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Federation of British Columbia Woodlot Associations

Canadian Forest Service

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

# Exploring Options for Aggregating and Selling Afforestation Carbon Credits from Small Landowners

# APPENDICES

*Prepared for*

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and
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# Appendix A
## Glossary

(Source: primarily from the Offset System Discussion Paper – June 2003)

### Acronyms and Abbreviations

| | |
|---|---|
| CDM | Clean Development Mechanism – project applicable to Annex 2 – developing countries. |
| CER | Certified Emission Reduction (international) credit from CDM projects. |
| $CO_2e$ | Carbon Dioxide ($CO_2$) equivalent (e). |
| ERU | Emission Reduction Units from JI projects. |
| GHG | Greenhouse Gas. |
| Ha | Hectare: A measurement of land 10 000 square metres in size, one hectare = 2.47 acres. |
| JI | Joint Implementation – applicable to Annex 1 parties (industrialized countries). |
| LFG | Landfill gas. |
| LIE | Large industrial emitters. |
| m3 | Cubic metre of wood |
| OSB | Oriented strand board (chip board) |

### Glossary

**Afforestation:** "Afforestation" is 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 human–induced promotion of natural seed sources.

**Annex 1 Parties:** Industrialized countries that have ratified the Kyoto Protocol.

**Annex 2 Parties:** Developing countries that have ratified the Kyoto Protocol.

**Baseline:** The baseline for a project that is a scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases ore removal by sinks that would occur in the absence of the proposed project. A baseline shall cover emissions from all gasses, sectors, and source categories listed in Annex A of the Kyoto Protocol and removals by all ecosystem carbon pools within the project boundary.

**Biomass:** The dry weight of all organic material, living or dead, above or below the soil surface.

**Boundary:** The project boundary encompasses all anthropogenic emissions by sources and removals by sinks of greenhouse gases under the control of the project proponents (landowner) that are significant and reasonably attributable to the project activity.

**Carbon Sequestration:** The uptake and storage of carbon. Trees and plants absorb carbon dioxide, release the oxygen and store the carbon.

**Carbon Stock Change:** The change in carbon stock over a specified time period.

**Clean Development Mechanism (CDM):** A mechanism that allows emission reduction and afforestation / reforestation projects to be implemented in developing countries that have ratified the Kyoto Protocol. CDM projects earn Certified Emission Reductions for the emission reductions / removals achieved.

**Commitment Period:** A period for which the emissions limitation commitment apply under the Kyoto Protocol. The first commitment period is 2008 though 2012.

**Deforestation:** The direct human-induced conversion of forested land to non-forested land.

**Emissions:** Greenhouse gas emissions, as stipulated in the Kyoto Protocol: carbon dioxide ($CO_2$), methane ($CH_4$), nirtrous oxide ($N_2O$), hydrofluorocarbons (HFCs); perfluorocarbons (PFCs), and sulphur hexafluoride ($SF_6$).

**Emission Reduction:** A decrease in emissions released into the atmosphere by a source (e.g. capture and flaring of landfill gas reduces emissions).

**Emissions Removal:** A removal of greenhouse gases from the atmosphere (i.e., by sequestration).

**Forest:** Under the Kyoto Protocol, a forest is an area of land of minimum 1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10 – 30 percent, with trees having the potential to reach a minimum height of 2 – 5 metres at maturity.

**Greenhouse Gases:** Greenhouse gases are constituents of the atmosphere, both natural and anthropogenic (caused by human activities), that absorb and re-emit infared radiation. Greenhouse gas emissions covered by the emission limitation commitments of the Kyoto Protocol are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

**Joint Implementation (JI):** A mechanism that allows emission reduction and removal projects to be implemented in countries that have ratified the Kyoto Protocol. A JI project can be located in an industrialized country (Annex 1) with emission limitation commitment under the Kyoto Protocol. JI projects earn Emission Reduction Units (ERU) for the emission reductions / removals achieved.

**Kyoto Compliance Units:** Units recognized under the Kyoto Protocol compliance units for national emission limitation commitments.

**Large Industry Emitters (LIEs):** Companies in the thermal electricity, oil and gas, and manufacturing sectors.

**Leakage:** Leakage is an increase in emissions or reductions in removals outside a project's boundary (the boundary defined for the purposes of estimating the project's net GHG impact), and resulting from the project's activities. Leakage is associated with changes in reductions / removals that are significant and reasonably attributable to the project, but are not under the control of the proponent.

**Reforestation:** The direct human-induced conversion of non-forested land to forested land through planting, seeding, and / or the human-induced promotion of natural seed sources, on land that was forested but has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

**Sequestration:** The process of increasing the carbon in a carbon pool other than the atmosphere.

**Sink:** Any process, activity, or mechanism which removes a greenhouse gas from the atmosphere.

# Appendix B
## Conversion Formulas and Factors:
### Conversion Factors and calculations from cubic metres of wood to metric tonnes of carbon dioxide equivalent

**Example #1: Conversion Factors showing the proportions of solid wood found in various parts of the tree**

**A poplar tree with a merchantable bole volume of 1.0 cubic metre.**
(*Note:* 1.0 cubic metre of merchantable wood is similar in size to a wooden utility pole).
The bole of the tree, which is easy to measure, is used as the starting point:

- Bole or main stem of tree contains 1 cubic metre in volume. This might be stated as the volume of the bole or main stem wood. (Using 1 cubic metre in this example simplifies the understanding of wood and carbon proportions in a tree – above and below ground.)
- "Merchantable" means the portion of the tree that is marketable for manufacturing lumber; i.e., the main stem log up to a 10+ cm top diameter.
- Top and Branches contain 0.454 cubic metres of wood.
- The Below Ground Root Mass contains 0.396 cubic meters of wood.
- Factor to convert wood to solid matter (dry wood density)= 0.37 (for poplar).
- The average dry wood density factor for Canadian conifers is 0.43.
- Factor to convert solid matter to carbon = 0.50.
- Factor to convert carbon to carbon dioxide equivalent ($CO_2e$) = 3.667.

| Tree part | Volume in cubic metres | Multiplication factors to tonnes of $CO_2e$ | Metric tonnes $CO_2e$ |
|---|---|---|---|
| **Merchantable main stem or bole** | 1.000 $m^3$ | 1.0 $m^3$ x 0.37 x 0.5 x 3.667 | 0.678 tonnes |
| **Non-merchantable tree top & branches** | 0.454 $m^3$ | 1.0 $m^3$ x 0.454 x 0.37 x 0.5 x 3.667 | 0.308 tonnes |
| **Below ground root mass** | 0.396 $m^3$ | 1.0 $m^3$ x 0.396 x 0.37 x 0.5 x 3.667 | 0.269 tonnes |
| **Total** | 1.850 $m^3$ | 1.850 $m^3$ x 0.37 x 0.5 x 3.667 | 1.255 tonnes |

**Table 1: Conversion Factors and calculations for a poplar tree with a merchantable bole volume of 1.0 cubic metre [1]**

***Note*:** There is a small amount of carbon sequestered in the soil and litter layer, and in ground vegetation in closed canopy forest stands. The amount of carbon is considered to be variable, of relative insignificance in volume, relative to that stored in the wood of the trees, is difficult to measure, and therefore has not been considered as part of this report. Carbon in the soil and litter layer is both sequestered and released during the year.

[1] Based on factors reported by IPCC Greenhouse Gas Inventory Guidelines Reference Manual as modified by Environment Canada (1997), Nagle (1990), and Bonner (1985) using Canadian data

**Example #2 Conversion of tree volumes per hectare to tonnes $CO_2e$.**

**Step #1 Convert cubic metres of a merchantable tree bole volume to metric tonnes of $CO_2e$ ($CO_2e$ = carbon dioxide equivalent)**

Example: 1 hectare of hybrid poplar with a mean annual increment (MAI) growth rate (for tree bole) of 15 cubic metres per hectare ($m^3$/ha). How many tonnes of $CO_2e$ does 15 cubic metres of wood equate to?

MAI x 0.37 x 0.5 x 3.667 = 15 $m^3$ x 0.37 x 0.5 x 3.667 = 10.2 tonnes $CO_2e$ / ha

Factor 0.37 relates to the dry wood density of hybrid poplar (tonnes dry weight / per $m^3$).
Factor 0.5 relates to carbon concentration of wood (approx 50% of dry mass).
Factor 3.667 converts carbon to carbon dioxide equivalent.

**Step #2 Convert cubic metres of merchantable bole and above and below ground non-merchantable biomass volume to metric tonnes of $CO_2e$**

The factor to add above ground volume to include non-merchantable volume such as bark, top, and branches added to the merchantable bole volume is 1.454 (add 45 %). Example: 15 m3/ha merchantable bole x 1.454 = 21.81 m3/ha – 15.0 m3/ha = 6.81 m3/ha above ground, non-merch, volume.

The factor to add below ground biomass volume to include the non-merchantable volume of roots is added to the merchantable bole volume is 0.396 (add 40%). Example: 15 m3/ha merchantable bole x 0.396 = 5.94 m3 / ha below ground volume.

Total volume

| | |
|---|---|
| merchantable bole | 15.00 m3 / ha |
| above ground | 6.81 m3 / ha |
| below ground | 5.94 m3 / ha |
| | 27.75 m3 / ha |

Convert to $CO_2e$: 27.75 m3/ha x 0.37 x 0.5 x 3.667 = 18.8 tonnes $CO_2e$ /ha

Using above ground only biomass: 15.00 + 6.81 m3 = 21.81 m3 / ha
Convert to $CO_2e$: 21.81 m3/ha x 0.37 x 0.5 x 3.667 = 14.8 tonnes $CO_2e$ / ha.

*Note:* For simplification of conversion, merchantable bole volume almost equals total above-ground $CO_2e$ tonnes (15.0 m3 versus 14.8 $CO_2e$ tonnes).

## Wood Volume cubic metres (m3) to Weight Conversion

**Wood Volume to Weight conversion:** The conversion from cubic metres of stem volume to metric tonnes for green poplar species (aspen, cottonwood, hybrid poplar) is approximately 1 cubic metre = 0.9 tonne. This conversion factor will fluctuate depending on moisture content. Since 0.9 is close to being a 1:1 ratio, one can consider 1 cubic metre = 1 metric tonne for quick simplification of conversion.

The source of this conversion 0.9 factor for aspen was Ainsworth's woodlands department at 100 Mile House, BC. They stated that 0.9 tonnes per 1 cubic metre (m3) was the current (October 2003) conversion factor being used by the Ministry of Forests for aspen logs for that area.

# Appendix C
## Carbon Sequestration Rates

Not all tree species grow at the same rate. Carbon sequestration rates (increases in carbon within trees) are directly related to tree growth rates – more growth means more carbon. Hybrid poplars grow faster than conifers (up to 100 times faster in the first ten years – see following examples) and are managed on shorter rotations (15 - 20 years). If the primary purpose of afforestation is to sequester carbon and produce maximum carbon credits in the short term, then hybrid poplar is the species of choice for many regions of Canada.

**It is very important to note that hybrid poplar species may not be biologically or ecologically suitable to grow on all lands, nor desirable by all landowners or provincial governments for planting.**

It should be noted that eligible lands that have not yet been afforested (present year 2003), conifer species will not sequester much carbon that can be used to offset emissions in the first compliance / measurement period 2008-2012. Trees grow very slowly in their first ten years before their growth increment accelerates. The following three examples provide growth examples for trees planted in year 2005 and growth comparisons between hybrid poplar and two species of conifer, pine and spruce. Hybrid poplar growth outperforms conifer growth in these examples by more than 100 times in the first 7 years.

*Note*: For conversion formulas and factors, please see Appendix B.

| Year | Approx. growth in m3/ha | Approx. metric tonnes of $CO_2e$[2] |
|---|---|---|
| 2005 | 0.05 | 0.05 |
| 2006 | 0.05 | 0.05 |
| 2008 | 0.05 | 0.05 |
| 2009 | 0.05 | 0.05 |
| 2010 | 0.05 | 0.05 |
| 2011 | 0.05 | 0.05 |
| 2012 | 0.1 | 0.1 |
| Total | 0.3 m3/ha for years 2008-2012 | 0.3 metric tonnes for years 2008-2012 |

**Table 2: Conifer spruce trees planted in 2005 in BC's southern Interior[3]**

[2] t $CO_2e$ = metric tonnes of carbon dioxide equivalent. One metric tonne = one carbon credit

[3] "Carbon Sequestration Aspects of an Afforestation Program in British Columbia, Canada," *Table A-2 Yield Data Table in cubic metres per hectare of bole wood*, authored by Nawitka Renewable Resource Consultants, April 1999

| Year | Approx. growth in m3/ha | Approx. metric tonnes of $CO_2e$ |
|---|---|---|
| 2005 | 0.1 | 0.1 |
| 2006 | 0.1 | 0.1 |
| 2008 | 0.1 | 0.1 |
| 2009 | 0.1 | 0.1 |
| 2010 | 0.1 | 0.1 |
| 2011 | 0.1 | 0.1 |
| 2012 | 0.1 | 0.1 |
| Total | 0.5 m3/ha for years 2008-2012 | 0.5 metric tonnes for years 2008-2012 |

**Table 3: Conifer lodgepole pine trees planted in 2005 in BC's southern Interior**

| Year | Approx. growth in m3/ha | Approx. metric tonnes of $CO_2e$ |
|---|---|---|
| 2006 | 1 | 1 |
| 2007 | 3 | 3 |
| 2008 | 7 | 7 |
| 2009 | 10 | 10 |
| 2010 | 13 | 13 |
| 2011 | 15 | 15 |
| 2012 | 16 | 16 |
| Total | 61 m3/ha for years 2008-2012 | 61 metric tonnes for years 2008-2012 |

**Table 4: Hybrid poplar trees planted in 2005 in BC's southern Interior**

Slow growth in the early years for conifer species should not discourage people from planting conifer species. Conifers continue to sequester carbon (help reduce climate change) over the long term (100 years). Growth rates for conifers increase considerably over time, with their best growth years at 50 – 100 years of age, whereas hybrid poplar's growth rate slows after 13 years (2018).

| Year | Lodgepole pine growth (m3/ha) | Spruce growth (m3/ha) |
|---|---|---|
| 2030 | 3.2 | 0.9 |
| 2055 | 5.1 | 13.9 |

**Table 5: Approximate annual growth rates for trees planted in 2005 in BC's southern Interior**

# Appendix D
## Federal Government Afforestation / Reforestation Programs – Past and Current

**Past Programs**

Forest Resource Development Agreement (FRDA) Small Scale Forestry Programs have been delivered throughout the provinces sporadically during the 1980's and 90's. These were federal - provincial cost shared agreements that provided funding for planting and tending not-sufficiently restocked lands or 'backlog NSR' lands. Private lands were eligible for funding. With most agreements, landowners cost shared with cash and in-kind contributions of 10 percent of the total private land plantation establishment costs.

Many landowners were ‘early adopters’ of planting trees on marginal agriculture lands. These landowners utilized FRDA funding to assist planting portions of their private lands during the 1980's and 90's.

**Current Programs**

The Prairie Farm Rehabilitation Administration (PFRA) has a well known and successful program on the prairies which helps farmers establish trees / shelterbelts. Free seedlings and extension services are provided to prairie farmers who request them. Seedlings are grown at the PFRA Shelterbelt Centre, Indian Head, Saskatchewan. The PFRA has been in existence for approximately 100 years and is funded by Agriculture and Agri-food Canada.

Forest 2020 / Greencover is a federal government program that includes tree-planting. The program has several program objectives including carbon sequestration.

# Appendix E
## Landowner Perspectives

### Appendix E1
### Canadian Landowner Survey (2003)

A Survey of Farmers, Ranchers, and Rural Landowners was completed by Environics Research Group in June 2003. The survey was prepared for Agriculture and Agri-food Canada, Canadian Federation of Agriculture, Natural Resources Canada – Canadian Forestry Service, Ontario Ministry of Natural Resources, and Wildlife Habitat Canada. The survey was entitled "Attitudes and Behaviours Regarding Land Stewardship."

This survey collected data from landowners across Canada, including 950 farmers who had a minimum of 4 hectares and earned a minimum of $2500 per year from their lands. The survey also included an additional 664 private rural landowners who owned more than 4 hectares but were non-farmers. The survey provides the most recent national information available.

Note that there are approximately 7 - 11 million hectares of marginal agriculture soils in Canada where the land has been cleared and cultivated, but is now going out of production due to crop economics.

Presented below are survey highlights (relevant portions of the full report).

**Forests and Climate Change (2003)**
Eight-eight percent of rural landowners believe that forests help reduce effects of climate change, and 53 percent of these same respondents would be willing to plant trees to help reduce climate change.

**Age of Survey Respondents as of April 2003**

| | |
|---|---|
| Age 18 – 34 | 8 % |
| Age 35 – 44 | 19 % |
| Age 45 – 54 | 28 % |
| Age 55 – 64 | 22 % |
| Age 65 + | 20 % |

**Total Number of Hectares owned in 2003 for all landowners (farmers and non-farmers)**

| | |
|---|---|
| 10 hectares or less | 18 % of landowners |
| 11 – 40 hectares | 21 % of landowners |
| 41 – 80 hectares | 17 % of landowners |
| 81 – 120 hectares | 4 % landowners |
| 121 + hectares | 38 % of landowners |

**Farm Operations as of 2003**
Grain farmers made up 38 % of farmer respondents. Beef and dairy farmers made up 35% of farmer respondents.

**Number of Idle Hectares not currently in crop or forest (and not a wetland)**

| | |
|---|---|
| 10 hectares or less | 41 % of landowners |
| 11 – 40 hectares | 21 % of landowners |
| 41 – 80 hectares | 15 % of landowners |
| 81- 120 hectares | 11 % of landowners |
| 121+ hectares | 9 % of landowners |

**Landowner Issues of Greatest Concern regarding their lands for 2000 – 2003 period**

Environmental issues (particularly water issues) and commodity prices (farming economics) were greatest concerns. Environmental restrictions or loss of farmer control (due to environmental regulations) were also an area of great concern for farmers.

**Landowners' definition of 'Stewardship'**

The average landowner's definition of stewardship not only includes voluntarily conserving the natural environment, but also keeping the land economically productive. Most landowners consider the timeframe for 'stewardship' activities to be the future rather than the present.

**Planted Trees on Bare Land from 1990 – 2002**

Fourteen percent of farmers and 20 percent of non-farmers planted trees on bare land between 1990 and 2002.

**Hectares Planted Still Alive and in Good Health**

| | |
|---|---|
| No hectares | 9 % of respondents |
| 1 – 4 hectares | 60 % of respondents |
| 5 – 10 hectares | 10 % of respondents |
| 11 – 20 hectares | 7 % of respondents |
| 21 – 40 hectares | 3 % of respondents |
| 41 + hectares | 2 % of respondents |

**Reason for Planting Trees**

Shelterbelts and aesthetics were the top two reasons for planting trees. The farmer's top reason was shelterbelts and the non-farmer's top reason was aesthetics.

**Types of Species Planted as of 2003**

The respective order of types of trees selected to be planted was spruce, pine, maple, poplar, ash, cedar, fir, oak, willow, birch, walnut, and other. In other words, spruce was selected more often than any other species.

**Financing of Tree-Planting (2003)**

| | |
|---|---|
| Paid out-of-pocket | 55 % of respondents |
| Grant / subsidy | 24 % of respondents |
| Combination | 8 % of respondents |
| Given to me | 5 % of respondents |
| Other | 6 % of respondents |

**Would Have Planted Trees Even Without Grant (2003)**

Forty-eight percent of farmers and fifty-seven percent of non-farmers said they would have planted trees even without a grant.

**Planning to Plant Trees in Next Five Years (as of 2003)**
Fifteen percent of farmers and twenty-three percent of non-farmers said they planned to plant blocks of trees on lands that had been bare of trees since 1990.

**Main Reasons for Not Planting Trees**
The farmers' top five reasons (in order) for not planting trees were

1. Land is needed for crops
2. Land is needed for pasture
3. Have enough trees
4. Already forested, and
5. My age/retiring.

Non-farmers' top five reasons (in order) for not planting trees were

1. Have enough trees
2. Already forested
3. Land is needed for pasture
4. Not enough space, and
5. My age/retiring.

**Hectares Planning to Plant as of 2003**
The average landowner plans to plant 3 hectares. Farmers responded with an average of 3.5 hectares and non-farmers responded with an average of 2.7 hectares.

**Soil Productivity of Land on which Planning to Plant Trees (2003)**
The majority of lands planned to plant on have a soil productivity of high to medium.

**Reasons for Planting Trees in the Future (2003)**
The top three reasons for planting trees were shelterbelts, aesthetics, and conservation / wildlife habitat.

**Hectares Would Plant if Trees Free and Costs Covered (2003)**

| | |
|---|---|
| No hectares | 42 % of respondents |
| 1 – 4 hectares | 34 % of respondents |
| 5- 10 hectares | 8 % of respondents |
| 11 – 20 hectares | 4 % of respondents |
| 21 + hectares | 4 % of respondents |

**Impact of Work Involved on Decision to Plant - Barrier (2003)**
About half of rural landowners say the work that is involved in tending trees after they have been planted has a major or moderate impact on their decision to plant blocks of trees. This proportion increases significantly when rural landowners are told specifically what needs to be done.

**Important to Plant Trees Native to Area (2003)**
Eighty-six percent of rural landowners feel that it is important to plant trees native to the area.

**Interest in Planting Naturally Fast-growing Trees (2003)**
Only forty-three percent of rural landowners are interested in planting fast-growing trees.

**Taxes Should be Used to Help Landowners to Make Improvements Protecting Natural Resources (2003)**

Eighty-eight percent of rural landowners feel that tax dollars should be used to provide financial assistance to rural landowners who undertake improvements that will protect or improve natural resources. Opinion is somewhat divided as to whether they should be federal or provincial tax dollars.

**Technical Assistance or Information Required (2003)**

About one-third of rural landowners say they require technical assistance or information regarding choosing trees species and tending them long term.

## Appendix E2
## BC Agroforestry Producer's Survey (Fall 2002)

In the fall of 2002, an Agroforestry Producer and Buyer Questionnaire was circulated throughout British Columbia for the purposes of developing an Agroforestry Strategic Plan for BC. One hundred and seventy-two producer surveys were returned. The survey and report was completed by SYLVIS Environmental. Portions of the survey data are relevant to understanding the profile of BC landowners and their perspectives related to growing trees / carbon credits. This survey data is listed below.

**Age of Respondents (Fall 2002)**

| | |
|---|---|
| Age under 35 | 6 % |
| Age 36 – 45 | 21 % |
| Age 46 – 55 | 36 % |
| Age 56 – 65 | 21 % |
| Age over 65 | 16 % |

**Number of Hectares Owned**

| | |
|---|---|
| 0 hectares | 3 % |
| 1 – 20 | 28 % |
| 21 – 200 | 47 % |
| 201 – 400 | 11 % |
| > 400 | 11 % |

**What is your primary field of practice?**

| | | | |
|---|---|---|---|
| Field crops | 2.2 % | Beef | 12.9 % |
| Hay | 14.8 % | Sheep | 4.6 % |
| Pasture | 13.5 % | Dairy | 0.3 % |
| Specialty crops | 0.8 % | Agroforestry | 5.4% |
| Woodlot | 24.3 % | Christmas trees | 8.4% |
| Intensive animal production | 1.3 % | Other | 11.6 % |

**Sustainability of my farm or woodlot activities is the most important factor in my deciding to adopt a new practice.**

Percentage of respondents strongly agreeing with this statement: 78 %

**Protection of the environment in my farm or woodlot activities is the most important factor in my deciding to adopt a new practice.**

Percentage of respondents strongly agreeing with this statement: 68 %

**Profitability of my farm or woodlot activities is the most important factor in my deciding to adopt a new practice.**

Percentage of respondents strongly agreeing with this statement: 42 %

**Social acceptance of my farm or woodlot activities is the most important factor in my deciding to adopt a new practice.**

Percentage of respondents strongly agreeing with this statement: 21 %

**In the past five years have you sold any trees for firewood, fine wood products, or trees for timber or wood fibre?**

Percentage of respondents stating yes: 48 %

**Assuming you desire to produce a new crop, what are the top factors which would play the greatest role in your decision?**

The top three factors were:

1. Market has high potential;
2. Low capital investment; and
3. Established market.

**Do you use internet to access information?**

Percent of respondents saying yes: 75 %

**What would be your top choices for learning about agroforestry practices?**

The top four choices were:

1. Attending a demonstration site on producer's land;
2. Site visits to provide evaluations;
3. Receiving printed information; and
4. Workshops through professional organizations.

**Do you belong to any farm related, ranch related, or timber related organizations?**

Percentage of respondents saying yes: 73 %

## Appendix E3
## Carbon Workshop (2003) Participant Input, Prince George, BC.

Under the "Feasibility of Assessment of Afforestation for Carbon Sequestration Initiative" (FAACS) program, a workshop was held in Prince George, BC in March 2003 entitled "Cashing in on Carbon Credits." Over 100 private landowners, First Nations, forest and other industry, government, and non-government, and utility companies attended and participated. The majority of attendees were rural landowners.

From participants' input during the workshop, several common themes emerged:

- The concept of a carbon sequestration program was appealing to landowners.
- Participants demanded that a carbon sequestration program must not infringe on a landowner's private property rights.
- There must be clarity and certainty around the definition of land eligibility for carbon sequestration.
- There was a demand for monetary / business analysis of carbon sequestration projects. (Is it good business to grow wood and carbon credits on their private land?)
- There should be a free market for carbon credits, without interference by government.
- There should be two distinct components to a carbon sequestration program: a) establishment and growth of carbon crops, and b) the measurement and sale of carbon credits.
- There must be good communications by all parties at all levels regarding all aspects of Kyoto and the carbon sequestration program. (There are currently many more questions than answers about an afforestation program).

A complete summary of the Prince George "Cashing in on Carbon Credits" Workshop is available at www.woodlot.bc.ca (Federation of BC Woodlot Associations website).

## Appendix E4
## Landowner Incentives Focus Sessions (November 2003) Ontario

As a FAACS project, the Eastern Ontario Model Forest group organized and facilitated three "Landowner Incentive Focus Sessions" in November 2003 in the Ontario communities of Kemptville, Barrie, and Woodstock. The main question posed was "What incentives are required to get trees in the ground?"

Participating landowners' input from all three sessions was very similar in nature. Some of the common themes listed for incentives included the following:

- Removal of disincentives such as higher property taxes, loss of farm status, and making tree-related expenses deductible from off-farm income.
- Government should fund the majority of costs to establish tree plantations.
- Keep funding agreements simple and no longer than a 15-year term.
- Landowners to maintain freedom to manage with little to no infringement on property rights.

- Provision for technical assistance and advice to landowners.
- A government afforestation program should be stable and long-term.

Also in November 2003, the Eastern Ontario Model Forest organization hosted a seminar in Mississauga, Ontario, entitled "Establishing New Forests to Address Kyoto Carbon Credits from Afforestation & Customer Needs." This seminar provided information-sharing between government and industry on the latest thoughts and developments around afforestation carbon credits.

Full summaries from both the Landowner Incentive focus sessions and the Mississauga seminar will be posted in January 2004 on the Eastern Ontario Model Forest's website at www.eomf.on.ca

## Appendix E5
## Summary Profile of the Average Landowner

### Landowners' Interest in Afforestation

There is interest in afforestation amongst rural landowners.

### Rural landowners desire a financial return on their land investment(s)

1. Rural landowners desire a financial return on their land investment(s), including their sweat equity. For the past two decades, active land managers (woodland managers and farmers) have perceived their landowner property rights to be somewhat eroded via environmental regulations (endangered species, forest practices code, etc.) that reduce their freedom to manage their property for maximum financial benefit.

   This is probably most true in the urban interface, where urban opinion is greatly at odds with the farmer's over land management practices, from manure management to retention of wildlife habitat. The landowner may be 'environmentally conscious' and desire to manage the lands in consideration of public and scientific opinion; however, no one, including the government implementing more stringent rules, has been willing to compensate the farmer for his lost freedom to manage his personal property for economic gain. Farmers are therefore wary of both urban folks and governments and their agendas.

2. The economic viability of farming is in decline, due to a number of trends:
   a) Increased global trade and competition lowering farm commodity prices;
   b) Increased operating costs (fuel prices, equipment costs, insurance premiums, environmental regulations, water supply, and various taxes); and
   c) US trade barriers.

   There is good likelihood of further increases in each one of these trends over the next decade.

3. Within the 2003 Survey of Farmers, Ranchers, and Rural Landowners, surveyed rural landowners said their six top concerns regarding their lands for the 2000 – 2003 period were farm commodity prices, environmental issues, drought / water issues, other economic concerns, urban sprawl, and government restrictions.

4. Farming has always been considered a risky business. Landowners / farmers / ranchers are currently pessimistic about their future. Landowners will review their crop options and risks carefully before choosing a crop that will provides the best chance of economic gain with the least risk. Another option chosen by many is to grow more than one crop to diversify risks.

5. Most agricultural landowners are not familiar with the markets or economics of growing trees.

6. Approximately fifty percent of landowners would like free seedlings and / or financial assistance from government with any afforestation programs.

7. Farmers are reluctant to involve 'middlemen' such as professionals and tradespersons. Farmers have traditionally found that middlemen are costly and are themselves making a better income than the farmers, without the land and equipment investments.

8. Landowners are often skeptical of government programs and policies.

9. Landowners will not want a covenant or liability registered or associated with their land title that could potentially devalue their property or restrict management options.

**Rural landowners are starting to consider their retirement options**

1. The demographic population profile of the average Canadian rural landowner is as follows[4]:

| | |
|---|---|
| Age 18 – 34 | 8 % |
| Age 35 – 44 | 19 % |
| Age 45 – 54 | 28 % |
| Age 55 – 64 | 22 % |
| Age 65 + | 20 % |

The Canadian survey indicates that roughly forty-two percent of rural landowners will be considering their retirement options within the next five years (prior to 2008) and that a further twenty-eight percent will be considering their retirement options over the next fifteen years (prior to 2018). These demographics indicate a number of potential trends:

a) The majority of rural landowners are currently focussed on saving money for retirement. If a landowner is 50 or more years old, they are more averse to taking financial risks or making large capital investments that might jeopardize their savings. They also want to protect their ability to take

[4] *Survey of Farmers, Ranchers, and Rural Landowners.* Canada, June 2003

advantage of income producing or financial gain opportunities from crops, or from selling their lands.

b) There will be major changes in rural land ownership and loss of continuity of land management and expertise on a given landbase during the next fifteen years (2003 – 2018), as landowners sell their lands, or portions of their lands, to enable retirement.

2. Most farmers, particularly the older farmers in their 50's, 60's, and 70's, would prefer to avoid paper administration and business carried out via written, complex contracts.

3. Landowners considering selling their lands within the next 15 years may consider that cropping trees will lower their property values due to the inflexibility of changing crop strategies to meet good, short-term agriculture markets.

In summary, the average rural landowner is not likely to be investing in large, new-to-them, types of crops that are long-term; have high capital establishment costs; and have market uncertainties, and / or risks including penalties for shortfalls in crop delivery (carbon credit contract shortfalls). Landowners will be conservative and not risk their dollars or flexibility to retire. However, landowners may be interested in small afforestation projects (1 – 6 hectares), particularly if government pays for all or some of the establishment costs.

# Appendix F
# Landowner Economics for Afforestation Projects

## Appendix F1
## Current and Future Markets for Carbon Credits and Forest Products

### F1.1 Carbon Credits - Current Market

It is perceived that large greenhouse gas (GHG) industry emitters in Canada will be purchasing domestic afforestation carbon credits to offset their GHG emissions. This will create a domestic (Canadian) market. To date, carbon markets have been divided into two different categories: *voluntary credits* (not for compliance purposes) and *Kyoto Pre-compliance credits* (forward options on credits eligible for Kyoto compliance).

Internationally, for 2003, voluntary credit sales prices ranged from $2.50 – 4.00 CDN tonne, whereas Kyoto Pre-compliance credits were higher at $4.00 – 8.00 CDN tonne. These were not forestry credits, but were derived primarily from landfill methane gas and other sources. Ninety percent of the sales were from projects in transition or developing countries – primarily Latin America. (*Note*: See www.prototypecarbonfund.org for the "State and Trends of the Carbon Market 2003" report.) The market is still thinly traded and no true supply and demand has been established yet.

The Chicago Climate Exchange held its first auction September 30, 2003. The Exchange auctioned off the following carbon credits by sealed bid: 100,000 metric tonnes $CO_2e$ for vintage year 2003, and 25,000 tonnes for vintage year 2005. The selling price for the 2003 vintage was $0.98 US per tonne, and for the 2005 vintage, $0.84 US per tonne. These prices appear low but were for voluntary credits not eligible for Kyoto compliance.

Forestry credits lack permanence. The issue of permanence has reduced the marketability of afforestation / forestry credits, and they are therefore theoretically discounted in price by ten to fifty percent. There have been few forestry sales. Currently (December 2003) there is a Conference of the Kyoto Parties in Italy where the issue of forestry permanence is being discussed. The outcome of these discussions should help determine how the issue of permanence will be addressed and what, if any, standard discounting should be used.

Landfill methane gas projects are considered low risk to carbon buyers compared to forestry projects. Buyers currently lack interest in afforestation credits.

The market has been awaiting the international ratification of the Kyoto Protocol. International acceptance and full implementation of the Kyoto Protocol requires that 55 percent of the countries accounting for at least 55 percent of global emissions in 1990 to sign / ratify the Kyoto treaty. Over one hundred countries have ratified/signed on, but signatures from the United States or Russia are needed to fulfill the 55 percent emissions criterion. The United States has declined to ratify, and Russia announced on December 2, 2003 that it would not ratify Kyoto as written, or without the US signing on. Without Kyoto being ratified internationally, market demand for credits is expected to remain low.

With Russia's recent announcement, it is expected that Kyoto is not dead, but that further negotiations over time are required to bring the international community to consensus on actions to reduce greenhouse gas emissions and climate change. (This is being written December 3, 2003).

**Note:** In late 2002, Canada ratified the Kyoto accord. In late 2003, Canada stated that it will implement the treaty even if Russia declines to ratify. This should provide for a Canadian market.

## F1.2 Carbon Credits - Future Market

**Factors that will affect the carbon credit market as it evolves into the future:**

- Balances between physical supply and demand ultimately drive market prices (particularly spot prices).
- The emission reduction credit market will be international in nature.
- Given the political and regulatory uncertainty inherent in the developing GHG market, forward price signals (transacted in today's market) are commonly driven by a perception of what future prices "ought to be" under expected political and regulatory outcomes.
- The current climate change market is largely based on forward transactions, and perception plays a central role in setting the price signals.

**Future factors that may change the perception of supply and demand include the following:**

1. The number of participating countries and their emission volumes indicates supply and demand for credits. Although Russia and the United States did not sign the Kyoto Protocol in 2003, the northeastern US states are about to legislate emission caps for their jurisdictions. The more buyers of carbon credits there are in the market, the higher the demand and the higher the prices. Should the US sign on in the future, market prices should rise considerably.

2. The willingness of sellers to release their credits into the market. It is currently expected that Russia, for instance, will have a large supply of "hot air" (emission reduction credits due merely to a decline in economic activity since the 1990 baseline). Some observers believe that this supply (along with the supply of "hot air" from similar nations in similar circumstances – much of central and eastern Europe) may flood the market and drive prices down toward zero. If "hot air" holders act in concert to withhold "hot air" from the market in a monopolist or oligopolistic fashion, prices may remain very strong. These present very different pricing expectations based on views of how nations treat their supplies of "hot air".

3. The Clean Development Mechanism (CDM) and associated international policies have been developed for Annex 2 developing countries. There are many creative project ideas being reviewed by the international CDM Executive Board and Methodology Panel to determine Kyoto compliance eligibility / certified emission reduction (CER) status. Should eligibility of certain projects be approved, this will

greatly increase the world supply of available Kyoto compliance credit sources (equal to Canada's domestic offset credits), and reduce the international market price. Conversely, if these international executive panels take a conservative approach and reject a large percentage of project types for eligibility, then the market price will rise.

4. Improvements in the world's political stability situation will stabilize or lower risks for those considering investing in projects or buying carbon credits in foreign countries. Political unrest increases risks and reduces supply.

5. The European Union's (EU) first emission reduction measurement period is planned to start in 2005. Europe's carbon credit purchases will establish better benchmark trading price ranges and provide solid transaction-based indications of supply and price trends in the international marketplace. (Canada's first commitment / measurement period starts in 2008 and covers the period 2008 - 2012). European prices may be biased upwards if the EU market remains relatively closed to international supply. This may promote unnatural perceptions about prices in the broader, open world market. On the other hand, if the EU market is relatively open with no constraints on importing Joint Implementation (industrialized Annex 1 countries) ERU credits or CDM (developing countries) CER credits, this market may be biased downwards, since early buyers are able to capture "low hanging fruit" that will not be available for later entrants (like Canada). This could affect 2008-2012 world markets.

6. Canada's future policies on project eligibility, measurement standards, and the implementation of a credit offset system for accounting practices, etc., will affect perception of domestic supply and demand. The purpose of the credit offset system is to increase domestic project eligibility (supply), increase domestic investment, and lower the costs to the Canadian economy of achieving Canada's overall emission reduction targets. Afforestation on eligible lands will contribute to offset credits.

7. Clear environmental events that can be labeled as resulting from climate change may motivate political leaders to negotiate stricter targets in the second round of Kyoto Protocol, which will determine emissions reduction targets and mechanisms for later compliance commitment periods. Stricter emission reduction targets mean more demand, less supply, and higher prices.

8. Technological advances may reduce the costs of reducing emissions. Breakthroughs on clean coal technology, for instance, may significantly reduce the demand and possibly increase the supply of credits resulting from emissions reductions.

9. Scientific advances may alter the understanding of climate change, its drivers, its effects, etc. Clearer science may lead politicians to adjust the stringency of targets, which would have an associated pressure on price.

10. Given present market uncertainty, the announcement of a single transaction of sufficient volume with prices different than "market" could bias future transactions toward that price level (whether it be up or down).

11. Political negotiations, such as Conferences of the Kyoto Parties could strengthen prices if perceived as "successful." If there is progress on the second commitment period, this may firm longer-term pricing. If there are indications of bringing additional countries under the cap (such as China and India, for instance), there may be a perception of reduced CER credit supply, and prices may increase. If there is favourable progress on rules for carbon and other sinks and related activities, supply may increase and prices may decrease, etc.

## F1.3 Forest Products - Current Aspen – Deciduous Log Market

Too few mature hybrid poplar trees that have been sold in Canada to provide a reliable log market benchmark. The closest market reference that can be used is the current market for native aspen and cottonwood logs. Aspen and cottonwood are members of the poplar family, having similar wood fiber structures and characteristics for end-product use. The following provides methods to analyze the return to the landowner.

**Land Rent / Lease**
The only benchmark we have for hybrid poplar land lease is that large pulp mills in northern Alberta are leasing cropland at $25 per year per acre ($62 / ha) from private landowners to grow hybrid poplar on a 20-year rotation. At the end of 20 years, with an accumulated rent of $1240 per hectare and the volume of the crop being 15 m3/ha/yr x 20 yr = 300 m3 per hectare, this provides for a $4.13 net return to the landowner per cubic metre grown ($1240 / 300 m3 = $4.13 / m3), or $4.59 per metric tonne. For more on conversion formulas and factors, refer to Appendix B.

**Current Aspen Log Prices – Single Payment to Landowner for a Natural Forest**
Current (2003) native aspen log prices delivered to BC, Alberta, and Saskatchewan mills range from $20 – 32 CDN per tonne for oriented strand board (OSB) chip logs and pulp logs. The average price offered is approx $26.00 per tonne. A small percentage of aspen and cottonwood logs have quality features that raise their value to peeler / veneer / plywood logs and command higher prices. Again, the prices paid at a plywood mill for veneer logs vary according to supply and demand. The range is $35 - $90 per tonne. One Saskatchewan mill pays the landowner a stumpage of $5.18 per tonne for veneer logs and $2.45 per tonne for OSB / pulp logs (and also offers free seedlings). This is the net return to the landowner for supplying aspen from private land. All other logging and hauling costs are covered by the mill.

**Landowner Harvests and Sells**

The landowner decides to harvest and haul native aspen logs directly to a pulp mill.

Example: Selling price of all logs $ 26.00 CDN per tonne
- logging cost - 12.00
- loading cost - 2.00
- hauling cost - 8.00 [1.5 hour haul distance one-way)

stumpage or net gain $ 4.00 per tonne or $4.44 per cubic metre

Because hardwood pulp logs have low values, they cannot be transported for more than two hours, or a distance of 200 km, without the economic viability being lost for most operations.

## F1.4 Forest Products – Future Market – Deciduous Log Market

**Future (20 years forward) Market at Harvest for hybrid poplar veneer, sawlog, OSB (oriented strand board) and / or pulp**

The future market price for hardwood pulp logs is unknown but not expected to rise substantially, due to large amounts of fiber currently being grown and coming to maturity in warm southern climates for pulp and chip purposes. Many countries in the world have half the labour costs and twice the timber growth rates for most tree species compared with Canada. Therefore, it is very difficult to compete in the global market.

There will be no markets in certain parts of Canada if there are no manufacturing facilities in close proximity. Plantations must be within a two hour travel time radius of a manufacturing facility to ensure a future market. Conversely, if there is a collective effort and vision by a community to grow sufficient volumes of a certain species – like hybrid poplar – they may be able to support a new manufacturing facility in 20 years time, whether it be pulp or furniture, and create their own local industry by planning now. The economic viability of growing hybrid poplar is directly related to what value-added products can be made and sold.

As well, over time there are always sporadic niche global markets that can provide good short-term markets for poplar trees and poplar wood products.

Predicting the future market for fast growing deciduous forest products, log, or chip sales is difficult and the economic analysis for each and every landowner will be different. There are many factors and questions to consider:

a) Will 'x' specie logs and fiber be in demand and command a price adequate to cover the cost of harvesting and transport and leave a profit for the landowner?
b) Will there be an operating facility that will buy logs or chips in year 2025 that is within a reasonable (financially viable) hauling distance from the plantation?

Predicting the future markets for slower-growing conifer forest products is even more difficult. Although softwood lumber product prices could be relatively high (based on today's markets relative to poplar) the growing time to maturity and merchantability is much longer (70 – 100 years for most regions of Canada). Guessing at the market prices for year 2080 would be very difficult.

# Appendix F2
## Discussion on Financial Viability of Afforestation Investments

There is significant variability between different land parcels when it comes to financial viability with afforestation projects. Below are a number of examples and discussion. These provide the landowner with a simplistic approach to financial analysis.

**Assumptions for this financial analysis example:**

- The land is marginal for agriculture and is eligible under the Kyoto Protocol for afforestation and the production of carbon credits.
- The landowner already owns the land and the land is debt-free.
- The landowner desires maximum carbon sequestration and income in the near term from carbon sales.
- The landowner also considers the production of intangible environmental, aesthetic, and recreational services to be a valid management objective(s).
- The landowner recognizes that an adequate return on investment will not come directly from carbon sales, but from the combination of early carbon sales and future veneer, sawlog, OSB, and / or pulp log chip sales at the time of harvest.
- Assume that log, veneer and / or chip markets are within a relatively short travel distance (1.5 hours) from the land's location, which will minimize log / chip transport to market costs.
- New plantations will be established using fast-growing hybrid poplar to maximize carbon sequestration. Hybrid poplar sequesters up to 100 times more than conifer species in the first ten years of growth. The land is suitable for growing hybrid poplar (ecologically, moisture levels, soils, climate, etc).
- Hybrid poplar rotations will be approximately 20 years. Planting density will be 1100 stems per hectare.
- Assume there is no leakage and the carbon baseline at the time of planting is 0 tonnes of $C0_2$ e (best case scenario).

| **Rough Estimated Costs per Hectare for Plantation Establishment and Maintenance (using a 40-hectare plantation as an example)** | **$ / ha** |
|---|---|
| Administration: initial land review, project documentation, eligibility approval, site prescription, measurement of baseline carbon. $ 5 – 30+ / ha (may be at lower end with aggregation with other lands) | $ 25 |
| Site Preparation (discing, herbicide, V- plow, or other to reduce competition, enhance drainage on wet sites, and / or breakup compacted soil layers) | $ 400 |
| Seedling Costs | $ 350 |
| Planting Costs | $ 350 |
| Plantation Maintenance (control competing vegetation, replant mortality) | $ 675 |
| Total | $ 1800 |

Past literature reviews have noted hybrid poplar establishment costs generally range between $1400 and $2600 per hectare. The above example shows rough cost proportioning, but plantation establishment costs can vary considerably.

For the above 40 hectare example, the total establishment costs would be:

$1800 x 40 ha = $72,000

Note that the size (40ha) of plantation offers some economies of scale. This is particularly important when amortizing administration and equipment transport if the landowner does not own his own equipment. Costs should decrease on a per hectare basis as the average area of plantations increase, and as the total size of the program increases within a reasonable operating region.

**Carbon Calculations**

The assumption is to plant fast-growing clonal hybrid poplar planting stock. Estimated mean annual increment (MAI) growth rates range from 6 – 35 $m^3$/ha depending on the climate, soil productivity, plantation maintenance, etc. The growth rate used for the example below is 15 cubic metres per hectare per year of (merchantable bole volume) based on "average" site productivity.

See Appendix B for Conversion Formulas and Factors.

**Example:** One hectare of hybrid poplar with a mean annual increment (MAI) of 15 cubic metres per hectare ($m^3$/ha) merchantable volume. Formula for merchantable bole of the tree:

> MAI x 0.37 (tonnes dry wt. per m3) x 0.5 (carbon component of dry wood) x 3.667(conversion C to $CO_2e$) = 15 $m^3$ x 0.37 x 0.5 x 3.667 = 10.2 metric tonnes $CO_2e$ / ha annual growth.

There are also portions of the tree volume and carbon in the tree crown, tree top, and branches. The total above-ground tree volume (merchantable and non-merchantable) can be estimated by using the multiplication factor of 1.454 multiplied by the merchantable bole tonnes. In this case 1.454 x 10.2 t = 14.8 metric tonnes C02e per hectare annually.

As well, there are below-ground volumes of carbon sequestered in the roots, litter layer, and soil. The additional $C0_2e$ volume can be estimated for the roots by multiplying the merchantable above-ground volume by the factor 0.396. In this case, this relates to 10.2 t x 0.396 = 4.0 tonnes $C0_2e$ per hectare annually.

For this calculation, it is assumed that the below ground of carbon will be kept as an insurance reserve against losses from an aggregation of plantations and not sold or considered in this financial analysis example. This reduces potential liability exposure to the landowner regarding the 'permanence' issue, or carbon contract delivery shortfalls.

**Explanatory note regarding carbon reserves:** Where carbon is being aggregated with many landowners and plantations that are geographically separated, the below-ground, non-merchantable, carbon volume might not be sold. This below-ground carbon may be considered as reserves of carbon that can be used to counter the 'risk' and 'permanence' issues of forest carbon credits. These reserves are a form of insurance and count as additional carbon on-site. If there are carbon losses in the plantation due to fire, insects, wind, ice storms, animals, disease, and / or floods these additional volumes may be needed to fulfill carbon credit contract delivery shortfalls. This is a type of landowner self-insurance against contractual liabilities requiring guaranteed delivery of 'x' tonnes of

carbon credits. Buyers of carbon credits will require these reserves, commercial insurance, and / or financial guarantees against non-delivery.

**Carbon Sales**

The selling price per tonne of carbon credits will vary depending on the marketplace. In this example, it is assumed that large GHG emitters in Canada will be purchasing these carbon credits. The range of selling prices is expected to be $1 – 15 CDN per tonne. (Canada's emitters do not have to pay more than $15 CDN per tonne if they have been progressive about trying to meet their emission reduction compliance targets – a Canadian compliance cap.) If the market supply is tight and prices rise above $15 CDN per tonne, the Canadian government (taxpayer) will pay the balance.

When using a broker to buy and sell credits, there is currently a fee of seven percent. There will be other administration and transaction costs as well to cover lawyers, accounting, carbon measurement and verification costs, aggregation fees, and perhaps insurance premiums. In total, this will probably range in the area of $2.50 to $5.00 CDN per tonne. If large aggregations of landowners sell their carbon credits collectively, then administration and transaction fees will be at the lower end ($3 CDN / tonne).

Past world prices per tonne have ranged $1 – 8 CDN for all types of carbon credits. Afforestation carbon credits markets are currently perceived to be in a lower range ($1- 5 CDN). There are many factors that can affect the market. See Appendix F1.2 for Carbon Credits - Future Markets for factors.

For revenue in the first commitment measurement period (2008-2012) using the previous example, we have 14.8 tonnes per hectare x 5 years = 74 tonnes x $5 (selling price) = $370 / ha. Transaction / administration expenses against gross revenue may be $3 per tonne. Hence, $370 minus expenses consisting of (14.8 tonnes x 5 years = 74 x $3 transaction = $222) = net revenue of $148 per hectare over a five-year period, with 40 hectares @ $148 / ha = $5920 over a five-year period. If sales could continue for a period of 15 years (2008 – 2023) then net sales could total $17,760 using the above selling price and transaction assumptions. Obviously, with this particular example, net carbon sales over fifteen years are still minuscule relative to the investment cost of establishing the plantation at $72,000.

With an increase in market prices of carbon credits to $10 per tonne $CO_2e$, the financial picture improves. With a selling price of $10, and transaction and administration costing $3, net revenue of $7 x 14.8 tonnes x 5 years = $ 518 x 3 (for 15 years) = $1554 X 40 hectares = $62,160 relative to plantation establishment cost of $72,000.

With an optimistic gross selling price of $15 per tonne, then the financial picture gets even rosier. If transaction and administration cost $3, net revenue of $12 x 14.8 tonnes x 5 years = $888 x 3 (for 15 years) = $2664 x 40 hectares = $106,560. Plantation establishment costs are now fully recovered with a gross profit of $34,560 ($105,560 – $72,000 = $34,560), but there is no allowance for net present value over fifteen years or for interest on a financial loan borrowed to pay for plantation establishment costs.

**Explanatory notes on the previous examples:**

1. The examples above use the assumptions provided. Every piece of land will have its own variables, from MAI to aggregation / transaction costs to selling price. Each landowner must do his or her own assessment of revenue and expenses.
2. Currently, there is a market for only one 5-year sale period (2008-2012), not three 5-year sale periods as used above. This may change if the Government of Canada extends the compliance commitment past year 2012.
3. Transaction and administration fees will vary depending upon the aggregation model and the situations that arise with carbon measurement, verification and compliance rules.
4. The above example provides no return on the cost of the land or on the costs of ownership (land taxes, land mortgage interest, etc). Nor does it provide for lost opportunity for a higher value use of the land or for present day value (discounted revenues due to time to get a return on investments).
5. There has been no cost allowance for bank interest if the landowner borrowed the funds to establish the plantation – which is likely.
6. There has been no allowance for inflation of either costs or market prices over the rotation period.
7. There have been no deductions of carbon credits to allow for 'leakage' of carbon (within the boundary of the project), for carbon emissions due to fuel used in establishing the plantation, or for carbon losses due to harvesting, fire, etc.
8. There has been discounting of carbon (from 18.8 tonnes to 14.8 tonnes) in this example to provide a carbon reserve (root mass). In reality, this could be considered discounting of price by 21 percent.
9. For small plantations under 6 hectares, plantation establishment costs will be much higher than in the 40-hectare example, due to economies of scale (equipment transport, etc). As well, aggregation costs will be higher with the need for more landowners.
10. If Canada's commitment to the Kyoto Protocol continues past 20 years, then at the time of harvesting (in 20 years), the carbon losses from harvesting must be accounted for and the landowner will need to save or buy credits to cover this loss in carbon. These factors will all reduce the number of available tonnes of carbon credits and reduce net revenues.
11. There will need to be deductions for baseline carbon (how much carbon would be growing on this land if man had not induced the change by planting trees for carbon sequestration). This baseline carbon tonnage must be subtracted from the 14.8 tonnes per hectare in the earlier example, leaving the landowner with less tonnage and less revenue.
12. There have been no allowances made for the risk of losses due to fire, ice storms, wind, animal damage, floods, insects, or disease, all of which would reduce credit sales revenue.

With net carbon sales revenues uncertain and not likely to pay for plantation establishment, the net revenue from log and chip sales, at harvest, must be sufficient to give the landowner a financial return on his investment with the added revenues from the sale of carbon credits. Otherwise, the landowner will not be planting trees with an expectation for financial return on their investment.

Appendix F1, "Current and Future Markets for Carbon Credits & Forest Products" provides discussion around forest product values and current markets for aspen. There were three different approaches to determining the net return to the landowner: Land Rent / Lease; Current Aspen Log Prices – Stumpage Payment to Landowner; and Landowner Harvests and Sells.

Each one of these three approaches netted the landowner approximately $4.00 CDN per tonne of wood, which could be considered the current return to the landowner for deciduous pulp logs. In two of these approaches, aspen logs were wild, native stands with no plantation investments.

*Conversion Note:* See Appendix B for conversion formulas and factors for converting cubic metres to metric tonnes, and cubic metres to their carbon dixoide equivalent.

## Combined Sales of Carbon Credits and Forest Products – Estimated Total Revenues and Expenses for 20 Year Rotation (Example)

**Expenses Estimated per Hectare over 20 year rotation**

| | |
|---|---|
| Plantation Establishment and Maintenance (range $1400 – 2600 / hectare) | $1800 |
| Administration, Verification Measurements, and Transaction Costs with aggregation ($3 per tonne x 20 years x 14.8 tonnes) | $ 888 |
| Total estimated expenses | **$2688** |

**Revenue Estimated per Hectare over 20 year rotation**

| | |
|---|---|
| Harvest net sales of hybrid poplar pulp (or land rental) of $60 per hectare x 20 years (could also be $4 / tonne x 300 tonnes / ha [15 m3/ha x 20 yr] = $1200) | $1200 |
| Carbon credit ($CO_2e$) sales of 14.8 tonnes / hectare x $5.00 / tonne x 20 years = | $1480 |
| Total estimated revenue | **$2680** |

Estimated **Loss per Hectare** (rough breakeven point without consideration for bank loan interest for plantation establishment costs) **$ 8**

| | |
|---|---|
| **Bank loan interest of 7% on $1800 for 20 years** (landowner loss per hectare) | $1524 |
| **Total landowner loss** | **$1532** |

**Annual average carbon price needed to breakeven** $1800 + 1524 - 1200 = $2124 / 296 credits = $7.18 per credit + Aggregation costs @ $3.00 / credit = **$10.18 / carbon credit**

In summary, the landowner could breakeven with $10.18 per tonne annual carbon sales and $4.00 per tonne net pulp log sales at harvest, but he or she would still receive zero return on land investment value. However, the landowner can gain work and associated income from establishing and tending the plantation and harvesting the trees.

**Explanatory Notes to the combined revenue calculations above:**

1. Harvest net sales are predicated on the plantation being within 1.5 hours travel distance of a purchasing mill.
2. Selling range could be $1–15 + CDN per tonne $CO_2e$.
3. Carbon sales are predicated on 20 years, not limited to five years as the current compliance period (market period).

4. There is no allowance for return on the cost of the land or the costs of ownership (land taxes, property mortgage interest, etc.)
5. There is no allowance for lost opportunity for a higher value use of the land.
6. There has been no deduction for 'leakage' of carbon due to emissions or losses by the same proponent.
7. There have been no deductions for the 'baseline carbon' initially growing on the site.
8. Below-ground root mass carbon reserves of 4.0 tonnes has not been sold or entered into revenue. In this example, roots have been used as a carbon reserve and considered as the cost of insurance against carbon losses or shortfalls.
9. Should the landowner decide to change crops from hybrid poplar to grain after the 20-year rotation, it will be costly to remove roots from the soil. This has not been allowed for in the example.
10. The costs above may not reflect the lack of economy of scale for plantations 1 to 10 hectares in size. The financial viability is lessened with small plantations.
11. There has been no consideration of adjustments to carbon accounting for harvesting to sell forest products and associated loss of carbon. This relates to negative financial reality, depending on accounting rules and contractual conditions at harvest time.

## Appendix F3
## Summary of Economics

**Financial Return to the Landowner**

Every piece of land has its own variability in tree growth rates, revenues, and expenses. However, it appears that growing hybrid poplar plantations for the pulp log market and carbon credit market is not seen as a profitable business venture based on today's market (2003) and short term outlook. (Slower growing tree species have even less financial viability in the near future—less than 20 years—than hybrid poplar.)

There is potential for financial viability if value-added hybrid poplar products (plywood, furniture, etc.) can be manufactured and marketed at a profit; or if there is significant demand for carbon credits and the market prices rise above $15 per tonne $CO_2e$ from the past $1 – 8 CDN per tonne. Neither of these scenarios are foreseen as likely to happen in the near future. As well, the current issue of permanence for forestry credits has discounted the value of afforestation credits relative to other types of credits.

**Financial Assistance is Needed**

In order to make growing trees financially viable to the landowner, financial assistance by government or industry is needed to cover the front-end costs of plantation establishment and maintenance. The assistance required is approximately $1000 – 2000 per hectare for establishment and maintenance.

# Appendix G
## Carbon Credit Buyer Perspectives

Carbon credit buyers are large industrial GHG emitters such as the oil and gas sector, producers of thermal (coal fired) electricity, and the mining and manufacturing sectors.

Consideration of all possible risks that could negatively affect the corporate financial bottom line is a cornerstone of good corporate governance. The following list presents some of these risks:

- Managing risks to reduce potential liabilities is a daily practice of corporate decision-makers. Large GHG industry emitter (LIE) (buyers) who do not comply with emission reductions will pay penalties.
- LIE companies are challenged with staying in compliance through emission reduction or the purchase of offset credits, and at the same time identifying all risks, including those associated with carbon credit purchases that will offset emissions. For example, permanence of carbon credits.
- Carbon credit trades are expected to be in packages of a minimum of 100,000 tonnes, which is estimated to have a value of approximately $100,000 - 800,000 CDN based on past transactions. Under-rating the risk or lack of due diligence with one such trade can be career-ending for a corporate executive.
- The lack of clear policy and regulatory framework, complete with emissions reduction targets and compliance requirements beyond 2012, restricts business to a short-term horizon (8 years from 2004) for planning major capital expenditures and carbon credit purchases to ensure compliance.

Consequently, corporate decision makers (buyers) are very cautious in managing risks, particularly when carbon credits / offsets are a new commodity and carbon transaction experience levels are low.

### Appendix G1
### Financial Accountability and Risk Aversion (Buyer's Perspective)

1. **Large industrial emitters (LIEs / Buyers) plan to comply** with Canada's GHG emission policies. Purchased credits must meet Canadian compliance eligibility rules. Until those rules are established, foreign credits that are purchased must meet international compliance and eligibility rules.

2. **Low prices for carbon credits are important.** The purchase price of credits must be as low as possible ($ 0 – 15 CDN per tonne range) and include consideration of the "quality" of the credit. This is directly related to the risk of being out of compliance at the end of the first measurement period (2008-2012). The "quality" of a carbon credit is related to its eligibility, degree of risk and timely delivery. Buyers will not be required to pay more than $15 CDN per tonne due to the government's price cap per tonne for the industrial sector. Any cost in excess of $15 CDN per tonne may have to be paid by the Canadian government (taxpayers).

3. **Transaction costs must be kept low.** The transaction costs (fees for broker, lawyers, etc.) per credit should be low on a per-unit basis; hence, large transaction units (minimum 100,000 tonnes) and long-term contracts with renewal options are generally required.

4. **Written contracts and options will be used to reduce risks.** Ironclad contractual conditions to reduce risks will be required at all times. The seller must own and provide clear title to carbon credits before the buyer will consider a purchase. Buyers want to purchase credits outright, not lease temporary credits. Buyers are typically only interested in owning carbon credits, not the land, trees, etc., because such assets do not relate to the buyer's core business. Sellers of carbon credits will have to deliver the contracted volume of credits or replace any shortfalls. Purchase agreements will be made only with sellers who have financial resources, a pool of reserve credits, or insurance guarantees adequate to replace large delivery shortfalls. Buyers want to use written options to secure credits for 2008 – 2012, Canada's first measurement period, to reduce their risk in a very uncertain marketplace. Written 'options' to secure credits do not guarantee that the option will be taken up and followed through with a financial sale. The market is uncertain, largely due to the lack of clear government decisions on important policy matters and to the lack of experience in making transactions in this new and untried market. Some buyers may be flexible in negotiating contract terms to ensure that the contract fits the carbon credit producer's needs in areas such as upfront advances, bankable contracts, and so on, as well as providing carbon delivery incentives.

5. **Delivery of credits must be assured.** There should be assurance of delivery and sustainability for credits with a purchase agreement. It is not just the volume of credits that is important – the delivery schedule is also important. There should be a low risk of non-delivery on an annual basis, and the long-term delivery flow should be assured and sustainable. The risk of a lack of 'permanence' (particularly with forest sequestration) must be assessed and if it is determined to carry a high risk, discounting of price and volume will have to be considered. Forestry projects lack permanence in the way that actual emissions reductions have permanence. Contract renewal options may be used for periods after 2012, but no financial contract commitments should be expected until Canada's policies extend and clarify the requirements for compliance past 2012. Carbon credits are a compliance tool. They are required only if compliance with new emission reduction targets is required. Current Canadian policy is unclear on this point.

6. **Pay only on delivery**. Purchase payments will only be made upon verified delivery. Carbon must be measured and verified annually, or periodically (for example, every five years), by a credible third party. Verification will be at the expense of the seller.

7. **Prioritize ER preferences.** Priorities for meeting emission reduction (ER) requirements are listed below in order of LIEs / buyer's preference:
    a) Use current technology and / or other alternatives to reduce emissions;
    b) Invest in new, affordable, emission reducing technology that supports the 'core business' of the company and that will benefit the company long term;

c) Purchase low-risk domestic offset credits and international credits at low prices. Buyers will consider CDM eligible projects in developing countries. CDM project credits (CER) can be accumulated for use in 2008 - 2012.
d) Buyers / LIEs consider landfill methane gas reduction projects as low-risk and very cost-effective. Buyers of carbon credits perceive forestry / agriculture carbon sequestration projects as slower to produce, higher in risk, and lacking permanence.

*Note*: Buying domestic offset credits (methane, forestry, agriculture) is a bridging tool for industry compliance until advanced technology solutions are identified and become economical to implement. Industry will generally choose the cheapest compliance option but will continue to conduct research and development for improved technology to obtain emission reduction advancements.

8. **Diversify the portfolio** of purchased credits geographically and by source. Large industry emitters believe Canadian companies will have to buy many credits from outside Canada to obtain the required compliance volumes. Canada will be a net importer of credits, causing a net outflow of Canadian funds. Brokers will be used to help diversify company portfolios. Brokers currently require a seven percent selling commission paid by the carbon credit seller.

9. **Do business only with reputable, politically stable countries and established sellers.** Due diligence will be practiced when assessing the history and track record of sellers, their project managers, the credibility of carbon measurement systems, the risk management systems in place, their financial resources, and the seller's ability to guarantee to replace delivery shortfalls. Commercial terms (contracts) are fundamental to a transaction, but given the environmental basis of these transactions, socio-economic impacts of the project, and the related reputation of the seller will also be given consideration. For example, buyers may be negotiable with their contract terms pending circumstances.

# Appendix H
## Summary of Landowner Selling Difficulties

It is clear that for small landowners, selling forestry carbon credits to large industry emitters will not be easy. Traditional rules of business include the following:

- "The Customer is always right" – so that the buyer's demands must be met by the seller.
- "Those with the money make the rules" – Buyers pay on their own written contract terms.

**Large Volume Transactions – 100,000 tonnes minimum**

The buyer desires the minimum trade or purchase unit of 100,000 tonnes $CO_2e$, but no individual landowner has 100,000 tonnes to sell. If the average landowner sells credits from only 3 hectares of trees, then the total annual tonnes would be 14.8 tonnes x 3 hectares = 44 tonnes; or 220 tonnes for a 5-year period. To make one 100,000-tonne sale, one would need to group together 2252 landowners annually with 44 tonnes each, or 455 landowners for a five-year sale period. An alternative option may be to sell small volumes to an aggregator / broker (or work with a broker) who is collecting landfill and agriculture credits to combine tonnes from the three sources to make up 100,000 tonnes blocks for sale to buyers.

It is administratively difficult to aggregate credits amongst numerous landowners. Governance, registration of all lands, legal contracts, monitoring and verifying carbon measurements annually, selling the credits, and distributing the money back to the individual landowners must be organized and carried out. Based on a landowner growing only 3 hectares or 44 tonnes, the annual payment at $6 / tonne is only $264 minus the landowner's share of the administration and transaction costs, which could include brokerage fees. These costs could total $4 per tonne ($176), leaving the landowner with $88.

**Carbon Credits from Afforestation / Forestry Sources Are Not Currently Desirable to Buyers**

Forestry is considered by buyers to be a high-risk source of carbon credits due to lack of permanence. Currently, buyers are looking at forestry or afforestation projects only if they can be purchased at discounted prices relative to other compliance credit sources. Other sources of credits currently include landfill methane gas capture projects around the world.

Investments in forestry credits do not benefit the core businesses of the oil and gas, electrical or mining sectors on a long-term basis relative to other types of emission reduction credits or projects, such as pumping $CO_2$ gas underground to reduce emissions while increasing oil / gas well head production.

Should future demand for sources of carbon credits increase, forestry credits may become much more desirable and command a better price from buyers.

**Low Interest in Providing Financial Assistance to Forestry**
The oil and gas, electrical, and mining sectors are not interested in assisting small landowners with afforestation projects. Up-front financial assistance or investments to help landowners establish afforestation projects or an aggregation structure is counter to their "core business" and corporate missions. Corporate managers risk shareholder anger and confusion whenever they stray from their core business. This is unhealthy for both their company and their executives' careers.

**Contract Only with Reputable, Established Sellers with Financial Resources**
Most landowners are small businesspeople who are unknown to large industry. The industry buyer desires the seller to guarantee delivery of credits (buy insurance), be in possession of reserve credits, and / or have the financial resources to replace any shortfalls in delivery of credits. An example would be where a company buys 100,000 tonnes of credits from a landowner group at $6.00 per tonne. If there is a delivery shortfall of 30,000 tonnes due to any factor (insects, drought, etc.), then the landowner group may have to go out into the market place at that point in time and buy replacement credits. The market prices may have increased to $11 per tonne, costing the association $150,000 out of their pocket through no fault of their own. Buyers want to ensure that sellers can meet all the conditions in their delivery contracts. An established company with financial resources is the preferred seller. Landowners, or newly established cooperatives or corporations, do not have the track record or financial resources to meet the buyer's contract expectations.

**Measurement, Aggregation, and Brokerage Costs**
Measurement, aggregation, administration, brokerage fees, etc are expected to cost in the range of $2.50 - $5.00 CDN for aggregating 100,000 – 300,000 tonnes. Unless market prices are a minimum of $5.00 CDN, aggregation and selling will not be financially viable.

# Appendix I
## Current Obstacles to Afforestation and Aggregation Initiatives

Obstacles and barriers that limit interest in growing and trading carbon credits include, but are not limited to, the following.

**Landowner Abilities and Mindset**

- The average landowner's current age is approximately 60 years. This close to retirement, most landowners are reluctant to invest (or borrow money) in an unknown commodity and market. First income from sales will take several years to materialize, and meanwhile investment and use of land require a long-term commitment.
- The average landowner has crop management experience but lacks legal experience and experience with complex business transactions.
- The landowner may be able to personally establish and maintain a plantation, but lacks the knowledge and qualifications to prepare project documents, measure tree growth and calculate carbon credit development, or understand contract language. In all these situations, the landowner must pay professional fees that can be exorbitant in the eyes of landowner. The landowner feels the middleman will get all the profits from his labours and investments in, and on, the land. Meanwhile, most risks gravitate to the landowner.
- The older landowner may not have the energy and focus required to maintain a new plantation free of competing vegetation.
- Many landowners with farming ancestors on the same landbase will not want to plant trees. They recognize their ancestor's hard labours in removing the trees and roots in order to make every acre productive and feel they will compromise the vision of their agricultural forefathers by growing trees.
- Landowners want freedom to manage and to take advantage of opportunities as they arise. This could include changing to higher value land uses. Being locked into a long-term project with penalties reduces the freedom to change land use. A covenant on the land title—no deforestation—potentially changes the land value. In some cases, this may reduce value. In others, land value may increase as new landowners desire forest cover.
- Landowners will have to consider and account for 'leakage' or carbon losses and emissions on all their lands.
- The average landowner wishes to plant only approximately 3 hectares.
- The average landowner wants trees for environmental and aesthetic reasons.

**Too Many Complexities Regarding Emission Reduction Credits, Trading, and Accounting**

- There are complex international and domestic rules.
- There are many emission reduction concepts and approaches to the accounting of credits associated with these various project types.
- The complexities are beyond the understanding of the average landowner.
- Average landowners lack scientific knowledge about carbon sequestration rates.

- Can carbon credit ownership be separated from the wood of the tree and sold separate from the wood? This is a current legal question.

**Taxation Disincentives**

- In some provinces there is a rise in property taxes if lands are reclassified from agriculture lands to forest lands. In BC, the lowest property assessment tax rates apply to farm or agriculture. To qualify for 'farm status', the length of the crop rotation must be 12 – 14 years or less to qualify for this lowest property tax. Unless hybrid poplar trees are grown on the southern BC coast, 12 years is too short for a crop rotation period and will not qualify for farm status.
- If not proven that there is "reasonable expectation of profit," silviculture (planting and maintenance) expenses cannot be deducted from off-woodlot or off-farm income at income tax filing time.

**Regulatory Uncertainty and Lack of Emission Reduction Policies**

- Lack of information written and distributed to improve landowners' understanding.
- Question of project and land eligibility.
- Question of 'leakage' accounting and carbon credit liabilities for participating landowners.
- Question of a registered agreement (covenant / easement) encumbering the land title.
- Unknown requirements / standards of measurement / verification (baseline and incremental carbon sequestration measurements).
- Uncertainty over ownership of carbon credits.
- Question of financial assistance.
- What will be the official start date for growing carbon with afforestation projects?
- Will carbon credits have value after the first compliance period 2008-2012?
- Will farmers need to hold and own their own carbon credits to offset total farm emissions with future regulatory changes?

**Social Acceptance / Public Opinion**

- There are many people against genetic engineering for food grain, animal, human cloning, etc. Although tree improvement—hybrids and clones—is not genetic engineering, the public must be educated. As well, public opinion may not accept increased planting of hybrid clones, non-native to an area.
- In growing trees on marginal agriculture lands, herbicide is a cost effective tool for minimizing competing vegetation, particularly grass species. There are many people opposed to herbicide use, particularly in BC. In BC, herbicide is commonly used for agriculture purposes; however, there are stringent regulations in place for herbicide use on private lands for 'forestry' purposes. The landowner must apply for a permit and go through an environmental appeal process. Many communities have organized environmental and first nation groups appealing every permit application on principle. In most cases, the environmental appeal process is too onerous and expensive for small private landowners to undertake and they are forced to choose more expensive manual or mechanical alternatives to herbicide use.

- The majority of the public and landowners, for environmental and aesthetic reasons, desire conifer species, slow growing spruce and pine, compared to faster-growing species that can sequester carbon faster.
- The offset credit system allows for emitters to increase their emissions by purchasing offset credits. People concerned with pollution will not be impressed with offset credit rules allowing increased emissions.

**Biological Time Frames**

- The first compliance measurement period (2008-2012) is very near in time relative to the substantive planning and implementation time required for a nation-wide afforestation program. As well, time is needed for more clonal research to ensure there are hybrid poplar clones suitable for growing across Canada's diverse ecological landscape. Time may be needed to expand nursery capacities in different parts of Canada.

**Market Uncertainty**

- Prudent investors want a more mature carbon credit marketplace with less downside risk.
- There are many complex international factors that will determine the carbon credit market. (The market is difficult to predict from a landowner's perspective.)
- The minimum trade volume is 100,000 tonnes. Landowners require aggregation of thousands of landowners collectively consigning their tonnes to sell their commodity. This requires significant administration energy and costs.
- Carbon credits are a new commodity that is not well-understood.
- Large industrial emitters (buyers) do not see forestry carbon credits to be a desirable carbon credit source relative to others. This leads to discounted prices for forestry carbon credits.
- Current and future market prices for hybrid poplar as a forest product are not seen as very lucrative.
- There is no guarantee of a market past the year 2012.

**Administration and 3rd Party Expenses for Afforestation Carbon Projects**

- There are project documentation requirements to produce a carbon credit.
- There are annual or periodic monitoring / measurement / verification costs.
- There is not yet any standardized contract wording, nor precedents determined by the courts for contractual non-performance; hence, due diligence is expensive prior to signing contracts.
- There are transaction costs including fees for a forester, lawyer, broker, and / or insurance premiums.

**Selling – Aggregation Issue**

- Landowners must aggregate their tonnes of carbon credits into selling packages of 100,000 tonnes in order to sell them to large industry emitters—the primary buyers of credits. Ideally, landowners desire to control the aggregation, but this may not be possible. Thousands of independent businesses (small landowners) would need to form a cooperative, corporation, or other aggregating

structure in order to aggregate and control the selling of their carbon credits. This takes time, energy, money and leadership. Aggregation's administration and transaction costs will likely be $2.50 - $5.00 CDN per tonne. There may be easier aggregation options but they have not been identified as yet. There may be opportunity to add agriculture and landfill credits to forestry in order to achieve 100,000-tonne trade units.

- Aggregation is not viable unless market prices are a minimum of approx $5.00 CDN to cover aggregation-related costs and give the landowner a profit.
- Buyers want to own the carbon credits outright for the long-term, with the landowner taking liability risk for permanence for the plantation and credits. If credits are not long-term, then buyer will only pay discounted prices.
- Potential aggregators have not been clearly identified or accepted by landowners.

# Appendix J
## Questionnaires Used

### Appendix J1
### Woodlot Owner / Association Questionnaire

October 2003

**Landowner - Forestry Carbon Credit Aggregation - Questions Needing Answers:**

1. What are the key considerations for landowners in your area in deciding if a proposed aggregation model is credible or worth considering?_____

_____

_____

_____

_____

**2. a) What is the most efficient aggregation model? (need to keep costs low)**

(Who should be driving aggregation? Who should be the administrator? and why?)

- ☐ Government gov't run organization; or just gov't funded? _____ who? _____
- ☐ Landowners' Cooperative newly organized cooperative? _____ or woodlot federation, associations, other existing bodies? Suggest: _____
- ☐ Landowners' Corporation or Private investor Corp? _____ use an existing company, startup a new entity? Suggestions:_____
- ☐ Brokerage House who? _____
- ☐ Other _____
- ☐ Combination of _____ and _____

b) Why did you choose this model?

_____

_____

_____

3. a) Would your provincial woodlot federation, regional association, marketing board, and / or group venture be interested in assisting with aggregation of carbon credits?

YES or NO, and why or why not? _____

_____

b) If Yes, what role might this organization play? _____

_____

c) Name of organization? _____

**4. What is the minimum annual net income in carbon credit sales that would cause you to grow trees for carbon credits (along with other purposes)?**

Minimum total annual net income? $ _____. Minimum income per hectare? $_____

5. What promotion, etc will government and associations have to do to interest landowners in an afforestation program? (financial assistance? how much? extension support? other?)

_____
_____
_____
_____
_____
_____
_____

6. In your opinion, what percentage of landowners will agree with an afforestation program to counter greenhouse gas emissions and climate change / global warming and want to do something about it? _____ percent

Any specific reasons / comments?

_____
_____

7. Other Comments and Suggestions: _____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

8. Your province? _____

Optional: Contact Name, Address, phone number, email, affiliation and information about yourself and / or your organization:

_____
_____
_____

## Appendix J2
## Interview Questions for Buyers of Carbon Credits

**A. The Past**

1. Has your company purchased carbon credits in the past? Y or N
2. What source(s) of carbon credits did you purchase? trees, agriculture, emission reductions, other? _____
3. What were the term(s) of purchase of the carbon credits? _____ years. Leased credits or outright purchase? _____
4. In general, who did you purchase from and did you use a broker? _____
5. What verification / guarantee processes or forms of insurance against loss have you used? _____
6. Can you explain the transaction process used? _____
7. What price range(s) have you paid? _____ and what was the purchase unit size in tonnes of CO2e? _____
8. Company attitude / philosophy toward Kyoto reduction targets? _____
9. Other information from the past? _____

**B. Forecasting the Future**

1. What factors will a buyer consider when purchasing carbon credits?
2. Minimum size trade unit (tonnes) that your company would consider buying?
3. How many tonnes of credits will your company be purchasing in the future?
4. What sources for credits are you looking for? _____
5. What types of carbon credit and sources are considered the lowest risk from your perspective? _____
6. Term of contract desired? _____ yrs. Lease / Rent vs Outright Purchase?
7. Do you prefer to use a broker or purchase direct? _____
8. How much are brokerage fees as a percent of the value of sales?_____
9. What are the steps in a purchase transaction? _____
10. What verification processes do you prefer? _____ and what is the frequency and options? _____
11. What do you see as the future market price range per tonne of carbon credits?
12. For your company, is there a maximum carbon price per tonne that you are able to pay before buying new technology for emissions reductions? _____
13. Do you predict that credits in the future will be in surplus domestically or internationally? _____ And what time frames do you consider applicable? _____
14. What factors or trends do you see for the carbon credit market place? _____
15. Do you think that it will be financially viable for small landowners to grow new forests and agricultural crops for the purpose of developing and selling carbon credits? Y or N
    (landowners will have significant admin costs incurred in aggregating and verifying their credits, without considering the planting / crop establishment costs).

16. Does your company foresee difficulty in achieving Kyoto reduction targets and would you be interested in assisting in some way with afforestation in partnership with small private landowners to secure credits. Y , N, Maybe. What type of assistance?

    _____

    (Assistance could be in the form(s) of guaranteed purchases, long term price stability, small trade units, paying up front for the establishment of new plantations / crops, etc.)
17. Would your company be interested in assisting or entering into a contractual arrangement or partnership arrangement with an aggregating cooperative of private landowners to avoid brokerage fees? Y or N
18. Do you have templates, contractual conditions, etc that you would be willing to share? _____
19. Other? _____

**C. <u>Views on Aggregating Credits and a Carbon Credit Program?</u>**

1. Do you consider forestry carbon credits to be higher risk than other credit sources? Y or N
   Why?_____
2. What should be the government's role in the sale and purchase of carbon credits? Incentives / subsidies / tax incentives / or 100 % market driven and for whom?
   _____
   _____
3. What should be the government's role is assisting aggregation of credits from small landowners? _____

**D. <u>Suggestions for Small Private Landowners</u>**

1. In your opinion, should small private landowners consider afforestation to develop and sell carbon credits? Will there be a good market for them? Y or N _____
2. Suggestions for efficient carbon credit aggregation systems for small landowners in order to sell efficiently in the domestic and international marketplace? _____
3. What business structure should be used in the aggregation business?
   (Considering efficiency of aggregating credits and the preferred form of business for a buyer to work with).
   [Your company lawyer may be helpful to assist with this question]
   Cooperative and its structure: _____
   (operated by producer, buyer, or gov't?)
   Corporation and its structure: _____
   _____
   Partnership and type: _____
   _____
   Other: _____
4. Other advice? _____

# Appendix K
## References

**Questionnaire - Input from Woodlot Owner-related Associations (listed by organization / association)**

Canadian Federation of Woodlot Owners: deMarsh, Peter.

Carleton – Victoria Wood Producer's Assoc, New Brunswick: Fox, Tim.

Federation of BC Woodlot Associations: Fuller, Miles.

Federation of Wood Producers of Quebec: Dansereau, Jean-Pierre.

Ontario Woodlot Association (OWA), and Algoma Chapter of OWA: Cybulski, Cat.

New Brunswick Federation of Woodlot Owners: Doucett, Rick.

New Brunswick Federation of Woodlot Owners: Maillet, Marel.

Northumberland County Woodlot Owners Association, New Brunswick: Forgave, Kevin.

Renfrew County Chapter of the Ontario Woodlot Association: Morganstern, E.K.

S.N.B. Forest Products Marketing Board, New Brunswick: Corbin, Dave.

Woodlot Association of Alberta: Brinker, Curtis.

Woodlot Association of Alberta: Grundberg, Byron.

Woodlot Association of Manitob: Austman, Bob.

**Interviews – face to face (listed by company or agency)**

Canadian Customs and Revenue Agency: Hildebrand, Cheryl, and McClure, Denis.

EnCana Corporation: Dilling, Kendall; Godman, Paul.

Natsource – Tulett (Alberta) Co.: Vickers, Paul.

Suncor Energy Inc.: Lambert, Gord.

TransAlta: Pancoast, Rochelle.

TransCanada Pipelines Ltd.: Siarkowski, E., Venugopal, S., and Walker, E.

Western Stock Grower's Association: Ward, Norman.

**Interviews – telephone (listed by company, agency, or organization)**

Agcheck Canada Inc. & Valdrew Environmental Services Ltd,.: Hastie, John

Ainsworth OSB Plant, 100 Mile House, BC: Robinson, Laurie (Woodlands)

ALPAC Pulp Mill, Boyle, Alberta: Kaiser, Chuck, hybrid poplar expert; Ramsome, Ernest, log buyer.

Brinkman & Associates Reforestation: Seaton, Robert.

Canadian Cattlemen's Association: Strankman, Peggy, General Manager

Canadian Cancer Society: Thompson, Kim

Canadian Federation of Woodlot Owners: deMarsh, Peter

Canadian Forest Products, Vancouver office: Jordan, Mike, environmental department.

Clark, Mark: Forestry consultant with FAACs, BC pilot plantation project

Climate Change Central, Calgary office: Peace, Janet

Climate Change Central, Edmonton office: Maynes, Tanya

GEMCo (Greenhouse Emissions Management Consortium): Donnelly, Aldyen

Griss, Paul: carbon credit policy consultant

Grundberg, Byron: Forest 2020 landowner candidate, Alberta

Mikro-Tech Inc.: Kean, Mark, and Wood, Marilyn

Natural Resources Canada, CFS Pacific Centre: White, Thomas

Tree Canada Foundation: Monty, Jeff, President

T. Rotherham Forest Consulting Inc.: Rotherham, Tony

USDA Natural Resources Conservation Service, Nebraska: Schaaf, Tim

Weyerhaeuser, Hudson Bay, Saskatchewan: Woodlands department

West Fraser Timber, Vancouver office: Macdonald, Cindy, environmental department

Woodrising Consulting Inc.: Bird, Neil

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*Agroforestry Producer Questionnaire Survey Results BC – 2003*, SYLVIS Environmental

"An Introduction to Forests and the Kyoto Protocol." Toronto presentation, November 2003 Tony Lempriere, CFS.

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"Carbon Registries and Aggregation." Toronto presentation, Ray Rivers, Clean Air Canada, November 2003

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*Cost Estimates for Carbon Sequestration in Canada from Fast Growing Plantations (Draft).* Dan McKenney and Denys Yemshanov, Canadian Forest Service, Great Lakes Forestry Centre. April 2003

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*Mikro-Tek Carbon Sequestration Pool*. Mikro-Tek Inc., September 2003

*Offset System Discussion Paper*, June 2003

*State and Trends of the Carbon Market 2003.* Franck Lecocq and Karan Capoor, Pacific Forestry Centre / Research, World Bank, December 2003

*Survey of Farmers, Ranchers, and Rural Landowners (Canada) – Attitudes and Behaviours Regarding Land Stewardship.* Environics Research Group, June 2003

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Canadian Federation of Agriculture www.cfa-fca.ca

Chicago Climate Exchange (announces results of first auction) www.chicagoclimatex.com

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Climate Change Central (Alberta) www.climatechangecentral.com

Climate Change Plan for Canadawww.climatechange.gc.ca/plan_for_canada/plan

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"Hybrid Poplars as a Crop" John Kort, Agroforester, PFRA Shelterbelt Center, Indian Head, Sk www.agr.gov.sk.ca/docs/crownlandspastures/conference_info/jkort.asp

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Prairie Farm Rehabilitation Administration www.agr.gc.ca/pfra

"Private Forestry: Some Basic Information for Landholders About Carbon Credits and Farm Forestry" Bruce Cole-Clark (Australia) www.privateforestry.org.au/carbonfs.htm

Prototype Carbon Fund www.prototypecarbonfund.org

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Tree Canada Foundation www.treecanada.ca

TREEmendous Saskatchewan www.geocities.com/treesask/

Trexler & Associates – Delivering the Greenhouse Gas Market www.climateservices.com