Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) Focus Group Research

Final Report

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Executive Summary

This research was funded by the federal Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) Initiative, through the Canadian Forest Service office in Edmonton, Alberta (Northern Forestry Centre) and by the Manitoba Forestry Association, a non-governmental organization based in Winnipeg, Manitoba. This report represents the results of intensive focus group sessions in the three prairie provinces of Canada. Private landowner attitudes toward a potential federal afforestation scheme and their required incentives for participation was the main focus of the research. The reason for this participatory research was the necessity of 'on-the-ground' discussions about afforestation; this federal program will be the first in Canada and the institutional support, technical and socio-economic information, and delivery mechanisms are untested and largely undeveloped. This presents a good opportunity to gather the most relevant needs of private (agricultural) landowners with respect to afforestation.

Afforestation is defined at the planting of trees on land that has not supported trees for a significant period of time (beyond fifty years) and whose primary purpose is now agricultural production, and marginal or idle land thereof.

The research examined the potential benefits and drawbacks from afforestation and considered the challenges and barriers to implementation of a federal program. Each focus group also discussed the necessary conditions for implementation of both small scale and large scale programs. Small scale programs were defined as small plantations (less than ten acres) and large scale programs would be plantations larger than these. The original terms of reference referred to afforestation on marginal land. The use of this term was problematic in the focus group sessions and analogous (and more accurate) terms were used at different points: 'fragile land' and 'conservation areas'. The focus group discussion also moved beyond a focus on marginal land with the direction that good quality trees and high volume production for carbon sequestration should be directed at both good quality land and soil as well as marginal land.

The literature reviewed during the secondary data collection provides a basis for placing this research in context of other Canadian and international research on afforestation programs. The review shows that afforestation programs have been demonstrated around the world with various degrees of success to this point. National and multilateral programs have been developed and many efforts have been focused at developing countries and areas of Europe that have had working forests for several centuries. Afforestation is also one of a number of carbon management techniques, all of which should be considered by the federal government for carbon sequestration in the future.

Under the Kyoto Protocol, afforestation will potentially play a large role in carbon sequestration by the 2008-2012 compliance period. Different policy tools are available to encourage participation in an afforestation project: direct and indirect control mechanisms are supported with economic and institutional incentives and regulatory development. The economics of afforestation in western Canada has been studied to a limited extent, mainly focused on macro-economic issues. Some practical scenarios have been examined which generally look at small pilot projects and expansion of acreage over time (due to real-world economic and technical constraints in the region). The opportunity cost estimation for afforestation on private agricultural land needs

development and little guidance is available from the literature. The need to develop accurate but flexible opportunity cost analyses is affirmed with the behavioral literature (examining decision making factors) that emphasizes the primary role of short term economic considerations when deciding to plant trees.

The results of the focus group sessions are presented in both summarized note form and thematically. The essential elements for a federal afforestation program are taken from these results and are as follows.

1. Flexible incentive packages

- Address opportunity costs
    - The opportunity costs vary by region and microclimate. Participants were very reluctant to put a dollar figure for a particular piece or type of land because of the many factors that need to considered in the calculation. [Various dollar figures can be found in the individual focus group result tables.] There was a desire for financial incentives that paid an annual return, perhaps based on a sliding scale over time, and that this compensation would have to worked out on a regional or site by site basis. This approach would be consistent with the discussion as a whole (a regionally differentiated program).
- Tax incentives
    - The discussion about tax incentives focused on both tax rebates and tax relief. Income tax on the sale of timber at the end of tree life cycles could be amortized over the preceding years and land tax assessments would have to be of an incentive nature; currently they are not.
- Sharing of risks
    - An afforestation program must be promoted on a risk sharing basis. If delivery agents cover costs completely, there is a risk of 'program milkers' participating (individuals who are not serious about afforestation or who are trying to make as much money as possible by manipulating the program).
- Long term commitment
    - The commitment needed by government must be consistent with the lifecycle of the trees. Short term programs that match political or fiscal timeframes (four or one year(s)) would not adequately support afforestation.
- Information and infrastructure support
    - More information is needed before participants would be willing to make firm commitments. A wide variety of information needs were expressed, and generally these have to do with growing, establishing, maintaining, and harvesting trees. Infrastructure support would come in the form of appropriate technology sourcing and leasing or renting of machinery through delivery agents.
    - Growers manuals, best practices guides, and business planning tools are an immediate priority for all research participants and it is recommended that these be researched and compiled.

2. Regionally differentiated program

- Microclimate and ecosystem differences
    - The focus group participants were adamant that a 'one size fits all approach' would not work in this situation. Microclimate and regional economy differences mean that different incentive packages would be suited to different regions of the prairies and that different tree species may be best suited to different areas.

- In order to get large acreages planted and tree growth within an adequate timeframe, trees will have to planted on good quality soil. All participants indicated that 'good soil grows good trees', and any large scale effort should be directed at viable agricultural land. This will change the nature of incentive packages and program targeting. 'Marginal land' was a controversial term although there was some acceptance that there is a need for conservation type planting. Aggregating conservation planting acres would require program and monitoring flexibility.

· Distance from markets and program delivery agents

  - Private landowners have varied geographic situations with respect to their distance from major centers and from government delivery agents. Many are also long distance from potential timber markets or processing facilities. There should be a distance quotient factored into any financial incentive package(s) and this would have to consider unevenness in transportation and communication access.

3. Contingent aspects

· Carbon credit accounting

  - Most participants were interested in learning more about carbon credits and the potential role that they would play in an afforestation program. It was expressed that having more concrete knowledge about carbon credits would help decision-making. In some respects, carbon credits were seen as the 'unknown element' and as potential good income source.

· Cooperative development

  - There was some suggestion that aggregating individual landowner acreages in order to be account for carbon credits and count carbon sequestering acres would be a good idea. A program that provided this option would be viewed positively. Additionally, there could be some incentive provided for the cooperative ownership of specialized machinery with a buy-back option. Many landowners felt that they could not participate because of cash flow and acreage constraints, but that they would be interested if a program could be structured to these constraints.

· Timber supply and demand

  - The speculation on future timber markets and demand for timber products is a very big uncertainty that needs to be minimized through program planning. The management of an afforestation scheme on the basis of future timber profits is extremely high risk, given current market conditions and volatility within the forestry industry, and most private agricultural landowners are risk averse over the long term.

4. Parallel research, program delivery, and monitoring

· Afforestation research

  - Participants recognized the relative lack of research specifically targeted to afforestation schemes of this type and suggested that government departments need to invest in research and education before they do too much prescription. There are examples of hybrid poplar plantations in North America and case studies or best practices from these could be provided. The general feeling was that these examples were not successful enough to justify an ambitious planting scheme across the prairies and a cost-benefit analysis has not yet been systematically done.

· Delivery of program

- Program delivery needs to be coordinated with local agriculture representatives and local agencies, instead of a separate delivery system. Most participants suggested that the delivery of programs would have to be well coordinated and 'hands-on' due to the nature of afforestation on the prairies (a relatively new activity, new infrastructure, different knowledge base).

· Monitoring of results, program delivery, and incentives

  - Proper monitoring of an afforestation scheme will be critical, especially given the high cost and labour inputs for establishment, and the sometimes high mortality rates of young trees. Site assessment would be a good precursor to monitoring and it was suggested that many landowners would not be the best judge of land quality for specific tree species. Some feedback mechanism needs to be in place so that incentive packages can be evaluated.

· Iterative aspects

  - Because of the lack of experience by both landowners and government in afforestation in Canada, any planned program must have an iterative planning aspect (through monitoring and evaluation). It is likely that adaptation will need to occur especially during the initial years of the program (prior to the first Kyoto compliance period) and improvements can benefit landowners as the program expands.

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Introduction

The Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) Initiative is funded by Natural Resources Canada under Action Plan 2000 and is designed to investigate eligible carbon sequestration activity within the Kyoto Protocol. The primary focus of FAACS research is on private land and current work efforts include improving afforestation land assessment data and information, developing afforestation carbon accounting tools, assessing policy issues (potential program design, incentives, and afforestation co-benefits), and establishing a network of afforestation pilots involving different levels of government and interested environmental and non-government organizations and private sector partners.

The Manitoba Forestry Association, a non-profit education organization based in Winnipeg, Manitoba, established a collaborative research partnership in November of 2002 with the Canadian Forest Service (Northern Forestry Centre) in Edmonton, Alberta, to deliver a FAACS Pilot Project for the prairies. This prairie-centered pilot project is one of five across Canada under the federal FAACS initiative; each conducted and designed separately by various organizations.

This report outlines the results obtained from of a series of seven focus groups sessions that were conducted across Manitoba, Saskatchewan and Alberta under the FAACS Pilot Project. The overall objective of these focus group sessions were: (1) to determine landowner attitudes towards participating in an afforestation program for the purpose of carbon sequestration, and (2) to determine what characteristics the program should have to attract landowner interest.

Afforestation is defined as the planting of trees on land that has not supported trees for a significant period of time (beyond fifty years) and whose primary purpose is now agricultural production, or marginal / idle land thereof.

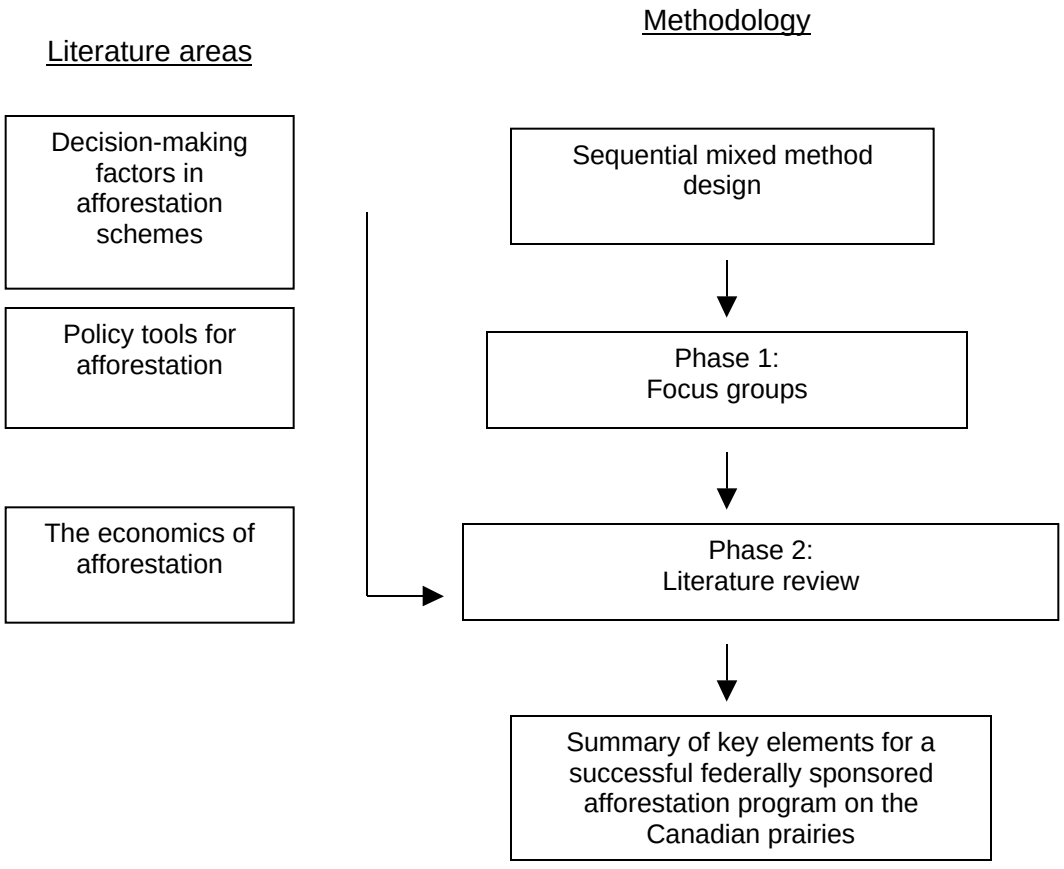
The seven focus group sessions were evenly spread throughout the three provinces: three were held in Manitoba, two in Saskatchewan, and two in Alberta. In Manitoba, sessions were held in La Broquerie, Brandon, and Dauphin; in Saskatchewan, Yorkton and Saskatoon; and in Alberta, Athabasca and Peace River. Generally, each focus group site was the most central location for participants that had to travel from up to two or three hours away. Three sites were selected for Manitoba mainly for logistical and familiarity reasons; the Manitoba Forestry Association has a large number of well established contacts in Manitoba that it was able to use in this research. In Saskatchewan and Alberta, organizers relied more on agricultural representatives and government extension officers as initial points of contact to develop participant lists.

These focus groups sessions were unique as the researchers were able to take advantage of many individual landowner ideas, current knowledge, and practical experience about afforestation. Focus group researchers were well received in the different communities because of an open agenda and request for informed input.

Research methodology

This study uses two techniques for the research. Focus groups and secondary data collection through literature review were conducted at different stages in the research. Through a sequential mixed method design, the research methodology used in this study used qualitative methods for primary data collection in the first stage of work and some secondary data sources in the second stage. Using a combination of methods allowed for the emergence of contradictions and fresh perspectives that would not always be revealed with the use of one method of investigation (Mason 1998). Mixed methods added scope and breadth to the study, allowing the study to examine the research objective with different techniques. This research was able to converge the results of the focus groups with literature support, providing triangulation of results (Yin 1994). This inquiry used a sequential mixed-methodology design as outlined by Mason (1998) and Tashakkori and Teddlie (1998) which represents qualitative methodologies and the use of different methods at different stages. Figure 1 below diagrams the different stages, and method for each, of this study.

Figure 1: The Research Process



The focus group design

Phase one of the research included the focus group design through a key informant workshop and the conducting of the focus groups. Babbie (2001) notes that the focus group format has several advantages: 1) it has flexibility, 2) has a high face validity, 3) has speedy results, 4) is a socially oriented research method capturing real-life data in a social environment, and 5) is low in cost. Given this, the data are also harder to analyze, the group is harder to assemble than a single interview, and the use of facilitators is required. The focus group sessions were designed so that each was conducted in a similar fashion with a common template as a guide. The design of the focus group template was an collaborated effort between Ross Smith, the author of this report, Patricia Pohrebniuk, of the Manitoba Forestry Association (MFA), Sheldon McLeod, an independent facilitator, Denis De Pape, a senior consultant with InterGroup Consultants and staff at the Social Science Research Group at the CFS's Northern Forestry Centre, including John Parkins and Bonnie McFarlane. The key informant workshop was then used to test the focus group design initially.

It was decided, at an initial meeting with the FAACS Focus Group Sub-Committee, that a two pronged approach would best cover the range of issues that were likely to come up. In an effort to not limit the range of discussion, small-scale, or conservation-type afforestation, was coupled with large scale, or commercial plantation-type afforestation as the main categories for discussion. These two categories were first introduced with a general discussion on the benefits, drawbacks, and challenges of an afforestation program. Then probing questions were used to generate a discussion about small-scale afforestation, first, and then large-scale afforestation (see Appendix 1 for the focus group guide). The discussion was then concluded with a review of the important themes and any missed points.

The introduction to afforestation was a significant section of each focus group and generally many of the issues appeared here. The benefits, drawbacks, challenges and barriers were covered separately and elaborated upon with feedback from each participant around the table. Of significance to this report (see Results section for detail) was the information needs identified through this introductory discussion. It was found that there is a need for more information on many different aspects of afforestation and these information needs cut across both small and large scale efforts.

Small-scale afforestation referred to small marginal land planting of trees, shelterbelt planting, and planting for conservation purposes such as slope stabilization and erosion prevention. It was deemed necessary to cover this aspect of afforestation juxtaposed against the larger commercial planting of trees in order to achieve significant discussion on afforestation co-benefits. Generally, when asked, the researchers would say that small-scale referred to plantings of less than ten acres.

Large-scale afforestation referred to larger, block planting, of trees with acreages generally greater than ten acres with the primary intent of producing harvestable qualities and quantities. The probing questions used for this section focused on species selection, marketing and harvesting issues, and large scale establishment and maintenance concerns.

The focus group process

A detailed agenda was mailed to the participant prior to the focus group session (see Appendix 1) in order to provide some further information about afforestation and give the participant time to think about answers to specific questions outlined in the agenda.

The focus group sessions began with the facilitators, Denis De Pape (La Broquerie) and Sheldon McLeod covering the day's agenda and introducing the topic of afforestation. Patricia Pohrebniuk, Manitoba Forestry Association, then explained the goals and objectives of the focus group research. Each focus group started at roughly 10:30 AM with the introductory discussion and broke for lunch at 12:00 or 12:15 PM. The afternoons began with a discussion of small-scale and then large scale afforestation issues. The length of each of these discussions was generally about 45 minutes and the session would conclude around 2:30 PM.

The facilitators made use of individual handouts for each section that provided information on a particular topic, questions regarding the topic and space to write responses. These handouts were not collected and the participants usually took them home for their own reference. A final handout was distributed at the end of the day which asked for any further thoughts or missed points. This handout was either handed back or could be mailed or faxed back at a later date.

Participant selection

The participants were selected on the basis of their geographic proximity to the selected sites and their diversity in terms of farm size, farming type, interest in afforestation, and previous personal experience with forestry-related issues. There were also participants who were not landowners; technical experts in afforestation, woodlot management, local municipal officials, local agrologists, and local agricultural representatives. Typically a maximum of two or three non-landowner participants of these types would be at any one focus group with ten local landowners on average. The two Alberta focus groups also included some industry representatives as the non-landowner participants. These representatives came from Alberta Pacific and Daishowa-Marubeni International Ltd., in Athabasca and Peace River respectively. These participants were selected through purposive sampling and through the use of existing Manitoba Forestry Association contacts. Agricultural representatives in Manitoba and Saskatchewan were able to provide lists of eligible contacts in order to get the necessary cross-section of farm types, interests, and experience with afforestation. In Alberta, a woodlot management specialist was able to provide similar lists for the Athabasca and Peace River regions.

Data collection and confidentiality issues

The focus groups were conducted in such a way to ensure confidentiality of the participants to the wider audience of this report. The participants were told that were free to answer as many or as few questions they were comfortable with and were not obliged to answer any single question, or participate in discussion with which they did not feel comfortable.

The data were collected by both tape recorder and hand written notes and transferred to electronic file at a later date. A list of the focus group participants was collected at each of the seven focus groups. This information is for the purposes of follow-up and to send complementary copies of the final report. During the handwritten transcription of each workshop, the names of participants were either coded when attributing specific comments, or else left anonymous.

Literature support

Introduction

Afforestation programs have been demonstrated by governments and business for many decades in different regions of the world. In parts of western and southern Europe, where population pressures and limited land bases are challenges, afforestation programs have been on going for more than a century. The reasons for planting trees on land that has not been previously forested vary, from agricultural production purposes in the case of Israel and other Mediterranean countries (Ginsberg 2002), to a supplanting of agricultural production in Mexico, western Europe and Nordic countries (Sheinbaum and Masera 2000). These are large scale and centrally organized afforestation schemes.

There are also aesthetic and ecological reasons for afforestation. Urban municipalities in Canada and the United States have had some of the most significant afforestation schemes (in terms of the area planted) to date. In western Canada, the Prairie Farm Rehabilitation Act (PFRA) initiated tree planting programs for shelterbelt purposes, primarily, in the 1930s and continue this presently. Afforestation efforts have also been initiated to stabilize fragile soil, protect riparian areas, and wind mitigation. A recent afforestation program in Britain was initiated to supply biomass for electricity generation (The Guardian 2003).

Recently, afforestation programs have been proposed for carbon management purposes. Atmospheric carbon dioxide (CO_2) concentration can be reduced by an increase in the terrestrial ecosystems that serve as sinks for CO_2. Afforestation is just one forestry activity that can increase carbon storage, maintain existing carbon storage, or reduce energy carbon emissions (Richards et al. 1997) (see Table 1). Afforestation is unique because it specifically refers to the planting of trees on land that has not previously been forested. While this increases overall forested area, it poses some challenges because of the different degrees of suitability of land for trees. The listed forestry activities in Table 1 provide effective carbon management tools; this research specifically deals with afforestation. There are also carbon management techniques available within agricultural practices. The trade-offs between the afforestation of agricultural land and using agricultural practices for carbon management are discussed in the Results section of this report.

Table 1: Land-use and forestry practices to manage carbon

	Main Objective		
Practice	Increase C storage	Maintain C storage	Reduce energy C (fossil fuel) emissions
Afforestation	X		
Agroforestry	X	X	X
Breeding/genetics	X	X	
Biomass for energy			X
Disease control		X	
Drainage	X		

Fertilization	X		
Fire control		X	
Herbivore control		X	
Improved regeneration	X		
Increased forest products	X	X	X
Insect control		X	
Longer rotation	X		
Preservation		X	
Irrigation	X		
Recycling of wood products		X	X
Reduced impact logging		X	
Reforestation	X		
Salvage dead biomass		X	
Shade trees			X
Shelterbelts		X	X
Soil management	X	X	
Stocking control (thinning, etc.)	X		

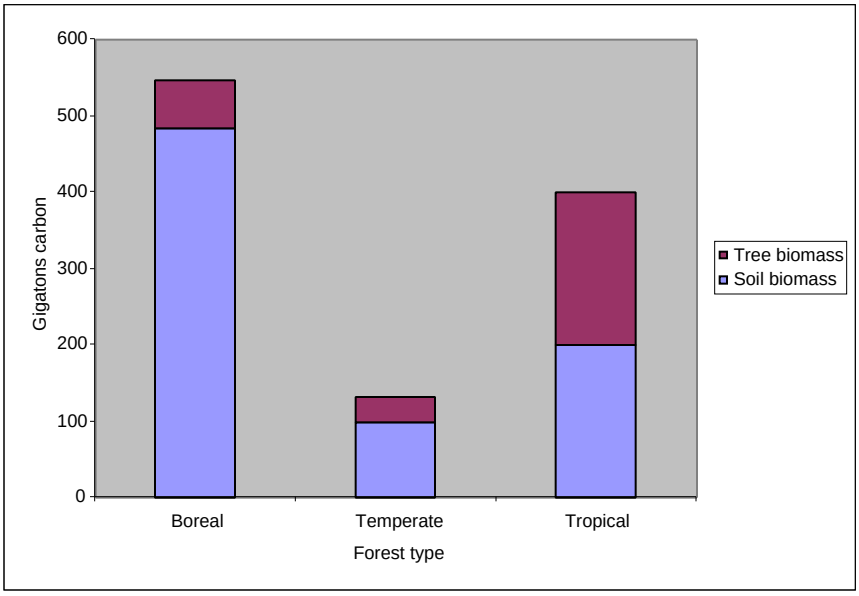
Source: Richards et al. 1997

The role of afforestation in greenhouse gas mitigation

Forest ecosystems sequester carbon, through the process of photosynthesis, during the growth stage of both trees and understory species. Forest carbon sinks have a significant potential to mitigate the rise in mean global temperatures caused by the increase in atmospheric CO2 concentrations (Intergovernmental Panel on Climate Change [IPCC] 2001). Roughly eight gigatons of carbon are released into the atmosphere each year by fossil fuel burning and deforestation; plant growth on land absorbs about 2.5 gigatons of carbon each year world wide. Overall, the world's forests store two-thirds of all terrestrial carbon and the IPCC estimates that preservation, reforestation, and afforestation activities could sequester an additional 60-87 gigatons of carbon by 2050 (IPCC 2001).

Forest ecosystems transfer carbon from the air into plant tissue and eventually into the soil. Over time, a greater proportion of the carbon is accumulated as decaying plant material in the soil than as tree biomass (see Figure 2). The boreal forest (of significance to this research) contains roughly seven to eight times as much carbon in the soil as it does in the trees. Temperate and tropical forests have much lower ratios and can act as carbon sources if respiration outpaces photosynthesis. Disease outbreaks, insect outbreaks, and forest fires can turn forests from carbon sinks to carbon sources; boreal forests have much greater resilience as sinks.

Figure 2: Forest carbon pools



Source: IPCC 2003

There is currently a good deal of debate about the science of forest ecosystems as carbon sinks (Pelley 2003, Yamagata 2001). Whether forests act as sinks or sources of carbon is dependant on many factors operating within each forested region. These include the severity of insect or disease outbreak, fire occurrence, forest age structure and biomass ratio. According to the Integrated Terrestrial Carbon Cycle Model (InTEC), based at the University of Toronto and driven with remote sensing data, Canada's forests absorb about 50 megatons of carbon per year, although this model shows that carbon stores have declined over the past two decades because of increasing levels of fire and insect disturbance. The Carbon Budget Model of the Canadian Forest Sector, driven by detailed on-the-ground inventories of forest biomass and property of the Canadian Forest Service, shows that Canada's forests sequestered roughly 250 megatons of carbon annually in the early part of last century, but between 1985 and 1989 released roughly 70 megatons of carbon annually because of fire and insect disturbance. Environment Canada has stated that forest and agricultural carbon sinks will account for 10-15% of Canada's effort to reach its Kyoto Protocol target (Environment Canada 2003). In June of 2003, the Government of Canada added $12 million into a new carbon sink research program to study these issues.

The role of afforestation in Canada's greenhouse gas mitigation

Despite the debate over an accounting of carbon sources and sinks in Canada's forest ecosystems, afforestation in the prairie regions offers the potential for carbon sequestration over and above current land use in many regions. Canada has agreed to a 6% reduction in CO2 emissions, below that of 1990 levels, by 2012 with its signing of the Kyoto Protocol to the United Nations Framework Convention on Climate Change. The compliance period, 2008-2012, is the period in which emissions accounting will be done; Canada will use a range of afforestation, reforestation, and other land-use strategies to sequester carbon and thereby offset some of its emissions.

The Kyoto Protocol allows countries to claim as a credit any carbon sequestered as a result of afforestation and reforestation since 1990, while carbon lost as a result of deforestation is a debit (Canadian Forest Service 1998). van Kooten et al. (2000)

discuss several important interpretations of the Kyoto Protocol relevant to afforestation issues. Notably, the difficulty with inventory measurement will mean that measures such as the mean annual increment (MAI) may be used to determine carbon uptake. There is also the potential that only the commercial (and measurable) component of the trees will be counted, so changes in soil carbon may be ignored. This would have the most implication for afforestation programs in boreal forest regions.

Most countries have not adopted large-scale afforestation programs for carbon sequestration to date, and this will have important consequences for the first compliance period. For most temperate forests such as those found in Scandinavia, Russia, much of United States, and Canada, the increase in biomass over the first two decades after planting is usually very small (van Kooten et al. 2000). The exception is short-rotation woody crops and high-yielding hardwood species such as hybrid poplar. In many instances, growth tables do not even begin until the third or fourth decade. The measure of carbon uptake for the first compliance period (five years from present) is likely to be small from current afforestation efforts. The planting of more natural, commercially viable species appear to be more of a intermediate strategy rather than a short term solution to the Kyoto Protocol. The planting of hybrid poplar, with short rotation periods (12-20 years) is more of a short term solution, put planting these species can result in adverse environmental consequences (through monoculture crops, intensive establishment methods, etc.).

Planting trees involves more than simply carbon uptake of the forest biomass; the carbon balance that remains in soil and in forest products is largely deterministic of the success of carbon sequestration activities. Wood products can substitute for fossil fuels (replacing large carbon emissions) and wood products can serve as carbon sinks for a long period of time (degrading very slowly). Policies oriented toward greater substitution of wood for non-wood products (e.g. in construction) and greater use of wood products also improve carbon balances (van Kooten et al. 2000). Afforestation with commercially viable species may reduce the price of wood products for such uses and plantation forests can be a cost-effective means of sequestering carbon.

In 1990, Canadian emissions of CO_2 amounted to 162.5 million metric tonnes of carbon. In 1996, emissions amounted to 182.4 million metric tonnes of carbon. Business as usual scenarios project annual emissions to remain stable for a short period and then rise to 203.2 million metric tonnes in 2010 and 225-230 million metric tonnes in 2020 (van Kooten et al. 2000). To meet its Kyoto target, Canadian emissions must be roughly 25% lower than that expected in the commitment period. A large part of Canada's commitment (~25%) will potentially come from afforestation strategies across the country (Canadian Forest Service 1998). Some of this afforestation will occur on public land and, of concern to this research, a good deal will occur on private agricultural land.

Policy tools

There are many different policy tools that can be used to encourage afforestation schemes on private land. There is probably no universal policy tool that is the best or most accepted or most effective in every situation. Because of the different microclimates, land values, agricultural focuses, government emphasis, and desired outcome (acres of afforested land), different policy tools can be used simultaneously. Richards et al. (1997) discuss some of the different policy options to enhance carbon sequestration in forest ecosystems, generally with afforestation management (see Table 2).

Direct and indirect control are the two main policy mechanisms available to government. Direct control usually involves government producing (or sequestering) carbon itself or regulating carbon production on public land. There are some on-going afforestation efforts on public land in Canada (e.g. Forest 2020) and these are directly controlled by government.

With indirect controls, government utilizes economic tools to induce private landowners to increase the stock of carbon on their land. This can be done through afforestation and through changes in land-use of existing forested areas (i.e. better management).

Table 2: Policy tools to encourage afforestation

Mechanism	Policy tool	Detail
Direct control	Regulation and fiscal expenditure	Afforestation on government land
		Government run afforestation on leased land
		Input regulation to existing forest ecosystems
		Output regulation of existing and new forested areas
Indirect control	Economic incentives	Taxes
		Subsidies
		Contracts
		Carbon markets
	Institutional incentives	Private property rights
		Market reforms
		Education and extension
		Research and development
		Volunteerism and encouragement

Source: after Richards et al. 1997

Indirect control mechanisms are most relevant to this research as they pertain most directly to private land. Market-based incentives provide a good deal of flexibility to private land owners and can be specifically developed to serve different needs. These economic incentives include taxes, subsidies, contracts, and tradable carbon permits. (Each of these incentives was discussed in the workshops.)

Taxes and subsidies can be used in a variety of ways to encourage the planting of trees on marginal or other agricultural land. Income or land tax reprieves can be given to landowners who are planting trees or taxes can be levied on landowners that remove or release carbon. Subsidies can be given as an incentive for the establishment of trees on private land. The cost of establishing trees is relatively high and subsidies, in combination with tax incentives, would be an effective way to encourage participation in an afforestation program.

There are two types of contracts that may be employed by government as carbon management incentives (Richards et al. 1997). Government agencies may contract with private landowners ***not*** to harvest a particular stand of trees, in return for financial gain. Government agencies may also contract with private landowners to convert marginal or other land to trees. This would be similar to leasing private land, although the responsibilities may differ.

Marketable permits provide a promising incentive for private landowners to adopt afforestation schemes. While not necessarily the responsibility of government, and indeed new carbon trading markets have begun on public exchanges, there is a potential role for government in setting the overall pool of carbon it wishes to store. Government can also trade carbon permits, similar to any private entity, thereby encouraging afforestation on private lands through the incentive of financial return.

Institutional incentives cover a range of needs, including information and research priorities for private landowners. Education and extension work is also an important incentive and different government agencies currently have experience and points of contact for this within appropriate sectors (e.g. Ministry of Agriculture, Canadian Forest Service, Rural Secretariat, PFRA, etc.). Participants in each of the workshops expressed a desire for these sort of incentives. Likely, any determined incentives package will combine market-based incentives with institutional support incentives.

The establishment (and or maintenance) or private property rights in the management of natural resources is important. A link has been established between private property ownership and sustainable resource management (Palmer and Synnott 1993) and between a community's or individual's decision making flexibility and ecological sustainability (Flora 2001, Holling 1978). It is critical the ownership of private land remain in the hands of the current owners (generally farmers or absentee owners) as they are best able to determine the ongoing efficacy and appropriateness of any afforestation scheme.

Market reform incentives pose a large and complex set of issues that government agencies can mediate to some extent, although it depends on the circumstance. Currently the sale and market of timber, for a variety of uses, is mediated by government but generally determined by a global marketplace. In order for people to invest in some sort of sustainable afforestation program (with a timber product at the end of rotation), price and market activity needs to be available and somewhat predictable. The uncertainty over future markets poses a large risk for landowners thinking of afforestation and market support by government could help reduce that risk.

Extension and education incentives are a necessary part of most afforestation programs. Through extension services, government can provide information and education on land management practices that will improve carbon sequestration and that will enhance the potential for afforestation on agricultural land. Education services can be provided in a number of ways: on-the-ground training in afforestation techniques for landowners, growers manuals, site preparation manuals, and business case studies.

Research and development incentives include government funding for research on new tree species, genetically improved tree species for a particular region, developing new agroforestry techniques, or developing herbicide, pesticide and fertilization techniques to enhance productivity. A significant challenge in afforestation on the prairies will be the long rotation periods, even for hybrid poplar, and research and development work to improve tree productivity would help any afforestation program. Research and development funding can also be placed in projects that improve the efficiency of harvesting and production and that look for new end uses for afforested timber.

There are some agencies that encourage afforestation and other carbon sequestration options on a voluntary basis (e.g. PFRA's shelterbelt enhancement program) and this can be done on a rewards or small subsidy basis. Carbon offset project have worked in many regions (Dixon et al. 1993) and include the establishment of agroforestry programs

in developing countries and the planting of tree on private land with private funds in the United States and Canada.

Key decision-making factors

The matching of appropriate policy tools, and in the right combination, will necessarily depend upon the nature of the desired program, the intended outcome (e.g. number of acres planted across the prairies), legal issues, and previously held relationships between government, its agencies, and private landowners. There are several key characteristics (see Table 3) of carbon sequestration practices (all relevant and applicable to afforestation specifically) that influence the decisions made by both government and private landowners (Richards et al. 1997). (Each of these issues also came up in the workshops.)

Table 3: Key decision-making factors of carbon sequestration practices

Risk	Timing of carbon uptake
	Capital intensity
	Market risk
	Natural risk
Difficulty of measurement	Need for/ease of establishing a baseline
	Cost of measuring on-site carbon
Importance of discretion	Variability of application
	Potential for innovation in practices

Source: after Richards et al. 1997

The risk of investment is a large factor affecting whether an individual landowner decides to afforest private land. Four aspects of the risk presented by carbon sequestration practices are presented in Table 3. The first aspect relates to the timing of carbon uptake that results from afforestation. Carbon uptake associated with afforestation can spread over several decades, or longer for some tree species, and the financial rewards associated with this are consequently spread out over that time period or come at the end of tree maturity. More immediate rewards from carbon uptake would come from the preservation of existing tree stands, or in shorter term agricultural carbon sequestration strategies. There is a large risk present for the landowner with the long period of time associated with carbon uptake; payments from a program or even the program itself could be dismantled or discontinued.

The capital intensity of afforestation is also a significant factor in the overall risk of investment. Whereas the capital intensity of less permanent carbon sequestration activities such as fire control, or low impact logging is lower, the cost of establishment for afforestation is high and the cost of reversing the decision (i.e. returning the land to agricultural uses) is also high. The adds to the risk of investment. Most private landowners of concern to this research are farmers and are more adjusted to making land use decisions on an annual or biannual basis as opposed to decades.

Market risk is also a key determinant of the overall risk of the carbon sequestration investment. The projection of market prices for timber is more feasible over the short term period and works well for short term rotations, but large scale afforestation is more difficult if landowners are uncertain about long-term timber prices and demand (Richards et al. 1997). One solution to this is the development of more markets for timber and for

multifunctional accounting of carbon benefits (e.g. carbon credits, timber sales, agroforestry, agri-tourism, green energy). Again the projection of markets in energy, tourism, or carbon trading is difficult but the risk can be spread between options.

The risk of natural loss also increases the investment risk. Fire, insect, and disease outbreaks in planted forest pose a large risk because of the large investment required for establishment and the delay in receiving financial benefit from tree rotation. The risk in concentrated and spread over a time when the financial returns are minimal.

The difficulty of measuring carbon sequestration benefits, and the difficulty with establishing firm guidelines for measurement, is a further decision-making risk for landowners. Perhaps the greatest difficulty in measuring the effects of carbon sequestration activity is establishing baseline or reference cases. The construction of baseline measure involves substantial speculation about the biological and social/economic factors affecting carbon sequestration practice. The sequestration potential of marginal or productive agricultural land must be compared to afforested land and the carbon emissions as a result of tree establishment discounted. Additionally, a cost/benefit analysis for other land uses, other than planting trees, should be done.

Measurement difficulties also arise when accounting for on-site carbon after afforestation has begun. There are different models available that give a rough approximation, but differences in land quality and management practices will greatly affect individual sites. If landowners are interested in carbon trading with other private business or with government, then a reliable measurement tool will have to be developed.

There are also important discretionary factors in decision-making around afforestation practices. Because afforestation practices are not well established, as compared to common agricultural commodities, there are many variabilities in management practice and many new techniques not familiar to most landowners. Most afforestation practices require significant technical expertise, site-specific knowledge and discretion in application. The potential for managerial innovation and marketing innovation by private landowners is high, however, and offer the potential that early adopters of afforestation schemes may develop lucrative markets and take advantage of speculative market pricing in the early stages of marketplace development.

The economics of afforestation for carbon sequestration on the prairies

van Kooten et al. (2000), Plantinga and Mauldin (2001) and van Kooten (2000a) have investigated the economic feasibility of planting trees on agricultural land, through afforestation programs, in western Canada. These studies examine afforestation on marginal land and use various economic models to show the cost of CO_2 mitigation through afforestation, and the probability of successful afforestation programs based on the feasibility.

The basic inputs to economic analyses are economic data on the costs of afforestation and biological data on carbon conversion of trees. Costs include land acquisition, stand establishment, maintenance and carbon conversion rates reflecting land productivity, tree species composition, and previous land uses. From this, the average cost per unit of carbon sequestered can be found. In an early study Sedjo and Solomon (1989) estimate the cost of offsetting 0.8 gigatons of carbon per year through tree planting in temperate forest regions was about $15 per metric ton. Moulton and Richards (1990) have conducted a more detailed study in different regions of the U.S. and found that carbon sequestration costs, when planting trees, ranges from $8.50 per metric ton in

pasture regions of the southern plains to $41 per metric ton when planting on cropland in the cornbelt. The cost variation includes many factors, notably land rental rates.

The modeling of afforestation costs improves when endogenous costs are included. The cost of enrolling land in an afforestation program is a large variability, and will likely increase as more land is enrolled. Parks and Hardie (1995) have conducted a thorough analysis that include some of these endogenous costs. The rise of agricultural commodity prices, as agricultural land is converted to trees, is a possibility as is the rise in land rental values, tree establishment costs, and the opportunity costs as a result. The success of a particular afforestation program will have an iterative effect on the costs of carbon sequestration and affect the range of cost estimates. Parks and Hardie estimate that with low levels of enrollment in an afforestation program the costs would be similar to those found by Moulton and Richards (1990) and with high levels of enrollment the cost range would be 50% higher.

Programs that permit the harvesting of timber on enrolled land will alter the cost estimates. Enrollment costs may be lower because landowners receive revenue from the sale of timber which reduces the amount of compensation they require divert land from agricultural uses (Plantinga and Mauldin 2000). Approximately 60% of carbon stored in the merchantable portion of trees is converted to CO_2 during harvesting, however, with the rest remaining sequestered for long periods of time in solid wood products and land fills. The net effect of timber harvesting may be to reduce sequestration costs in some regions and increase them in others (Plantinga et al. 1999).

Plantinga and Mauldin (2000) present evidence that landowners are reluctant to shift land into forest and slow to respond to changes in the relative net returns to forestry. An important issue is the irreversibility of the afforestation decision coupled with uncertainty about future net returns. Econometric models can capture these effects with data on observed landowner behaviour. Plantinga and Mauldin examine three US regions utilizing an econometric model to track carbon sequestration costs given this observed landowner behaviour (risk aberrant). Their cost estimates per ton of carbon sequestered vary depending on region but are higher than previous studies. Incorporating endogenous costs such as rising land values, shifts in land use as a result of future climate change, and changes in commodity prices for agricultural products all generally tend to drive the cost of carbon sequestration up. The exception may be climate change variables, in some regions, whereby it becomes more feasible to convert agricultural land to forest activities as a result of temperature and precipitation changes.

van Kooten (2000) studies the economic dynamics of afforestation in northern British Columbia and northern Alberta using ground truthed data from the region. The identification of marginal land is done using Statistics Canada data and from this the econometric model shows that, for a cost of $20 per metric ton of carbon sequestered, it would be optimal to afforest as much as 50% of the identified marginal agricultural land. This estimate is done using large plantations of hybrid poplar and assuming that many costs (e.g. agricultural commodity price, land prices, etc.) are exogenous. With these assumptions van Kooten estimates that roughly 25% of Canada's Kyoto commitment could be met with afforestation in the study region annually. When the result is extended, hypothetically, to the rest of available marginal agricultural land in Canada, 50-60% of Canada's annual Kyoto commitment could be met through afforestation policies. This is the most optimistic scenario and does ignore many real aspects of afforestation over time.

In order to keep the costs of carbon uptake at a reasonable level, large areas cannot be afforested all at once. Based on rising planting costs, van Kooten (2000) estimates that 200,000 hectares or less, across Canada, could be planted in the initial years of an afforestation program, and would decline over time. This means that by the compliance period, only 15% of Canada's Kyoto commitment could be met by afforestation across all of Canada. Second, there are many unknown environmental costs that could be associated with planting large monocultures of hybrid poplar on a large scale. These include the potential loss of wildlife habitat, especially on non-cultivated agricultural land, and loss of scenic amenities (this could also occur in reverse, depending on the initial conditions of agricultural land), disease outbreaks and the risk of fire.

The difficulty in making an accurate assessment of the economic costs and benefits of afforestation relate to the unknown factors in establishing hybrid poplar (or other species) on a large scale, on existing private land. Establishing the proper incentives for landowners to grow trees (as per this research) will be an iterative process. The outright purchase of agricultural land will be infeasible because of budget limitations (van Kooten 2000) and contracting between landowners and government authorities will not necessarily be consistent or cost predictable over an extended period of time. The cost of monitoring tree growth and carbon uptake will be costly, and there do not now exist institutions in the prairie provinces that monitor growth and yield. Finally, there is a great deal of uncertainty associated with planting hybrid poplar on a large scale because it has not been done previously. There is also uncertainty about the current and future prices for timber products and agricultural products. Thus, the speculation on timber profits is combined with speculation on opportunity costs.

Opportunity costs

The opportunity cost of afforestation schemes on private agricultural land refers to the loss of potential income from that land from agricultural production. This involves a number of factors, including the loss of income from current production, forgoing future market opportunities, and changes in resale or appraisal values of that land. A compounding factor is the length of time for afforested areas to mature, with figures of 12 to 25 years for hybrid poplar and even longer (up to 50 years for other slow growing tree species). Agricultural producers currently deal with production cycles of one or two or three years at the most, and the predication of market prices is not usually done in any quantifiable way beyond an annual basis. Afforestation requires the adoption of a completely different risk assessment approach.

There is very little supporting evidence to make accurate opportunity cost predictions. There is an on-going body of work in estimating the environmental cost of afforestation projects in developing countries, and some attention paid to the opportunity costs. Grainger (1997) outlines basic principles of opportunity cost estimation and the major factors to consider in afforestation schemes in this regard. When estimating the opportunity cost there are five important factors to consider: 1) income lost from agricultural production, 2) the contribution this income makes to national economic development, 3) the specific contribution this income makes to the economy of the region, 4) the opportunity cost (benefit) of not overworking agricultural land and of soil rebuilding properties of afforestation, and 5) the income and developmental benefits from the afforested land.

Given these five factors, the opportunity cost of afforestation becomes a challenging accounting process as there are both costs and benefits to afforestation and not all are realizable in the initial stages. Some of the costs (and benefits) affect regions,

provinces, and national level economies and this accounting is very contingent on the temporal and spatial factors in any afforestation scheme.

The decision to plant trees

Farmers' attitudes towards trees are well studied. British research (Sidwell 1989, Scambler 1989) has examined why farmers value (or not) trees and the decision-making factors involved in deciding whether to remove or retain trees on agricultural land. The studies specifically examine behavioural or attitudinal approaches to trees and group these based on socio-economic or cultural characteristics. New Zealand literature follows much the same pattern (Fairweather 1996) although some of this literature is slightly dated. This research consists mainly of survey analyses and examines reasons for planting trees with a ranking system. Fairweather (1996) has built upon this research and developed decision-making trees that model the factors considered when deciding to plant trees on private land. This research is in the New Zealand context, but provides relevant reference for this study.

Fairweather's (1996) decision trees indicate that economic assessments were important in all decisions even if the assessments of the long-term returns from forestry were either positive or negative. Aesthetic or environmental values do not compensate for economic feasibility in the short term, nor do long term return on investment potentials. Earlier studies have found that non-economic factors were important in farmers' decisions to plant trees, although it was reported that a lack of money was a major constraint to planting. Fairweather's study is useful in its explicit examination of the economic aspects of decision making in this regard. The study also highlights constraints that prevented farmers who were favourably disposed to forestry from planting trees. These were: 1) need for immediate cash return because of cash flow issues, 2) lack of time and, 3) lack of money for establishment of trees. Forestry joint ventures and partnership arrangements may be able to address the last two issues, but the return on investment (and possibly the high cost of tree establishment) needs to be addressed with a financial incentive scheme.

Results

Introduction

The focus group results are presented in the subsequent tables and discussion. As outlined in the research methodology, the focus group process and guiding methodology was the same for each of seven focus groups in three provinces. The following seven tables, for each focus group, were compiled using field notes, the facilitator's working notes, and supporting audio recordings. Each topic is supported with summarized detail found during the session. Notes are provided to support the detail statements; these notes are paraphrased statements and discussion from the workshop and have been summarized and amalgamated where repetition occurred. Some direct quotes have been indicated with quotation marks. Both the paraphrased comments and direct quotes have been included to best represent the nature of the focus group sessions and for the report audience to examine closely the discussion content. The topics and details are then summarized thematically; these themes are the main research findings from this study.

Focus Group #1

Location: La Broquerie, Manitoba		
Topic	**Detail**	Notes
Benefits	Shelter belt provisions	***Wider shelterbelts are a good idea***
	Better utilization of wetter land	***Unsuitable soil types could support trees***
	Buffer formation, wildlife corridors	***Wildlife habitat will improve the diversity at a regional scale.***
	Control of erosion	
	Wind protection	
	Income benefits from sale of timber	***Land can produce better biomass***
	Riparian zone protection and enhancement	
	Diversification of income	***Tree cuttings could be sold***
	Small acreage area utilization	***Corners of fields, near fencerows, around buildings and other properties.***
	Moisture retention	
	Personal benefits	***Self-satisfaction knowing that you are contributing to the environment***
	Future opportunities for integration with agriculture	***Tree production could be integrated with manure management plans from hog operations in the southern part of the province.***
Drawbacks	Defining marginal land	***How some agencies evaluate marginal land is outdated given new agricultural opportunities***
	Potential loss of land to landowner	
	Lack of current tax breaks	
	High risk speculation on future wood sales	***Value of hybrid poplar?***
	Long term cycle for afforestation	***You are locked in for the life of the crop***
	Technical requirements	***Planting and establishment are big challenges***

	Economic uncertainties	***The economics of afforestation on private land is critical to its success and there is not enough of an economic picture to make decisions yet.***
	Livestock versus crop land	***Most land in this area is livestock-based and will put pressure on marginal land for pasture; trees and livestock are not compatible***
	Wildlife increase/damage	Increase livestock/pest habitat
	Labour intensive production	
	Urban rural confrontation	***Planting trees in rural areas to sequester urban carbon emissions; the farmer is saddled with management again.***
Barriers/Challenges	Regional differences in land evaluations	
	Amenity value of afforested land may attract urban dwellers	***An influx of urban residents would change the culture/nature of rural areas***
	Attitude change required	***Changing the nature of what it means to be a farmer***
	Uncertain future markets is a barrier	***Requires a different management scheme for each end use***
	Technical barriers to afforestation; planting, establishment, etc.	
	Suspicion of both government programs and environmental causes is a challenge	
	Program participation is a big challenge	***A program's success will turn on the number of participants or the number of acres, so it has to be economically viable and widely adopted.***
	Public education at different levels	
	Program must be politically recognized and long-term	***Government investment must be long term and not on political whim***
	Potential / scientific uncertainties	***We need an assessment of the value of trees versus the value of alfalfa or other forages crops for CO2 sequestration.***
	Insurance programs not available.	***There would have to be some sort of insurance scheme to cover the risks, including fire, of this long term investment.***
Small scale	Conservation type planting	***Small scale versus large scale afforestation is a bit unclear – you should call it conservation-oriented afforestation versus commercially-oriented afforestation***
	Need for cash incentives	
	Technical requirements for establishment	***Start-up and maintenance will require equipment, education, labour components that should be a part of an incentives package***

	'Program milkers'	***'Program milkers' are people who would take advantage of any financial incentives and not really do the work.***
	Need for inspectors	
	Municipal – federal relations	***If this is a federal program, a rebate would be a better incentives so taxes don't come out of municipal pockets.***
Large scale	Loss of flexibility	***Treating trees as a crop, but with long-term cycles***
	Contract growing possibility	***Lease/pre purchase of trees, CRP program as an example.***
	Risk assessment	***Cannot predict far enough ahead to sign long-term contracts – e.g. future timber markets / Russia hasn't signed Kyoto***
	Partnering possibilities	***Getting investors to put up money (partner) with farmers to plant trees - $ for cuttings / weed control / land rental***
	Establishment costs are high	***~$500 / acre to get trees established, ~$350/400 / acre in the first year (this is a big disincentive)***
	Opportunity cost	***Figures and estimates vary depending on the region, previous use of land, quality of soil, climate change, etc.*** ***In this area it could be around $20+/acre for pasture, $80/acre for alfalfa, Steinbach area would be $40-60/acre no matter the crop.*** ***For grazing land, the price per acre depends on the price of cattle.***
	Location for success	***You will have to choose the right land to see results – not just any land will support trees.***
	Other tree species	***Planting for neutracueticals, high value tree products (e.g. sea buckthorn)***
	Landowner / program arrangements	1. ***straight rental*** 2. ***forward contracts (different rates)*** 3. ***sharing of costs all the way through*** 4. ***speculation only (no cost sharing)*** ***(can't see one program type fitting everybody)*** ***(sharing of risks and benefits will filter out the people that aren't serious)***
	RRSP model	***One idea would be to use this program as a way to help retiring farmers put their land to a longer term use that requires less labour and would provide income over time during their retirement years.***

Focus Group #2

Location: Brandon, Manitoba		
Topic	**Detail**	Notes
Benefits	Erosion control, water and snow retention	***Rebuilding of soil in poor or marginal areas***
	Provision of wildlife habitat	***Potential shelter for domestic livestock***
	Increased value of land	
	Cash crop potential	
	Reduction of annual farming costs	***Annual inputs would be much less when amortized over the lifecycle of trees, compared to grain***
	Aesthetic value	
	Heat units	***Improved heat units for crops, retain soil temperatures***
	Transition program	***An afforestation program may provide a good transition from active farming for aging farmers***
	Resource development	***The development of a renewable resource base on the prairies***
	Local habitat diversity	
Drawbacks	Weed control	
	Labour requirements	
	Opportunity costs	***"taxes to be paid, land payments have to be met, input costs are high and all up front, stump clean up when it's all over", "is this a rich man's program?"***
	Fire and disease risks	
	Infrastructure	***Small machinery needed is not often available and not owned by farmers***
	Long term returns	***Banks are not favourable to provide financing for unknown returns, long term returns***
Barriers/Challenges	Information needs	***(see small and large scale needs)***
	Current thinking	***Grain farmer mentality, "what will the neighbours think"*** ***A lot of farmers are still trying hard to remove any trees***
	Government controls and regulation for a program	***Government involvement often leads to inefficient programs***
	Perception problems	***Perception that an afforestation program is coming from tree huggers***
	Insurance	***Lack of experience or programs by insurers***
	Site preparation	***Need adequate soil sampling and land preparation for trees***
	Education	***Education of farmers, education of other private landowners, education of Canadian public about the need***
	Financial return	***Unknown financial returns and economic benefits, need to show success stories, marketing is critical.***

	Time conflicts	***Trees often require establishment care at the same time as other farm crops – time conflicts***
	Incentive packages	***Financial incentives need to go down to the landowners and programs should not be 'top heavy'*** ***Inefficient programs often waste money, going to those who know how to use the system*** ***Cash flow throughout the life of the program?***
	Other tree species	***Need to consider best tree species for soil type, microclimate. Fruit trees may be better in some areas.***
	Loss of farmer control	***There are many conservation programs currently that remove control of private land from private landowners, deliberately. "We don't want this program to do that."***
	Establishment	***The science and economics of establishing hybrid poplar plantations are not well known as it has not been done consistently in Canada. CFS and PFRA simply do not have enough experience or replication to reduce the risk.***
Small scale	Information needs	***Growers manuals, establishment information, soil type information, machinery information, market information.***
	Financial incentives	***Financial incentives (e.g. per acre) to cover some costs in first three years of establishment.*** ***Possible tax benefit (land taxes)*** ***Give landowners some carbon credit options?***
	Program questions	***Who owns the trees at the end of their lifetime?*** ***Are there going to be trade/WTO issues with subsidies?*** ***Are there private/public partnership possibilities?*** ***What are other countries doing in this regard?*** ***What are private companies doing in this regard? (ALPAC is currently doing rental arrangements for afforestation right now)***
Large scale	Incentives	***Land owner must retain control of land - 'right of first refusal'*** ***Contracting on the value of trees (per tonne, etc.)*** ***(every point from small scale discussion applies to large scale discussion)***

	Cooperative arrangements	***3 or 4 farmers could get together with a quarter of land to share risks and costs.***
	Land requirements	***"You need good land for good trees" Marginal land would only work for conservation type afforestation and may not provide the carbon sequestration potential that a gov't program desires.***
	Location	***The location of tree plantations has to be amenable to maintenance and harvest The distance from potential markets is also an important factor***
	Opportunity cost	***Needs to be calculated, perhaps on a sliding time scale, for different regions of the prairies, and depends on soil type.***
	Marginal land definition	***The definition of marginal land really depends on current markets for agricultural products and it's very relative (i.e. DU, grain farmers, acreages, hunters, foresters have different perceptions of marginal land) Marginal land, in the true sense, may be too marginal for trees.***
	Types of arrangements	***A continuum of arrangements from the producer taking all risks and benefits from sale of timber, carbon credits, through cost sharing and benefit sharing, to government rental of land (e.g. CRP program in US).***
	Unknown factors	***What are the long-term effects of large hybrid poplar plantations on the ecosystems of the prairies? Is it similar to monocropping of cereals in N.America or oranges and bananas in tropical regions (e.g. vulnerable to disease, drought)?***

Focus Group #3

Location: Dauphin, Manitoba		
Topic	**Detail**	Notes
Benefits	Ecosystem benefits	***Improvement of soil control, moisture retention, water quality, wind erosion, snow retention*** ***Act as natural filters for nutrients and run-off*** ***Habitat for insects, birds, wildlife*** ***Less chemicals used on the land? (depends on establishment methods)***
	Provision of shelterbelts	
	Income potential	
	Care of marginal land	***Neighbours are appreciative of marginal land care because of noxious weeds, etc.***
	Diversification of income	***Less vulnerable to markets for agricultural products***
	Reduction of chemical inputs to land	
Drawbacks	Opportunity cost	***Taking productive land out of revenue generation (short term)***
	Maintenance and establishment costs and labour	
	Harvesting efforts and costs	***Who will be able to do the harvesting?, especially if many participants are doing it at once.***
	Weed control	***High costs and labour required***
	Habitat	***Pest and weed propagation***
	Management	***Management on a large scale is going to be a nightmare and will have to be well organized (program delivery will have to drastically improve over current and previous programs)***
	Infrastructure	***Most large farmers would not have any of the appropriate equipment for planting trees***
	Biodiversity	***Monoculture plantings of hybrid poplar will not increase biodiversity***
Barriers/Challenges	Lack of information	
	Perception of 'farmers, farming'	***Many landowners are very entrenched in their ways*** ***Many farmers also think that trees are a nuisance and knock them down whenever possible.***
	Program coordination	***Lack of coordination between government people and producers, delivery agents are not good.***
	Transparency	***Need to have cost-benefit transparency in terms of sustainability (financial, environmental, etc.)***

	Country benefits, producer pays	***Trees may not meet the economy of scale needed for each landowner to make a profit (grain farmers currently operate on a very large economy of scale)***
	Education	***Sell the benefits of afforestation to the general public***
	Planting schemes	***Are we looking for a mature working forest with a complete stage cycle in one area, or we looking at it like a crop?***
	Incentives	***Tax relief or tax credit for grain farmers to plant corners or fields, near riparian or irregularly shaped areas***
Small scale	Information needs	***Machinery needed and machinery available?*** ***How many participants would a successful program need?*** ***How to establish small scale plantings (e.g. landscape design, weed control, maintenance, mortality rates)?*** ***Which trees would be most suitable for various soil types?***
	Alternative focus for afforestation schemes	***Look at municipal land and land within conservation districts that is not being used (e.g. examine road allowances for afforestation)*** ***Examine PFRA areas for planting (e.g. community pasture areas, government leased land)***
Large scale	Information needs	***Similar to small scale program needs but to a much greater extent*** ***-establishment costs*** ***-weed control, maintenance requirements*** ***-landscape design*** ***-sourcing of trees*** ***-business plans for successful operations*** ***-infrastructure requirements***
	Incentives and assistance	***Have to have an economically viable program (e.g. compete with cereal crops or cattle, etc.)***
	Marginal land	***Is it large scale on marginal land? – probably need good land for large scale production or the risk assessment is too high***
	Infrastructure needs	***A large planning infrastructure to support large scale afforestation schemes will be needed – this will have to be developed over time.***
	Economic planning	***"The numbers have to pencil out for anyone to seriously consider putting a lot of land into trees."***

	Carbon credits	***The ultimate role and value of carbon credits needs to be determined. This may have a role in decisions to afforest land and will affect the return on investment.***
	Opportunity cost	***Valuing of land will be difficult – it varies region to region.***
	Intergenerational issues	***What happens to the land when it is sold?*** ***There could be an option for inheriting afforestation agreements, but don't want caveats on the land.***
	Perception issues	***Public perception of afforestation will have to be improved with education, perception by landowners will have to change from 'tree hugger program', and rural/urban conflicts will have to be minimized.***
	Early innovators	***Any large scale attempt at afforestation across the prairies will have to go beyond targeting the early innovators.***

Focus Group #4

Location: Yorkton, Saskatchewan		
Topic	**Detail**	Notes
Benefits	Ecosystem benefits	***Shelter for livestock, land, wildlife*** ***Erosion control*** ***Water and snowmelt retention*** ***Marginal farm land can be kept covered and the soil protected.***
	Kyoto benefits	***Carbon sequestration***
	New income source	
	Soil building properties	***Marginal land can be stabilized and covered and soil rebuilding can occur with the right management scheme.***
	Structural diversification	***Farm-level diversification of income sources***
	Regional benefits	***Long term investment is good for the region as a whole.***
	Generational benefits	***Future generations will benefit from increase biodiversity and treed landscape.***
Drawbacks	Sustainability aspect	***How much fossil fuel energy is required to establish a plantation? "Does it really provide an overall benefit to the environment or are we taking from one hand to feed the other?"***
	Labour intensive	***Manual labour required for establishment, especially for small scale plantations.***
	Operational issues with large grain farms	***Trees are often cleared for equipment access and turnaround space.***
	Lack of short term income	
	Rotational time frame	***Hybrid poplar in this region of Saskatchewan takes at least 20 years (20-30 years normally) to reach maturity.***
Barriers/Challenges	Information needs	***All growing and maintenance information is needed (analogous to growers manuals for certain crops).*** ***Harvesting information*** ***End-use information*** ***Agronomic and technical aspects of growing hybrid poplar are not well known.*** ***Cross-jurisdictional issues with government research on these aspects – there is not much information sharing or awareness of one another's programs.***
	Cost of establishment	
	Market speculation / risk assessment	***Pricing and demand for timber products in the future is unknown.*** ***Carbon sinks may have speculative value in the future.***

	Establishment costs	***First three or five years require high input costs.***
	Return on investment (ROI)	***The length of time for ROI is long and not normal business practice for most private landowners.***
	Critical size of plantation	***In order to be feasible to harvest and plant at an efficient economy of scale, a certain size of plantation will have to be established.*** ***Large contractors will only harvest large acreages of trees.***
	Rotation systems / management needs	***Appropriate rotation systems for trees and best management practices will have to be established.***
	Locational challenges	***Deciding on which tree species is most appropriate for which area and which soil type is important. Relative location to future markets, future harvesting and processing infrastructure, is also important.***
	Opportunity costs	***Setting appropriate compensation or incentive schemes based upon opportunity costs will be necessary. Some combination of this with carbon credit valuation would also be possible.***
	Falldown effect	***Second generation of trees will probably only be good for minimal pulp (i.e. hybrid poplar is not necessarily part of a working forest scheme).***
	Crop comparison	***Carbon sink potential of a unit of hybrid poplar versus a unit of canola or a unit of alfalfa?***
Small scale	Lack of equipment, infrastructure	***Especially for small landholders and hobby farmers***
	Establishment time and costs	***You need to fallow for 2-3 years to prepare soil for trees.***
	Information needs	***Similar to those mentioned in challenges.*** ***Weed control issues – mulching on small acreages versus spraying or tilling on large acreages.*** ***Tree varieties and selection is critical and dependant on soil type and microclimate.*** ***Best practice information for weed control is needed.***
	Good soil, good trees	***If you can't grow crops on a piece of land, trees won't grow either.***
	Herbicide licensing	***Agricultural license for herbicide is different than a license for use on trees.***
	Valuing conservation land	***There currently is no compensation for set aside land, no tax incentives for land conservation.***

	Education needs	***Need an awareness program to educate landowners about forestry, marketing, logging, reforestation, afforestation, etc.***
Large scale	Information needs	***Similar to the above categories.*** ***-machinery requirements*** ***-market niches, demands in the future.*** ***-carbon credit accounting*** ***Need good business plans for different size operations.***
	Economics	***Case studies and successful business plans will have to be made available.*** ***If the economics work out, than many people would adopt an afforestation program on their land.***
	Financial incentives	***Have to be as good as cash rent (opportunity costs)*** ***Wary of financial incentives that are not properly developed or delivered (a few large producers get a lot of assistance because they can access/leverage programs and many small land owners get nothing).*** ***It's possible that carbon credits could become quite valuable and provide a viable means and incentive for financing afforestation on private land – this would push afforestation away from government programming.***
	Insurance needs	***Insurance schemes for tree crops is needed.***
	Possible market ideas	***Scandinavian example of selling standing wood at auction- this idea may work here as there is sure to be demand for wood in the future. (helps eliminate some harvesting risk and uncertainty)***
	Regional approach	***Groups of farmers, in a cooperative manner, could plant large acreages, thereby providing the economy of scale to bring in planting and harvesting infrastructure.***

Focus Group #5

Location: Saskatoon, Saskatchewan		
Topic	**Detail**	Notes
Benefits	Ecosystem benefits	***Protection from wind and water erosion. Snow retention and increased snowmelt benefit to soil. Habitat provision for wildlife and domestic livestock***
	New income source	***Financial return for carbon credits or through incentives packages.***
	Farm diversification	***New income sources from afforestation, potential for eco or agri tourism through afforestation.***
	Aesthetic value	***Improving land values through the improvement of aesthetics.***
	Soil husbandry tool	
	Regional development and economies	***Improves the economic outlook of whole regions if plantations are successful and adopted on a large enough scale.***
	Marginal or abandoned land solution	***Excellent opportunity to provide long-term care for marginal land areas.***
	Water quality	***Natural filter system; could provide good benefit for hog barns and other intensive livestock operations.***
	RRSP type potential	***Long term income source may provide some intergenerational transition solutions and or retirement solutions. Allows farmers to do some long-term planning which they cannot do a the moment.***
	Reduced input costs	***Amortized over lifecycle of trees.***
Drawbacks	Over regulation	***Too much government control on a program could turn people off.***
	Nuisance wildlife habitat	
	Establishment costs	***The first three or five years of input cost are quite prohibitive for most people.***
	Long term return on investment (ROI)	***Long term realization of income will deter many people – too risky.***
	Disease / fire outbreaks	***Insurance will have to cover this and new programs would have to be developed.***
	Liability issues	***Who owns the below-ground carbon? Who owns the carbon credits? What happens if the program fails, or if the trees become diseased or infested with pests (monoculture risks)?***
	Taxes	***Need to reduce taxes as incentive***
	Labour inputs	***High manual labour requirements***
	Infrastructure limitations	***Small machinery and specialized machinery is not readily available and not owned by many landowners.***

	Financial and mental burn out	***Making land and mortgage payments, off farm jobs – many do not have the means or energy to break the income cycle.***
Barriers/Challenges	Byproduct use	***Ethanol or hog fuel plants could use thinnings, etc.***
	Information needs	***Need more information to make concrete decisions*** ***-market information*** ***-grower information*** ***-don't want to 'reinvent the wheel', so case studies and success stories are necessary*** ***-identify partners (private sector) who could help manage an afforestation program*** ***-information packages should encourage those that are not just the innovators (get broad support)***
	Establishment challenges	***Costs and knowledge about tree establishment are a big barrier and challenge to those interested in afforestation.*** ***"You're assured the work, but not the income."***
	Opportunity costs	***The numbers given different agricultural production schemes have to be established. These vary quite a bit by region and microclimate.***
	Polyculture	***Polyculture instead of monoculture hybrid poplar? – is our goal a mature working forest for carbon sequestration?***
	Long term commitment from government	***Commitment has to match the life cycle of trees and not just political term.***
	Marketing	***Individually, cooperatively, determination of end use will affect management strategy and selection of tree species.***
	Knowledge accumulation	***We need a method of collecting information that is beyond the traditional academic or government formats. There are many people on the prairies right now that have afforestation experience and we need to get their stories.***
	Carbon sinks	***The value of carbon sinks should be well established so that any economic opportunities are best realized.*** ***Role of private business in the buying or selling of carbon credits is also important – need to clarify their potential role.***
	Value of carbon sinks	***Need to distinguish (quantitatively) the difference between forage as carbon sink and trees as carbon sink – also the carbon emissions from cutting trees versus the emissions from summerfallowing or cutting crops.***

Small scale	Information needs	***Where to get stock*** ***How to establish a planting*** ***How to space trees*** ***How to control weeds*** ***Maintenance over time*** ***Different options available depending on species, size of plantation, etc.*** ***'Growers guides' would be a good initiative***
	Incentive options	***Free trees, carbon credit options, sharing of establishment costs, profit sharing on harvesting.***
	Partnership opportunities	***With conservation groups, with private forestry businesses, community organizations that want to plants trees, schools and educational institutions, etc.***
	Role of agriculture representatives	***Ag. Reps. could link up and down with farmers and delivery agents***
	Role of economic benefits	***For small scale or conservation type planting, many participants would participate based on break-even finances and rely more upon the less tangible benefits of afforestation.***
	Scaling up of efforts	***It may be difficult to get enough small scale or conservation type plantations on marginal land to provide enough acres to satisfy the goals of the program or of Kyoto. Large scale plantation on good quality soil would be needed.***
Large scale	Environmental farm plans (Agriculture Policy Framework)	***Would a potential afforestation program tie in with EFPs that are going to be mandatory soon?***
	Sharing or risks	***Landowners must have some risks (financially) if the program is to succeed or else you will get 'program milkers'. Incentive packages must assist participants but not provide free services or income.***
	Information needs	***Similar to small scale needs*** ***-need even more marketing information.***
	Land owner commitment	***This commitment is critical to the success of the program – can't have people pulling out after five years.***
	Progressive planting options	***Planting 10-20 acres per year would help spread costs and risks over time.***
	Case studies	***We need to see how people have done this successfully (or not) previously.***
	Social utility and responsibility	***ROI may not be until the next generation but that is a good argument for this type of program (improve the sustainability of agriculture).***

	Opportunity cost	***Many areas of Saskatchewan would have opportunity costs of $20-25/acre because of the agricultural situation. You can't make that number universal however.*** ***One idea would be to eliminate the quote per acre for opportunity costs and give a quote per land type or quote per growth unit and have this assessed and re-evaluated every five years.*** ***"But this will not cover the cost of establishment ($1000-1200/acre) in the first years."***

Focus Group #6

Location: Athabasca, Alberta		
Topic	**Detail**	Notes
Benefits	Diversification of farm operations	***Income diversification, diversification of planning horizons, crop diversification***
	Increase in land values	***Aesthetic role of trees would increase land value.***
	Ecosystem benefits	***Soil protection, water protection, wind and erosion control*** ***Improvement of water sources*** ***Soil building properties of trees***
	Possibility for retirement income	***Timber harvest income***
	Possibility for steady income	***If a program is set up for annual financial incentives***
	Transitional strategy	***Keeping land within farm families is tough, and this program may provide a means to do that.***
	Employment	***Local employment possibilities for maintenance***
Drawbacks	Return on investment (ROI) timeframe	***Long term ROI is a hindrance to many landowners with immediate cash flow needs***
	Land use conflicts Land owner attitudes	***Traditionally farmers have been knocking trees down, draining swamps, etc. This type of program flies in the face of many perspectives.*** ***"My grandfather cleared this land and I'm not putting a tree back on it."***
	High cost of establishment	
	Weed control	
	Fire and disease risk	***Especially from hybrid poplar plantations that are effectively a monoculture crop.***
	Tax issues	***Tax assessment on woodland is higher now and would have to be adapted for incentive purposes.*** ***There could be an amortization of income tax for harvested product over the preceding growth years.*** ***A need for a capital gains exemption for intergenerational transfer.***
	Long term leases on land	***Long term leases (20-30-40 years) often have unexpected drawbacks (e.g. road allowances in land that would get developed, change in gov't policy, etc.).***
Barriers/Challenges	Timeframe	***The long cycle of hybrid poplar (15-20 years) and subsequent ROI is a challenge because of cash flow issues.***
	Financial incentives	***Tax relief programs*** ***Monetary compensation for establishment costs.***

	Regulatory roles	***Municipal versus provincial or federal regulatory roles?***
	Rights of other land users	***It's important to consider the rights of other land users such as oil and gas industry, mining, etc.***
	Regulatory uncertainty	***The direction and ratification of Kyoto is still unknown, the role of US policy with respect to climate change may be an important factor.*** ***Uncertainty of the project (if and how long it will continue) is a big barrier for adoption of afforestation).***
	Need for more information	***Need information about growing trees, marketing, etc.***
	Need for regional differentiation of program	***One size fits all type of program will not work across the prairies.***
	Ownership of carbon credits	***Above ground and below ground carbon?***
	Lack of appropriate research	***There is no good research available on woodlot management with afforestation as a crop (i.e. hybrid poplar).*** ***Need some best management practices.***
	Markets	***A lot of the market control in forestry (as in beef and grain) is not in the hands of producers – afforestation could be another form of dependency on large market players.***
	Integrating industries	***Traditionally forestry and agriculture have been very separate – we are trying to blend or amalgamate the two industries and this could have institutional and developmental problems (and perception problems).***
Small scale	Species available?	***Are there options besides hybrid poplar for both small and large plantations – species that may be more appropriate for soil type?***
	Site preparation and tree establishment	***The ground would have to be prepared and left fallow / weed free for a couple of year before planting. Planting and maintenance requirements would also have to be provided to program participants.***
	Aggregation of small areas	***Will it be possible to add small plantations and even shelterbelts or windbreaks together when counting carbon sequestration acres?***
	Information needs	***Soil type information, management schemes, weed control and establishment practices (best practices or growers manuals), markets for small volumes, business planning scenarios for both small and large scale plantations.***

	Financial incentives	***Cost sharing for establishment period***
	Contract arrangements	***Long term leasing of land by government, program enrollment with incentives paid out over a number of years, contracts must be established with the tree life cycles in mind.***
	Infrastructure and technical assistance	***Machinery requirements need to be known, sourcing assistance would be beneficial. Technical assistance in the development of appropriate fencing strategies, site preparation, etc.***
Large scale	Fire protection / insurance provision	***It will be necessary to have fire protection equipment and insurance policies because of the huge investment and high risk.***
	Information needs	***Similar to small scale, but to a greater extent.*** ***Need to know all silviculture information. One idea would be the development of growers manuals and business planning or best practices manuals for interested participants.***
	Incentive and assistance packages	***Assistance could come in the form of site assessments, soil testing, etc.*** ***Incentives would be both informational and financial.*** ***Financial incentives would include cost sharing packages during establishment (covering opportunity costs) and tax relief or rebate programs.***
	Carbon credit accounting	***The value and potential of carbon credits needs to be better established so that landowners can factor this into decision making.***
	Polyculture possibilities	***Monoculture versus polyculture plantations? (Is this an option?)***
	Management arrangements	***Grower sell-back arrangements such as that of Alberta-Pacific (ALPAC)*** ***Long-term lease arrangements*** ***Landowner speculation***

Focus Group #7

Location: Peace River, Alberta		
Topic	**Detail**	Notes
Benefits	Reduction of input costs	***Once the cost of establishment is covered there is are considerably less input costs.***
	Ecosystem benefits	***Ecosystem integrity, wind and erosion protection, retention of snowmelt and spring runoff, wildlife habitat, increased biodiversity.***
	Recreational opportunities	***Cross-country skiing trails, summer use, etc.***
	Source of income	
	Good use for marginal land	***Doesn't grow crops*** ***Rocky land, soil quality is poor*** ***Little fields that equipment cannot turn around in*** ***Frost retention areas (early frosts in late summer, late spring frosts)***
	RRSP potential	***A source of retirement income, or income layaway.***
	Inter generational transfer	
	Increase in land value	***Through aesthetic improvements***
	Soil building properties of trees	***More productive forests and productive soils with the use of polycultures and companion planting. Some agroforestry initiatives are good examples.***
Drawbacks	Initial establishment costs	
	Infrastructure costs	***Small machinery is not readily available or owned.***
	Opportunity costs	***Need to be compensated for these through cash or tax incentives***
	Changes the nature of agriculture	***"Changing the face of agriculture on the prairies, changing what it means to be a farmer"*** ***"producing fibre and not food"***
	Increase in wildlife problems	
	Source of trees	***Is there going to be enough supply for a large scale problem?*** ***"How long will it take to ramp up the nurseries to supply this many trees?"***
	Return on investment	***The long time frame for ROI is not conducive to current management practices.***
	Labour intensive program	
Barriers/Challenges	Marginal land issues	***Marginal land can mean marginal trees*** ***Use of the term 'fragile land' may be a better option.***
	Climate change factors	***Many of these are unknown and will or can affect tree growth and establishment***

	Silviculture knowledge	***"it seems like forestry is 20 years behind agriculture in terms of agronomic (analogy) knowledge"***
	Public education	***There is a public mindset against hybrid trees, people think they are GMO, we therefore need education and awareness raising.***
	Incentives	***Need for financial incentives such as tax breaks and payment per year for establishment costs***
	Management plans	***Best practices manuals and business planning tools needed.***
	Risk sharing	***Need to find the right combination of risk sharing so that you get dedicated program participants.***
	Weed control, pest control, fire control	***These issues are major challenges and should be addressed with management planning.***
	End-use considerations	***Speculation on final markets is risky – what is the best approach?***
	Information needs	***A lot more information must be provided before anyone can make a firm commitment.*** ***-growers manuals*** ***-business plans*** ***-market information*** ***-Kyoto confirmation and information*** ***-carbon credit information***
	Trees versus forage	***What is value of hybrid poplar for carbon sequestration versus that of forage crops or other shrubs, cover crops, new species, etc?***
	Non-timber forest products (NTFPs)	***Is there a role for NTFPs in a polyculture or working forest? Can we add value to an afforestation scheme beyond just the value of trees for timber or carbon sequestration?***
	Partnerships	***Need to explore all of the possible partnership arrangements – with industry and with government.***
Small scale	Program flexibility	***This is a requirement as small scale or conservation planting will have very different site circumstances.***
	Information needs	***-site requirements*** ***-stalk and zone*** ***-species requirements*** ***-density*** ***-cost/benefit of particular species*** ***-best management practices*** ***-how to maintain stock (before planting)*** ***-weed control / pest control / wildlife management (e.g. growers manuals)*** ***-impact on adjacent agricultural land***
	First right of veto	***Need to retain control of private land***
	Tax breaks	***Land and income tax breaks or rebates***

	Economic planning	***The economic planning for small scale is much different than for large scale plantings (where profit is key)***
	Infrastructure support	***Some sort of assistance or cooperative development to obtain and utilize specialty equipment.***
Large scale	Joint venture idea	***Private landowners could act as managers over larger blocks of trees in conjunction with private business (e.g. ALPAC's afforestation program)***
	Information needs	***Same as small scale***
	Opportunity cost	***Needs to be financial incentives to cover the opportunity costs*** ***-minimum for grazing land in this area is $25/acre/year*** ***-central Alberta is still $50/acre/year*** ***-forage land in Alberta is $30/acre/year*** ***-need to be flexible with the rates***
	Complementary programs	***An afforestation program should complement other reforestation efforts, at least for public image reasons.***
	Management plans	***Need detailed and comprehensive management plans available to prospective program participants.*** ***-what land to use*** ***-how to prepare sites*** ***-secondary opportunities for trees*** ***-water proximity / requirements*** ***-soil / microclimate limitations***
	Practice change	***"Afforestation is being pushed because it is a practice change – agricultural land is already sequestering carbon, but the argument is that afforested land will sequester more carbon. In this case, carbon credit would be given on the difference."***

Thematic summary of results

Introduction

The preceding focus group results have been summarized and organized thematically below. Many comments and issues were raised repeatedly in the different sessions, providing a basis for the thematic approach. Following the focus group template design, the results are organized according to the potential benefits, the drawbacks, and the challenges and barriers to afforestation. The themes from the discussion of a small scale approach and a large scale approach follow these sections.

The tables above provide details and notes for each topic and quotes have been included where appropriate. The notes section is a summary of comments made during the participatory research and has been used to develop the themes below. These themes are the best way the research team was able to organize comments by category for this report. There is no weighting of themes nor is this possible based on the research methodology. The objective of the thematic approach is to provide background for the essential elements needed in a federal afforestation program. This is provided following the summary of results.

Benefits

Ecosystem benefits

The ecosystem benefits noted by the majority of the participants include the increase in biodiversity, the provision of windbreaks through the use of either shelterbelt or larger block planting, and the prevention of soil erosion with the stabilization properties of mature trees. A comment repeated by many participants from Saskatchewan was the potential for increased snow retention and reduction of wind speed with both large and small scale plantings.

Wildlife benefits would also come in the form of increased habitat for ungulates and bird species. The connection of existing and new treed areas would also provide wildlife corridors and increase migration habitat. It was also observed that there are some marginal or abandoned lands, often in very remote areas, or very close to urban areas, that would benefit from the weed control in a managed afforestation scheme. Currently these areas are sources for noxious weeds and require control.

Afforested areas can act as natural filters for nutrient run-off in riparian or fragile areas. The improvement of moisture content and improved soil fertility in a well managed plantation would also benefit soil quality in drier regions of the prairies (e.g. the “soil husbandry potential” of afforestation was noted in focus group 5 held in Saskatoon, SK). In addition, it was noted that there are probably microclimate benefits over the long term that would be difficult to quantify or predict. One of the most immediate benefits is carbon sequestration with both local and extended impacts.

Potential income benefits

Most participants at each focus group noted, with caution, that there is income potential, in the long term, with the harvest of afforested areas. Many participants observed that this potential income is a high risk investment because of the uncertainty with regard to future markets. The potential for an income based on carbon credits was also discussed at each focus group. It was noted that carbon trading has begun on both the Chicago and Winnipeg futures markets and that there would be some potential for annual income in this regard. Participants said that any afforestation program should account for carbon credits and find a way to provide returns to individual landowners.

The potential diversification of income sources, through afforestation, would also eliminate some of the variability in annual returns from more traditional commodity crops. The potential reduction of input costs, when compared to continued long term conventional agriculture, on good soil would also provide income benefits. A participant in focus group 5 made the linkage that, "afforestation on larger scales has the potential to improve the economies of whole regions." The improved property values, as a result of an increase in trees, were also noted in the majority of the sessions.

Inter-generational benefits

Many of the participants stated that afforestation initiatives have to recognize the average age (nearing 60 in most areas) of farmers across the prairies. Comments seemed to either emphasize the value of afforestation as a way of keeping land within families and providing a transition method from one generation to another, or emphasize the need for current young farmers to take advantage of afforestation programs because they are potentially the only ones that will see any income benefits from the sale of trees. Many participants expressed this idea in the form of an RRSP analogy; afforestation would provide retirement income for the current generation of farmers and maintain land ownership and income support for the upcoming generation.

Structural benefits (agriculture)

A good deal of discussion in the focus groups examined the potential changes to the current structure of the agricultural industry on the Canadian prairies. The changes are and will occur regardless of a particular afforestation initiative, but there was a lot of interest in afforestation as a potential mitigator of negative trends. In particular, the potential for increasing the stability of income is seen as one way to reduce vulnerability to commodity price cycles; the potential for carbon credit compensation was discussed as a tool to form new industry / landowner and government / landowner partnerships. With regard to adapting to future climate changes and predicted growing conditions, the use of trees as a new type of 'crop' was mentioned to be a good alternative to current grain crops and some forages.

Drawbacks

Opportunity cost

The opportunity cost was the biggest drawback noted by almost every participant. This means that, usually, afforestation will occur on lands that are productive in some manner or have some value to the landowner as rental, grazing area, or commodity crop production and that afforestation will result in less realized income in the short term. Participants stated that this factor will largely determine which lands can be used for afforestation purposes, and that many active farmers would not be able to take highly productive lands away from producing annual income unless there were risk minimization measures in place. In specific cases, some participants were able to put a dollar value range on a particular piece of property that they owned, but this usually varied year to year and was difficult to project into the future beyond three to five years. The on-going requirements to meet land taxes and land payments will also have to be accounted for in any afforestation initiative.

A second important issue raised was the future opportunity cost depending on changes in markets, technology, or crops that farmers would be unable to take advantage of if land were tied up in an afforestation program. This concern was echoed in each session and many participants stated that any program must be flexible and competitive with future land uses; this would offset opportunity cost in future years.

Some of the landowners with experience in afforestation and reforestation stated that the return on investment in harvestable trees is linked to the quality of land used for afforestation. Good quality soil will generally produce more biomass in a shorter period of time and more marginal soils will not necessarily produce the same quality or quantity of harvestable trees. The degree of opportunity cost is directly correlated to the potential return on investment.

Time commitment

The length of time required for the establishment, maintenance, and growth before harvestable trees were produced was seen as a hindrance to many participants. The reaction to the time commitment was generally due the difference between current farm and business planning timeframes and one that would be required for an afforestation initiative. There were a number of older farmers that were worried that afforestation initiatives on their land would tie up any potential immediate returns should they need to sell parts of their land for retirement or other financial needs.

The other concern with time commitment was the risk of not seeing a return on their investment after putting fifteen to twenty years or more into one potential harvest. Many participants said that they were less comfortable with this risk than with crops that mature typically in one or two years. There was also some skepticism that fifteen years would produce a harvestable quality and quantity of hybrid poplar except under ideal conditions. Participants in Saskatchewan stated that it could take up to thirty years, even with fast growing species, and some of the slower growing softwoods, which may have more value, could take fifty years or longer. The variation in potential timeframes was a concern at most sessions because most landowners do not usually plan with such uncertainty.

Establishment and maintenance requirements

The unique requirements for the establishment and maintenance of trees was noted as a drawback for many landowners. The special equipment needed to plant seedlings (e.g. small tractors, planters, small cultivators, mulch applicators, etc.) is not readily available to most landowners and the additional expense of this equipment would be prohibitive. There was some discussion of solutions to this in the form of cooperative arrangements or the inclusion of equipment rentals in an incentive package.

The high requirement for labour during the planting process and subsequent maintenance throughout the establishment period was highlighted as a deterrent for many participants. Much of these labour needs run concurrent to existing seeding and field preparation, for grain growers, and during calving for many livestock producers. Particularly for small-scale efforts and in areas where equipment access is poor, manual labour will probably require the hiring of additional people during the planting process.

Weed control was cited as one of the biggest challenges and drawbacks to any planting initiative. During the establishment period (3-5 years), weeds must be controlled with either mulch, spraying, the use of cover crops, or cultivation and this requires both special equipment and time. Finally, the knowledge and technical requirements for proper care and maintenance were not well known among the participants, although it was recognized that a different management scheme, from conventional crops, is needed.

Attitude changes

The requirements for an attitudinal change by potential program participants were highlighted in all of the sessions. It was recognized that there will be a good deal of reluctance by many landowners, especially those who are not normally innovators or early adopters to begin with, to put agricultural land into trees. In many cases, agricultural land, especially along the edges of the boreal forest and parkland regions, had to be cleared of trees by earlier family generations. One participant commented that, “my grandfather would roll in his grave if someone were planting trees in those fields”.

Participants also pointed out that farmers generally separate themselves from foresters and the two industries have not worked closely together in the past. Forestry is commonly thought of as something that is done with idle land, and any agricultural land in forest is unproductive or can be ignored. A common perception of farmers is that they are working soil and planting crops that have very tangible and immediate returns. The required change in both public and self perception was a commonly mentioned theme in the focus groups and is a potential drawback if many landowners are resistant to the idea of trees as a form of agriculture.

Ecosystem changes

While there are many ecosystem benefits from afforestation, several drawbacks were noted at different sessions. The potential increase in available wildlife habitat was seen as having some negative impacts. Participants in most focus groups commented that the proliferation of deer could become a nuisance, and that this would require, at minimum, more fencing. It was also mentioned that increased forest acreage could become a refuge for pests and noxious weeds and many farmers currently remove forest areas to eliminate this problem. There was discussion about the potential problems with monoculture afforestation, analogous with monoculture cropping methods. Some participants suggested that mixed stands and polyculture plantings would provide better biodiversity and eliminate the risk of pest or disease outbreaks.

The increased risk of forest fire as a result of increased forest area was seen as a potential insurance problem and large risk factor for a long term investment in a stand of trees. Some participants in Manitoba discussed the potential for new wildlife diseases or the proliferation of additional diseases such as tuberculosis which could be spread through increased wildlife habitat.

Barriers and Challenges

Carbon credit accounting

The issue of potential carbon credits was repeated many times in each session. Most people felt that there was much opportunity for remuneration from carbon credits but that there was still a lot of information needed before they could really speculate further. It was noted that carbon trading had begun on the Winnipeg and Chicago futures markets but the valuation of credits and the assignation of credits were largely unknown. There was speculation that carbon credits may go to the federal government, especially if an afforestation program was sponsored by a federal program. There was an expressed desire for carbon credits to be assigned to individual landowners, whereby they would receive compensation for the husbandry of carbon sinks. In one Saskatchewan session, the idea was raised where cooperative formation among private landowners would allow them to offer aggregate numbers of carbon credits, to the extent that it would be of interest to industry.

Many participants felt that the issue of carbon credits needed to be fully realized in an accounting process before an afforestation program should begin. Several points were raised: if carbon credits were given fair value and a method could be developed whereby individual landowners could receive compensation for their own carbon sinks, then this would provide all the incentive needed for a large scale program; participants were worried about liability issues and speculated that a future scenario could hold them responsible for carbon sources as a result of farming activity; the ownership of carbon credits was an important issue, one tied with the ownership of trees, where retention of ownership with private landholders was critical for almost every participant; the role of industry in the trading of carbon credits versus the role of government was also discussed and needs resolution before many of participants would be willing to enter into a federal afforestation program.

Information needs

The need for information was probably the most cited and most discussed issue at each session. The idea of afforestation on its own was generally well received but many information needs were identified that participants needed before they could be more definitive. Most participants in the sessions lacked the necessary technical information needed to plant trees (see theme below). Another information need identified was some definitive answers to some of the economic questions surrounding an afforestation initiative on private lands. Participants wanted to know how much it would cost for establishment, given the variety of species and growing/maintenance conditions, what the expected return on investment would be given the timeframes and potential markets, and what other options for profit making ventures there were aside from selling to existing lumber or pulp mills.

One particular issue raised was the lack of readily available (or existing) information about the suitability of new hybrid species for lumber or pulp. In other words, many participants wanted to know that the trees they are planting now will be suitable for a particular end market in twenty or more years. Several participants stated that they would really benefit from seeing some example business plans for an afforestation venture (of different sizes) and others stated that some 'best and worst practices' manuals would help a lot of people who are interested in afforestation. Additionally, some practical and easy to use grower's manuals would also help for the establishment and maintenance periods. No attempt was made to identify whether this information was currently available, but several landowners with experience in afforestation stated that they began largely on their own and little information was accessible.

Technical knowledge

The need for more technical knowledge as well as more public availability of this information was discussed in most sessions. Several of the landowners with experience in afforestation and several of the extension agents of government departments stated that there is not a lot of eco-region specific information about species suitability and potential growth rates. Many participants contributed their own personal knowledge of their experience on their own properties and the suitability of different trees and different growth rates (the majority stating that realistic timelines for tree maturity, for many species, would be at least 25% longer than is often reported from research stations). Particular microclimates and soil conditions would require a precise planting scheme and many participants felt that good information about this would eliminate some risk.

It was stated that land assessments would be beneficial to landowners that lacked experience with afforestation (these assessments could be analogous to a timber

cruise). This would help landowners determine which species would grow best for their land conditions and whether it was appropriate for them to initiate an afforestation program. Other participants stated that this would help prevent 'program milkers', or those individuals that would take advantage of any financial incentives although their land was not suited for afforestation.

Ownership issues

The ownership issues touched on several particular points. There was a consensus among all of the focus group participants that continued ownership of land and ownership of trees belong to the current landowners. Many expressed concern that any leasing arrangements would remove control of the land from their hands and place it with the leasee (generally assumed to be the federal government). Participants also explained that ownership of the trees should belong to landowners, unless an incentive scheme was such that annual incomes would be beneficial in and of themselves. The concept of conservation easements and caveats on the land would be a problem, and a general consensus among farmers was that previous experience in Canada and the United States has proved that these set asides don't always benefit farmers in the long run.

The ownership of carbon credits, as explained above, should also belong to the landowners as participants felt that relinquishing control of these credits could mean relinquishing control of a new source of income. A final issue about ownership was the expressed 'first right of veto'. In all sessions, the question was raised about whether landowners could decide to change the land use, from forestry back to agricultural crop, if the opportunity was right. Most participants wanted the first right of veto so that they would not be locked into an afforestation scheme if it was determined they were going to benefit to a much greater extent from some other land use.

A continuum emerged, progressively through the focus group sessions, that ran from an absolute lease on land by a government program (similar to the Conservation Reserve Program in the U.S.) to having landowners assume complete risk for expenses, labour, and maintenance, and receive all benefits from the sale of wood or a carbon credit scheme. This continuum was useful for participants, but many were reluctant to place their priorities on one particular point because of a lack of information.

Financial incentives

Financial incentives for participation in an afforestation scheme were discussed in two respects; compensation per year per acre and tax credit programs. The issue of what land was worth (per year or per acre) was introduced by the facilitator at each session, but many participants were reluctant to discuss numbers directly. A range of values were discussed for particular land types (e.g. pasture land, forage land, grain or cereal crop land, fragile lands, etc.) and these values also varied depending on the particular region of the prairies in which the landowners resided. The concept of 'opportunity cost' was raised at almost every focus group and participants stated that identifying a dollar figure for the opportunity cost on a particular piece of property would depend a great deal on where the land was located, the soil type, distance from certain markets, changing values for land rental, land speculation in areas closer to urban centers, and even climate change. The opportunity cost would probably vary each year and it would be difficult to project a dollar value beyond a five year time horizon.

Tax incentives were also discussed at each focus group and it was a general consensus that this could be a good way to get participants to change their current land use

practice. Municipal land taxes and income taxes were both discussed as barriers to any large scale afforestation scheme. Participants expressed a variety of opinions about land taxes; some stating that they would not want to see fewer tax dollars go the municipalities because of conversion to forested land (currently assessed less than agricultural land) while others insisted that lowering the land taxes would encourage them to participate in an afforestation program. Income tax issues were raised and many participants thought that it would be beneficial to amortize income, earned from the sale of trees at maturity, over the lifetime of the trees. While this would be difficult to implement in practice, some way of declaring income for assumed annual returns would be beneficial for most landowners.

Multifaceted program approach

Of particular importance to this research was the clear direction given from the participants at the focus groups sessions, that any afforestation program must be multifaceted and not any one program or incentive would work for each region of the prairies. The regional differentiation in microclimates, soil types, and economies would mean that a blanket approach for the entire Canadian prairies would not work except for those landowners in privileged positions (those with excess and owned land or those with enough income to absorb greater risk). The focus group research was able to pull out some of this differentiation (and incentives) by region and provides some direction, in this regard, for a potential federal afforestation program. This theme will be discussed in more detail in the final report.

Public education

Public education was consistently noted as a challenge for any afforestation program, referring to both education of private landowners and education of the public at large to the benefits of carbon sequestration. Participants said that it would be necessary to get their local municipalities involved in a public education initiative that complemented an afforestation program. There was also some suggestion that education programs in schools could also promote the hiring of summer students for silviculture training and tree planting.

Small scale afforestation

Defining marginal land

The use of the term marginal land, in the focus group discussion, prompted some criticism and objection by many participants. Generally, there was no clear definition that could be agreed upon for marginal land and most participants felt it was a poor descriptor for the discussion. Some producers said that their marginal land was only marginal because of current prices for commodity crops, while others said that marginal land had more to do with access or suitability for equipment than it did with soil quality. The point was made that there are a variety of crops or uses for different types of land and land that may be considered marginal for growing grain may do well in pasture. The general theme was that all land had an opportunity cost, and it was best not to think of marginal land as land having little agricultural value.

The use of the term fragile land was used in several instances as a better synonym for marginal land. Participants used the term to refer to land that consisted of unstable slopes or near sensitive areas (riparian areas, streams, sloughs, hilltops, etc.). The suitability of fragile areas for afforestation was questioned in many sessions as these areas may either be too sensitive for the planting of trees or of too poor a soil quality to support adequate tree growth. At the focus group sessions in Saskatchewan,

participants stated that there was opportunity for afforestation on rocky land; this land provided good quality soil but was generally too rocky for tillage equipment and it may potentially provide good sites for afforestation.

Conservation versus commercial planting

Most participants were interested in a potential small scale afforestation initiative, one that didn't necessarily repeat existing shelterbelt enhancement programs and offered more flexibility. It was observed that a small scale initiative would not necessarily provide commercially viable qualities or quantities, however. Small scale planting was referred to as conservation planting in several of the sessions and to many participants this term was more relevant. Discussion centered around afforestation for the purposes of slope stabilization, to fill in field corners, line waterways or buffer riparian areas, and for aesthetic purposes near roadways and houses.

There was some expression of interest in aggregating small scale plantings so that they would be counted under carbon sequestration schemes or carbon credit programs. It was felt that new shelterbelts, widened fencerows, and conservation plantings could contribute significant tonnage of sequestered carbon and that some method could be devised to account for this. If a small scale afforestation initiative had this sort of flexibility, then many participants said that they would be interested even though they had more difficulty imagining their participation in a larger scale block planting scheme.

A distinction was made at each session between small scale afforestation for conservation purposes or for carbon sequestration purposes, and large scale afforestation with an end use of commercially viable timber. Most participants felt that planting on marginal land (read fragile land) meant a yield of marginal trees and that any afforestation program should not confuse this in its design.

Large scale afforestation

Information needs

The information needs for a large scale afforestation initiative reflect those mentioned in the ***Barriers and Challenges*** section above. Participants emphasized the need for technical information, grower's manuals, business planning scenarios, and best/worst practices manuals or case studies. The most commonly mentioned need for information was about the economics of any potential afforestation initiative. Participants stated that they needed to see typical accounting figures for different sizes of operations. Essentially, an economic argument has to be presented in order for the majority of people to participate in any large scale planting that has an opportunity cost for them.

A second consistent theme from the sessions was the need to know how this potential federal program fit with other on-going or proposed federal programs. Participants also wanted to know how this afforestation initiative fit into the Kyoto Protocol and what role industry or government partnerships would play in the future (i.e. will industry buy carbon credits from landowners, from a carbon trading body, or will government act as a mediator or facilitator or owner of these carbon credits). Some of this information is available and understood and can be made publicly available relatively easily, while other pieces still need conceptualization and more effort by policy makers. These information needs will be addressed in more detail in the final report.

End use scenarios

The potential end use of trees from an afforestation scheme was subject to speculation in the different sessions. Most participants agreed that it was probably naïve to assume that a ***secure*** potential market for mature trees could be pulp or small dimensional lumber at any one of the existing mills. The locational flexibility of these mills, combined with the fluctuating price and demand for wood, as well as the unknown marketability of new hybrid tree species makes this sort of speculation very risky. Observations about the potential for value-added products and/or carbon credit sales were seen as having more potential for a good return on investment.

Some of the experienced woodlot owners at the focus group sessions offered valuable ideas about woodlot management, polyculture planting, and selective harvesting. Examples were provided that demonstrated how stand management and maintenance can produce returns over a number of years and niche marketing can provide stable income returns. These participants were a valuable resource and demonstrated the potential of large scale afforestation. Their comments will be utilized in the final report.

Good soil, good trees

At each of the focus groups, participants were asked how they would decide which of their lands they might contribute to an afforestation program. The general consensus was that any large scale program that was concerned with good growth rates and with productive stands of trees would have to be placed on good quality soil. The sentiment, 'good soil grows good trees and poor soil grows poor trees' was echoed at the different sessions. Any program that is encouraging landowners to participate in an afforestation program for a significant part of their income (i.e. as an alternative to a crop they are currently producing) will have to account for planting on good quality land with higher opportunity costs. To achieve large acres of afforested land will not be possible on only marginal land (or fragile land), noted many participants.

Summary of elements for a federal afforestation program

Flexible incentive packages

- Address opportunity costs
    - The opportunity costs vary by region and microclimate. Participants were very reluctant to put a dollar figure for a particular piece or type of land because of the many factors that need to considered in the calculation. [Various dollar figures can be found in the individual focus group result tables.] There was a desire for financial incentives that paid an annual return, perhaps based on a sliding scale over time, and that this compensation would have to worked out on a regional or site by site basis. This approach would be consistent with the discussion as a whole (a regionally differentiated program).
- Tax incentives
    - The discussion about tax incentives focused on both tax rebates and tax relief. Income tax on the sale of timber at the end of tree life cycles could be amortized over the preceding years and land tax assessments would have to be of an incentive nature; currently they are not.
- Sharing of risks
    - An afforestation program must be promoted on a risk sharing basis. If delivery agents cover costs completely, there is a risk of 'program milkers' participating (individuals who are not serious about afforestation or who are trying to make as much money as possible by manipulating the program).
- Long term commitment
    - The commitment needed by government must be consistent with the lifecycle of the trees. Short term programs that match political or fiscal timeframes (four or one year(s)) would not adequately support afforestation.
- Information and infrastructure support
    - More information is needed before participants would be willing to make firm commitments. A wide variety of information needs were expressed, and generally these have to do with growing, establishing, maintaining, and harvesting trees. Infrastructure support would come in the form of appropriate technology sourcing and leasing or renting of machinery through delivery agents.
    - Growers manuals, best practices guides, and business planning tools are an immediate priority for all research participants and it is recommended that these be researched and compiled.

Regionally differentiated program

- Microclimate and ecosystem differences
    - The focus group participants were adamant that a 'one size fits all approach' would not work in this situation. Microclimate and regional economy differences mean that different incentive packages would be suited to different regions of the prairies and that different tree species may be best suited to different areas.
    - In order to get large acreages planted and tree growth within an adequate timeframe, trees will have to planted on good quality soil. All participants indicated that 'good soil grows good trees', and any large scale effort should be directed at viable agricultural land. This will change the nature of incentive packages and program targeting. 'Marginal land' was a controversial term although there was some acceptance that there is a need for conservation type planting. Aggregating conservation planting acres would require program and monitoring flexibility.
- Distance from markets and program delivery agents
    - Private landowners have varied geographic situations with respect to their distance from major centers and from government delivery agents. Many are also long distance from potential timber markets or processing facilities. There should be a distance quotient factored into any financial incentive package(s) and this would have to consider unevenness in transportation and communication access.

Contingent aspects

- Carbon credit accounting
    - Most participants were interested in learning more about carbon credits and the potential role that they would play in an afforestation program. It was expressed that having more concrete knowledge about carbon credits would help decision-making. In some respects, carbon credits were seen as the 'unknown element' and as potential good income source.
- Cooperative development
    - There was some suggestion that aggregating individual landowner acreages in order to be account for carbon credits and count carbon sequestering acres would be a good idea. A program that provided this option would be viewed positively. Additionally, there could be some incentive provided for the cooperative ownership of specialized machinery with a buy-back option. Many landowners felt that they could not participate because of cash flow and acreage constraints, but that they would be interested if a program could be structured to these constraints.
- Timber supply and demand

- The speculation on future timber markets and demand for timber products is a very big uncertainty that needs to be minimized through program planning. The management of an afforestation scheme on the basis of future timber profits is extremely high risk, given current market conditions and volatility within the forestry industry, and most private agricultural landowners are risk averse over the long term.

Parallel research, program delivery, and monitoring

- Afforestation research
  - Participants recognized the relative lack of research specifically targeted to afforestation schemes of this type and suggested that government departments need to invest in research and education before they do too much prescription. There are examples of hybrid poplar plantations in North America and case studies or best practices from these could be provided. The general feeling was that these examples were not successful enough to justify an ambitious planting scheme across the prairies and a cost-benefit analysis has not yet been systematically done.
- Delivery of program
  - Program delivery needs to be coordinated with local agriculture representatives and local agencies, instead of a separate delivery system. Most participants suggested that the delivery of programs would have to be well coordinated and 'hands-on' due to the nature of afforestation on the prairies (a relatively new activity, new infrastructure, different knowledge base).
- Monitoring of results, program delivery, and incentives
  - Proper monitoring of an afforestation scheme will be critical, especially given the high cost and labour inputs for establishment, and the sometimes high mortality rates of young trees. Site assessment would be a good precursor to monitoring and it was suggested that many landowners would not be the best judge of land quality for specific tree species. Some feedback mechanism needs to be in place so that incentive packages can be evaluated.
- Iterative aspects
  - Because of the lack of experience by both landowners and government in afforestation in Canada, any planned program must have an iterative planning aspect (through monitoring and evaluation). It is likely that adaptation will need to occur especially during the initial years of the program (prior to the first Kyoto compliance period) and improvements can benefit landowners as the program expands.

Conclusion

This research was funded by the federal Feasibility Assessment of Afforestation for Carbon Sequestration (FAACS) Initiative, through Natural Resources Canada's Canadian Forest Service office in Edmonton, Alberta (Northern Forestry Centre) and by the Manitoba Forestry Association, a non-governmental organization based in Winnipeg, Manitoba. This report represents the results of intensive focus group sessions in the three prairie provinces of Canada. Private landowner attitudes toward a potential federal afforestation scheme and their required incentives for participation was the main focus of the research. The reason for this participatory research was the necessity of 'on-the-ground' discussions about afforestation; a federal program will be the first in Canada and the institutional support, technical and socio-economic information, and delivery mechanisms are untested and largely undeveloped. This presents a good opportunity to gather the most relevant needs of private (agricultural) landowners with respect to afforestation.

The research examined the potential benefits and drawbacks from afforestation and considered the challenges and barriers to implementation of a federal program. Each focus group also discussed the necessary conditions for implementation of both small scale and large scale programs. Small scale programs were defined as small plantations (less than ten acres) and large scale programs would be plantations larger than these. The original terms of reference referred to afforestation on marginal land; the use of this term was problematic in the focus group sessions and analogous (and more accurate) terms were used at different points ('fragile land' and 'conservation areas'). The focus group discussion also moved beyond a focus on marginal land with the direction that good quality trees and high volume production for carbon sequestration should be directed at both good quality land and soil as well as marginal land.

The literature reviewed during the secondary data collection provides a basis for placing this research in context of other Canadian and international research on afforestation programs. The review shows that afforestation programs have been demonstrated around the world with various degrees of success to this point. National and multilateral programs have been developed and many efforts have been focused at developing countries and areas of Europe that have had working forests for several centuries. Afforestation is also one of a number of carbon management techniques, all of which should be considered by the federal government for carbon sequestration in the future.

Under the Kyoto Protocol, afforestation will potentially play a large role in carbon sequestration by the 2008-2012 compliance period. Different policy tools are available to encourage participation in an afforestation project: direct and indirect control mechanisms are supported with economic and institutional incentives and regulatory development. The economics of afforestation in western Canada has been studied to a limited extent, mainly focused on macro-economic issues. Some practical scenarios have been examined which generally look at small pilot projects and expansion of acreage over time (due to real-world economic and technical constraints in the region). The opportunity cost estimation for afforestation planting on private agricultural land needs development and little guidance is available from the literature. The need to develop accurate but flexible opportunity cost analyses is affirmed with the behavioral literature (examining decision making factors) that emphasizes the primary role of short term economic considerations when deciding to plant trees.

The results of the focus group sessions are presented in both summarized note form and thematically. The essential elements for a federal afforestation program are taken

from these results and are summarized in this report. Flexible incentive packages must address opportunity costs, tax incentives, risk sharing arrangements, the necessary long term commitment by government and landowners, and the need for information and infrastructure support. A regionally differentiated program must include microclimate and ecosystem differences and locational aspects of the prairie regions because of distance from delivery centers, markets, and support infrastructure. The contingent aspects of an afforestation program are the potential role of carbon credit accounting, cooperative development for both acreage and infrastructure development, and the uncertainty of timber markets in the future. Finally, there is a need for the development of parallel research, program delivery, and monitoring mechanisms. These include increased and appropriate afforestation-related research, program delivery models, and monitoring techniques that are both participatory and iterative with program development.

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Appendix 1 – Sample Focus Group Template

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Overall Session Objective – ***to determine landowner attitudes towards participating in an afforestation program to plant trees for the purpose of carbon sequestration, and to determine what characteristics the program should have to attract landowner interest in being involved.***

Time	**Item**
10:30 am	**Introduction and Background** · Introductions · Background to the Focus Group Sessions
	Afforestation Issues · Topic Objective: To discover and discuss the range of opportunities, challenges, and barriers surrounding afforestation. · Sample Questions: o What is the value of afforestation to individual landowners? o What pitfalls are to be avoided in an afforestation program and how might they be avoided?
	Small Scale Afforestation · Background Information on Small Scale Afforestation · Topic Objective: To have participants explore the potential of a small-scale afforestation and what it would require for landowners to become involved in such a program · Sample Questions: o What has been tried in the past and with what success? o What are some of the factors that should be considered in a small scale approach (e.g. planning timeline, size of farm, proximity to water, diversity of existing operation (including woodlots), skill or knowledge of the producer, technical support)?
	Refreshment Break
	Large Scale Afforestation

- Background Information on Large Scale Afforestation
- Topic Objective: To have participants explore the potential of a large scale afforestation program and what it would require for landowners to be prepared to commit marginal land for the planting and growing of trees.
- Sample Questions:
    - What strategies are recommended to get buy-in to a large scale program?
    - What type of incentives or assistance would be necessary or desirable from the landowner's perspective?
    - Who is most likely to take advantage of such a program? Why?
    - On what basis should it be decided that land is marginal and thus suited to the planting of trees?
    - What kind of government – landowner arrangement would be most supportive of a long-term program?
    - What would be the best way to put a dollar value on the use of private, marginal land?
    - If the government – landowner arrangement was a rental agreement, what dollar value would you put on your marginal land?
    - Who should own the trees when the program is over?

Most Critical Elements and Next Steps

- Reiteration of Critical Background; Information on Next Steps in the Process and Follow-up
- Topic Objective: To have participants outline the minimum requirements of a successful afforestation program.

2:30 pm **Closing Comments**

- Opportunity for each participant to make a final comment
- Adjourn