

# **A Plantation Establishment Program to Sequester Atmospheric Carbon**

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This paper has been prepared to discuss and make recommendations on the structure and conditions of a national program to establish forest plantations on unused or marginal cleared lands across Canada. The main impetus for the plantation program will be to sequester atmospheric carbon but there will be several other important effects.

The contents of this paper are based on meetings and discussions held with private forest landowners and land managers across Canada during June-August 2002.

The purpose of this paper is to present the views of the private landowners on the best way to enlist them as willing participants in the program and to deliver the program in a cost effective way.

The author assumes full responsibility for all statements and recommendations in the report.

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## Table of Contents

<b>Section I- Introduction and Consultations</b>	4
<b>Section II-Findings and Recommendations</b>	5
<b>1. Policy Considerations</b>	
1.1 Jurisdiction over Private Lands	5
1.2 Forest Management Programs for Private Lands	6
1.3 The Evolution of Agriculture in Canada	6
1.4 Forest Plantations and Marginal Agricultural Lands	7
1.4 Policy Alignment and Joint Planning with Agriculture Depts.	7
1.5 Policy Alignment with the Provinces	8
1.6 Involvement of Industry	8
<b>2. Program Structure and Conditions</b>	
2.1 Species Selection	8
2.2 Entry Requirements	9
<b>3. Geographic and Landscape Considerations</b>	
3.1 Climatic Conditions	9
3.2 Fitting into the Landscape	10
3.3 Multiple Benefits of the Program	10
<b>4. Relations With Private Landowners</b>	
4.1 The Private Landowners Contribution to the Program	11
4.2 Opportunity Costs	12
4.3 The Agreement between Landowners and the Government	13
4.4 The Federal Contribution	14
<b>5. Program Implementation</b>	
5.1 Silviculture Regimes	14
5.2 Seedling Production and Availability	15
5.3 Program Delivery	16
5.4 GPS Measurement, Planning and Control Tools	17
5.5 Planning a Plantation Operation	18
5.6 Program Promotion	18
5.7 Due Diligence and Auditing	19
5.8 Avoidance of Unreasonable Bureaucracy and Controls	19
5.9 Administration and Planning Expenses	20
<b>6. Carbon Credits and Fiscal Arrangements</b>	
6.1 Trading in Carbon Credits	20
6.2 Fiscal and Financial Incentives	21

## Section I - Introduction and Consultations

### Introduction

Canada's Climate Change agreement requires a reduction in net emissions of Greenhouse Gas (GHG) to an annual rate that equals 6% less than the 1990 GHG emission rate.

The establishment of forest plantations is seen as a way to sequester carbon, thus contributing to a net reduction in GHG emissions. These same plantations will grow a lot of wood and make a solid contribution to the stability of rural communities. There will also be other significant environmental benefits from a well-planned program.

Based on recent estimates of GHG emissions, the indicated reduction is 238Mt of GHG, or 29% of present emissions. This challenging reduction must be accomplished by 2010 to meet Canada's Kyoto schedule.

Net reductions of GHG emissions can be accomplished either through actual reductions in GHG emissions, by the sequestration of atmospheric carbon dioxide by agricultural soils and trees, or by a combination of these.

Canada's reduction requirement is so challenging that we will need to use every possible approach to reach our target.

Canada's signature on the Kyoto Protocol has created an interest in Carbon sequestration. Ratification will create a national need to reduce net emissions of GHG. Private landowners can participate in meeting this national need through the development of carbon credits by the sequestration of atmospheric carbon by forest plantations on private land. A lot of wood will be produced at the same time.

Trees sequester carbon as they grow. Carbon is embodied in wood and comprises approximately 25% of the weight of green wood.

The Kyoto Protocol recognizes the sequestration of carbon by trees as one of the ways to reduce net GHG emissions. Article 3.3 of the Protocol deals with Afforestation, Reforestation and Deforestation (ARD).

### Planting of New Forests under the ARD provision of the Kyoto Protocol

#### Definitions:

- The **Afforestation** of lands that have never been under forest cover.
- The **Reforestation** of lands that were once forested but have been cleared and used for some other purpose,
- There must be an accounting for any release of carbon to the atmosphere due to **Deforestation**, the permanent removal of forest cover and conversion of the land to some other use. See Annex B for complete definitions.

All claims of new or additional carbon sequestration must be transparent and verifiable.

One of the more promising approaches is to establish plantations of trees on cleared lands because there is little or no question that all, or most, of the carbon embodied in the wood in these new forests is newly sequestered carbon and is therefore eligible for carbon credits.

The Canadian Forest Service is conducting a study to determine the area of cleared land in private ownership that would potentially be available for planting with trees in Canada.

The author has held discussions with private landowners and private land managers across Canada to determine their views on a national plantation establishment program. Based on these discussions the author has prepared this report that discusses and recommends the structure(s) and conditions of a program to ensure that large numbers of private landowners are willingly enlisted into the program, and that the program can be implemented in a cost effective way.

## **Consultations**

Consultations and discussions have been held with private landowners and private land managers in all provinces except Newfoundland and Labrador. There is very little privately owned forest land in Newfoundland and Labrador.

The consultations took place between June 5<sup>th</sup> and August 28<sup>th</sup> and were carried through face-to-face meetings during a coast-to-coast trip (Victoria to Halifax) across the country.

The result of these discussions is a recommendation for a program structure and conditions that will enlist the participation of large numbers of private landowners.

## **Section II-Findings and Recommendations**

### **1. Policy Considerations**

#### **1.1 Jurisdiction over Private Lands**

The provinces have jurisdiction over private lands. To be successful, any plantation establishment program must be aligned with provincial government policy.

Some of the provinces have regulated the use of private lands. In some cases other, lower levels of government (regional or municipal) have also regulated the use of private lands to prevent clear cutting or to discourage tree planting to maintain a landscape that is a mosaic of fields and woodlands.

As an example, Quebec has an Agricultural Land Protection Law. Land within regions of the province covered by the law must be maintained in a condition that will permit their use for agriculture. In these regions land that is no longer actively used for agriculture but is in Land Capability for Agriculture Classes 4 & 5 are not generally eligible for provincial financial assistance to establish plantations despite their low productivity. The Dept of Agriculture policy is to retain these lands in a state and condition appropriate for a resumption of agriculture. In most areas of the province there is little chance that Class 4 & 5 lands will be used for active agricultural purposes in the foreseeable future.

## **1.2 Forest Management Programs for Private Lands**

Most provinces have forest landowners' organizations and forest management programs directed at private lands. The programs are increasingly delivered by private or para-public organizations.

Present experience indicates that organizations that are close to private land owners are most successful in the delivery of programs. During the consultations there was little support for the establishment of a federal government delivery mechanism for this program. Comments centered on the relatively short life of a plantation establishment and stand tending program (10-15 years) and on the existence of organizations at the provincial or regional level that have, or can build, the capacity to deliver the program.

Discussions will have to be held with the provinces to ensure that policies and objectives are well aligned and that existing programs and organizations will be able to deliver the program.

## **1.3 The Evolution of Agriculture in Canada**

Canada's agricultural and rural evolution continues. Since the early 1900's the population has become increasingly urban and the rural areas are being depopulated. Agriculture is facing severe difficulties.

Four aspects of agricultural evolution affect this program:

- Gradual withdrawal from active cultivation of lands in the marginal/sub-marginal soil capability for agriculture classes 4 & 5. This withdrawal is due in part to long-term low economic returns on inputs of labour and investment on these lands as the productivity of better lands increases. Many of these lands were cleared during the early days of colonization in the 18<sup>th</sup> and 19<sup>th</sup> centuries. These family farms raised 3-5 generations of children but are no longer economic to farm.
- The increasing influence of subsidies by the EU and the USA that Canada cannot match. These subsidies distort domestic and export markets and put Canadian farmers at a competitive disadvantage.
- A serious drought, that may be the straw that breaks the economic backs of many farming families and the communities they live in. The continuing drought, especially in the southern prairies, increases the risk of crop failure and makes farming less attractive and profitable over the long term.
- An aging farm population will accelerate the withdrawal of less productive lands from active cultivation. This will have a marked effect on the availability of lands for a plantation program, or in some regions the availability of land for lease to the remaining active farmers.

These four factors will have a significant effect on the availability of land for forest plantations during the course of a 10-15 year plantation establishment and tending program.

## **1.4 Forest Plantations and Marginal Agricultural Lands**

The Canada Land Inventory - Soil Capability for Agriculture – has seven capability (productivity) classes. Class 1 is the highest and Class 7 is the lowest of the productivity classes. In most regions of Canada the

margin between the lands that are capable of economic use for agriculture and those that are uneconomic for agriculture lies in the Class 4 & 5 range.

Changes in the economics of agriculture and levels of human population and activity cause lands at the economic margin to move into and out of agricultural use. Lands in the Productivity Class 4-5 range have been going into, and out of, agricultural production for centuries. Slope, drainage and stoniness are factors that will affect the use of any specific area. The southwestern region of Quebec offers an opportunity to illustrate the point. Similar situations will arise in other provinces and regions of Canada for other reasons.

The recent Ice Storm in Quebec (and eastern Ontario) caused severe damage to second-growth tolerant hardwood stands on the St. Lawrence Lowlands to the southeast of Montreal. In some cases the damage was so severe that it was obvious that the trees would not recover. In other cases there was hope that new growth would repair the damage to crowns and that the stand would recover.

At the same time the growth of the pork industry in Quebec and new regulations governing the amount of pig manure spread per hectare increased both the area required for the disposal of manure and the market for corn. These two factors caused the clearing of significant areas of land with stands damaged by the Ice Storm that had been under cultivation in the past but which had gone back to forest due to marginal productivity and returns on agricultural inputs.

This example offers an illustration of the importance of consulting with the provincial agricultural agencies and the agricultural and woodlot owners' associations in the planning of plantation establishment programs. These people know the local conditions and trends.

### **1.5 Policy Alignment and Joint Planning with Departments of Agriculture**

The lands that are targeted for planting under the program have been in agricultural use for decades. In most provinces these lands are considered to be part of the agricultural land resource. In many cases the owners were, or are still, actively engaged in farming. These lands and their present use are part of the economic fabric of many rural communities. The Federal and Provincial Departments of Agriculture as well as the agricultural and woodlot associations, should be brought into the discussion of this national program to gain the benefit of their experience in the agricultural economics and productivity of the various classes of land in each region. This will be an important factor in determining which land productivity classes should be part of the program. This will help to ensure policy alignment and to avoid unexpected disruption of rural communities.

The land management objectives of the owner are an additional important consideration.

### **1.6 Policy Alignment with the Provinces**

As the first step in the development of the program the federal government should enter into discussions with the provinces to accomplish two things.

1. To ensure that the idea of establishing plantations to sequester carbon and create carbon credits in and for use in Canada is well aligned with provincial land use policy and objectives. This is not expected to be a problem in most provinces.

In some provinces there may be provincial guidelines on the specific categories of land that is eligible for entry into the program.

2. To determine how the existing private land forest management programs and organizations within each province can best deliver the national program.

## **1.7 Involvement of Industry**

There are two industrial sectors with an interest in plantations. The forest products industry will be interested in using the new wood supply and the electric power generation industry (among others) will be interested in the carbon credits. While these two interests are not precisely aligned they have a lot in common. The structure of the Carbon Trading System and the conditions/characteristics of the Credits can go a long way towards overcoming many of the potential conflicts between the two interests.

The new wood supply, estimated on a regional basis to illustrate the potential, may be as much as 100,000 ha with an MAI of 4 m<sup>3</sup>/ha/yr.= 400,000 m<sup>3</sup>/yr. But this wood supply will not be available for 35-50 years depending on growth conditions and forest resource management objectives.

The Carbon Credits will slowly start to be available within 10 years of planting as the plantations demonstrate success, vigorous growth, and volume measurements become practical.

Discussion with the two private sector interests, wood supply and Carbon Credits, may reveal opportunities for worthwhile joint ventures. At least the forest products industry can be enlisted to assist with seed collection and seedling production. It is also possible that industry expertise in planning the logistics of large silviculture programs will be helpful.

## **2. Program Structure and Conditions**

### **2.1 Species Selection**

The new plantations must fit into the local 'landscape'. This includes the local ecology, social and aesthetic fabric, and the forest products industry.

Canada has 8 Forest Regions. Each has a characteristic mix of species.

Landowners have preferences concerning the forest cover and the appearance of their land. The species available for planting must be adapted to the local forest region and to the site being planted. The species offered should have growth characteristics that are suitable for the purpose/ management objectives of the plantation. One species does not fit all sites, nor all purposes.

Hybrid Poplar - There was no support in any region for a plantation program that emphasizes or is centered on the planting of hybrid poplars. This species requires fertile sites and heavy investments in site preparation and fertilizer to promote vigorous growth. Weed control is also important. There was broad agreement that hybrid poplars should be offered as one of several options.

Several people noted the recent development of some native Aspen crosses that offer excellent performance in the Prairie Parkland and Boreal Transition regions. See additional discussion of silvicultural practices and forest resource management objectives in Section 5.1.

## **2.2 Entry Requirements**

Section 3.3 of the Kyoto Protocol provides definitions of Afforestation, Reforestation and Deforestation (ARD) and specifies a (genuine) change in land use as the key requirement for eligibility under this Section of the Protocol.

Any lands planted under the heading of Afforestation in the Protocol are lands that have not been forested for a period of 50 years.

Lands planted under the Reforestation heading of the Protocol are those lands that did not contain forest on 31 December 1989.

In Canada the absence of tree stumps would provide a practical test of eligibility for Afforestation in most cases. In rare cases old tree stumps will persist for years after clearing, nevertheless the land is eligible under the program. These entry requirements must be enforced to avoid valid questions about the legitimacy of the program.

It may be wise to establish a minimum size for plantable areas on properties entering the program. This has little to do with eligibility under the Kyoto Protocol but will help to reduce the administration costs per hectare of lands planted.

Plantations established under other programs will also be eligible for measurement and entry into the carbon credit ledger. Some of these may be on areas smaller than the minimum size established for the national program.

## **3. Geographic and Landscape Considerations**

### **3.1 Climatic Conditions**

There is one region of Canada where low annual precipitation favours grasslands rather than forest. This is the Central Plains, including the southern regions of Alberta, Saskatchewan, and Manitoba. As we proceed north the annual precipitation increases, and the true Grasslands give way to the Parkland Region, the Boreal Transition Region and the Boreal Forest. South Central BC also has areas where precipitation is a limiting factor.

Every province includes significant areas that are climatically suited to supporting forest plantations.

### **3.2 Fitting into the Landscape**

In this case the “landscape” is a combination of social, economic and ecological factors.

During the consultations people kept returning to the need for the program to be tailored to local conditions. Several referred to the need for the delivery mechanism to be based on existing private land forest management programs. The most universal point was that the plantations and the species used must fit into the local landscape. The local landscape includes: regional forest cover types, aesthetics, wildlife habitat, landowner preferences and the forest products industry.

The forest products industry was established to use the native species of the region. Companies usually specialize in the processing of a specific species, or groups of related species, within the variety of species available in a region. It is possible to establish new industry in any region if the supply of appropriate wood is adequate. Industry tends to know the market best. .

Tasmania has some experience with the disruption of agricultural communities by forest plantation programs. In Tasmania the purchase or rental of marginal agricultural land for the planting and growth of Eucalyptus plantations has caused serious economic and social disruptions to some rural communities. Plantation establishment and tending provide a short flurry of employment. There is then a period of employment drought until the plantations are ready for thinning, harvest and processing. During the period of employment drought the community will often wither away as stores and schools close down.

Those who value the community and wish to stay in the area do not welcome the entry into a region of a forestry plantation company.

Wise planning will reduce the chances of this program becoming a threat to rural communities. The program must be designed, planned and implemented in ways that will fit into the local social and economic landscape and will deliver a variety of benefits.

Involvement of private woodlot associations in program planning will help to ensure a good fit with local "landscape" conditions. Involvement of the associations in program delivery will help in capacity building that will foster better and more landowner involvement in the management of their lands.

### **3.3 Multiple Benefits of the Program**

While the prime impetus of the program is the sequestration of atmospheric carbon and the production of Carbon Credits there will be many other effects of the program. The Senate Report on the Boreal Forest-Competing Realities: The Boreal Forest at Risk -1999; made a persuasive case for supplementing the supply of timber from natural forests by reforesting marginal farmland near the forest fringe.

In many cases these other benefits will have a greater impact on the region and the people who live there than will the creation of Carbon Credits. For this reason, the other benefits and changes that will result from the national program deserve very serious consideration by the government.

These need consideration during the conceptual planning of the program and its delivery, not as an afterthought.

Some of the obvious effects and benefits that will result from the program are listed below:

- Landowners have objectives and preferences in the management of their lands. The program must be designed to accommodate their preferences or they will be reluctant to enlist in the program.

- The Prime Objective is Carbon Credits. It is likely that an average MAI of 4 cubic metres per hectare per year can be achieved and will result in a credit of 1 tonne of carbon per hectare per year.
- Production of good quality sawlogs and pulpwood will help to improve the wood supply by the addition of significant volumes of wood that is easily and economically accessible.
- Job creation during the spring planting season and stand tending operations during the summer and autumn.
- A contribution to the stability of rural communities through jobs based on planting and tending programs in the shorter term, and on the increased wood supply in the longer term.
- Reforestation of large areas of cleared land will gradually replace wildlife habitat lost when the land was originally cleared for agriculture. (See more on this in the section on Silviculture 5.1.)
- The addition of large areas of forest cover will moderate storm and spring runoff, reduce flood events and improve the state of many watersheds.
- Soil conservation will improve with a reduction in erosion.
- Water quality should benefit with a return to closed canopy forest cover and a reduction in the runoff of the residues of agricultural fertilizers, both natural and chemical.
- Aesthetics are a significant consideration in some regions where tourism is important and the topography and field/woodland mosaic offers broad views of the landscape.

## 4. Relations With Private Landowners

### 4.1 The Private Landowners' Contribution to the Program

There is a national need for carbon credits due to the federal government's decision to sign and (probably) ratify the Kyoto Protocol.

Reforestation and Afforestation to establish plantations to sequester carbon offer a way to meet part of this national need.

There are two classes of private forest landowner in Canada, the small family forest landowner, and the large industrial forest landowner. Consideration must be given to the quite different characteristics and circumstances of these two classes of owners. The family forest landowner is typically an individual or a family with no direct interest in a forest products processing plant. An industrial forest landowner may own and operate a sawmill or a pulp and paper mill.

Will the national program be open to both classes of owner? If so will the terms and conditions of participation be the same for both?

Private landowners are prepared to enter into a partnership with the federal government to meet this need. The partnership will be formalized in an agreement.

Landowners will contribute three things to the partnership.

- **Land:** The land is worth from \$750 - \$2,500 per ha depending on the location
- **Forgone Opportunities:** The owner will forego any opportunities to develop the land for a period of 'one rotation' of the species planted.

- **Agreement:** The owner will sign an agreement to maintain the land as a forest plantation and accept some reasonable limits on the sale of the carbon credits.

While at present in some regions there are often no alternative uses for the lands that will be the prime target for planting under this program, we must bear in mind that a rotation (50 - 70 yr.) is a long time. During the course of a rotation opportunities may arise that a landowner will not be able to take advantage of.

This is the main reason why the contribution of land and an agreement to maintain it in forest plantation for one rotation must be understood to be a very significant contribution to the national program by private landowners.

A carefully planned program including payment for Carbon Credits will add another reason for owners of non-economic lands to plant trees and for their associations to facilitate landowner involvement in a program.

### **Program Funding**

The Canadian government will provide base funding at an appropriate level:

- To establish plantations.
- For tending programs to the Free-to-Grow stage to ensure plantation success and achieve the objectives of the program.

### **Ownership of the Wood and Carbon Credits**

The wood will belong to the landowner. The carbon is embodied in the wood and, since the signing of the Kyoto Protocol, has become a discrete tradable commodity. The carbon credits should also belong to the landowner to avoid the complications of dividing the ownership of the same product.

Several landowners expressed extreme reluctance to give up title to a commodity (carbon) of unknown value.

### **4.2 Opportunity Costs**

In some regions of Canada there are few or no alternative uses for marginal/sub-marginal, abandoned agricultural land. When active agriculture stops the owner continues to pay taxes and the land is simply left to nature

The landowner will usually regard the chance to have the land planted to some commercially valuable, site adapted species of tree, as an attractive land use and economic opportunity.

If a system can be developed and implemented to make annual payments for Carbon Credits the need for an "opportunity cost" may be met. Agro-Forestry management systems may be applicable in some areas. This will allow grazing or other revenue producing agricultural uses to continue for a time while trees are growing.

It may be that additional measures will be required in some parts of the country to stimulate widespread participation.

Among the factors to be considered are:

- The economic basis for program conditions vary from one part of the country, to another.
- Ecological and landscape reasons for a program that fits diverse landscape conditions.
- Precedents that can provide examples of ways to structure programs that are fitted to the different conditions across the country.
- The size of the program that is required. Developing a large plantation program that is well distributed across the country may require some significant incentives.

#### **4.3 The Agreement between Landowners and the Government**

Discussions with landowners on the subject of an agreement also covered possible names and the legal weight of the document. Suggestions included: Covenant, Easement, Contract and Agreement. It was decided that Agreement would cover the requirement adequately and had none of the hard, permanent connotations of the other words.

The Agreement will cover the obligations of the two, or more frequently, three parties involved in the establishment and tending of the plantation: the Landowner, the Government and the delivery agency /silviculture contractor. The Agreement will include:

- The area to be planted, the site preparation required, the species to be planted, and the juvenile stand tending program required to ensure the success of the plantation.
- The silviculture prescription that is proposed including any stand treatments or commercial thinning that may be planned after completion of the initial phase of juvenile stand tending to reach a free-to-grow state.
- Access to the lands for the purpose of carrying out the work as well as any notice of entry required.
- The landowner will undertake to look after the plantation as, “un bon pere de famille” and notify the government of any threat of damage or actual loss due to fire, disease, or insect attack.
- The length of the agreement- based on a period equal to one rotation of the species planted.
- The ownership of the wood and the right to sell it at the end of the agreement.
- The ownership of the carbon rights to the carbon sequestered by the plantation.
- **Note:** the carbon is embodied in the wood and the title to what is essentially one product should not be divided between two owners, as this would create all sorts of management and transaction problems.
- The impetus for the national program and the prime objective of the federal government is to create carbon credits within Canada for use by Canadians and for the benefit of the Canadian economy. The landowner should accept reasonable conditions on the sale of the carbon rights to ensure that the objectives of the program are achieved. Sales of carbon credits are expected to be at open market prices.

#### **4.4 The Federal Contribution**

The federal government should accept that if the program is to enlist large numbers of landowners and effect the planting of large areas of cleared land in a short period (10-15 years) the program will have to pay all costs of stand establishment including: site-preparation, planting and juvenile stand tending to Free-

to-Grow. As noted in Section 4.1 of this report the landowners will be making a substantial contribution to the program. There may also be a way to enlist industry involvement, see Section 1.7.

In many private land silviculture programs there is a general rule that the landowner should contribute something to the costs of the operation to ensure that the owner has a sense of ownership and responsibility for the success of the plantation. This program may be a bit different due to the carbon sequestration impetus of the program and the desire of the government to quickly ramp up to a large program. If a landowner contribution is to be included it should not exceed 5-10% of the costs of establishment. The Program should cover the costs of tending. This will ensure that there is no risk of tending being an un-funded obligation due to reduced landowner enthusiasm.

## **5. Program Implementation**

### **5.1 Silviculture Regimes**

The main impetus and an important objective of the plantation program is to sequester atmospheric Carbon and develop Carbon Credits. The program designers must plan a plantation establishment program and silvicultural prescriptions that will deliver the program objectives of Carbon sequestration and Credits. At the same time, consideration of landowners objectives and preferences, landscape ecology, a new wood supply and all the other benefits and effects that will flow from the program must be built into the program planning. Eventual certification of the new forest areas should not be overlooked.

This will be complex but not impossible.

A significant question that will be raised by environmentalists and concerned citizens will be the question of conifers versus deciduous species. The reason for favouring conifers as the first generation or stand, in what will become a new forest, is their success when planted on old fields. Conifers are better able to compete with grass than are most deciduous species. Conifers require much less site preparation and herbicide or mechanical tending to get to a Free-to Grow state than do deciduous species.

Hybrid poplars require very intensive mechanical or chemical site preparation and tending.

The front-end costs of plantation establishment must be minimized.

Careful management of the conifer plantations can assist the establishment of a naturally regenerated, mixed or hardwood stand as the second generation of forest where hardwoods are a more natural part of the forest cover.

Conifers as pioneer species usually offer the most cost-effective way to 'recapture the site for the forest'.

Some factors to be considered are:

- Landowner's objectives and preferences.
- Pioneer vs. later successional species.
- Growth rates.
- Resistance to disease and insect attack.

- Ease of establishment in old fields.
- Vigour after planting in old fields considering allelopathic reactions and root competition.
- Planting spacing/ Stocking rates to avoid pre-commercial thinning and early commercial thinning. These may be costly and will complicate the calculation of Carbon volumes and weights.
- Relatively wide initial spacing will reduce the costs of site preparation, planting stock and planting operations.
- The effects of different rectangulation ratios (tree and row spacing) on site preparation and planting costs as well as on growth should be investigated. Experience in the US south indicates that a ratio of up to 1:3 is OK.
- Trees per ha at different spacing: 6'x6'= 3,000; 8'x8'=1,680; 9'x9'= 1,325; 10'x10'= 1,080
- These seedling per ha numbers indicate the possibilities for savings in planting stock production expense. This may be significant when seed collection and availability challenges are considered. The effects on planting costs are obvious.
- Careful assessment of silvicultural prescriptions that are the best to achieve the specific goals of this program.

## 5.2 Seedling Production and Availability

At present Canadian forest tree nurseries produce some 630 million seedlings per year. The vast majority are conifers. There are very few hardwoods due to the expense and difficulty of successfully planting hardwoods on old fields, and their often-vigourous natural regeneration in forest conditions.

In 1999 a total of 421,000 ha of land was planted in Canada. Of this only 65,500 ha was privately owned.

A national program to plant 100,000 ha per year at a spacing of 8'x8' or (2.4m x 2.4m) will require 680 seedlings per ac. or 1,700 seedlings per ha for a total of 170 million seedlings.

If the federal government is going to establish an ambitious plantation program directed at the planting of private lands the production of seedlings will have to be ramped-up accordingly. Most of the nursery capacity is probably in place.

It is likely that a different mix of species and stock type/size will be required as the site conditions encountered when planting old fields differ from those in post-harvest reforestation.

Do not underestimate the problems of seed collection. This planting program will take place in a different area, outside of the regions now used as a seed source and there may be inadequate Plus-Tree seed available that is suited to the regions to be planted. The species mix may also be significantly different.

**Do not compromise on seed quality! We will pay for it over the entire rotation.**

### 5.3 Program Delivery

The program should be delivered in each province by organizations that are close to the woodlot owners and landowners that have land suitable for the program. In provinces where private land forest management programs, associations or boards exist, these organizations should be the first option considered as the delivery agency. Where suitable organizations do not exist they will have to be developed out of existing organizations or established.

Many people advised against the federal government setting up a new organization to deliver the program. It will be duplicative and expensive to do so. It will take time for a new organization to establish a rapport with private owners and get ramped-up to deliver. Establishment of a new organization may alienate landowners working with existing private land forest management programs that they themselves have established and perhaps also cause concern to the provincial government.

Parallel programs also offer the possibility for double dipping. This must not be permitted.

Experienced private forest land managers working with planting teams or silvicultural contractors should implement the program on the ground. This will be a big program and will require the investment of large sums of public money. Since the 1980s we have learned a great deal about growing seedlings and the successful operation of large planting and stand tending programs. This hard won experience must be used to ensure the success of this program.

In cases where the landowner has the ability and the desire to do the work, this should be an option, but the landowner must work under the same program performance guidelines as a silvicultural contractor. Planting is done in a short period in the spring. This narrow window of activity may not fit in with the agricultural workload of a farmer or of a landowner with a full time job. The longer season available for stand tending may offer more opportunity for landowner involvement.

Working with the programs in each province will require flexibility but will result in program savings and efficiency. Several provinces have well-organized and well-funded programs. Funding often comes from the provincial government, industry and private landowners. These programs cover many aspects of the sort of program envisaged by the federal government.

Often they do not have enough money to support the size of plantation program proposed. Nor do they have the money to pay for site preparation on areas with well - established brush. The rich bottomlands covered with alder in NB and NS offer excellent examples of very productive sites that cannot be rehabilitated at present levels of funding.

The program should target sites that are clear of brush and ready for planting with little or no site preparation as a first order of priority. If the brushy sites are tackled first while leaving clean sites till later in the program, costs will be high and relatively clean sites may be choked by brush by the time they are scheduled for planting.

The federal government should provide funding to supplement or "top up" existing funding. The federal funds should not replace or displace any existing funding but be additive.

In provinces or regions where programs do not exist or where funding is inadequate the federal government will have to act to provide adequate funding in cooperation with provincial agencies and landowners' associations.

Equity between provinces will be a consideration but must not become a barrier to intelligent action. If all planting funded by the national program is additional to present programs and if policy is well aligned with provincial policy there should be no problems.

The implementation of a federal program must result in identifiable and clearly measurable increases in the area of bare land planted in Canada.

Any type of competition between provincial and national programs must be avoided.

#### **5.4 GPS Measurement, Planning and Control Tools**

It is difficult to estimate the number of individual fields or patches of land that will be planted each year. If the program size is considered in increments of 100,000 ha per year it is likely that the number of discrete patches planted each year might be in the order of 4 - 5,000 for each 100,000 ha. Each of the areas to be planted will have to be located and mapped so that the area can be determined, the appropriate planting stock ordered, the operation planned and contracts awarded.

Good planning and well-executed logistics will be a key factor in efficient operations. A GPS based, field location, mapping and planning tool will make a big contribution to the efficiency of the operation.

A Program Registry system will also be required to record the location, dates of treatment, area, ownership, etc. of each plantation in the program

##### **GPS Planning Tools**

Portable GPS receivers with "real time" correction programs are available off the shelf. Robust hand held data recorders are also available. What is needed is to marry the two tools and write appropriate software menus to permit easy and accurate field planning for the operation on each area to be planted. The same tool can be used in supervision and contract inspections and approvals.

These tools will also make the work of the auditors easier, more accurate and cheaper.

When the time comes for stand tending the same data can be used to plan and supervise these operations.

Measurement to determine the wood volumes and carbon credits will also be facilitated by this system.

One of the chief values of a GPS based system is that it will prevent isolated patches of plantation from getting lost in the huge landscape within which the program will be implemented. FERIC in Pointe Claire, Quebec has the expertise to develop the tool and the software menu.

Information collected on each plantation area can be fed into a central Program Registry that can be used to manage and schedule field operations and activities across the provincial or regional program.

## **Program Registry**

In order to record and schedule the management of: planting, stand tending, growth measurements, carbon sequestration rates and credits for sale, auditing, costs, etc. a computer-based registry will be needed. This system will probably be operated at the provincial level to assist with management of the program but should be compatible with registries used across the country to facilitate calculation of national summaries and totals.

## **5.5 Planning a Plantation Operation**

Each property is different. The characteristics of each property must be taken into consideration in order to achieve the optimum mix of benefits from the program. (See Section 6)

The Canadian Federation of Woodlot Owners is developing a Pan Canadian Woodlot Management and Certification program that includes a standard for good woodlot management. The standard covers many aspects of good environmental, social and economic performance for Canadian private woodlot owners. This standard may be a very useful tool to guide the development of planting and silvicultural programs for each property. The use of this tool will help to ensure excellent and sensitive planning and to avoid criticism of the program.

## **5.6 Program Promotion**

The program will have to be promoted to ensure that landowners and the public at large understand the objectives and benefits expected from the program. The combined environmental (carbon sequestration & wildlife habitat) and social benefits (rural jobs & community stability) are expected to have the greatest resonance with the public.

Landowners will also want to know about the expected financial benefits as they are making a significant, in-kind, financial contribution to the program. Information on the growth rates and value of wood must be made available. The best information available on the expected value of the carbon rights will also be a factor in the landowner's decision-making process.

The program can be promoted through the member associations of The Canadian Federation of Woodlot Owners. Provincial woodlot organizations delivering forest management extension services offer an effective way to communicate with landowners. The national and provincial offices of the Canadian Forestry Association and regional agricultural associations will play a role. Provincial private forest land management organizations, and agricultural extension services can also be effective ways to communicate with private landowners.

Several people suggested that an appeal to the public values and duty of Canadians (but not specifically landowners) to take action on Climate Change could be influential. Providing public support for, and getting involved in the program may be an appealing way for urban Canadians to make a contribution to the climate change program.

## **5.7 Due Diligence and Auditing**

Accountability for program performance is essential.

- This program will involve the investment of very large sums of public funds.
- The federal government and the Canadian public have the right to excellent and cost/effective performance in plantation establishment and tending. This is something we do a lot of and are good at. We have 20 years of experience in running huge silviculture programs.
- The program will be a field operation that is not easy to monitor.
- The development of a “manual of operating guidelines” to cover all variables is impossible and prohibitively expensive.
- The use of such an operating manual will increase the field operating costs.
- The program will gradually become quite visible on the rural landscape.

Some of the people consulted recommend that a “private sector management approach” be taken to the implementation and auditing of the program. The tendering and performance auditing of silviculture programs run by Canadian forest products companies can serve as a ready model. This does not imply that existing programs should be replaced but that a large program involving considerable sums of public or private funds must be managed with diligence and accountability.

To ensure overall accountability for the implementation of the program, private sector auditing firms should be contracted to carry out periodic audits of administration and field operations. These companies must have experience in auditing forest management field operations and performance. The recent program to certify millions of hectares of forest management operations in Canada has given several companies the experience required to do this.

This is the best way to get value for money and protect the reputations of politicians and bureaucrats charged with central responsibility for the program.

## **5.8 Avoidance of Unreasonable Bureaucracy and Controls**

There must be controls on any program that is spending large sums of money whether it is public or private sector money. Controls imply a paper trail. This is particularly important where and if, there is little or no hard evidence of work accomplished. A dense control system can reduce productivity, increase levels of frustration among production-oriented field operations staff and have no compensating gains in cost or efficiency. The consultant has seen this at work in living colour on a forest industry project in Iran.

Forest operations leave evidence on the ground for several years. Plantation plans developed for each property, with records of all operations contracted and completed, provide the first stop on the audit trail.

The advice of an auditing firm that is experienced in forest operations auditing should be sought to guide the development of effective but simple controls to ensure responsibility and accountability in the implementation of the program.

## **5.9 Administration and Planning Expenses**

The success of this program will rest on excellent planning, scheduling and operational efficiency.

Good planning costs money. So does the supervision of operations. These are steps and costs that will make a solid contribution to the successful achievement of the multiple objectives of the program (See

Section 6 of this report). Allowances to cover the costs of administration, planning, scheduling and supervision must be built into the program.

## **6. Carbon Credits and Fiscal Arrangements**

While the sequestration of atmospheric Carbon is the prime impetus of the program there will be many other benefits. Planning must ensure that all benefits are optimized. These can be grouped under three headings; Social, Environmental and Economic.

Social: rural jobs and community stability.

Environmental: carbon sequestration, wildlife habitat, watershed and water quality conservation benefits.

Economic: jobs in the short term during the plantation establishment and tending phase and more jobs generated in the longer term by an increase in wood supply.

### **6.1 Trading in Carbon Credits**

Trading in Carbon Credits that will result from the program presents a challenge. The challenge has several components but is founded on the relatively small size of the individual properties with carbon credits to sell. This increases the transaction costs but offers an opportunity for forest landowners' organizations to organize and offer a brokerage service to their members.

One option that should not be overlooked is for the landowner to retain some of the carbon credits for personal /family use. This may provide the family a significant advantage as the market for credits develops and as our society and economy becomes more, "carbon constrained".

What will be measured and sold? The aboveground Carbon contained in the trunk and branches? The below ground Carbon in the root mass of the trees? The Carbon content in the forest soil? Some of these things are more easily measured than others.

There is also the problem of developing and carrying out a credible and verifiable wood and carbon measurement program to quantify the carbon credits that are produced on many small properties and are available for sale.

Setting up a sales program should be relatively easy.

Safeguards against loss of credits due to fire and insect attack must be established.

The possible/ probable harvest of the wood and loss of some or all of the credits at the end of the rotation must also be factored in.

This is a matter of risk management. It must be transparent, but it is not 'rocket science'.

The system that is developed and the potential revenue flows will have an effect on the landowners' management decisions.

## 6.2 Fiscal and Financial Incentives

There are several other ways that the federal and provincial governments can provide additional useful incentives to landowners to plant bare lands and tend the juvenile plantations through to the Free-to-Grow state.

- An allowance in the Federal Income Tax Act to permit these specific expenses to be written off against other income for the duration of the 10-15 year plantation establishment and tending phase of the program.
- A special low municipal land tax rate for planted and managed forest lands.
- Some ingenious tax treatment that would create an “RRSP” type vehicle for investments in planting trees on bare land.
- An annual payment to the landowner, based on the value of the carbon credits that are held by the landowner. The agency making the payments will be buying the carbon credits from the landowner. A feature like this will make the program more attractive to landowners.