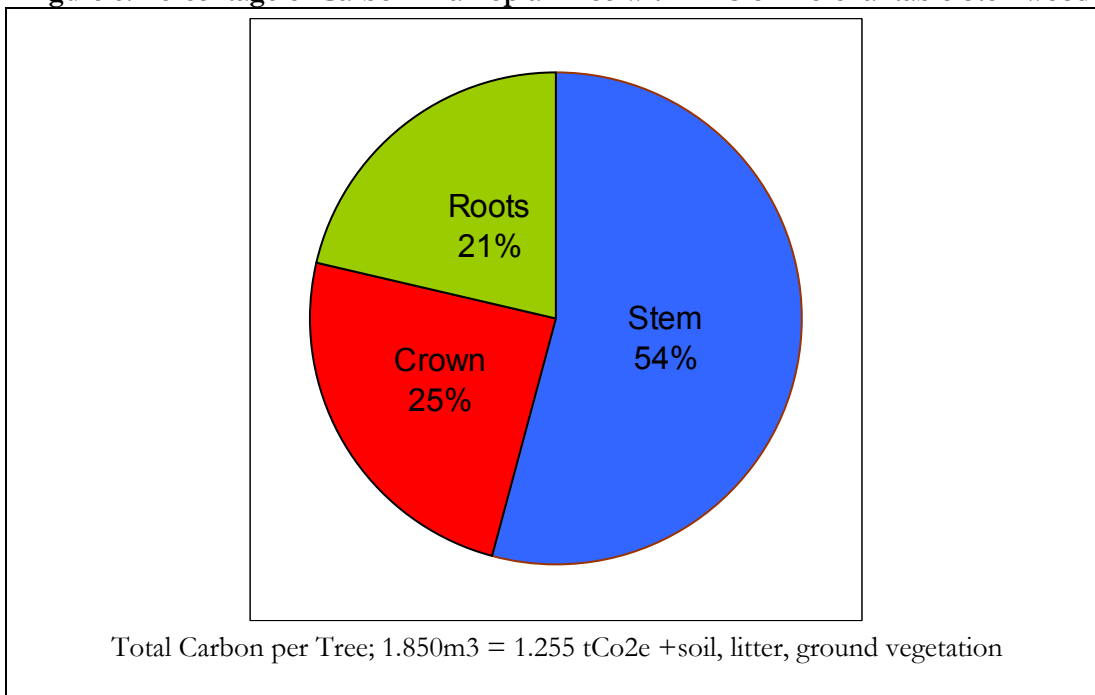
<sup>7</sup> Conversion Factors are all standards used by the Canadian Forest Service.

**Table 2: Converting Merchantable Wood to Tonnes of CO2e: Examples for Poplar and conifers**

Tree Type	Tree part	Comparative Volume of wood	Conversion to tonnes (t) CO2e	CO2e (t)	%
<b>Poplar</b>	Stem	1.000 m3	$1.000 \times 0.37 \times 0.5 \times 3.667 =$	0.678	54
	Crown	0.454 m3	$0.454 \times 0.37 \times 0.5 \times 3.667 =$	0.308	25
	Root-mass	0.396 m3	$0.396 \times 0.37 \times 0.5 \times 3.667 =$	0.269	21
	Total	1.850 m3	$1.850 \times 0.37 \times 0.5 \times 3.667 =$	1.255	100
<b>Conifers</b>	Stem	1.000 m3	$1.000 \times 0.43 \times 0.5 \times 3.667 =$	0.788	54
	Crown	0.454 m3	$0.454 \times 0.43 \times 0.5 \times 3.667 =$	0.358	25
	Root-mass	0.396 m3	$0.396 \times 0.43 \times 0.5 \times 3.667 =$	0.312	21
	Total	1.850 m3	$1.850 \times 0.43 \times 0.5 \times 3.667 =$	1.458	100
<b>Birch</b>	Stem	1.000 m3	$1.000 \times 0.54 \times 0.5 \times 3.667 =$	0.990	54
	Crown	0.454 m3	$0.454 \times 0.54 \times 0.5 \times 3.667 =$	0.450	25
	Rootmass	0.396 m3	$0.396 \times 0.54 \times 0.5 \times 3.667 =$	0.392	21
	Total	1.850 m3	$1.850 \times 0.54 \times 0.5 \times 3.667 =$	1.832	100
<b>Maple</b>	Stem	1.000 m3	$1.000 \times 0.56 \times 0.5 \times 3.667 =$	1.027	54
	Crown	0.454 m3	$0.454 \times 0.56 \times 0.5 \times 3.667 =$	0.466	25
	Rootmass	0.396 m3	$0.396 \times 0.56 \times 0.5 \times 3.667 =$	0.407	21
	Total	1.850 m3	$1.850 \times 0.56 \times 0.5 \times 3.667 =$	1.900	100

Note: the density factors for birch and maple were derived by ratio and proportion based on BTU content of different species used for firewood.

**Figure 6: Percentage of Carbon in a Poplar Tree with 1 m3 of Merchantable Stemwood**



The conversion factors and table presented above (Table 2, Figure 3), provide information on the measurement and calculation of Offset Credits contained in various parts of the tree based on 1.0 cubic meter of merchantable wood in the stem or the trunk of trees. It is important to understand that there are two commodities in one material; wood and carbon. Wood is a well recognized raw material used in the production of sawn lumber, wood based panels and pulp and paper. Carbon and therefore Offset Credits are new commodities embodied in the wood. Having two commodities embodied in the same material, with each commodity sold in a different marketplace, presents some problems for ownership, management and commercial transactions. Careful consideration of the added complexity of having two commodities in one material is required during the preparation of contracts and agreements with landowners and investors

### **3.7 Monitoring Plantation Performance, Measurement and Verification of Wood & Offset Credits**

#### ***Monitoring Plantation Performance***

Monitoring can be done through a combination of field measurements and satellite imagery to provide the required levels of confidence at the lowest cost. There is a need for extra rigour in monitoring and measurement to support program governance on behalf of investors and the requirements of an Offset Credit production and sales program.

#### ***Measuring Plantation Performance***

Credible and verifiable measurements are required for the calculation and sale of Offset Credits, reports to investors and to permit analysis and projections of wood supply and Offset Credit production.

Consideration should be given to the use of a Continuous Forest Inventory (CFI) system designed to track trends and is carefully aligned with the needs of aggregators for specific area coverage, accuracy and statistical validity.

Some measurements that will be required:

- Site index assessment and classification at age 10-15 years (approx.)
- Growth performance at 10 year intervals (height, DBH, stand density, etc.)
- Tree quality assessments at age 30 and 45 years to permit preparation of prescriptions for commercial thinning and bid documents.

#### ***Measurement and Verification of Wood and Offset Credits***

The merchantable volume of trees and the volume per hectare of stands, stated in solid cubic meters, can be used as a multiplier for factors to provide the volume of offset carbon credits See Section 3.6. A well organized database is needed to facilitate verification by auditors as required for program governance and reporting as well as assurance of Offset Credit availability and wood sales. In addition, soil carbon and associated fluxes will need to be accounted for.

#### ***A Database of Afforested Lands***

Management of an afforestation program will be driven as much by investor needs for revenues as by forest management. A successful afforestation program on private lands may involve as many as 10,000 landowners. A program to afforest private lands in Ontario for the purpose of carbon sequestration will be different than previous private land plantation programs in that there is a need to record not only the location and size of all plantations, but also to measure the growth of wood and the development of Offset Credits. A database will be required to manage the program and to keep track of all plantations, their growth rates, the development of Offset Credits and wood supply projections and sales. The database will include information and activities such as:

- The name and address of the landowner.
- The identification number of the planting agreement and management plan,
- The location (Land registry lot numbers and GPS) and size of the plantations.
- The year and month of planting, species, seedling type and nursery, seed source.
- Planting contractor, survival rate and fill planting required and performed
- Plantation tending operations required and dates performed to reach Free-to-Grow state.
- Record any losses due to fire, wind, insect and disease attack, unauthorized harvest or clearing.
- Record the growth rates (height, diameter and merchantable volume /ha) of the plantations.
- Record the production of Offset Credits contained within the three components of the trees (stem, crown and root mass) and soil, as well as wood supply projections.

#### ***Program planning, projections of wood production and Offset Credit development***

The same database should be able to:

- Assist general program management, administration and reporting,
- Project annual silvicultural operations based on management plans and plantation performance.
- Project annual budgets for operations and administration and assist in program audits.

- Create wood production projections based on the management plans as well as the associated total Offset Credit development projections to permit marketing and sale of these products. Sales and revenues can be recorded.
- Be programmed to perform the required risk management tasks and deductions from the total Offset Credits developed.
- All measurements of Offset Credits must be credible and verifiable. The database can also be used by the auditors/verifiers as part of the evidence that the Offset Credits have been accurately measured and are available for sale.

### 3.8 Risk Management and Offset Credit Aggregation

#### *Risk Management*

Offset Credits developed through sequestration rather than emissions reductions may sell at a discount in the marketplace due to concerns about ‘permanence’. This concern is based on the risk that sequestered carbon may be released to the atmosphere through poor management of the forest, massive deforestation or through a natural catastrophe. Unless there are well designed risk management strategies in place the buyers of Offset Credits developed through sequestration will discount the value of the Offset Credits and pay a lower price. Risk management strategies can reduce these risks. They cannot remove them completely.

#### *Risks involved in afforestation*

There are two levels of risk involved with afforestation projects: deforested at some point in the future; and loss due to natural catastrophe/disturbance.

The first level of risk is that the planted area will be cleared and deforested at some point in the future and the sequestered carbon will be released to the atmosphere. This is a real risk. It is hard to control land use permanently and ensure that the forest will remain in place forever. There are ways to reduce the risk of wholesale clearing of afforested areas. The first is to direct afforestation programs towards lands that have few other economic uses. Program managers should target lands with marginal/sub-marginal capability for agriculture and avoid lands that are located close to the development zones of expanding urban areas. The establishment of large landscape-scale areas of plantations on lands with few prospects for other economic uses will tend to create new areas of permanent forest. The permanence of these new forests can be further supported by their allocation to new property tax classifications with low annual taxes coupled with the strong provision that the land must remain in forest.

The second level of risk is that areas of plantation will be lost to natural catastrophe, like fire, disease and insect attack; or poor management, such as unauthorized harvesting. These are also real risks but they are risks that can be assessed based on past experience and the losses can be limited through good management practices as well as fire and pest management strategies. Provision must also be made to ensure that wood cut and removed during planned stand management operations does not reduce the Offset Credit account below the amount sold and/or held in reserve against loss.

Buyers will require assurance that risk management strategies are in place to reduce their exposure to the loss of Offset Credits that they have purchased. This can be done through holding a proportion of the Offset Credits in reserve to protect buyers against unexpected loss.

Carbon is sequestered and stored in three components of the tree. See Section 3.6, Figure 3.

- The merchantable stem or trunk of the tree- 54 %
- The crown or top and branches- 25 %
- The stump and below-ground root mass-21 %



One approach could be to sell only the Offset Credits contained in the merchantable stem. This would maintain a reserve of 46% against loss. This may be an excessively conservative position if losses to natural catastrophe alone are considered, but allowances must also be made for reductions in standing volumes due to harvesting during scheduled management operations.

### ***The need for Offset Credit aggregation***

An afforestation program on private land will result in the establishment of plantations with an average area of perhaps 10 ha each. Each of these 10 ha plantations will sequester 55<sup>8</sup> tonnes of CO<sub>2</sub>e in the merchantable stem each year. The marketplace for Offset Credits will deal in large 100,000 tonne blocks of CO<sub>2</sub>e. It will not deal in ‘retail’ amounts of 10 to 20 tonnes. Due to the size of individual blocks of plantations and the need to assemble tradable blocks of 100,000 tonnes of CO<sub>2</sub>e there will be a need to aggregate or assemble 1820 such 10 ha plantations (or 18,200 ha) to develop 1 tradable block of 100,000 tonnes CO<sub>2</sub>e each year.

### ***Approaches to aggregation***

There are organizations now establishing themselves as aggregators specializing in CO<sub>2</sub>e from agricultural and afforestation sequestration programs as well as agricultural emissions reduction projects. These organizations will be able to pool Offset Credits from a variety of projects thus spreading the risk and enhancing the value of their pooled assets. To a degree the choice of type of aggregator depends on the investor. Landowners will want to deal with organizations that they know and trust and believe to be working in their interests. These may be extensions of existing agricultural co-ops or woodlot owners associations. Institutional investors may be more comfortable working with a specialized and incorporated forest management organization, possibly a forest products company. All organizations involved in the measurement and aggregation of carbon sequestered through afforestation must have solid credentials in forest inventory, mensuration and wood supply modeling as well as risk assessment and management.

An organization established to aggregate Offset Credits from afforestation programs will have an advantage if it is closely linked with the plantation establishment organization.

This will permit and facilitate:

- Close cooperation on plantation data sharing- size, age, growth measurement and monitoring, scheduling of stand tending operations and loss control strategies.
- Seasonal allocation of work to enable year-round productive use of technical field staff.
- Permit better use of administrative staff.
- The economic mass and stability of a joint program will assist in providing assurance to clients.

## **3.9 The Market for Offset Credits from Afforestation**

Large Final Emitters (LFEs) that must reduce GHG emissions have two opportunities to meet their targets: Reduce GHG emissions produced by their own operations; and/or through the purchase of offset credits.

Three considerations will determine their course of action:

- Cost is one of the key considerations. Meeting GHG emissions reduction targets is an additional cost of doing business. Some organizations may factor in social aspects but for most LFEs it will be a business decision. Offset credits from afforestation have a business and social attraction due to the widely understood environmental and ecological benefits that come with well planned large-scale afforestation programs.
- Review of opportunities available to LFEs to improve the competitiveness of their core business through implementation of new technology.

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<sup>8</sup> 10 ha (conifer) x 7 m<sup>3</sup>/ha/yr. x 0.788t CO<sub>2</sub>e/m<sup>3</sup> stem wood = 55 tonnes of CO<sub>2</sub>e (see Section 3.6)

10 ha (poplar) x 12 m<sup>3</sup>/ha/yr x 0.678t CO<sub>2</sub>e/m<sup>3</sup> stem wood = 81 tonnes of CO<sub>2</sub>e (see Section 3.6)

- The length of planning horizon required to install new technology and recover the costs of investment compared to the degree of policy certainty within Canada’s Climate Change Program and the Kyoto Protocol. At this point there is no certainty about Canada’s Climate Change Program after 2012. High capital cost projects are placed at a disadvantage.

Afforestation offset credits suffer from six disadvantages in the marketplace.

- The desire of LFEs to deal in offset credits developed through projects that are related to their core business; ie something they understand and that may bring associated business benefits. This disadvantage will be less serious when the rules governing Canada’s Offset Program are firm and clear.
- Most LFEs do not understand the process of carbon sequestration by trees. One category of LFE that does understand afforestation offset credits is the Canadian forest products industry. There are some indications that forest products companies have an interest in afforestation credits and the associated additions to the wood supply.
- The long time periods required to develop substantial volumes of offset credits through afforestation. Canada has made no firm commitment for GHG reductions after the first commitment period 2008-2012. Significant volumes of offset credits from afforestation will not be available until after 2012. Options or firm contracts for offset credits for delivery after 2012 are unlikely to be signed until there is more clarity.
- The perception that offset credits developed through afforestation lack permanence and will be temporary or “rent-a-credits” that will require replacement by ‘real’ credits in the future.
- The weight given to this lack of “permanence” will determine the size of any price discounts. Some of the problems associated with ‘lack of permanence’ can be overcome by using well designed Risk Management Strategies. See Section 3.8 of report.
- Some may believe that afforestation offset credits are not a legitimate way to reduce GHG emissions.

There is general agreement among LFEs contacted that there will be a shortage of offset credits available on the domestic markets and that Canadian offset credits will be competing with offset credit products available on world markets. Canadian offset credits from afforestation must be cost-competitive. Canadian LFEs will pay no more than world prices for Canadian offset credits.

### **3.10 Afforestation for Carbon Sequestration: Assessing the Investment Opportunity**

Under the Kyoto Protocol afforestation for carbon sequestration is an investment opportunity. This opportunity is created by the sale of offset carbon credits on the carbon market. Potential investors in afforestation for carbon sequestration include; governments, large industrial emitters (LIEs), foundations, trusts, and private landholders. As is the case in any investment opportunity, an investment analysis is necessary to determine if, from the investor’s perspective, economics are in favor of investing in afforestation for offset carbon credits. The investment analysis plays fundamental role in determining the feasibility of using afforestation for carbon sequestration as a tool to offset carbon emissions. This section will give a snapshot of afforestation for carbon sequestration as an investment opportunity using a simple cost/benefit analysis model developed by the CFS.

The development of the cost/benefit analysis model, which is in the form of an Excel spreadsheet, is a result of requests for a simple, quick, and easy to use “calculator” that shows the bottom line economics of an investment in afforestation. The model was developed by Dan McKenney and Denys Yemshanov of the CFS as a laymen’s tool to assess afforestation feasibility. It was presented at the “Offset Carbon Credits from Afforestation Focus Session” in November 2003 in Toronto. The model outputs are as follows:

- the present values (PV) for the timber and carbon benefits of afforestation (\$/ha)
- the total net present value (NPV) of the afforestation project (\$/ha)
- the break even price for carbon (\$/ha)
- a breakdown of the amount of carbon sequestered (both aboveground and belowground) and emitted (through stem removal and biomass decay) throughout the project (ton C/ha)

The NPV calculation includes the benefits from sequestered carbon and timber products, and the costs associated with plantation establishment, tending, monitoring, and the opportunity costs of agriculture land use. The related equation is as follows:

$$NPV_{aff} = PV_{timb} +/- PV_{carb} - PV_{est} - PV_{tend} - PV_{agoc}$$

The opportunity cost of agriculture land use accounts for the fact that in converting agricultural land to forest there is a loss in potential revenue to the landowner. This cost can be described as payment to the landowner to cover the lost revenue. If the scenario does not produce a positive NPV, a break even price for carbon is indicated. The break even price for carbon is the price of carbon required to make the afforestation project economically feasible; i.e. the carbon price that returns a positive NPV. The break even price is indicated as 0 if the NPV is positive.

The amount of carbon sequestered is calculated as follows:

$$C_{totalseq} = C_{accum} - C_{emit}$$

The carbon accumulated accounts for the soil carbon and that of the above and belowground (or root and change in soil carbon) biomass. The carbon emitted accounts for that of the harvested wood and the non-merchantable biomass left on site post-harvest. It should be noted that the amount of carbon sequestered by forest litter and from fossil fuel substitution is not included in this calculation.

The model user is required to provide economic and biological inputs. The model indicates suggested values for normal cases. The economic inputs required are as follows:

- A growth and yield table for the given species that includes merchantable timber volume in m<sup>3</sup>/ha
- Discount rate
- Plantation rotation age in years (it is up to the user to decide how they determine this, it can be specified up to 100 years)
- Price for carbon in \$/ton C
- Price for timber in \$/m<sup>3</sup>
- Cost for plantation establishment in \$/ha (this includes site preparation, seedling purchase, and tree planting)
- Cost for tending in \$/ha/year
- Cost for monitoring in \$/ha/year
- Agricultural land opportunity costs in \$/ha/year

The biological inputs are as follows:

- Conversion factor from timber volume into dry timber weight (wood density)
- Conversion factor from timber biomass into aboveground biomass
- Conversion factor from aboveground biomass into belowground biomass
- Conversion factor from biomass into carbon equivalent
- Site suitability factor (this is a multiplier for the growth and yield curve)
- Annual carbon accumulation rate by soil in ton C/ha/year
- Period of soil carbon accumulation since the beginning of afforestation in years
- Period of post-harvest biomass decomposition in years
- Decay rate for harvested forest products in years

The input for the decay rate for harvested forest products is where users can specify the “style” of carbon accounting. For example, “Kyoto-style” accounting indicates that all carbon from the aboveground biomass is assumed to be released into the atmosphere within a year of harvesting; in this case the user would enter 1.

To give a snapshot of the afforestation investment a realistic case study was developed. This involves the establishment of a fast growing poplar plantation. This plantation will have a mean annual increment (MAI) of 16m<sup>3</sup>/ha/year and it will be harvested on a 20 year rotation. This scenario was chosen for illustration because fast growing poplar plantations provide a unique benefit in that the return realized from the sale of wood products and the accumulation of carbon is significantly sooner than for plantations of most other species. For this reason plantations of this type seem to be the most feasible option for an afforestation investment. It should be noted, however, that landowners have clearly indicated that a suite of species choices for private land plantations is more desirable than fast growing mono-cultures. The fast growing poplar plantation is a “best case scenario” from a purely economical perspective. The following Tables 1 & 2<sup>9</sup> show the economic and biological inputs for this scenario. Please refer to Appendix I for the full model sheet showing the illustrative scenario, this includes the yield tables used.

**Table 3: Economic Inputs to Afforestation Cost/Benefit Calculator**

<b>Economic inputs:</b>		<b>Suggested values</b>
Discount rate (Min - >0; Max - 1)	0.06	0.06
Rotation age (Min - 1; Max - 100 years)	20	40
Price for carbon (\$ per ton C)	1.9	10
Price for timber (\$ per m <sup>3</sup> log)	10	12
Establishment costs (\$ per ha)	1030	800
Annual tending costs (\$ per ha per year)	6.5	10
Annual monitoring costs (\$ per ha per year)	10	5
Annual agricultural land opportunity costs (land rent, \$ per ha per year)	0	0

It should be noted that the model was run with an annual agricultural land opportunity cost of 0. Decisions have not yet been made regarding incentives or compensation to the landowner; for this reason the illustrative scenario was kept as simple as possible by not including a value here.

**Table 4: Biological Inputs to Afforestation Cost/Benefit Calculator<sup>10</sup>**

<b>Biological inputs:</b>		<b>Suggested values</b>
Timber volume -> into dry timber weight (wood density)	0.37	0.389
Timber volume -> into aboveground biomass	1.454	1.5
Aboveground -> into belowground biomass	0.396	0.396
Conversion from biomass -> into carbon	0.5	0.5
Site suitability factor (growth/yield curve multiplier)	1	1
Post-harvest (on-site) biomass decay period (years)	3	3
For. products decay rate (Min - > 0; Max - 1)*	1	0.96
Annual carbon accumulation rate by soil, ton C/ha/year	0.67	0.67
Period of soil carbon accumulation, years	50	50

\* Set for.prod. decay rate to 1 to choose a "Kyoto" accounting

The results of the illustrative scenario are as follows:

<sup>9</sup> The input values are from CFS and from an informal survey of costs and productivity for planting operations in Northern Ontario by Tony Rotherham.

<sup>10</sup> Please refer to Section 3.6 for details on the use of conversion factor for calculating carbon sequestered.

**Table 5: Results - Present Values**

<b>Present values , \$ per ha:</b>	
Total NPV	79.36
PV(carbon sequestered)	133.75
PV(carbon BG biomass)	40.90
PV(carbon AG biomass)	150.09
PV(carbon for.prod. emissions)	54.10
PV(carbon on-site biomass decay)	23.20
PV(soil carbon accumulation)	20.06
PV(establishment)	1496.67
PV(tending)	74.55
PV(monitorsing)	114.70
PV(agric.land value)	0.00
PV(timber products)	1631.53

Table 3 shows that the total NPV for the project is \$79.36. This indicates that the revenue generated by the sale of accumulated carbon and wood is adequate to offset the costs involved in establishing, tending, and monitoring the plantation. The decision to invest in this scenario would be based the cost/benefit ratio of the investment as a whole. In this case the cost/benefit ratio is 1.001. This indicates that the benefits just barely offset the costs in this scenario. The cost/benefit ratio and the NPV figures for this investment would have to be comparable to other investment opportunities to attract capital.

**Table 6: Results - Break Even Carbon Price**

<b>Break-even carbon price:</b>	<b>\$ per ton C</b>	<b>\$ per ton CO2</b>
(Break-even price = 0, when NPV > 0)	0	0

Table 4 indicates the break even price for carbon; in this case, because the NPV is positive, the break even price is indicated as 0 as explained above.

**Table 7: Results - Carbon Sink**

<b>Discounted carbon, t C per ha:</b>	<b>Lump sum</b>	<b>Annualized</b>
Total carbon sink	70.397	4.224
Belowground biomass sink	21.528	1.292
Aboveground biomass sink	78.993	4.740
Emissions from forest products	28.475	1.708
Emissions from on-site biomass decay	12.210	0.733
Accumulation by soil	10.560	0.634
Timber volume at harvest age, m <sup>3</sup> per ha		360.1

Table 5 indicates that the total carbon sink created in this project is 70.4 tons C per hectare. It also shows that the total volume of wood harvested at 20 years was 360.1 m<sup>3</sup>/ha.

The model used has some limitations. It does not account for risk of loss due to natural disturbance which could severely reduce the carbon and wood available for sale. Risk and risk management allowances should be factored into any analysis. See section 3.8. The model does not permit analysis for any stand management schedule other than a single harvest at the end of the rotation. Costs must be entered as a one time per hectare cost or as an annual cost per hectare. For most operations this is not realistic as multiple entry techniques are often used in plantation scenarios. It should be noted that if the results obtained in this scenario were compared to those of a conifer plantation, because of the longer rotations involved; the investment would be even less attractive.

As mentioned above, this scenario does not account for agricultural land opportunity cost but the model allows for this payment. If this is included it drives up the cost of the investment significantly rendering the scenario financially unviable.

The model provides a quick investment tool. The bottom line in this case study is that the benefits just cover the costs incurred. In order to determine if the investment is a viable one, the NPV and/or the cost/benefit ratio must be compared to other potential investments. It will be seen that the cost/benefit ratio of 1.001 in this scenario is quite low; carbon offset credit prices must increase in order for the investment to be a competitive option.

## **4.0 Summary and Recommendations**

### **4.1 Recommendations**

#### ***Landowner Incentives and Plantation Establishment Agreements***

- Landowners are interested in the idea of an afforestation program linked to carbon sequestration.
- They are willing to enter into some form of partnership with an agency/organization in a potential afforestation program across southern Ontario.
- A well-designed program, that provides long-term commitment to program participants, respect for landowner's rights and management objectives and provides a range of attractive incentives, should get broad landowner participation.

#### ***Plantation Establishment Agreement and Carbon Ownership and Sales Agreement***

- Due to the different roles and responsibilities of the parties involved in establishing a plantation to produce both wood and offset carbon credits, it is likely that two separate agreements will be needed. One agreement for the establishment and growing of the trees, and a second agreement covering the ownership and sale of offset credits.
- The agreements should be in simple language and be 'landowner friendly'.

#### ***Investor Needs***

- An afforestation program carried out on private land will involve two inputs of capital:
  - The land, which will be dedicated to growing trees for periods of at least 20 years and as much as 75 years.
  - Capital to pay for the costs of plantation establishment and management.
- Because the trees are attached to the land and the carbon is embodied in the wood it is difficult to handle the investment as two completely separate transactions.
- It would be simpler and easier if the landowner were enabled to support the investment in plantation establishment. The return on investment required to provide landowners with an attractive opportunity will also be lower. The landowner will get part of their returns from intangible land ownership rewards and full control of their lands.

#### ***Plantation Establishment Costs and Revenues***

- It will cost an estimated \$1200-1500 per ha to cover the costs of: plantation establishment and juvenile tending to the Free-To-Grow stage. This money may come from an investor who will require a competitive return on the investment. Incentives provided through direct grants or tax write-offs against earned and other income will have the effect of reducing the investment required. The revenues flowing from the investment are a combination of sales of offset credits and wood sales. Offset credit sales revenues will start about 10 years after planting. Revenues from the sale of wood will come in a lump sum on average at age 20 for hybrid poplar plantations; and in 3 payments generally at ages 30, 45, 60 for commercial thinning and at 75 years for final harvest for conifers.
- At present the investment characteristics are:
  - Offset credits carry a high risk due to the non-fungible nature of GHG compliance credits. There are several levels of policy uncertainty over the long term.

- Forestry and wood production is not well understood by Canadian investors due to the small percent of Canadian forest land in private hands.
- The risk levels for the forestry aspects of the investment are low but the payback period is long.
- Both parts of this investment suffer from low liquidity rates. At present there is no established market for offset credit futures. There is no market for softwood sawlog and pulpwood futures.
- The lower the establishment and tending costs, the higher the return on investment. Species and site selection as well as silvicultural prescriptions must be designed to reduce costs as much as possible.
- The market is really a specialized niche in the real estate market for rural land.

### ***Attracting Capital for Afforestation***

- An ROI of as much as 15 -20% will be required to attract investor capital (2004 Annon).
- The uncertainties around the long-term value of offset credits must be resolved. Policy stability for up to 30 years will be required.
- There is another way to increase ROI and reduce risk due to policy change. Provide investors with an income tax based program to write-off plantation establishment costs. This program that will significantly reduce the effective investment in plantation establishment costs.
- This may be easier than a government undertaking to maintain GHG compliance offset policy stability over 30 or more years. Investors may doubt the ability of government to do this.

### ***Plantation Establishment Objectives and Ongoing Management of the Plantation Estate***

There are four objectives to be achieved:

- Produce optimum amounts of offset credits.
- Grow large quantities of wood to supplement the existing wood supply for industry.
- Ensure that plantations meet environmental objectives and qualify for certification at the time of harvest.
- Manage plantations to provide optimum socio-economic benefits to rural communities.

To achieve these four objectives:

- With silviculturists, economists and forest products industry experts; develop crop plans to achieve wood production and offset credit development objectives.
- Model the effects of plantation patch size on the transaction costs of plantation establishment, wood and carbon measurement, aggregation and sales.
- Plan and manage plantation establishment, growth and harvest to produce carbon and wood at competitive costs. A forest management services organization may be required to do some or all of this work.

### ***Overcoming Policy Barriers***

There are four significant policy and supply barriers to the implementation of a large afforestation program:

1. Long term government commitment to a private land forest management program is not in place and is essential.
2. Taxation rates on forest land are higher than on farm land. This effectively persuades landowners to keep their land in farm status and not to establish plantations. It also influences landowner decisions to break up larger properties into smaller development lots. Forest land should have, at the least, the same tax status as agricultural land. This is an effective way to compensate landowners for the provision of ecological services.
3. There is no clear direction on land use provided to rural landowners by the often conflicting policy priorities of municipalities, Dept of Agriculture and the OMNR.
4. There is little or no ready supply of seed suitable to grow seedlings for a large-scale afforestation program in Southern and Eastern Ontario.

### ***Wood and Carbon Measurement***

- The revenue side of the operation will be dependent on accurate and timely measurement of growth rates of wood and calculations of the volume of offset credits.
- Risk management strategies will be an essential aspect of program management.

- Wood growth and supply projections based on well planned forest inventory sampling systems will be important to sales and revenue predictions for both offset carbon credits and wood. Successful price negotiations depend on knowledge and buyer confidence.
- A computer database with appropriate modeling software will be essential.

### ***Record Keeping***

- Unlike past private land plantation establishment programs in Canada there will be a need for permanent records of both costs and forest management aspects of the program. The location, size, ownership of all plantations must be known and easily available.

### ***Aggregators and Brokers***

- Offset credit Aggregators and Brokers will depend on accurate, credible and verifiable information on offset credit production and availability. A well organized database will ease verification.
- Close coordination of wood and carbon sales will be essential to avoid failure to deliver on offset credit contracts.

## **4.2 A Program With and Without Supporting Policy**

Without a supporting policy change, there will not be a behaviour change and therefore potential uptake will be low. However if the national and provincial policy is changed as recommended in sections 3.2 and 3.3, and an attractive program is developed as recommended in section 4, then the potential uptake should be considerable based on the fact that there is approximately 50,000 and 300,000 hectares presently available in Ontario (Bird 2002).

### ***Future Without Supporting Policies***

Currently - Policy Uncertainty  
 No commitment beyond 2012  
 Uncertain Prices, uncertain product  
 Long-term investment 20- 30yrs min  
 No liquidity, Investors with low understanding of forest investments  
 Two commodities, possibly 2 investors  
 Very low ROI on offset carbon credit sales 1-3%  
 Hard to advise an investor to put money in

### ***Future With Supporting Policies***

Low and stable plantation property tax regimes  
 Tax credit against income to reduce costs of plantation establishment from \$1500/ha to \$500/ha??  
 Policy clarity to 2040?  
 Landowner friendly investment & forest management programs  
 Single Investor would own both wood & carbon.  
 Or - Possible federal ownership of credits??  
 Many landowners may invest!

## **4.3 Examination of Business Models to Establish Wood and Carbon Production Enterprises through Afforestation**

### ***Assumptions***

This section is based on the assumption that a favourable and stable policy foundation has been put in place to support the investment and expected revenues. The first three assumptions are within the jurisdiction of the federal government, they are as follows;

- Domestic Climate Change policy stability over a period of 30-40 years.
- An appropriate offset trading program
- Preferential tax treatment for investments/expenditures in afforestation

The final assumption is in provincial/municipal government jurisdiction, it is as follows;

- Fair and stable property tax rates for land dedicated to forestry

All points suggested in this section are based on information received during the meetings and focus sessions organized during the pilot study. References can be found in the body of the report.



### ***Wood and carbon production enterprises***

It is understood that the main driver for Afforestation projects at this time is to make a contribution to meeting GHG reduction targets as part of Canada's Climate Change Program. These plantations will produce both Wood and offset carbon credits through sequestration and might be thought of as Wood and Carbon Production Enterprises.

Both the wood and the offset carbon credits will provide revenues to contribute to an ROI to attract investors to this project. The returns from sales of offset carbon credits are uncertain due to the new and exploratory nature of this market. Investment in the 'Enterprise' is also complicated by the fact that we are dealing with two products embodied in one material-wood. The two products are sold on very different markets but must be carefully 'co-managed' to ensure a good result for the investor(s).

### ***Costs***

The costs of establishment of plantations are assumed to be \$1500/ha including planting and allowances for planning and tending to FTG. We know that some landowners who may want to participate in afforestation do not have the disposable capital to plant all of the land that they may have available (10-20 ha) in any one year. There may be either one investor; the landowner, or two investors; the landowner and a cash investor who will pay for all or part of the costs of plantation establishment.

To overcome problems of limited discretionary capital for landowners interested in participating in an afforestation program a 5 year payment plan should be set up. This program would presume an investor or foundation seeding the program with an initial investment that would get leveraged into a larger program. This would also ensure larger areas of land are planted at once, thus reducing the cost of planting smaller areas of a landowner's property over a series of years, by ensuring economies of scale.

### ***The basket of benefits***

There are a wide range of benefits flowing from planting trees on marginal agricultural lands: wood production and carbon offset revenues, pride of ownership, enjoyment of the property, future benefits for the family or estate, conservation of natural ecological values, increases in supply of forest habitat, rural job creation and contributions to long-term stability of rural communities. The more of these benefits that can be captured by a single investor, the lower the cash ROI required to satisfy that investor. The ideal combination is a sole investor, the landowner, rewarded by all of the above and enabled to pay for the costs of plantation establishment through a variety of approaches. This helps with the problems of low and uncertain ROI over a long period and the lack of liquidity in the market for offset carbon credits and wood.

### ***Economies of scale***

We do not want to establish small patches of plantations (1-3 ha per year) but to plant the largest patches possible (10-20 ha) on the lands available in order to benefit from economies of scale on all aspects of planning, establishment, tending, administration through to the sale of offset carbon credits and wood.

### ***Priorities for planting***

Lands that are marginal/sub-marginal for agriculture and remote from the development pressures near expanding urban areas should be the top priority for afforestation projects. Annual payments of 'opportunity costs' should be avoided. It will drive up the cost of the projects and reduce ROI. It may distort local agricultural economies and impact rural community stability. Opportunity cost payments must be differentiated from grants to defray the costs of planting. Annual opportunity cost will be taxable as income. Grants should be tax free.

### ***Potential Business Models***

#### **1. Traditional small business approach with market based trading**

The landowner or landowner/investor combination seeks a satisfactory ROI from the sale of offset carbon credits and wood. This is complex if two parties are involved due to the long-term agreement and cooperation required and the variance in the interests of the parties and their sharing of the benefits.

## **2. Financial support from Large Final Emitters (LFE) with an interest in Corporate Social Responsibility (CSR) programs**

There may be large organizations that need offset credits to meet their GHG emissions reduction targets, have an interest in CSR programs in communities and regions surrounding their operations, that find afforestation an attractive partnership enterprise that meets a variety of objectives. These organizations can provide capital to pay or defray the costs of afforestation to make the operation attractive to landowners and to the organization. The offset credits would belong to the LFE. The title or credit for the rest of the benefits could be discussed with the landowner.

## **3. Government grants**

Well planned government grants to defray the costs of afforestation might be influential in getting a lot of planting done. Grants are an obvious way to provide the capital that landowners do not have. The grants should be as low as possible and designed as a 'catalytic incentive' to enable afforestation to take place and not as an income stream. The government should own the offset carbon credits if the grant is substantial.

## **4. Preferential tax treatment for investments/expenditures to establish plantations**

The ROI on investments in afforestation will be low and long in coming. Analysis indicates that the ROI based on sales of offset carbon credits will be in the range of 1-4%. A foundation of long-term policy stability will be essential to support revenues from carbon sales. If revenues from wood sales are included in the ROI calculation the management agreement becomes complex and the benefits to the landowner lower and in some cases questionable. Attractive and preferential tax treatment of investments/expenditures to pay for planting will increase the ROI and simplify the contractual arrangements. Some landowners will be able to support the cost of afforestation.

## **5. A partnership with a forest products company**

There are some examples of Canadian forest products companies leasing lands from farmers to plant and grow trees. In both cases the species is Hybrid Poplar. The rotations are short: 15-20 years. The programs were developed to mitigate a wood supply shortage and/or high wood transport costs and are implemented within a radius of 50-80 km of the mill. Poplar is not hauled great distances.

Programs jointly implemented by landowners and forest products companies have promise in some areas of Canada. Unlike most investors, forest products companies understand afforestation programs and forestry investments. They have an interest in both offset carbon credits and wood and have the ability to gain value added benefits from the wood through vertical integration within their manufacturing plants. Many forest products companies in the US have landowner assistance programs of a variety of types. Most ask that they have first refusal as a competitive bidder when the wood is ready to be harvested.

## **6. Hybrids**

The elements of a successful program are known. A judicious mix of government grants, preferential tax treatment for investments in afforestation and the involvement of companies with an interest in wood production, offset credits or improvements in corporate image through CSR programs offer potential benefits to all at an acceptable cost. Flexibility will be essential. Fair property tax rates, competitive with rates paid for agricultural land is important.

## 4.4 Our recipe for success: Recommendations for the structure of an afforestation program

### *Deciding Factors:*

- Policy uncertainty at the international level.
- The need for and the difficulty in maintaining GHG emissions reduction compliance policy stability in Canada for 20-40 years.
- Wood and offset carbon credits: two commodities in one material.
- Difficulty of coordinating management and sales of these two commodities, especially if two investor/owners are involved.
- Carbon offsets are a non-fungible commodity
- Forestry investments are poorly understood by the private sector in Canada.
- The investment will be long-term and have very low liquidity.
- Based on a consideration of the factors noted above, the need for a competitive ROI (15-20%) for investors.
- Property tax rates that mitigate against plantation establishment on marginal agricultural lands. Forest land is taxed at a higher rate than farm land.
- Landowners' reluctance to sign long-term agreements on the planting, and growth of trees and the sale of offset credits.
- Landowners desire to maintain property rights and management control of their land and enjoy the ownership of a forested property. These are important but intangible returns to the landowner.
- Limited capital availability on the part of most landowners must be addressed. This could come in the form of government grants covering a portion of the planting costs. There must be another system in place to pay for the rest of the land that the landowner is willing to offer into an afforestation program, should the landowner not be able to pay for all of the planting at once. This would ensure that larger areas of land are planted at once, and thus reduce the cost of planting smaller areas of a landowners land over a series of years.

### *The structure and conditions for a successful afforestation program:*

- Ensure that managed forest land property tax rates are competitive with farm land tax rates.
- Ensure harmony of land-use policies at the provincial & municipal levels.
- Provide firm and long-term policy commitments necessary to support an afforestation program and the market for offset carbon credits.
- Determine the long-term ROI that will be high enough to attract landowner investment. This will be significantly lower than the ROI required by an independent investor due to the intangible returns to the landowner. Include lower property taxes, and sales revenues from offset credit and wood in the calculation.
- Provide an attractive income tax write-off allowance to defray the costs of plantation establishment and tending to FTG. This is designed particularly to enable landowners to fund plantation establishment. Use this to provide an attractive ROI.
- Consider an 'Afforestation RRSP' approach.
- Stimulate the establishment of private sector forest management organizations to deliver all aspects of the afforestation program including landowner information and agreements, plantation establishment, wood growth measurement and calculation of offset carbon credits.
- Provide well designed guidelines for species selection, silvicultural crop planning to achieve wood and carbon sequestration goals. Provide environmental management objectives to ensure eligibility for certification.

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## Appendix I

### Cost/Benefit Calculator Illustrative Scenario – Fast Growing Poplar

#### Afforestation cost-benefit calculator

<b>Economic inputs:</b>		Suggested values
Discount rate (Min - >0; Max - 1)	0.06	0.06
Rotation age (Min - 1; Max - 100 years)	20	40
Price for carbon (\$ per ton C)	1.9	10
Price for timber (\$ per m3 log)	10	12
Establishment costs (\$ per ha)	1030	800
Annual tending costs (\$ per ha per year)	6.5	10
Annual monitoring costs (\$ per ha per year)	10	5
Annual agricultural land opportunity costs (land rent, \$ per ha per year)	0	0

<b>Biological inputs:</b>		Suggested values
Timber volume -> into dry timber weight (wood density)	0.37	0.389
Timber volume -> into aboveground biomass	1.454	1.5
Aboveground -> into belowground biomass	0.396	0.396
Conversion from biomass -> into carbon	0.5	0.5
Site suitability factor (growth/yield curve multiplier)	1	1
Post-harvest (on-site) biomass decay period (years)	3	3
For. products decay rate (Min - > 0; Max - 1)*	1	0.96
Annual carbon accumulation rate by soil, ton C/ha/year	0.67	0.67
Period of soil carbon accumulation, years	50	50

\* Set for.prod. decay rate to 1 to choose a "Kyoto" accounting

#### Growth and yield table:

Growth year	Timb.volume, m3 per ha	Vol.incr., m3/ha	Carbon equivalent	PV_C_Bgbio	PV_C_Agbio
1	1	1.00	0.27	0.10	0.37
2	6.6	5.60	1.51	0.53	1.95
3	18.2	11.60	3.12	1.04	3.81
4	35.5	17.30	4.65	1.46	5.36
5	57.3	21.80	5.86	1.74	6.37
6	82.1	24.80	6.67	1.86	6.83
7	108.7	26.60	7.16	1.88	6.91
8	136	27.30	7.34	1.82	6.69
9	163	27.00	7.26	1.70	6.25
10	189.1	26.10	7.02	1.55	5.70
11	213.9	24.80	6.67	1.39	5.11
12	237.1	23.20	6.24	1.23	4.51
13	258.5	21.40	5.76	1.07	3.92
14	278	19.50	5.25	0.92	3.37
15	295.7	17.70	4.76	0.79	2.89
16	311.7	16.00	4.30	0.67	2.46
17	326	14.30	3.85	0.57	2.08
18	338.7	12.70	3.42	0.47	1.74
19	350.1	11.40	3.07	0.40	1.47
20	360.1	10.00	2.69	0.33	1.22

**Results:**

<b>Present values , \$ per ha:</b>	
Total NPV	79.36
PV(carbon sequestered)	133.75
PV(carbon BG biomass)	40.90
PV(carbon AG biomass)	150.09
PV(carbon for.prod. emissions)	54.10
PV(carbon on-site biomass decay)	23.20
PV(soil carbon accumulation)	20.06
PV(establishment)	1496.67
PV(tending)	74.55
PV(monitorsing)	114.70
PV(agric.land value)	0.00
PV(timber products)	1631.53

<b>Break-even carbon price:</b>	<b>\$ per ton C</b>	<b>\$ per ton CO2</b>
(Break-even price = 0, when NPV > 0)	0.00	0.00

<b>Discounted carbon, t C per ha:</b>	<b>Lump sum</b>	<b>Annualized</b>
Total carbon sink	70.397	4.224
Belowground biomass sink	21.528	1.292
Aboveground biomass sink	78.993	4.740
Emissions from for.products	28.475	1.708
Emissions from on-site biomass decay	12.210	0.733
Accumulation by soil	10.560	0.634
Timber volume at harvest age, m3 per ha		360.1