Forest Carbon Management in Canada

Final Report of the
Pollution Probe Forest Carbon Management Workshop Series

Prepared by
Paul Griss

July 2002

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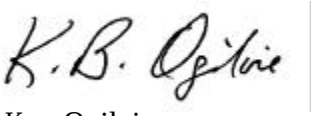
Pollution Probe is pleased to present this report on Forest Carbon Management in Canada. We believe that all options for reducing or offsetting greenhouse gas emissions to the environment must be explored and implemented. Carbon sequestration in forests is clearly an option to pursue, especially as Canada played a leading role in securing recognition in the Kyoto Protocol for the contribution that forest sinks can make to mitigating greenhouse gas emissions.

The workshop series that led to the publication of this report was a stimulating experience that drew upon the expertise of a wide range of companies (both forestry and energy companies), private landowners, investors and traders, government officials, environmental organizations, consulting firms and scientists. A rich array of information has been summarized and presented in this report. As Canada looks at ways to implement the Kyoto Protocol and future climate change commitments, Pollution Probe hopes that the workshop series report and other information that emerged from this initiative will be valuable resources for anyone interested in pursuing Forest Carbon Management.

This report does not represent the views or positions of any group or individual and it is not a consensus report. It does, however, try to fairly capture the range of views and experiences of the participants in the workshop series.

Pollution Probe thanks the many organizations and individuals who spent considerable time and effort to make the workshop series a success. We believe that this report contains information of value to any stakeholder group or member of the public that is interested in and concerned about climate change and the role that forests can play in resolving this most serious environmental problem.



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Acknowledgements

This report was prepared for the FCM Workshop Series sponsors and the Canadian public.

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Pollution Probe thanks the following workshop sponsors for their generous support:

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British Columbia Ministry of Water, Land and Air Protection

Pollution Probe also thanks the following individuals for their advice and their review and comment on the draft FCM report:

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Dr. David Layzell, BIOCAP
Ken Ogilvie, Pollution Probe
Dr. Fred Pollett

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Dr. Mark Johnston, Saskatchewan Research Council
Gord Miller, Environmental Commissioner of Ontario
Martin von Mirbach, Sierra Club of Canada

FCM Workshop Series Presentations

Citing or footnoting the numerous presentations provided in the workshop series would be an onerous task and, unless the source of the information was highly relevant to its use in this document, citations have not been made. Copies of all original presentations can be found at www.pollutionprobe.org/whatwedo/Kyoto.htm. Pollution Probe gratefully acknowledges the input of the following presenters whose ideas and experiences have been incorporated into this report.

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D. Neil Bird, Woodrising Consultants
Dr. Darcie Booth, Canadian Forest Service, Natural Resources Canada
Doug Bradley, Domtar
Matthew Bramley, Pembina Institute for Appropriate Development
Dr. Gary Bull, University of British Columbia
Doug Chekay, Ducks Unlimited
Joseph Cunningham, Industry Canada
John Donner, National Air Issues Coordinating Committee
Duncan Dow, RTL Consulting Group
Fraser Dunn, Ontario Ministry of Natural Resources
Jim Farrell, Canadian Forest Service, Natural Resources Canada
Bob Flemington, VCR Inc.
Randal Goodfellow, Goodfellow Agricola Consultants
Dr. Paul Gray, Ontario Ministry of Natural Resources
Byron Grundberg, Woodlot Association of Alberta
Steve Hounsell, Ontario Power Generation
Mike Innes, Abitibi-Consolidated
Rob James, Clean Air Canada Incorporated
Dr. Mark Johnston, Saskatchewan Research Council
Charles Jordan, Canadian-Ecuador Development Fund
Chuck Kaiser, Alberta Pacific Forest Products Limited
Dr. Werner Kurz, Canadian Forest Service, Natural Resources Canada
Gord Lambert, Suncor Energy
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Jack MacDonald, Ecosecurities Ltd.
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Dr. Bob Page, TransAlta
Jane Rigby, CO_2e.com
Chris Rolfe, West Coast Environmental Law Association
Paul Vickers, TransAlta
Martin von Mirbach, Sierra Club of Canada
George Weyerhaeuser Jr., Weyerhaeuser
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Preface

Pollution Probe convened a national series of five progressive workshops on Forest Carbon Management (FCM) over the period November 2001 to March 2002. These workshops were intended to improve understanding of FCM within Canada and to identify associated opportunities and the policies and infrastructure necessary to capitalize on them effectively. More than 200 individuals representing government, industry, ENGOs, academia, brokers, traders and consultants participated in the series. The workshops took place as follows.

Workshop #1: Forest Carbon Management in Canada — What Are the Challenges?
Toronto, November 7–8, 2001
Objective: To provide an overview of current science, policy, and stakeholder perspectives as they relate to FCM, ensuring that the full range of associated issues emerges.

Workshop #2: Securing Optimal Benefits from Forest Carbon Management
Edmonton, December 4–5, 2001
Objective: To identify opportunities for Canada to secure multiple sustainability objectives through FCM.

Workshop #3: Enhancing, Quantifying and Verifying Forest Carbon Stock Changes: Kyoto and Beyond
(organized by BIOCAP)
Ottawa, January 17–18, 2002
Objective: To identify priorities for university FCM research in the sciences, engineering and social sciences, and to discuss strategies for addressing these priorities, especially within the university research community.

Workshop #4: Developing Forest Carbon Management Policies, Tools and Techniques
Montreal, February 11–12, 2002
Objective: To identify the policy and infrastructure necessary to enable Canada to capitalize on FCM opportunities.

Workshop #5: Designing a Credible Mechanism for Forest Carbon Management
Vancouver, March 11–12, 2002
Objective: To synthesize the results of the first four workshops into an action plan for proceeding with FCM projects in Canada.

This report was prepared by the FCM Workshop Series Coordinator, Paul Griss. It originated as a background paper for participants in Workshop #1 and was rewritten following each workshop in the series. A final draft of this paper was reviewed by the FCM Workshop Advisory Committee. In addition, several knowledgeable individuals who attended multiple workshops were provided with an opportunity to comment. The report summarizes the wide variety of information and perspectives presented during the workshop series and thus can be considered as a synthesis of the state of knowledge of FCM in Canada. *The report is not a consensus document*, nor were all workshop series participants asked to approve its content. Unless otherwise specified, the conclusions in the report are those of the author based on his interpretation of the discussions that took place and with consideration given to comments made on the draft report by the Project Advisory Committee and selected external reviewers. Areas in which common ground emerged during the series provided the foundation for the suggested path forward described in Part E.

Executive Summary

Canada played a leading role in securing recognition in the Kyoto Protocol of the contribution that forest sinks can make to mitigating greenhouse gas emissions. Despite the opportunity for Canada created by Forest Carbon Management (FCM) — defined as those forest-related land use and land-use changes in the Kyoto Protocol (deforestation, afforestation, reforestation and forest management) — Canada has yet to take action to create or enhance forest sinks domestically. There remains considerable uncertainty as to the role of forest sinks in Canada's GHG emissions reduction strategy and many fundamental policy questions are still to be resolved. Pollution Probe initiated an examination of the issues and opportunities associated with FCM through a series of five progressive national workshops convened between November 2001 and March 2002. The workshop series was intended to improve understanding of FCM within Canada and to identify associated opportunities and the policies and infrastructure necessary to capitalize on them effectively.

The majority of activities proposed to create or enhance forest sinks contribute to the achievement of other environmental, social and economic objectives that are not related to climate change. Depending on the type of forest sink, they can further existing efforts related to wildlife habitat conservation, endangered species recovery, soil and water conservation, and the provision of recreational and economic opportunities. Forest sinks also provide a transitional strategy for GHG emitters. Achieving targeted levels of reductions will often require significant investments in capital stock turnover or the development of new technologies, many of which may not be currently economically feasible or available, and investments in sinks can offset emissions in the short term while emitters search for longer term solutions. The economic value of the additional carbon that finds its way into forest sinks — whether it assists Canada to meet its national targets, provides tradable carbon credits to an investor, or both — can be a lever to achieve a wide range of other policy objectives.

The government of Canada believes that up to 15% of its commitment to reduce GHG emissions to 6% below 1990 levels can be met through the inclusion of existing forest management (FM) and agricultural soils sinks in its accounting. Afforestation (A), reforestation (R), the reduction of deforestation (D) and enhanced forest management may provide further contributions. Under the rules of the Kyoto Protocol, increases in Canada's forest sinks will result in the granting of Removal Units (RMUs), each of which equates to one tonne of CO_2 equivalent. Emissions, such as through deforestation, will result in the cancellation of an equivalent number of RMUs.

The degree to which forest management can contribute, though, will depend on the extent and type of land selected by Canada for accounting in that category, a decision which must be made by 2006. The so-called "managed forest" must comprise lands on which activities have been human-induced and have occurred since 1990. Canada's FM RMUs will be the change in carbon stocks on that land over the first commitment period of the Kyoto Protocol (2008–2012). Further, Canada's use of forest management sinks is capped. Up to 33 Mt CO_2/yr (9 Mt C/yr) generated through forest management can be used to offset any net emissions from afforestation, reforestation and deforestation (A+R-D) and further RMUs from forest management are capped at 44 Mt CO_2/yr (12 Mt C/yr). Thus, the total potential forest management RMUs would equate to 77 Mt CO_2/yr in the first commitment period.

Investment in enhanced forest management, afforestation, reforestation and the reduction of deforestation, whether by governments or the private sector, will also be dependent on the value of carbon and on the return that FCM can provide compared to other GHG emissions management opportunities. Due to the multiple benefits of forest sinks described above, afforestation, reforestation, sustainable forest management and the reduction of deforestation have long been policy goals of Canada for the social, economic and environmental benefits to society they provide. As a result of climate change negotiations an additional forest value — carbon — has been introduced that has the potential to become a commodity which can produce a separate revenue stream, thus enhancing the business case for projects that perhaps make sense anyway. If the price of carbon in a GHG-regulated environment rose to $US 50 per tonne of CO_2 equivalent, as some predict, the value of Canada's 44 Mt CO_2/yr FM allocation alone, if fully used and made available for trading, would be $US 2.2 billion per year. Even at current prices, Canada's FM allocation would be worth $US 44,000,000–132,000,000 annually if it were made available through an emissions trading mechanism.

Canada is still at a very early stage in operationalizing FCM. At the same time, though, the potential for AR to offset D and for FM to maximize Canada's opportunities under its assigned FM cap during the first commitment period is diminishing with the passage of time. Canadian GHG emitters are also searching for offset opportunities and many are investing in projects in other countries, meaning that the social, economic and environmental benefits tied to sound FCM projects are being secured elsewhere by Canadian dollars. Canada needs to put in place the policies and infrastructure necessary to support FCM in this country if it is to both maximize the opportunity it has secured through the Kyoto Protocol and utilize carbon to further other social, economic and environmental policy goals.

To capitalize on the opportunities provided by FCM, Canada must quickly establish a mechanism that:

- ensures that FCM is integrated with Sustainable Forest Management (SFM) initiatives;
- supports FCM in Canada, by providing cost-effective alternatives to investing in international offsets, ensuring that the co-benefits of FCM are realized domestically; and,
- ensures the integrity and credibility of any RMUs or tradable credits resulting from FCM activities.

While no decisions have been made yet about a domestic emissions trading program in Canada, or whether forest sinks could produce tradable credits within such a system, Canadian GHG emitters have begun looking for opportunities to offset their emissions, and if FCM is not available in Canada, their investments will flow elsewhere. They are looking for projects that, among other things:

- provide real net carbon benefits that can be accurately and simply measured, monitored and verified;
- are eligible for policy recognition (domestically and/or internationally) by governments;
- have sustainable development benefits (social, economic, environmental) with no significant tradeoffs; and,
- demonstrate benefits that are supplemental to what would have happened in the absence of the project.

Forest companies and private landowners are currently impeded from initiating projects that meet these criteria by a range of policy and economic uncertainties. Some of the barriers to reforestation and forest management projects include:

- limited understanding of how climate change, natural disturbance and human activities affect carbon stocks in Canada's forests, and how to accurately measure

carbon stock changes that occur as a result of management activities;
- lack of an organization with the authority to review and legitimize initiatives;
- lack of national targets for emissions reductions, meaning there is currently no market for tradable credits;
- lack of an opportunity to produce tradable credits before 2008;
- unclear ownership of tradable credits from forest management on Crown lands;
- perceived risk of loss or lack of permanence coupled with lack of rules governing pools or averaging; and,
- comparatively short tenures of forest licensees which inhibits long-term investment.

Implementing a significant program of afforestation will require the participation of private landowners across Canada. The business case for such an initiative will need to consider a number of critical factors, including:

- the costs of establishing and maintaining the plantations;
- opportunity costs to the landowner; and,
- the costs of recruiting, managing and monitoring potentially thousands of landowners.

Further, where deforestation occurs outside the "managed forest," the associated emissions will become a public liability as there is currently no mechanism for assigning liability to the landowner or the entity that produced the emission. Mechanisms to minimize deforestation need to be explored as under the Kyoto Protocol accounting rules deforestation is considered to be an immediate emission of carbon into the atmosphere and thus carries undue impact in accounting in the short term.

Many of the above barriers must be overcome whether the Government of Canada is to increase the amount of RMUs it will receive in Kyoto Protocol accounting through policies and incentives targeted at landowners or managers or whether private investment in FCM is to be encouraged through the creation of tradable credits as part of a domestic emissions trading mechanism. Assuming that Canada ratifies the Kyoto Protocol and decides to include forest management in its accounting in the first commitment period, a number of decisions must then be taken to make this happen, including:

- *allocating responsibility* for GHG emissions reduction (this includes any allocation of Canada's forest management cap);
- determining the *eligibility of FCM actions* in creating or enhancing forest sinks;
- *developing standard mechanisms for the measurement, monitoring and verification of carbon stocks* that are compatible with international guidelines; and,
- *developing the institutional structures and capacity* necessary to support a diverse range of FCM initiatives across Canada.

Further, Canada will need to decide whether FCM is to be included in a domestic emissions trading mechanism, which will entail:

- *defining a tradable credit*;
- *establishing ownership* of tradable credits, particularly for initiatives carried out on Crown land;
- *addressing risk and uncertainty*, including the impermanence of FCM projects, to ensure that tradable credits are viable and are secure in the long-term;
- *establishing a registry* for tradable credits; and,
- *facilitating trading* of FCM credits by ensuring their eligibility under any entity/project-based emission removal/ reduction credit trading system established in Canada.

Initiation of FCM activities cannot wait until all of these issues are resolved. There is an immediate need for Canada to enhance its

learning and practical experience with respect to FCM. There are very few examples of FCM initiatives in Canada, and those projects that could contribute to the offset of GHG emissions are currently stymied by the lack of policy and infrastructure. At least in the short term, FCM initiatives are likely to be purely voluntary, undertaken by a landowner and/or manager at their own risk and expense. Like all voluntary initiatives intended to contribute to government environmental policy objectives, FCM initiatives will need to be designed carefully to be credible and effective. A critical factor in the success or failure of such initiatives will be the extent of policy and regulatory support for the undertaking. And some initiatives will fail, or at least fail to live up to expectations, so tolerance for failure must be built in to any mechanisms designed to further FCM in Canada.

To enhance its learning and ensure that Canada can take full advantage of its FCM opportunities, Canada should:

- *confirm the role* of FCM in contributing to Canada's GHG emissions reduction target and the opportunities it provides;
- *support coordinated FCM pilot projects* in a wide range of forest types and including different forms of land ownership;
- *increase policy certainty for pilot projects*, particularly surrounding ownership of tradable credits, the establishment of baselines and appropriate approaches to risk management;
- *support FCM research* and the development and application of new technologies;
- *consider incentives* to reduce deforestation or enhance the business case for proponents of FCM, recognizing the multiple values that can be secured through pilot projects;
- *develop standardized measurement, monitoring and verification procedures* consistent with IPCC guidelines, to ensure the credibility of FCM projects;
- *authorize FCM tradable credit registration and trading* for FCM pilot projects, to enable proponents to create a revenue stream relating to carbon; and,
- *initiate outreach programs* to further understanding of FCM and to ensure that the learning from pilots informs relevant policies and strategies.

Canada has secured for itself a significant comparative advantage among Parties to the Kyoto Protocol by negotiating for the eligibility of a broad range of FCM activities as GHG emissions management strategies. Many of these activities provide a vehicle to deliver on other social, economic and environmental objectives, multiplying the benefits of employing these techniques to combat climate change. The challenge before Canada is to capitalize on this comparative advantage and to put in place the policies and infrastructure that will enable proponents of FCM to initiate, and have legitimized, FCM projects across Canada.

Introduction

Anthropogenic emissions into the atmosphere of carbon dioxide (CO_2) and other greenhouse gases (GHG) are believed to be contributing to a warming of the Earth's climate, with potentially disastrous consequences. The desire to reduce these emissions led to the development of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol to the UNFCCC in 1997.

The principal source of anthropogenic GHG emissions is through the burning of fossil fuels; however, unsustainable forestry and agricultural practices can also release carbon into the atmosphere. Forestry and agriculture, though, also provide one of the few opportunities for anthropogenic removals of existing carbon from the atmosphere through the creation or enhancement of so-called biological "sinks." Carbon is the building block of all organic matter and increasing the amount of organic matter (such as trees) removes more carbon from the atmosphere. This has long been recognized in the climate change debates. Article 3.3 of the UNFCCC states that policies and measures to deal with climate change should cover all relevant sources, sinks and reservoirs of greenhouse gases, and forestry and agriculture sinks are included as legitimate GHG emissions management strategies in the Kyoto Protocol.

Despite this, the issue of sinks remains contentious for two principal reasons. Firstly, all vegetation eventually dies and decomposes releasing its carbon back into the atmosphere. Thus, unless there is a continuous replenishment of the carbon through new growth, the sink will eventually become a source of carbon emissions. While many of those who are skeptical of the role of sinks are prepared to accept their inclusion in national accounting, they argue that the uncertainty, impermanence and difficulties with determining the additionality of sinks limit the opportunities for specific projects, particularly those that are intended to generate tradable carbon credits. Proponents of enhancing biological sinks argue that these issues can be addressed through regulation, policies, good management and the provision of incentives, and that the potential for employing sinks to mitigate GHG emissions is much greater than what is currently recognized through the Kyoto Protocol.

The second issue relates to the desire to secure reductions in GHG emissions at source. It is argued that the greater the role given to sinks, the less emphasis will be placed on reductions, especially if investment in sinks is more cost-effective than moving to cleaner technologies or easier than securing changes in human behaviour. Major GHG emitters counter that achieving targeted levels of reductions will require significant investments in capital stock turnover or the development of new technologies, neither of which are currently economically feasible or available. Sinks are seen as a transitional strategy that enable emitters to offset their GHG emissions in the short term while they continue to search for longer term solutions.

A further consideration with sinks, though, is that the majority of activities proposed to create or enhance sinks contribute to the achievement of other environmental, social and economic objectives that are not related to climate change. Improved soil conservation in agricultural practices has long been an objective of agricultural conservation policies. Similarly, revegetating marginal agricultural land, especially by returning it to forest cover, has been supported by numerous incentive programs in Canada. Depending on the type of biological sink, they can contribute to existing efforts related to wildlife habitat

conservation, endangered species recovery, soil and water conservation, and the provision of recreational and economic opportunities. The economic value of the additional carbon that finds its way into forestry and agricultural sinks — whether it assists Canada to meet its national targets, provides tradable carbon credits to an investor, or both — can be a lever to achieve a wide range of other policy objectives.

Canada was a leading advocate for the eligibility of biological sinks under the Kyoto Protocol, but has yet to seize the opportunity to take action in creating or enhancing sinks domestically. There remains considerable uncertainty as to the role of sinks in Canada's GHG emissions reduction strategy and many fundamental policy questions are still to be resolved, both providing impediments to action. Clear direction is required in reconciling the differing views of sinks described above and in evaluating the potential that the climate change contribution of sinks provides for achieving other policy objectives. In addition, there is a considerable lack of awareness and understanding of sinks and their associated opportunities among those whose engagement is necessary to move forward.

As a contribution to this process, Pollution Probe initiated an examination of the issues and opportunities associated with Forest Carbon Management (FCM) through a series of five national workshops over the period November 2001 to March 2002. The decision to concentrate on FCM does not in any way suggest a lack of interest in agricultural sinks or the opportunities they provide; rather, it was felt that it was possible to bring greater focus to the issues by concentrating on FCM.

The workshop series was designed to foster greater understanding of FCM and bring clarity to the priority issues to be resolved. The objectives of the workshop series were to:

- broaden the constituency for forest carbon management; and,
- identify the policies and infrastructure necessary for Canada to be able to capitalize on FCM opportunities in a credible and effective manner.

This report summarizes the issues discussed during the series.

Forest Carbon Management (FCM)

For the purposes of this workshop series, Forest Carbon Management encompasses all forest-related activities eligible under Articles 3.3 and 3.4 of the Kyoto Protocol, including afforestation, reforestation, forest management and reducing deforestation — see Section A.1.

Section A — Forest Sinks and Climate Change

As described above, the UNFCCC and the Kyoto Protocol both recognize the contribution of biological sinks to mitigating climate change. This section discusses the parameters governing forest sinks and their implications for FCM in Canada.

A.1 Forests and the Kyoto Protocol

The Kyoto Protocol recognizes that one method of mitigating greenhouse gas (GHG) emissions from human activities is to enhance the ability of forests to act as carbon sinks. Appendix I describes the cycle of carbon in Canada's forests. Owners and managers of forests can contribute to managing carbon in three ways:

- by protecting the forest, so that biomass is not reduced either from human activities, fire, disease or insect infestations;
- by enhancing the amount of carbon stored in the forest through increasing growth rates, conserving soils, etc.; and,
- by creating new forests to capture more carbon in the new growth than was present in the vegetation that is being replaced.

All of these options are eligible under the Kyoto Protocol, with the principal provisions relating to forests and forest management being found in Articles 3.3 and 3.4 (see Appendix 2) falling under the auspices of Land Use, Land-Use Change and Forestry (LULUCF). Article 3.3 refers to the establishment of new forests (afforestation / reforestation) on lands that were not forested prior to 1990 (the base year of the Kyoto Protocol) as well as to the permanent removal of forest cover (deforestation). Article 3.4 states that forest management is also eligible provided that activities are human-induced and that they have occurred since 1990. Until recently, there was considerable uncertainty as to how Articles 3.3 and 3.4 were to be interpreted and applied as many issues — not least the definitions of important terms — were left for future resolution, and this stalled progress in the negotiations surrounding forest sinks for a number of years.

The so-called "Bonn Agreement" arising from the second part of the sixth Conference of Parties (CoP6) to the Kyoto Protocol in 2001 resolved many of these outstanding issues for the first commitment period (2008–2012) of the Kyoto Protocol (see Appendix 3). The seventh Conference of the Parties (CoP7), in Marrakech, Morocco, adopted all the draft decisions related to forest sinks agreed to in Bonn (only increasing the size of the forest management cap for Russia) and also agreed to detailed technical rules for accounting, reporting and review. Collectively these adopted decisions are known as the Marrakech Accords. The three volumes of the Marrakech Accords can be found at the following URLs: http://unfccc.int/resource/docs/cop7/13a01.pdf; http://unfccc.int/resource/docs/cop7/13a02.pdf; and, http://unfccc.int/resource/docs/cop7/13a03.pdf.

The agreement related to Land Use, Land-Use Change and Forestry is included in the first of these volumes. It is important to note that the Marrakech Accords cover only the first commitment period in the Kyoto Protocol — the five-year period from 2008–2012. A great deal of uncertainty remains as to how FCM initiatives will be treated in subsequent commitment periods.

According to the Marrakech Accords, Parties to the Kyoto Protocol will account for FCM initiatives as follows. Countries will submit their accounting information for in-depth review against evaluation criteria that remain to be negotiated. If the review is satisfactory,

Removal Units (RMUs) will be issued, each equating to 1 tonne of CO_2 equivalent. If problems are encountered, a conservative adjustment (according to an as yet to be determined process) will be made and a reduced number of RMUs issued. Severe accounting problems will prevent any RMUs from being issued. A similar process will be followed in accounting for emissions from forest-related sources. Emissions will be accounted for by canceling out previously assigned RMUs or other accounting units established by the Marrakech Accords (AAUs — assigned amount units, ERUs — emission reduction units, CERs — certified emission reductions). Severe accounting problems for emissions will result in penalties, which are yet to be determined. RMUs can be traded in a Kyoto Protocol emissions trading system (i.e., among countries with targets which have ratified the Protocol), but they cannot be 'banked' or carried-over for use in a subsequent commitment period.

As described in the Kyoto Protocol, the role of forests in creating or canceling RMUs is in three areas, which are described in detail below:

- deforestation;
- afforestation/reforestation; and,
- forest management.

A.1.1 Deforestation (D)

> ***"Deforestation"*** is the direct human-induced conversion of forested land to non-forested land. *(Draft decision -/ CMP.1 Land Use, Land-Use Change and Forestry — FCCC/CP/2001/13/ Add.1)*

Deforestation refers to the permanent removal of land from the forest estate through, for example, agricultural expansion, urban development or road construction. The spatial assessment unit for deforestation must be no more than 1 ha, which means that it will not just be large-scale deforestation for which countries will be held accountable.

It is important to recognize that the Kyoto Protocol *does not* consider the removal of trees through harvesting to be deforestation, although harvesting does contribute to forest management accounting (see A.1.2). Under the accounting rules of the Kyoto Protocol, the removal of trees through deforestation is considered to be an immediate emission of carbon into the atmosphere no matter what the actual fate of the carbon. Minimizing deforestation associated with human activities, such as urbanization, is obviously one strategy to reduce CO_2 emissions.

A.1.2 Afforestation/Reforestation (AR)

"Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources. *(Draft decision -/CMP.1 Land Use, Land-Use Change and Forestry — FCCC/CP/2001/13/Add.1)*

"Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989. *(Draft decision -/CMP.1 Land Use, Land-Use Change and Forestry — FCCC/CP/2001/13/Add.1)*

Afforestation refers to planting trees on land that has not been forested for 50 years or more, while reforestation refers to planting trees on land that was forested but has not now got trees on it as a result of conversion to non-forest use. For all practical purposes, then, these terms are synonymous, as both mean putting trees on land that was not forested on December 31, 1989. The reason why the forest was removed from the land originally is irrelevant as, in each case, the same actions are required to bring the land back to forest. Should any lands accounted for under afforestation or reforestation be harvested in the future, the Kyoto Protocol limits emissions from harvesting to the size of any RMUs previously given for afforesting or reforesting the area.

A.1.3 Forest Management (FM)

"Forest Management" is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner. *(Draft decision -/CMP.1 Land Use, Land-Use Change and Forestry — FCCC/CP/2001/13/Add.1)*

The Marrakech Accords state that "forest management" is an eligible land use, land-use change and forestry activity under Article 3.4 of the Kyoto Protocol. Countries that wish to include forest management in their national accounting for the first commitment period (2008–2012) must decide so by 2006. They must also stipulate the portion of their landbase that is to be considered as "managed forest," bearing in mind the requirement that activities on that landbase must be human-induced and conducted since 1990. The number of RMUs derived from forest management on these lands in the first reporting period is capped (see A.2) and will be determined solely by the change in carbon stock in the "managed forest" over the first commitment period. While the selection of the "managed forest" must be based on the nature of the activities carried out on the land, the RMUs generated from the landbase are thus independent of the specific activities undertaken.

Forest management accounting must reflect the impacts of a wide range of activities. Harvesting and natural factors, such as fire, insects and disease, deplete the amount of carbon on the landbase. New growth must offset these losses for forest management to be sustainable. A variety of enhanced forest management activities (see C.2.3), however, can increase the carbon stored on the selected landbase, including juvenile spacing, increased pest and disease control and the

increased protection of forests from fire. The extent to which investment in these activities can secure additional RMUs for Parties is dependent on the difference between the potential for existing activities to store carbon and the cap on forest management placed on individual Parties. It is also influenced by the need to balance the role of forests as carbon sinks with the other social, economic and environmental values that are to be secured through forest management.

It is possible for reforestation and deforestation to occur within the selected "managed forest" so Parties will need to show that their accounting for forest management does not include emissions and removals resulting from these activities (as determined under Article 3.3) to prevent double-counting.

A.2 Implications for Canada's Forests

The Government of Canada believes that up to 15% of its Kyoto Protocol target of reducing GHG emissions to 6% below 1990 levels could be met through the inclusion of existing forest management and agricultural soil sinks in its national accounting. This is necessarily a crude estimate as Canada has yet to select an area of "managed forest" and is in the process of refining its forest inventories and measuring systems. This estimate, though, does not include the potential contribution of afforestation and reforestation nor does it consider the impact of the enhanced forest management that may be possible within the cap imposed on Canada.

Parties to the Kyoto Protocol accepted a cap on the use of forest management sinks in the first commitment period. In Canada's case:

- an FM sink can be used to offset net ARD emissions (i.e., when deforestation emissions exceed reforestation/ afforestation RMUs) up to a maximum of 33 Mt CO_2/yr (9 Mt C/yr); and,
- any remaining FM sink can be counted up to Canada's country specific cap of 44 Mt CO_2/yr (12 Mt C/yr). This cap includes any RMUs from forest management Joint Implementation projects (forest management projects undertaken in Canada by other industrialized countries).

The maximum contribution of FM in the first commitment period is thus 77 Mt CO_2/yr (21 Mt C/yr). There is no cap on afforestation and reforestation RMUs except those obtained through the Clean Development Mechanism (i.e., projects conducted in developing countries), which are capped at 22 Mt CO_2/yr (6 Mt C/yr). There is also no limit on deforestation emissions.

At present, it is not known by how much D will exceed AR in the first commitment period in Canada so the amount of FM RMUs needed to offset net ARD emissions is unknown. As the extent of the "managed forest" is yet to be determined, the proportion of the 44 Mt CO_2/yr cap on additional FM activities that will be secured through existing forest operations is also unknown, which makes the potential for securing additional RMUs through enhanced FM activities uncertain. The latter issue, in particular, may present a barrier to investment in enhanced FM activities.

Investment in enhanced forest management, afforestation, reforestation and the reduction of deforestation, whether by governments or the private sector, will also be dependent on the value of carbon and on the return that FCM can provide compared to other GHG emissions management opportunities. The economics of FCM are discussed in more detail in Section B.2, but it is important to note that if the price of carbon in a GHG-regulated environment rose to $US 50 per tonne of CO_2 equivalent, as some predict, the value of Canada's 44 Mt CO_2/yr FM allocation alone, if fully used and made available for emissions trading, would be

$US 2.2 billion per year. Even at current prices, Canada's FM allocation would be worth $US 44,000,000–132,000,000 annually.

While the Government of Canada worked hard to secure the increased scope and legitimacy of sinks within the Kyoto Protocol, it does not see sinks as a "quick fix" solution. To proceed with FCM activities relating to Article 3.3 and Article 3.4, Canada will need to commit to a substantial body of work. The Marrakech Accords require Canada to:

- account for carbon in above- and below-ground biomass, litter, dead wood, and soil organic carbon;
- account for non-CO_2 emissions/removals (CH_4 and N_2O);
- account for the flow of carbon on a given area beginning with the start of the activity (e.g., afforestation) or the beginning of the commitment period (2008), whichever is later;
- ensure that once land enters the accounting system it remains there in all future commitment periods;
- report how disturbance followed by regeneration of forest is distinguished from deforestation;
- decide by 2006 whether it wants to include forest management in its accounting in the first commitment period (must demonstrate that the area selected has been subject to human-induced forest management since 1990);
- ensure no double-counting of ARD sinks and sources with forest management sinks and sources;
- determine for each ARD and FM whether Canada will account annually or only once over the five-year commitment period (2008–2012);
- develop a report for each year in the commitment period, including aggregate emissions and removals from sinks activities, information on the areas involved, emissions and removals for these areas, information showing that only areas subject to activities after 1 January 1990 are included, and information showing that any omitted carbon pools do not have net emissions; and,
- upon ratification of the Kyoto Protocol and again during each commitment period provide a description of the national system for estimating emissions and removals and information on legislative and administrative arrangements for meeting the Protocol commitments (including information on arrangements that seek to ensure sinks activities contribute to conservation of biodiversity and sustainable use of natural resources).

So, even to take advantage of the basic opportunity presented by FCM, Canada will need to improve the certainty of its estimates of carbon stock changes within forests and develop better inventorying and monitoring systems, both of which will require funding; particularly, significant investments in developing expertise.

A.3 Terminology Designed to Confuse

One of the major impediments to progress in understanding and implementing FCM is that a variety of key terms are employed to mean different things in different contexts. This is not directly related to the Kyoto Protocol, but the use of certain words in the Kyoto Protocol differs from the interpretation of those words in other forestry or climate change contexts. Following are some examples of words that are proving, if not to be divisive, then at least to be confusing.

Credit can mean the RMUs that Canada receives through reporting its performance under the Kyoto Protocol. It can also mean positive changes to carbon stocks that might contribute to RMUs. GHG emitters, including forest companies, want credit for reducing or offsetting their emissions. And many

proponents of FCM wish to create carbon credits that can be applied against emissions reduction targets assigned to them or traded within an emissions trading mechanism.

Debit can mean an emission which cancels out RMUs (e.g., deforestation) or it can mean negative changes in carbon stocks that might reduce the amount of RMUs Canada can receive (e.g., harvesting). Some also use debits to mean a liability that is assigned to a GHG emitter, including a forest company, associated with the calculation of carbon credits, whether or not those credits are applied against performance targets or traded.

Permanence can mean the ability of carbon to remain in a sink in perpetuity or it can mean the ability of an FCM proponent to guarantee an investor that the carbon on which a tradable credit is based will remain in the sink for at least the life of the project or purchase contract.

Pools can be aggregations of FCM projects that mitigate risk for investors (like mutual funds) or they can be a storehouse of carbon (e.g., soil, above-ground biomass).

Reforestation usually means regeneration of a forest following disturbance (such as harvesting), but in the context of the Kyoto Protocol it is solely applicable to forest lands that did not have forest on them on December 31, 1989.

Attempts have been made throughout this report to be consistent and accurate in the use of terminology and to clarify what the terms mean in the context in which they are used.

A.4 Unfinished Business in the Kyoto Protocol

Since the Kyoto Protocol was developed in 1997, there has been a significant ongoing effort by Parties to clarify its requirements more precisely. As indicated earlier, the past year has seen substantial progress relating to forest sinks through the Bonn Agreement and the Marrakech Accords. Nevertheless, the slow pace of negotiations means that there remain a number of unresolved issues relating to FCM that may influence the type and extent of FCM activities possible in the first commitment period.

A.4.1 A Focus on the First Commitment Period

The Marrakech Accords have established the rules that will apply for ARD and FM in the first commitment period (2008–2012). Effective FCM is part of a long-term GHG emissions reduction strategy. Accordingly, the focus on the first commitment period, which commences in only six years, has the potential to compromise longer term objectives and investments. How FCM, particularly FM, will be treated beyond the first commitment period remains unclear; yet many investments in FCM will not fully produce carbon benefits until after 2012. While the rules for the first commitment period can provide greater certainty to those investing in FCM activities, the risk that projected tradable credits or RMUs from activities undertaken today may be ineligible or discounted in future remains quite real.

A further issue is that while Kyoto Protocol targets are set against a 1990 base year (and this reference point is specifically embedded in the definitions of A and R) Canada is only required to report changes in carbon stocks over the period 2008–2012. Any increases in carbon stocks resulting from FCM between 1990 and 2008 will not result in the creation

of RMUs or tradable credits (unless pilot trading programs are launched as learning exercises). Thus, there is little incentive for FCM proponents to take early action, even though early action is required to deliver the maximum possible carbon benefits during the first commitment period.

In implementing FCM in Canada, there is a danger of a preoccupation with the current rules at the expense of investing in the broader opportunities provided by FCM which, hopefully, will be recognized in the ongoing negotiations surrounding the Kyoto Protocol.

A.4.2 Forest Carbon Accounting Inconsistencies

One of the fundamental issues in FCM is the disparity between the potential of forests as carbon sinks and the limitations placed on them under the Kyoto Protocol (e.g., caps). The Kyoto Protocol is a political agreement that enables Parties to receive RMUs for certain FCM activities, establishing the rules for obtaining those RMUs in the short term. Not all activities that remove carbon from the atmosphere will be eligible for RMUs, and carbon that may never enter the atmosphere can be treated as an emission. An example of the former is any increase in a forest sink generated through enhanced FM that exceeds the country cap imposed on Parties. The most obvious example of the latter is the treatment of deforestation as an immediate emission of carbon into the atmosphere even though the trees removed from the site may be processed into wood products that may fix carbon for an extended period of time.

By not recognizing the wood products carbon pool, the Kyoto Protocol requires Parties to account for only part of the carbon cycle in forests. Under current rules, wood products derived from the tree are not considered to be carbon sinks and the burning of biomass wastes that may result from harvesting or the processing of the wood products is not considered to be an emission by the user (as the accounting of the emission occurs at harvest). The result is an accounting inconsistency — emissions for harvesting or deforestation are assigned long before the carbon reaches the atmosphere, yet RMUs or tradable credits will only be assigned based on the actual change in carbon stocks on the "managed forest," not the projected increase in carbon stocks over time resulting from the project. This accounting treatment stresses the negative over the positive providing a disincentive to AR and FM and overstating the impacts of D on carbon in the atmosphere.

A.4.3 The Limitations of Caps

Although Parties to the Kyoto Protocol agreed to accept caps on FM RMUs in the first commitment period, those caps may limit the extent of FM activities and may also have the perverse effect of providing no incentive at all to reduce D or increase AR. For example, in the first commitment period, Canada can use its first 33 MtCO_2/yr from FM to offset net emissions from ARD (deforestation minus afforestation/ reforestation) and can claim a maximum additional credit of 44 Mt CO_2/yr for FM. The maximum FM RMUs allowable to Canada is thus 77 Mt CO_2/yr.

If it is projected that the change in carbon stock in Canada's selected "managed forest" from ongoing FM activities will be equal to or greater than 77 Mt CO_2/yr in the first commitment period there is then no incentive to invest in additional FM activities that could enhance forest sinks.

Further, suppose for example that Canada's net ARD debit is 30 Mt CO_2/yr and its total FM credit is 100 Mt CO_2/yr. Only 30 Mt CO_2/yr of the 33 Mt CO_2/yr FM offset of ARD can be claimed and only 44 Mt CO_2/yr

of the remaining 70 Mt CO_2/yr of FM RMUs can be claimed, which means Canada has an outstanding forest sink of 26 Mt CO_2/yr that does not show up in the national accounts. Worse, even if the 30 Mt CO_2/yr ARD debit is reduced by decreasing D or increasing AR, Canada will still be able to claim only a net 44 Mt CO_2/yr from FM and thus, in theory, has no incentive to afforest, reforest or reduce deforestation.

A.5 The Scientific Challenges of FCM

Workshop #3 in the Pollution Probe Forest Carbon Management series was organized by BIOCAP to consider "Enhancing, Quantifying and Verifying Forest Carbon Stock Changes: Kyoto and Beyond". The intention of this workshop was to identify the science needs of FCM in Canada and to begin to develop a research agenda, principally for the university community. Appendix 4 presents the results of Workshop #3 and indicates the scale and scope of research required to enhance our understanding of FCM and its impacts.

In brief, some of the research priorities emerging from Workshop #3 included:

- exploring options and the relationships among accounting rules, incentive systems, carbon credits, timber supply and other forest values;
- developing tools to integrate data and model carbon stock changes in Canada's forests under scenarios that vary with time (before 1990 to 2050), scale (stand level to national) and input assumptions (climate, disturbance, species);
- understanding the processes that lead to changes in the sources and sinks of greenhouse gases from forest ecosystems in response to climate change, natural disturbance and human activities;
- developing cost-effective strategies for detecting land-cover change and new tools for measuring greenhouse gas emissions or carbon stock changes on forest ecosystems;
- determining whether climate change is mitigated (through carbon sequestration) or exacerbated (through changes in albedo) by afforestation efforts in various regions;
- exploring or developing new technologies for enhancing or preserving forest carbon stocks;
- assessing the impacts of human activities on forest carbon stock changes;
- assessing other costs and benefits of FCM activities in forest ecosystems; and,
- proposing and assessing various strategies for implementing management practices or technologies to enhance forest carbon stocks.

While science and social science research is a major limitation in our ability to enhance, quantify and verify carbon stock changes in Canada's forests, there was a widespread optimism that these limitations could be overcome with an appropriate research investment. Nevertheless, continued policy uncertainty and the extent of the infrastructure that will need to be put in place in Canada are significant factors in Canada's ability to pursue FCM opportunities.

Section B — Securing Multiple Benefits Through Forest Carbon Management

Neither climate change nor the Kyoto Protocol provide the only justification for conserving or enhancing forest sinks. Forests contribute to soil and water conservation, deliver a wide range of economic, recreational and cultural opportunities to Canadians, and provide wildlife habitat. As a result, afforestation, reforestation, sustainable forest management and the reduction of deforestation were policy goals of Canada long before climate change emerged as an issue. The fundamental change that has occurred as a result of climate change negotiations is that an additional value — carbon — has been introduced that provides added justification for Canada to invest in ARD and FM. The potential for emissions trading means that carbon could also become a commodity, which can produce a separate revenue stream that can enhance the business case for ARD and FM projects, assisting in the delivery of other social, economic and environmental benefits. FCM, then, is not solely dependent on the Kyoto Protocol and its accounting rules.

As a result of the role given to forests in the Kyoto Protocol, an increasingly diverse array of proponents has been promoting projects ranging from tree planting in city parks to the protection of tropical rainforests to the establishment of large-scale plantations in the hopes of securing investments in FCM. Subsequent decisions have firmed up the eligibility rules of FCM projects and many of these initial projects may be found to be uneconomic or ineligible. The evolving negotiations, though, have also created new opportunities, such as those provided by forest management activities. Appendix 5 provides a summary of some existing FCM initiatives worldwide. Few, if any, of these have been undertaken solely to create, protect or enhance forest sinks. To date, there has been much less FCM activity in Canada. Appendix 6 describes the actions taken to date on FCM by Canadian stakeholders.

B.1 Leveraging the New Value of Carbon

The current paradigm of Sustainable Forest Management (SFM) requires forest managers to integrate a wide variety of social, economic and environmental values into decision making. Over the past decade, provincial governments, to varying degrees, have revised legislation and policies to support SFM. The forest industry, again to varying degrees, has sought to demonstrate its support for SFM through activities such as certification and through other initiatives (such as participation in the Model Forest Program). A significant challenge in SFM is weighting and/or reconciling the wide range of values to be sustained in the forest. To date, the role of forests as carbon sinks, while often recognized, has not been a significant factor in these debates. It is likely to become so as awareness grows of the potential for conserving carbon to either further or impede other objectives.

A similar situation exists on private lands. SFM also applies to private woodlots and woodlot owners now have an additional value to consider when making management decisions. And on the agricultural landscape, programs to create shelterbelts, bring new lands into agricultural production or to reforest marginal land will also be influenced by the value placed on carbon.

International conservation organizations, such as Conservation International and The Nature Conservancy, were some of the first to recognize that promoting FCM projects

(particularly those that contribute to forest protection) could help them to further their conservation goals. Similarly, organizations promoting social and economic opportunities in developing countries have begun to stress the sinks component of agroforestry projects in those regions.

Carbon may only be one value provided by FCM initiatives and to be addressed through SFM — and it may not be the most important one — but given its potential economic value (see B.2) it could be a lever that secures other values. The question is: How big a lever?

One criticism of FCM has been the potential for carbon to override other values of the forest. A number of environmental concerns have been raised with respect to FCM, including:

- introduction of fast-growing exotic species;
- increased use of biocides to protect trees;
- potential loss of biodiversity through simplification of forest structure or the establishment of monoculture plantations; and,
- the fact that long-term (100+yrs) strategies may be at odds with short-term (<50 yrs) opportunities.

Interpreted from a solely carbon perspective, for example, adhering to the Kyoto Protocol could have legitimized logging an ecologically valuable old-growth forest to replace it with a fast-growing monoculture plantation. The Marrakech Accords have addressed this issue by affirming that LULUCF activities should be governed by the principle: "that the implementation of LULUCF activities contributes to the conservation of biodiversity and sustainable use of natural resources." Under the Marrakech Accords, Canada is required to provide a description of any national legislative arrangements or administrative procedures that seek to ensure that this occurs. Each LULUCF activity has differing impacts on other forest values.

Obviously, an FCM initiative oriented toward reducing deforestation would serve to keep land under forest cover, thus preventing values from being lost.

AR initiatives provide a number of conservation benefits, including:

- the creation of shelterbelts and urban forests (although these may not be eligible under the Kyoto Protocol);
- forest restoration;
- creation or protection of wildlife habitat;
- establishment of conservation easements;
- creation of plantations that may generate conservation gains elsewhere on the landscape (e.g., by reducing logging in natural forests); and,
- establishing plantations for biomass to reduce the need for fossil fuels, although the significant amount of biomass made available through current forest operations affects the viability of this approach.

FM initiatives may also have positive conservation benefits. Increasing the amount of carbon on the forest landbase can be achieved by:

- a lengthened rotation age;
- management for mature, old and old-growth forests;
- improved or more ecologically appropriate logging techniques;
- the establishment of large protected areas;
- reducing primary forest conversion;
- reducing road network expansion; and,
- limiting other incursions into the forested land base.

Further, many of the specific silvicultural activities described in Section C.2.3 can increase the amount of fibre on the landbase.

All FCM initiatives thus differ in their ability to conserve biodiversity and provide other environmental benefits, depending on how and where they are carried out. In balancing

the range of values to be addressed through SFM, emphasis is placed on the ability of all values to be secured on a landscape basis; that is, it is not possible to secure all values on every portion of the landscape at the same time. Intensive silviculture on a portion of the landscape, for example, may reduce management pressure on the balance of the forest landscape by allowing forest companies to secure more fibre from a smaller landbase. So, while the Marrakech Accords require that FCM initiatives consider biodiversity and the sustainable use of natural resources, this is best accomplished by considering initiatives in a landscape level context. The ability to address the new value of carbon in isolation of all other forest values is thus limited.

Further confidence in the relationship between carbon and other forest values can be established by incorporating FCM initiatives into programs for the certification of sustainable forest management. For example, the FACE Foundation in The Netherlands (www.facefoundation.nl) has adapted the Forest Stewardship Council's "Principles and Criteria for Natural Forest Management" to FCM projects. The Sustainable Forest Management System standard of the Canadian Standards Association explicitly requires applicants to consider carbon as one of the values to be addressed through their management system. The potential also exists to facilitate measurement, monitoring and verification of carbon by expanding certification audits to encompass these issues. As stated by one of the breakout groups at Workshop #2: "if sensitive to habitat considerations when increasing carbon stocks, the tools for monitoring, measuring and verifying carbon stock changes should be compatible with verifying biodiversity integrity and other forest values."

In reality, FCM and SFM are inseparable and will likely be addressed by the same planning processes in Canada. The relationship between FCM and SFM will vary across the country, though. In some forest types and regions, managing for carbon can be a driver of SFM (e.g., restoring forests in southern Ontario). In other areas, FCM will be a "passenger" that can add value to SFM initiatives. Given the commitments made by the federal and provincial governments to SFM and to biodiversity initiatives like the proposed Species at Risk Act, FCM must contribute to SFM at a landscape level and must also contribute to, or at least not detract from, other related domestic and international policy commitments.

B.2 Carbon as an Economic Driver

As stated, one attraction of FCM projects is that they have the potential to provide multiple revenue streams. AR or FM projects increase supplies of fibre and create or enhance forest sinks, meaning that carbon alone is not required to justify the project, and the value of timber provides additional security to those investing in the activity.

Under a potential emissions trading program among Parties to the Kyoto Protocol, Canada would be free to trade RMUs secured through FCM should they not be required to meet domestic targets. The potential also exists for the creation of a domestic market for tradable credits secured through FCM initiatives, enabling GHG emitters to buy credits to offset their emissions (see Section D). Predictions about the future value of carbon and the extent of emissions trading vary widely as, although trading has begun in some quarters, the processes and rules governing trading, both under the Kyoto Protocol and domestically, have yet to be developed. Current prices are in the range of US $1 to $3 per tonne of CO_2 equivalent. The value of carbon is expected to rise sharply as the first commitment period of the Kyoto Protocol approaches and countries (or GHG emitters) that are having difficulty reducing emissions attempt to purchase RMUs (or tradable credits) rather than face penalties and embarrassment. As suggested in Section A.2,

the economic value of Canada's FM allocation could be substantial and — depending on the portion (if any) of this allocation that is made available for trading — it could be a significant source of new investment in forest conservation in Canada.

At current carbon prices, though, FCM is seen principally as a risk management tool. The early market for carbon credits, including those from FCM, is informal and not transparent and buyers are driven by their perceptions of the risks of proposed or future policies. Thus, many buyers are purchasing carbon at the low price at which it is currently traded in the hope that it can be used as needed in the future or sold at a profit if the owner's store of carbon is greater than its need. Prices are low at this stage in the development of the market as buyers and sellers are sharing the policy risk — the possibility that the "credit" may not comply with future trading rules or may not be sanctioned by appropriate governments at a later date. As policy certainty increases, prices will adjust to reflect the reduced risk of investing in these projects.

The price of carbon is only one factor in a decision to invest in FCM. GHG emitters who wish to buy carbon credits have a number of choices in the development of their offset portfolio. They can make investments in other companies who may be able to secure GHG emission reductions at a lower cost than is possible in the investor's own operations. Buyers can also invest in either forest or agricultural/soils sinks. Further, the investor can support domestic action, can invest in other industrialized countries through the Kyoto Protocol's Joint Implementation (JI) program, or can invest in projects in developing countries through the Kyoto Protocol's Clean Development Mechanism (CDM). As a result, if domestic FCM projects are to attract investment they must create or enhance forest sinks at a price that is competitive with other options available to the buyer.

One way in which this can be done is to increase the policy certainty surrounding FCM. Countries, such as Costa Rica, Argentina and Australia, have already moved to facilitate investments in FCM domestically by providing the infrastructure necessary to enable FCM projects to proceed either to meet domestic commitments or to attract funding through the Kyoto Protocol. Australia, for example, is faced with the need to reforest five million hectares to address soil salinity issues. It sees carbon as a lever to make that happen and has developed a rigorous commercial framework for business interested in FCM. Measures include basing the program on the safest interpretation of Article 3.3 of the Kyoto Protocol, setting up carbon investment pools that are associated with good forest management, and providing independent verification of performance. The New South Wales government also introduced carbon rights legislation, which separates ownership of carbon from ownership of the trees.

Canada is still at a very early stage in operationalizing FCM. At the same time, though, the potential for AR to offset D and for FM to maximize Canada's opportunities under its assigned FM cap during the first commitment period is diminishing with the passage of time. Canadian GHG emitters are also searching for offset opportunities, and many are investing in projects in other countries, meaning that the social, economic and environmental benefits tied to sound FCM projects are being secured elsewhere by Canadian dollars. Canada needs to put in place the policies and infrastructure necessary to support FCM in this country if it is to both maximize the opportunity it has secured through the Marrakech Accords and utilize carbon to further other social, economic and environmental policy goals.

Section C — The Context for Forest Carbon Management in Canada

Canada negotiated hard to get forest sinks included in the Kyoto Protocol and, despite the limitations of the country cap on FM RMUs, Canada has secured a significant comparative advantage in this area over Parties that do not have similar FCM opportunities. For Canada to capitalize on this, a greater sense of urgency is required in establishing the requisite policies and infrastructure. Canadian GHG emitters also see carbon sinks as a tool that can leverage other activities that will secure reductions in GHG emissions at source (e.g., capital stock turnover). In brief, this means that FCM can offset emissions in the short term, giving industry time to move to less carbon intensive processes in a more cost-effective manner.

To address these opportunities, Canada needs to develop an FCM mechanism that:

- ensures that FCM is integrated with Sustainable Forest Management (SFM) initiatives;
- supports FCM in Canada, by providing cost-effective alternatives to investing in international offsets, ensuring that the co-benefits of FCM are realized domestically; and,
- ensures the integrity and credibility of any RMUs or tradable credits resulting from FCM activities.

In terms of the last point, it is important to recognize that, while FCM's legitimacy as a GHG emissions management strategy is strengthened by the Marrakech Accords, it is still viewed with skepticism by many critics who view it as less preferable than securing reductions in GHG emissions at source. Initial FCM initiatives will be scrutinized closely to ensure that they comply with the Marrakech Accords or are not an "easy way out" for Canada or for GHG emitters. Thus, the policies and infrastructure that support FCM initiatives in Canada must be closely integrated into Canada's mechanisms for reducing GHG emissions (e.g., a domestic emissions trading system).

FCM is only one approach to the mitigation of GHG emissions and must be seen as a legitimate and competitive option to other methods of offsetting or reducing GHG emissions in Canada's GHG emissions reduction strategy if it is to attract investment. While FCM and other forms of offsets and reductions at source are not mutually exclusive activities, Canada will not be in a position to provide an unlimited supply of incentives or the necessary policies and infrastructure to support equally all GHG emissions reduction or offset activities. Priorities will need to be established and a determination made of which initiatives have the highest potential to contribute to Canada's commitments at the lowest cost. If priority is given to other options, this need not preclude future FCM activities, but the provision of appropriate incentives, policies and infrastructure can greatly facilitate FCM's contribution to Canada's effort.

C.1 FCM Policy Challenges in Canada

In confirming the role of FCM in Canada's efforts to combat climate change, a number of complicating factors need to be addressed. First, the majority of Canada's forests are under provincial or territorial control. Only 5% of the forest landbase is under direct federal control and most of this is found on Aboriginal reservations, military bases and in national parks. Thus, in maximizing the opportunities available through forest carbon management, extensive cooperation with

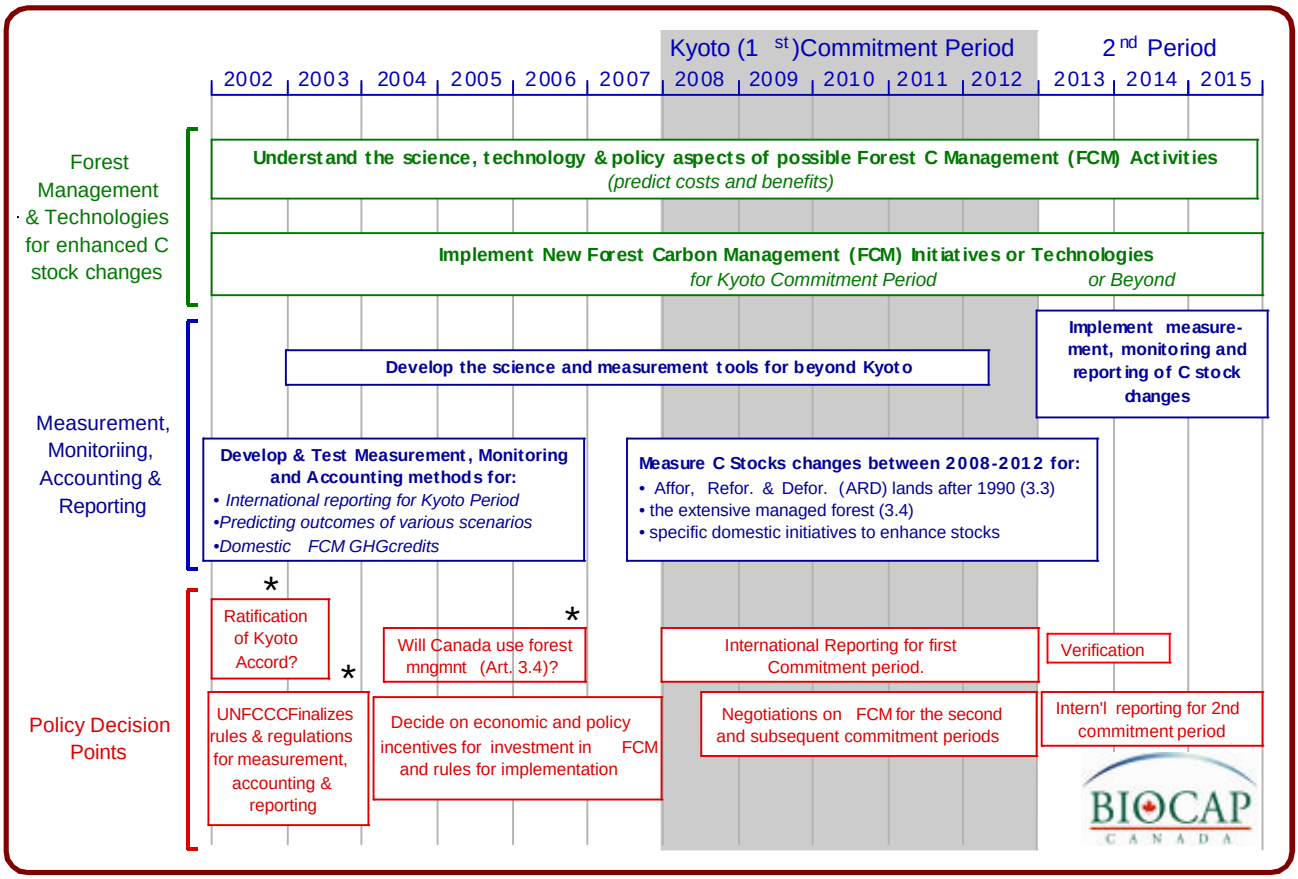
provincial and territorial governments will be required, particularly for FM initiatives.

In addition, the varying forest ownership and licensing regimes across Canada will influence the actions possible on the forest landbase and challenge the ability to create a consistent national framework for FCM. Some public lands are managed directly by the Crown, while others are licensed to forest companies on an area or volume basis. Forest management practices that contribute to forest sinks may be required in some jurisdictions, but considered voluntary in others, which may make it easier for forest operators to generate tradable carbon credits in some jurisdictions (see D.2). Private lands may or may not be used for the production of forest products, and more private land may be brought into the forest landbase through afforestation and reforestation. Urban or municipal forests may also have a role to play in FCM. Each of these categories of forest land is likely to present unique issues and policy implications (e.g., property rights/access to volume) that will need to be resolved, and each will contribute to FCM in different ways at different times.

No decisions have yet been taken with respect to the allocation of Canada's GHG reduction commitment (either jurisdictionally or sectorally), or its FM cap (see D.2.1). This lack of clarity as to who is responsible for taking action presents a significant impediment to moving forward on FCM opportunities. In order for Canada to pursue both short- and long-term opportunities, partnerships and cooperation among a wide range of stakeholders will be required; however, to date, the FCM constituency in Canada has been small, with little action taken in support of Canada's Kyoto commitments (see Appendix 6).

Figure C.1 describes some of the decisions and actions that must be taken by Canada if FCM is to be a credible component of the

Figure C.1 Implementing FCM in Canada



country's GHG emissions reductions strategy. There are some overarching decisions required, the most obvious relating to ratification of the Kyoto Protocol. Canada must then determine by 2006 whether or not it will include FM in its national accounting and select an associated forest landbase. Canada must also put in place the mechanisms to address the issues relating to measurement, monitoring and reporting addressed in Section A.2 that flow from the Marrakech Accords. To contribute to this, Canada has established a National Forest Sinks Committee to oversee the interpretation of the Kyoto Protocol, estimate carbon flow in the country's forested ecosystems, and provide management options for decision makers.

Should Canada not ratify the Kyoto Protocol, but commit to other approaches to addressing climate change, the policies and infrastructure in support of FCM will need to be adjusted to comply with any new commitment or with any requirements that may be forthcoming relating to international emissions trading.

C.2 Canadian Forest Carbon Management Opportunities

Canada has opportunities to address all four of the components of FCM that are eligible under the Kyoto Protocol.

C.2.1 Deforestation

Canada must account for emissions from deforestation at a spatial assessment of 1 ha. Although a final accounting decision has yet to be made, it is assumed that D in the "managed forest" will be included in FM accounting and that reducing D will be a component of management planning on those lands. Deforestation can also occur on forested lands that are not part of the "managed forest" through industrial activities, such as oil and gas exploration and development and mining. Addressing D in these circumstances will likely be done directly with the entities responsible. Much of the remaining D will occur on private lands or those owned by municipal governments. A key question is whether Canada will retain liability for all emissions from D outside the "managed forest," providing incentive programs to attempt to reduce D, or whether Canada will develop a mechanism for assigning the liability to the entity responsible. No matter which route is followed, Canada will need to account for deforestation emissions from all sources in reporting its progress under the Kyoto Protocol.

A study commissioned by the National Climate Change Process Issue Table on Sinks concluded that 54,000–80,500 hectares of land are deforested in Canada annually resulting in emissions of 9–14 Mt CO_2/yr (see Appendix 7). The forest sector is estimated to deforest 21,600 hectares annually resulting in emissions of 4 Mt CO_2/ yr, which are included in the above figures. Assuming that Canada elects to include FM in its national accounting, then deforestation on the selected "managed forest" will likely be included in FM accounting (as the measure is simply the change in carbon stock on the selected lands). The Sinks Table study suggested that by excluding forest sector deforestation and including below-ground biomass, deforestation in Canada since 1990 would result in emissions of 16 Mt CO_2/yr in the first commitment period (or 22 MtC over the 5 years) from a deforested area of 46,000 ha/yr. These figures are necessarily crude estimates and Canada will need to improve its ability to measure deforestation, particularly outside of the "managed forest," prior to the first commitment period.

It is important to re-state that a key issue surrounding the treatment of deforestation is that the Kyoto Protocol accounting rules assume that removal of trees results in an immediate emission of carbon to the atmosphere. Until the treatment of wood products is resolved, deforestation may thus

carry undue weight in carbon calculations. Within the present rules, though, it is clear that deforestation is a significant issue that currently outweighs the short-term potential of AR (see C.2.2).

If the Kyoto Protocol is ratified by Canada, the country will bear all the liabilities associated with deforestation unless mechanisms are put in place to assign responsibility to those causing deforestation, particularly on private land. This is of particular concern to critics of the trading of carbon credits generated through FCM in the marketplace. They feel that participants in the trade will profit while the public would retain the liability for deforestation emissions, which would not be traded.

Given the current accounting impact of deforestation, programs to prevent landowners from converting their forested lands to other uses will need to be a part of any FCM mechanism. Even without considering carbon, however, there are plentiful arguments against converting forest lands to other uses, so mitigating deforestation is a strategy that can be implemented for a variety of environmental and economic reasons.

C.2.2 Afforestation/Reforestation

The recognition of afforestation and reforestation as mechanisms to secure environmental and economic objectives dates back more than a century in North America. Numerous current and past programs have been employed at the federal and provincial levels in Canada to promote the conversion of marginal agricultural land to forests or other natural vegetative cover, such as the Permanent Cover Program. In the forest sector, Canada made a significant effort in the 1970s and 1980s to ensure that all harvested lands were restocked through federal-provincial/ territorial Forest Resource Development Agreements. New programs are continually being advanced, such as the proposed Conservation Cover program of Ducks Unlimited. The AR component of FCM provides an opportunity to build on these past initiatives. Opportunities for R exist within and outside of the "managed forest" and R will take place predominantly on Crown lands, likely with the participation of forest products companies. Afforestation can occur on either private, municipal or Crown lands, but is not likely to occur within the "managed forest."

On the agricultural landscape, in particular, market pressures and subsidy programs encourage the conversion of forest land to agriculture or cause land to be artificially maintained for agricultural purposes, both of which are impediments to AR. For example, in Ontario agricultural profitability is low — only 40% of farms have a *gross* revenue of more than $100,000. Cash crop farms produce a net income typically in the range of $50/ha, and 40% of tilled land is farmed by someone other than the owner. Some public policy challenges in pursuing AR in this environment are that:

- developers, speculators, tax deferrers and lifestyle residents hide behind the agricultural policies and will resist afforestation because they will lose this protection;
- trees are real property and thus a property right, leading to conflict if governments try to restrict removal of planted or natural trees; and,
- recognition of deforestation as an issue, and thus the importance of afforestation or reforestation, is completely absent.

In 1990, approximately 8 million hectares of Canada's forests were considered to be understocked (i.e., insufficient regeneration had taken place to replace the trees that had been harvested). As most of this land meets the requirement of not having forest on it on December 31, 1989, it is eligible for reforestation. Preliminary estimates indicated that a further 8 million hectares of land were available for afforestation in Canada. Studies by the Sinks Issue Table of the National Climate Change Process reduced that

number to approximately 1.1–1.4 million hectares of land that would be available, accessible and productive (see Appendix 7). The Sinks Issue Table further refined this work to suggest a plan for afforesting 843,000 ha over 15 years. It is important to note that even if implemented immediately, this aggressive program of afforestation would provide little benefit to Canada in the first commitment period and would not provide a large enough carbon sink to offset deforestation.

Afforestation and reforestation can be undertaken for a variety of reasons, including conservation of biodiversity and the enhancement of fibre supply, as demonstrated by the following two examples. Box C.2.2.1 describes the reforestation efforts of Ontario Power Generation and Box C.2.2.2 provides information on Al-Pac's afforestation initiatives. The Saskatchewan Forest Carbon Offset Project provides another good AR case study and is summarized in Appendix 8.

Box C.1 — Ontario Power Generation's Carbon Sequestration and Biodiversity Management Program

OPG plans to plant 1.6 million native trees and shrubs in southern Ontario by the end of 2005 and a minimum of 200,000 trees per year thereafter. The program is directly linked to greenhouse gas management and the conservation of biodiversity, which represents a multiple win for climate change, biodiversity and people. The objective is ecological restoration — the start of a healing process on a degraded landscape. The program targets regional scale forest habitat restoration, bulking up core forests and establishing habitat corridors. It is responsive to habitat needs of wildlife that are vulnerable to woodland habitat loss and fragmentation and is directed towards enhancing vital ecological services on the landscape.

In order to ensure success, project activities must:

- be in southern Ontario;
- use appropriate native plant stock;
- address regional scale habitat restoration priorities;
- identify biodiversity objectives and measures; and,
- assure protection of the land base for forest maturation.

Box C.2 — Alberta-Pacific Forest Products Limited's Woodlot Management Program

Al-Pac will plant 1200 hectares annually with poplar for the next twenty years as a means of augmenting its fibre supply. The program will also contribute to stemming the deforestation of private lands in northern Alberta. The company started to operationally plant private land in 2000 and is now scheduling land for future planting. Land acquisition is through long-term leasing within a 200 km radius of the mill.

Poplar farming is Short Rotation Intensive Culture (SRIC) and is similar to agriculture, except with a longer rotation period. Stands are intensively managed and use science to provide increased yields. Optimum management techniques include: site preparation, weed control, planting density and nutrient management. Among the impacts of poplar farming are its ability to:

- maintain competitive land costs;
- provide long-term economic opportunities; and,
- promote community employment and training.

Less than 1% of the agricultural land in the region will be farmed for poplar, and Class 3 and 4 soils are targeted for use

Leasing agreements with landowners provide returns that are equal to or greater than current agriculture pricing (based on AAFRD crop numbers — Long-Term Averages). The traditional agriculture rotations of oilseeds, cereal crops and forage have a 20 Year net present value (NPV) of $402/ha. Poplar farming provides an NPV of $474/ha with a maintenance contract with the landowner, and $462/ha in the absence of a maintenance contract.

C.2.3 Forest Management

The extent to which FM can contribute to FCM in Canada will depend on whether forest management activities in any, some, or all of Canada's forests are to be included in national accounting for the first commitment period. This decision will need to be taken by 2006, and the definition of "managed forest" will have to be applied consistently across the country. Central to that decision will be the ability to demonstrate that activities on the chosen landbase have been human-induced and have occurred since 1990. While concerns have been expressed about "cherry-picking" sites or particular activities for this purpose, the final selection of the "managed forest" must be area-based, rather than activity-based, which lessens the possibility of this occurring.

The question also arises as to where FM activities will be permitted. If a proponent were to undertake an FM project on lands that were outside of the "managed forest," the lands must become part of the national accounting system for RMUs or tradable credits to be secured, which means that the lands would need to be included in the "managed forest." This argues for an inclusive definition of "managed forest" as the more FM projects that occur outside the core the more difficult accounting becomes and the more open to criticism Canada's definition of "managed forest." One approach, for example, would be for Canada to determine that all of its timber-productive forests (approximately half of the forest landbase) will be included in national accounting as most of these lands are licensed to forest companies and can thus be considered to be under active management.

As discussed in Section A.2, Canada's performance under Article 3.4 will be determined simply by calculating the change in carbon stocks on the area selected as "managed forest" over the period 2008–2012. Assuming no additional investment in FM, these RMUs will accrue to Canada through "business as usual" (i.e., no modification to existing forest management practices). Some anthropogenic activities, such as harvesting and road construction, remove carbon from the landbase. Others, such as protecting the forest from fire, insect and disease, prevent emissions of carbon. And, regeneration following harvesting or natural disturbance increases the carbon on the site. It is the net effect of all of these activities on the "managed forest" over the period that will be accounted for; however, it is generally agreed that Canada's current national forest inventory is inadequate to support carbon accounting and a new one is in development. There is thus continued debate as to the size of the net sink or potential source that Canada's forests may provide. It is also highly likely that there will be regional disparities in the ability of forests to act as sinks, which will make an equitable allocation of responsibility for FCM difficult (see D.2.1).

Until the extent of the "managed forest" is determined, and inventories improve, it is difficult to predict how much room will exist between RMUs from business as usual and Canada's forest management cap, which will determine the opportunity for investing in enhanced forest management activities. Proponents of FM believe that they can enhance forest sinks in Canada through the application of a variety of forest management techniques. The increase in forest sinks through those activities could produce additional RMUs for Canada, which would also help the proponent achieve any emission reduction target that it may be assigned, or it could provide tradable credits that the proponent could sell into a domestic or international emissions trading program.

One of the criticisms of FM activities is that many silvicultural practices will both increase the amount of carbon stored on the land and increase the amount of fibre available for harvest, which could lead to increased future reductions in carbon stocks (should harvests increase) that could negate

some or all of the benefits derived from enhanced FM. Proponents argue that FM activities enable more wood to be produced from a smaller landbase, allowing more forest lands to be set aside for other purposes, and that a considerable amount of the harvested wood ends up in the wood products carbon pool, which is currently not included in accounting under the Kyoto Protocol.

Enhancing forest sinks through FM can be achieved through either broad policy or land-use decisions or through enhanced silvicultural practices.

One land use option is to create parks and protected areas and include them in the "managed forest." This may constitute an FM opportunity provided:

- the protected area's net carbon uptake is greater than its loss from natural factors (insects, fire, etc.), which is a function of its species, age, site quality, health, and the level of intervention to protect it from fire, insects, etc.; and,
- the establishment of the protected area does not simply cause harvesting to switch to another area in place of the land that has been protected.

It must also be recognized that management philosophies in parks may not always be conducive to FCM.

Other options include:
- increasing the rotation age, allowing trees that are still growing and capable of storing carbon to remain on the site longer;
- reducing harvest levels and thus the associated reductions in carbon stocks on the landbase;
- minimizing road construction or other incursions into the forest landbase, reducing emissions from deforestation; and,
- restoring degraded forests (areas which are not healthy, but that do not qualify for reforestation).

Obviously, the first three of these options are controversial and relate to the earlier discussion of the relative weight to assign to carbon vis-à-vis other forest values, in this case timber production.

Within existing approaches to forest management and silviculture, there are a number of enhanced activities that can be employed by managers to increase the ability of forests to act as carbon sinks (see Box C.2.3). Where these activities are undertaken to provide tradable carbon credits to the forest manager, a major challenge will be in establishing the baseline against which the amount of credits will be determined; that is, what would have happened in the absence of the enhanced activity (see D.3.2.2).

Despite the uncertainties, FM activities do have the potential to enhance forest sinks or mitigate forest emissions of carbon. It is the type and extent of activities, and often the region in which they are conducted, that will be the issue. As noted in Section A.2, FM could make a significant contribution to the achievement of Canada's Kyoto Protocol target for GHG emissions reductions and confer a sizeable economic benefit as well (should any of Canada's FM allocation be available for trade). Whether Canada will be able to utilize these opportunities to maximum advantage will depend on whether the selection of an appropriate "managed forest" can be done credibly and effectively, and how much room is left between the projected increase in carbon stock on this land in the first commitment period and Canada's forest management cap.

Box C.3 — Examples of FM Opportunities in Canada

Increased Fire Suppression

Governments currently invest a significant amount of resources in protecting forests from fire and have been actively suppressing fire in many parts of the country for over a century. Increasing the fire interval may increase the risk and severity of future fires and simply delay the problem. As fuel loads in the forests have built up, Canada has experienced some severe fire seasons in the past decade. The Ontario Ministry of Natural Resources estimates that with additional investment it could secure a reduction of 10% in the annual area burned in the Province. As fire is a natural process, increases in fire suppression may have consequences for biodiversity and ecosystem function.

Increased Protection from Insects

Canada actively protects its forests from insects, such as the spruce budworm, jack pine budworm, forest tent caterpillar and gypsy moth, which defoliated 7.3 million hectares in Ontario alone in 2000 by contributing to early tree mortality and loss of growth. Only a small percentage of the affected area is currently subject to insect control programs. Expanding insect control programs is seen as a method of improving forest health and conserving carbon. Given Canada's limited success with insect control, however, critics question whether the costs of expanding control programs would be justified.

Biomass Substitution

Forest companies have the opportunity to utilize some of the biomass they remove from the landbase that is not turned into commercial product (such as thinnings, tops and branches) to replace fossil fuels in their operations. Enhanced FM can produce more biomass than is currently available. The potential for this has yet to be fully explored, but concerns regarding the removal of nutrients from the forest (and a potential resulting loss of carbon in forest soils) will need to be considered.

Increased Pre-Commercial Thinning (PCT)

On productive forest land, thinning can increase the amount of carbon stored in forest, litter, soils and forest products pools. Thinning allows the remaining trees to grow faster, which enables a shortened rotation period, allowing more forest products to be produced from a smaller landbase. PCT results in a short term reduction in carbon on the site, but provides for much higher levels of carbon on the site in all pools over time than would have occurred had thinning not occurred, assuming that harvesting does not increase. The success of PCT is species, site class and age dependent, but it is believed to offer significant opportunities for FCM. The future treatment of carbon contained in wood products will impact the effectiveness of PCT.

Increased Commercial Thinning

This presents opportunities for FCM, provided that there is a positive growth response in the treated site; that is, the carbon in the thinnings and the final harvest is greater than what would have occurred in the unthinned final harvest volume alone. The fate of early thinnings is often the short-lived pulp and paper pool, and the method of accounting for these products has yet to be determined.

Tree Improvement

Canada has been working to improve tree seed to produce trees with faster volume growth. By 2005, 90% of Ontario's approximately 100 million jack pine and black spruce planted per year will be from first generation orchard seed having 5% faster volume growth, and by 2015 this will increase to 15% faster volume growth. Further, Mikro-Tek, an Ontario biotechnology company, has developed specific cultures of mycorrhizal fungi for inoculation of the boreal forest. The mycorrhizal inoculation of forestry seedlings has been shown to increase tree growth by an average of 20–30%, depending on species. This additional growth carries a corresponding increase in carbon as a direct result of the inoculations. Realizing the potential that these forms of tree improvement offer will require tending and protection from fire, insects and disease.

Section D — Operationalizing FCM

In order for Canada to capitalize on the opportunities described in previous sections, the factors that may hinder public or private investment in FCM need to be addressed, including the absence of policy certainty surrounding outstanding issues in FCM and the lack of tools and mechanisms necessary to support FCM projects on the ground.

D.1 Making the Business Case for FCM

All landowners, licensees or investors who wish to participate in FCM will need to develop a business case to justify their commitment or investment. This section considers some of the identified needs of investors in FCM that will need to be addressed and the potential barriers to progress to be overcome.

It is not yet known whether AR or FM projects in Canada will be eligible to produce tradable carbon credits, but this will be a prerequisite for securing private investment in FCM from GHG emitters. The potential market for FCM credits in Canada is large. Potentially capped GHG emitters with high abatement costs who may invest in FCM include:

- electricity and heat generation (responsible for the creation of 17% of the national CO_2 equivalent emissions);
- fossil fuel industries (9%);
- manufacturing (7%); and,
- industrial processes (7%).

FCM projects can provide a number of benefits to these investors. Carbon credits can currently be generated at low cost (although the transaction costs involved in getting those credits to market may be high), the potential for other economic benefits exists (e.g., fibre supply), the diversification potential is attractive and the expertise for managing projects is available. On the downside, investors shy away from complex and potentially expensive measurement and verification procedures, unclear ownership of tradable credits and the political and natural risk associated with FCM activities. For good FCM projects to succeed in Canada and to attract investment, the uncertainty relating to the latter points needs to be addressed.

D.1.1 Attributes of a Credible FCM Initiative

In assessing the role of FCM in emissions trading, it is useful to consider what potential investors are looking for in their offset portfolios. A number of GHG emitters in Canada have developed criteria to govern their involvement and/or investment in offset activities. As the most direct approach to addressing climate change is to reduce emissions at source, GHG emitters wish to ensure that any offset investments they make, including FCM, are credible and effective and do not leave them open to the criticism of taking the easy way out.

The characteristics of successful offset projects are being developed and/or adopted by companies planning to participate in the offset market. The following attributes of offset projects are compiled from the criteria employed by Suncor Energy, TransAlta and Ontario Power Generation in evaluating investments. Projects must:

- provide real, measurable and verified net carbon benefits, which can be accurately and simply measured, monitored and verified;
- be eligible for policy recognition (domestically and/or internationally) by governments (e.g., visible endorsement/ support from government, binding agreements to allow use against future regulatory obligations, clear ownership of resulting credits, unhindered economic

use of credits, and timely approval of credit transfers);
- have sustainable development benefits (social, economic, environmental) with no significant tradeoffs;
- demonstrate benefits that are supplemental to what would have happened without the project (additionality);
- demonstrate stakeholder support (e.g., local management and proponent funding, opportunities for local stewardship involvement, ownership and education, and the establishment of lasting partnerships);
- have sound risk management plans (addressing issues such as leakage, permanence and management performance) with equitable risk sharing by all parties, including contracts and effective due recourse;
- be price competitive with other offset options (i.e., provide an acceptable rate of return with cash flow matching the flow of credits), including acceptable transaction and management costs;
- be eligible for "World Class" third party verification and perhaps certification; and,
- have the ability to offer formal registration of GHG reductions.

Many of these attributes, as they apply to FCM, are discussed in more detail in Sections D.2 and D.3.

D.1.2 Barriers to Enhanced Forest Management

The FM component of FCM only became eligible under the Kyoto Protocol in 2001 and it is still not clear how Canada will pursue this opportunity (see C.2.3). As a result, provincial governments (the dominant forest landowner in Canada) and the forest products sector have yet to become fully engaged in exploring FCM. Those forest products companies that have made forays into FM have found themselves stymied by the lack of policy and infrastructure that is associated with such a recent legitimization of the concept.

As stated, one of the major barriers to additional investment in FM is the uncertainty regarding the ability of Canada's selected "managed forest" (should Canada decide to include FM at all in its accounting) to achieve Canada's cap on FM RMUs. It is also not yet clear how Canada's FM cap will be allocated; that is, whether each province will be assigned a portion based on the extent of the "managed forest" in the jurisdiction and the ability of those forests to contribute. Enhancing FM could become a requirement of provincial policies and regulation, with costs and benefits shared by the provincial government and forest products companies, or additional carbon stored through private sector activities could become eligible for introduction into emissions trading by the forest products company that undertook the activity.

Assuming that there is room to invest in the generation of FM tradable credits, some of the barriers identified by the forest sector in moving forward with FM initiatives include:

- limited understanding of how climate change, natural disturbance and human activities affect carbon stocks in Canada's forests, and how to accurately measure carbon stock changes that occur as a result of management activities;
- unclear ownership of tradable credits from FM on Crown lands;
- lack of an organization with the authority to review and legitimize FM initiatives;
- lack of national targets for emissions reductions, meaning there is currently no market for FM tradable credits;
- lack of an opportunity to produce legitimate FM tradable credits before 2008;
- the concerns over risk of loss or lack of permanence, coupled with lack of rules

governing carbon investment pools or averaging; and,
- the comparatively short tenures of forest licensees (20 years), which discourages long-term investment.

Some of the steps that could result in increased uptake of this issue by forest companies include:

- clear signals from governments that GHG reduction and FM are strategic and operational priorities;
- meaningful input into the development of FM strategies at both the federal and provincial levels;
- identification of eligible FM opportunities;
- identification and mitigation of business risks entailed with FM; and,
- opportunities to participate in FM learning projects.

D.1.3 Securing the Participation of Landowners in ARD

ARD presents a different set of challenges from FM. It is believed that much of Canada's afforestation opportunity, as well as a sizable portion of deforestation, will occur on private, principally agricultural, lands. While strategies will need to be developed to engage municipal governments and industry in ARD efforts, this section will focus on the particular challenges faced in recruiting private landowners to FCM initiatives. Although the issues described below relate to the factors preventing the conversion of land from agriculture to forest, many of them also influence the decision of the landowner to take land out of forest and bring it into agricultural production.

A significant disincentive to afforestation and an incentive to deforestation in many regions of Canada is that policies and programs targeted at the rural landscape have been developed over decades to bring lands into agricultural production or keep them as agricultural lands. Recognizing this, the federal and provincial governments have initiated a number of programs to encourage farmers and landowners to convert marginal agricultural lands back to natural cover. As a result, hundreds of thousands of hectares have been taken out of agricultural production across Canada (both pre- and post-1990), representing prime lands that could have been eligible for afforestation. This means that the case for afforestation may no longer be as compelling and that, at a minimum, afforestation initiatives will need to offer similar incentives to previous land use conversion programs.

Implementing a significant program of afforestation will require the participation of private landowners across Canada, and the business case for such an initiative will need to consider a number of critical factors, including:

- the costs of establishing and maintaining the plantations;
- opportunity costs to the landowner; and,
- the costs of recruiting, managing and monitoring potentially thousands of landowners.

Landowners have a number of concerns with entering into afforestation initiatives, including:

- inadequate (potentially negative) financial return to the landowner;
- costs of afforestation and the lengthy time to secure a return on investment;
- competition with alternative land uses (pasture and till crops), which provide better short-term returns;
- inability to transfer property to the next generation without an excessive tax levy;
- inability to deduct silviculture expenses against current income;
- risk of fire, storms, insects and disease; and,
- the potentially prohibitive costs of obtaining insurance.

The extent to which these issues can be addressed by the creation of tradable carbon credits is limited by:

- costs and complexity of measurement, monitoring and verification;
- the wide range in predicted values of carbon credits;
- current inability of private landowners to participate in a carbon pooling infrastructure; and,
- the current lack of transparency in the market.

Establishing the business case for afforestation, and for preventing deforestation, will require attention to the above factors. Further information on landowner attitudes is provided in Appendix 9.

D.2 Resolving Forest Carbon Management Policy Issues

In pursuing FCM projects, proponents will encounter many similar issues faced by those who are addressing GHG emission reductions or offsets in other areas. For tradable credits to be produced through FCM, projects will be need to be integrated into the mechanisms established in Canada for measuring, monitoring, reporting, verifying and trading carbon. This section, and the one following, examine in more detail the policy decisions that must be taken and the mechanisms that must be in place in order for this to happen.

The intention is not to suggest that Canada is unable to take advantage of its FCM opportunity in the absence of carbon trading. It is quite possible for the Government of Canada to select an area of "managed forest" that is projected to get Canada as close as possible to its FM cap and to provide some incentives to landowners or managers to encourage enhanced FM, AR or a reduction in D. Canada would account for all of the RMUs and would have to put in place only those elements described in Section A.2.

The creation of tradable credits from FCM activities, though, provides an additional incentive to support AR and, potentially, to reduce D. And it could also stimulate additional FM activities in the "managed forest," within the limitations of Canada's FM cap. It can also increase investment in Canada's forests, which can help to secure the multiple benefits associated with FCM initiatives described in Section B.1.

In each of the subsections below and in those in Section D.3, attempts will be made to distinguish between what is required to create credible RMUs and what is required to create tradable credits, so that both scenarios described above can be addressed.

D.2.1 Allocation of Responsibility and Eligibility of Actions

Although Canada has committed to reduce GHG emissions to 6% below 1990 levels, no determination has yet been made on how the emission reduction burden challenge will be allocated among Canadians should Canada ratify the Kyoto Protocol. Some advocate setting provincial targets and others call for sectoral targets. In the absence of targets, provincial governments, businesses and other GHG emitters do not know what is expected of them, and this is obviously an impediment to any serious action to address climate change.

This lack of direction raises a number of questions for those who wish to implement FCM activities, such as:

- will forest companies be held responsible for all FM activities, including D, on their license areas?
- will proponents of FCM be allowed to create tradable credits for introduction into a domestic emissions trading system?
- will FCM tradable credits be eligible for sale internationally?
- who will take responsibility for deforestation — the landowner or the entity that removes the tree?

- will Canada's FM cap be allocated among the provinces and territories or to industry and, if so, how?
- if Canada does not choose to include FM in national accounting in the first commitment period, does this then rule out investments in creating FM carbon credits that can be traded domestically or internationally?
- if Canada does include FM, and Canadian GHG emitters invest significant sums in FM to the extent that the resulting sinks exceed Canada's country cap (or the cap provided to the province in which the project is located), will the resulting credits be discounted? and,
- if Canada does not ratify the Kyoto Protocol, what options for FCM will be available to GHG emitters in an alternative system?

The above issues are simply examples. In the discussion that follows, similar questions are raised and some of the ones listed above are explored in more detail. Clearly, the uncertainty relating to who is going to be expected to do what, and what they are allowed to do, imposes significant risk on the leaders in FCM.

D.2.2 RMUs and Tradable Credits

Considerable confusion continues over what is meant by an FCM "credit" or "debit" (see Section A.3). Care has been taken throughout this report to distinguish between the "credits" and "debits" in Canada's national carbon accounting system under the Kyoto Protocol and those that may be eligible in an emissions trading mechanism.

National credits from AR and FM are referred to as RMUs (Removal Units), which is the unit of measurement for sinks (removals) of Parties to the Kyoto Protocol. National debits resulting from activities such as deforestation are referred to as "emissions" throughout the report. Emissions result in cancellations of RMUs or one of the other accounting units used in Kyoto Protocol accounting. In national accounting, RMUs or emissions are, respectively, simply positive or negative changes in carbon stocks on the landbase.

However, the issue of climate change is generating a market as well as a policy response. Complications (and confusion) arise since the term "credit" is also used to refer to a commodity produced by a carbon sink that can be traded within an emissions trading market. This commodity is referred to as a "tradable credit" throughout this report. Proponents of FCM projects wish to secure tradable credits that they can make available to GHG emitters or apply against any performance target that may be assigned to them. Assuming they are allowed to do so, it is necessary to use appropriate rigor to measure, verify and communicate FCM performance to ensure credibility with buyers, governments and the public. The need for clarity thus increases in determining what constitutes a tradable credit, and consistency with Kyoto Protocol accounting rules must be ensured.

It should be noted that a tradable credit need not be traded. Should the FCM proponent be assigned a performance target for GHG emissions reductions (see D.2.1), tradable credits may be assigned against that target or traded. In both circumstances, the "credit" must meet the same criteria.

Some of the issues raised at Workshop #1 relating to tradable credits include the need for:

- clear specifications as to what is being created or sold;
- refinement of existing criteria for carbon credit creation in other areas, especially the relationship of "real" and "surplus" to FCM (see D.2.2.1);
- a science-based and standard methodology for determining tradable credits;
- tradable credits from AR and FM to meet the same criteria (FM is currently more

challenging to quantify);
- clear direction as to how and when tradable credits are obtained;
- direction in addressing the long timelines of FCM;
- the ability to "rent" versus "buy" credits;
- equal opportunity for short- and long-term projects, although rules and investment needs may differ; and,
- rules or protocols for FCM projects, recognizing that they may be different for Articles 3.3 (AR) and 3.4 (FM).

There are similarities and differences between tradable credits and RMUs. Both are likely to be expressed in terms of a tonne of CO_2 equivalent. RMUs will not be associated with specific activities or sites whereas tradable credits will. A tradable credit is reflected in RMUs as FCM projects must be incorporated into national accounting, but RMUs do not necessarily produce tradable credits. RMUs can be traded internationally among Parties to the Kyoto Protocol. International trading of tradable credits is controversial as it removes RMUs (or other measurement units) that Canada may need to meet its national targets from the national accounting system. RMUs cannot be banked by Parties, whereas tradable credits may be eligible for banking (depending on trading rules).

Aside from being consistent in the use of terminology in FCM, perhaps the biggest challenge relates to the need to ensure that accounting for tradable credits and accounting for those activities that contribute to RMUs are integrated effectively to ensure that no double-counting or omissions occur.

D.2.2.1 Defining a Tradable Credit from an FCM Project

There is general agreement that tradable credits must be measured, validated and reported in a way that is rigorous, science-based, credible, transparent and accountable. Clean Air Canada Inc. has developed a set of criteria for emissions trading in other pollutants that it is trying to adapt to carbon. According to CAC Inc. criteria, carbon credits should be:

- *real* — actual emission reductions that have resulted from specific actions;
- *quantifiable* — based on reduction activities that can be accurately measured;
- *surplus* — reductions beyond what is required by regulation or obligation to reduce emissions;
- *verifiable* — calculated using data that is replicable and available to a third party auditor; and,
- *unique* — created once from a specific activity, at a specific time.

While these criteria make sense for an industrial process, their application to FCM is more complicated. The two that pose the greatest difficulty are "real" and "surplus."

"Surplus" poses a problem as the expectations of forest management agencies and industry are yet to be established (see D.2.1) and rules of ownership of tradable credits are not yet clarified (see D.2.3). Generally, investors wish to ensure that the credits they are purchasing would not have been created in the absence of the FCM initiative and that they are over and above any legislative or regulatory requirements. This is fairly easy to determine for AR projects as they, by definition, result in a change in land use. In FM, though, the issue is more complex. Compliance with regulation and policy on the "managed forest" will produce RMUs for Canada in the first commitment period. If forest products companies are assigned a GHG emissions reduction target, then the sinks and sources they create through their forest management activities *may* be eligible in calculating their performance against that target (and this may be a factor in calculating their performance target). Should forest companies exceed their performance target, any remaining carbon sinks could result in

tradable credits as they would be "surplus" to the company's requirements. If forest products companies are not assigned responsibility for the impacts of their forest operations then all of the RMUs and emissions would accrue to Canada (or to the provincial government, depending on the resolution of the allocation issues discussed in D.2.1). In this case, should the forest products company take voluntary action to enhance carbon stocks in the "managed forest," through FM initiatives, such action may produce tradable credits as they would be surplus to regulatory requirements and to the needs of the company. These actions, of course, would also produce additional RMUs. The accounting challenge is to quantify such tradable credits in relation to a baseline that would equate to the carbon stocks that would have been realized through regulatory compliance alone.

In terms of "real," the debate is whether "real" means the actual increase in a forest sink of a tonne of CO_2 equivalent or whether it means the establishment of a protocol that will demonstrate that the sink will gain a tonne of CO_2 equivalent in the future and would not have done so in the absence of the protocol. Due to the growth rate of trees, FCM projects may take decades to provide full carbon benefits, and in the interim a project may cycle between being a net source of emissions and a net sink. This is a critical issue as FCM projects initiated today may or may not provide any significant benefit during the first reporting period under the Kyoto Protocol (2008–2012) depending on the type of project and how "real" is defined. This compromises the ability to secure early investment in FCM. The question, then, is whether tradable credits can be granted to projects in advance of an actual increase in the forest sink based on the level of confidence that the sink will increase in the future. This is a fundamental issue for both proponents of and investors in FCM, and clear policy guidance is required as to how tradable credits are to be assigned.

This issue is explored further in Section D.2.4, but, to date, three methods of addressing the timing of allocation of tradable credits have been suggested:

- **Long-term averaging and tonne-year accounting** — the estimated increase in a carbon sink created by a project is averaged over the life of the project, or predetermined amounts are allocated annually based on the assumption that a strong protocol and good management will ensure that the project will produce the projected increase in the carbon sink over time. In both cases, tradable credits are provided in advance of an increase in the carbon sink, although in later years the amount of tradable credits allocated annually would likely be less than the actual increase in the sink in the same period. This approach, though, is inconsistent with accounting for emission reductions, in which credit is tied to actual reductions.
- **Risk management through a self-insurance reserve** — not all tradable credits generated by the project are claimed or made available for trade, with some kept in reserve in case projections are not achieved. These reserves require ongoing monitoring and assurance that the proponent(s) of the project will maintain them for the duration of the project.
- **Stock Change Method** — in this scenario, the purchaser of the tradable credits assumes some liability for adjustments that may be required during or at the end of the project when actual changes in carbon stocks are compared to the baseline. There is a risk that the purchaser of the tradable credits may not exist at the end of the project lifespan, in which case the liability for any emissions or adjustments would fall to society unless mechanisms are in place to make the seller assume such liability.

D.2.2.2 Assigning Responsibility for Emissions

As mentioned in the discussion of deforestation (Section C.2.1), Canada has yet to establish any mechanisms for assigning responsibility for the associated emissions to the entity that created them. As markets for carbon trading emerge, many feel that there is a danger that tradable credits could become a private commodity while emissions remain a public liability. This is of particular concern to critics when the entity causing an emission is also seeking to produce tradable credits for its own gain. An example would be a large landowner who afforests a portion of his land and receives tradable credits in return, providing a financial benefit to the landowner. On another portion of his land, the landowner could convert forest to agricultural land through deforestation. The emissions from that deforestation would not be a cost to the landowner.

A similar situation can be associated with FM activities. A forest company may be taking voluntary action to increase a forest sink on a portion of its license area, but may be taking no action to mitigate the reductions in carbon stock or emissions it is causing through its activities elsewhere on the landbase. It could receive tradable credits for the former activity yet not be assigned any responsibility for the latter. And some FM projects may be net sources of carbon at some point in their duration, while unforeseen events could result in emissions or reductions in carbon stocks either during or at the end of a project. Although it should be obvious that an emission is simply the inverse of a tradable credit and must satisfy the same criteria, quantifying such emissions and assigning responsibility for them is currently receiving far less attention.

Another significant policy question yet to be resolved is the treatment of avoided emissions. In national accounting some existing FM activities, such as fire suppression, will avoid emissions and produce RMUs as performance is measured simply by a change in carbon stock on the landbase over time. Whether an avoided emission can produce a tradable credit, though, is a different matter. For example, suppose forest companies and oil and gas companies collaborated to reduce the amount of road construction in a given year by agreeing to share resources. The reduced deforestation would result in an increase in RMUs for Canada, but does the difference between the reduced extent of deforestation and the amount of deforestation that would have taken place in the absence of the agreement constitute a credit that could be traded by either the forest company or the oil and gas company?

D.2.2.3 Legitimization of Tradable Credits

A key issue in the current policy environment is the lack of certainty that a tradable credit produced through FCM will be formally recognized from a policy or market perspective. Markets are unlikely to value any credits that do not have policy legitimacy. At present, no organization in Canada has the authority to recognize FCM tradable credits, with the exception of the federal government, which has not yet developed a mechanism for doing so. This is obviously an impediment to the implementation of FCM initiatives in Canada and is a double-edged sword as it will be difficult for governments to develop protocols for credible and effective FCM initiatives in the absence of pilot projects designed to test assumptions and approaches. In the short term, it may be advantageous for governments to agree to guarantee or buy credits resulting from a series of approved FCM pilot projects.

Governments have already taken a step in this direction through the Pilot Emission Removals, Reductions and Learnings (PERRL) Initiative, in which governments purchase emission removals/reductions (but provide no credits). The objectives of PERRL

are to encourage action to remove/reduce GHGs, develop expertise and understanding of projects, and inform analysis and the development of future policy responses. PERRL's scope is national, with opportunities for purchases in each province/territory and removals/reductions in strategic areas. The pilot recognizes new projects and will purchase 'sustainable' tonnes of CO_2 equivalent to 2007, with initial purchases targeted for the 2001–02 fiscal year. PERRL's principles include: support for a broad range of projects in strategic areas; ensuring individual projects do not absorb a disproportionately large part of the funds; encouraging the participation of smaller jurisdictions and small projects; ensuring requirements/processes are clear and simple; minimizing transaction costs; and, complementing other climate change initiatives.

D.2.3 Establishing Ownership of Tradable Credits

One of the most fundamental questions in pursuing FCM initiatives, particularly FM projects on Crown land, is the determination of who owns any resulting tradable credits. Ultimately, ownership decisions will be influenced by the decisions taken with respect to allocation (see D.2.1). On private land, the determination of ownership will be relatively straightforward. Where the ownership issue becomes complicated is when forest companies voluntarily invest in enhanced FM on Crown land.

D.2.3.1 Crown Lands

In awarding tradable credits for FCM activities, a key challenge is teasing apart ownership of the land, from ownership of the trees, from ownership of the carbon. Most FM activities will take place on Crown land, which is owned by the public, but on which forest companies are licensed to harvest timber. Depending on the resolution of allocation issues, governments may choose to assign accountability for sinks and emissions on Crown lands to the entity responsible for them, but it is more likely that RMUs and emissions generated from forest operations in compliance with regulations and policies will be retained by the Crown.

As discussed in Section D.2.2.2, critics are unlikely to support the creation of tradable credits from normal forest operations unless the forest company that receives them also takes responsibility for the emissions or reductions in carbon stocks those forest operations cause. For example, assuming all RMUs are held by the Crown, any reduction in carbon stocks due to harvesting will reduce the RMUs available to the Crown. If a forest company uses biomass wastes as a fuel substitute in its mill, the reductions in carbon emissions associated with reduced fossil fuel consumption accrue to the company as the emissions from biomass burning have already been accounted for through harvest.

Two possible approaches to the ownership issue emerged from the FCM workshop series. In the first scenario, the Crown retains responsibility for both the emissions and RMUs generated by FM and other activities on Crown forest lands, while licensees that wish to secure tradable credits for an incremental increase in carbon due to a voluntarily undertaken project could do so if the increase could be measured effectively. Of course, if that incremental increase in carbon resulted in a future increase in the annual allowable cut (due to more fibre) then providing tradable credits to the company that undertook the silvicultural activity could result in a future reduction in RMUs to the Crown, which would have to absorb the impact of a future increase in harvesting.

A second approach is to share the RMUs (in the form of tradable credits) and emissions from forest management and other activities

on Crown lands between the Crown and all users according to their contribution. This collective approach would mean that there would be no discrete FM projects, but that efforts would be undertaken to enhance the carbon stock on the landbase with the benefits shared according to some negotiated formula. This approach is obviously more dependent on the results of allocation decisions (see D.2.1) as unless all parties are required to meet established performance targets it is unlikely that those who have targets will want to lose tradable credits to those who have more freedom to trade them.

Carbon is not the only benefit provided by enhanced FM activities, though, and they will also result in the enhancement of fibre supply, which is a further incentive for investment by forest companies; however, few provincial governments allow forest companies to automatically increase their annual allowable cut, and tenures are comparatively short so there is no guarantee that investments in increasing fibre will recoup later on to the forest products company that made them. Can the forest company own the carbon, but not own the timber with which it is associated? Issues are further complicated under the volume-based tenure that exists in many areas where a number of companies may be operating on the same landbase. How does a company contributing to enhanced FM ensure that the increased fibre is not assigned to another forest company, which may emit the carbon through harvesting or deforestation? Does the company that produced the carbon still own tradable credits if the trees are gone? Further, if it is only activities that go beyond regulatory compliance that produce tradable credits, how does a company deal with differing regulatory requirements across Canada? FM activities that may generate tradable credits for a forest company in one province may not generate credits in another, even with a consistent definition of "managed forest."

If the wood products carbon pool is ever included under the Kyoto Protocol, ownership of tradable credits will become more complex. For example, who will get the tradable credits — the company that cut the trees, the management agency that authorized the level of harvest or the customer that buys the forest products? The majority of wood products produced in Canada are exported, principally to the United States, and it should not be taken for granted that any tradable credit would thus accrue to the producer.

D.2.3.2 Private Lands

Afforestation and reforestation, on the other hand, are most likely to occur on private land, with the focus on farms and private woodlots. In these cases, there is likely to be little or no regulatory impetus for the actions, addressing the concerns about "surplus." Nevertheless, ownership of tradable credits and liability for emissions still must be assigned among the landowner, investor, or the project manager (New South Wales, in Australia, has brought forward legislation to make it clear that the ownership of the carbon is separate from the ownership of the tree, for example). The landowner may receive an annual rent or a portion of the resulting sale of any fibre that may be produced. An investor may receive the carbon, but not the fibre. However such deals are struck, there will be financing, legal, insurance and ownership issues that need to be resolved.

D.2.4 Addressing Risk and Uncertainty

The principal issue relating to risk, and one of the major arguments of critics of creating tradable credits from FCM, is concern over the permanence of forest sinks. There are two underlying causes of concern. One is the fact that forests are natural systems and thus we have limited ability to accurately project what may occur decades hence. Assumptions

are only as good as our current level of knowledge. The other is that most advocates of action on climate change favour direct reductions in emissions, which are immediate and relatively certain, over carbon sinks, which are viewed as long-term and imprecise and thus potentially an easy way out for GHG emitters.

This issue is best considered on two different levels, which are often intermingled in debates on the issue. From a national accounting perspective, the issue is whether sinks continue to produce RMUs for Canada over time or whether they will become emissions that will cancel RMUs and, in both cases, how the benefits and costs are allocated. From a project perspective, the issue is the ability of the project to produce the estimated amount of tradable credits over its life. The latter obviously has an influence on the former, but permanence means differing things in each context.

D.2.4.1 Risk and Uncertainty in National Accounting

If FCM activities are not eligible for emissions trading, then permanence becomes less of an issue. Canada will generate RMUs from AR and FM, and some RMUs will be cancelled by any D that takes place. The measure is simply changes in carbon stocks over time, and once land is entered into the national accounting system it can not be taken out. Even with investment in AR, FM and reducing D, Canada's FCM RMUs are likely to fluctuate over time and it does not matter what happens on any particular piece of land within the system.

Should emissions trading take place, though, the situation changes somewhat. Any proponent who creates tradable credits through FCM will also create RMUs for Canada. If that land produces emissions in the future (e.g., if a plantation is harvested and converted to agricultural land), the emission will cancel RMUs, but may produce a financial benefit to the landowner. This relates to the earlier argument that proponents who wish to secure tradable credits from a project should also be required to bear responsibility for any emissions from those lands. If Canada does not wish to become liable for future emissions, then instruments, such as conservation easements, must be attached to FCM projects to ensure that lands included in the accounting system continue to contribute to Canada's GHG management objectives beyond the life of the project. Alternately, mechanisms can be established to make the landowner assume the liability for future emissions.

D.2.4.2 Addressing Risk and Uncertainty at the Project Level

If tradable credits from FCM initiatives become eligible under an emissions trading system, a different set of problems emerges. As forests are biological systems, investors in FCM projects must deal with the risk that the projected tradable credits may not be produced or may not be secure in the long-term. Risk is also created through the level of policy uncertainty and lack of infrastructure for FCM described throughout this report. Both forms of risk are currently reflected in the price of carbon. In the former case, risk will likely be shared among those who manage FCM projects and those who invest. In the latter case, at least in the short term, governments will need to find ways to reduce the risk associated with investing in FCM; for example, through pooling of initiatives, government guarantees of carbon credit recognition/purchase or incentives to support the non-carbon benefits of FCM initiatives.

A further issue is the interpretation of permanence as it relates to FCM initiatives. From a buyer's perspective, they are purchasing a defined amount of tradable credits for a defined period of time. The seller must ensure that the carbon is stored over the life of the project. Considerable debate

occurs over what happens at the end of the project. If the landowner, for example, cuts down all the trees, some argue that the buyer must forfeit or discount the tradable credits received earlier to account for the emission. Buyers maintain that what happens at the end of the project is not their responsibility. If they are required to ensure the carbon they have purchased remains in the sink in perpetuity, it is likely better for them to actually buy the land than to purchase tradable credits. There is another party involved, though, in the Government of Canada, which will have to account for any reductions in or cancellations of RMUs associated with future decreases in the sink created by the project. This is discussed in more detail in Section D.2.4.1.

Of more concern to the buyer is the ability of the project to produce the estimated level of tradable credits over its life or the life of a contract. Some of the uncertainties relating to FCM are described in Sections D.1.2 and D.1.3. Even a fast-growing plantation may take over twenty years to reach maturity. No one can predict what might happen to those trees over time. Bad management and natural factors, such as insects or fire, may compromise the plantation. Changing economic conditions may influence owners or managers to harvest quickly or not at all, and landowners may or may not replant to offset future emissions. While these can be factored into calculations, they are of considerable concern in determining how and when carbon credits are earned by the owner or investor as they are based on assumptions. Projections must therefore be tested constantly against actual experience.

As discussed in Section D.1.1, one concern of investors is the disparity between the up-front investment required for FCM and the slow speed at which tradable credits are created, increasing the risk of investing in a project. One approach to addressing this risk and uncertainty involves long-term averaging, in which the projected amount of tradable credits to be generated over the life of a project is averaged and then allocated annually with adjustments for actual performance.

Another strategy is to create investment pools of FCM projects which, depending on the mix, could provide real-time tradable credits to investors and help to spread risk ("Pool" is another term in FCM that means different things in different contexts — these types of investment pools are not the same as the carbon pools referred to in accounting). Combined with a 'futures' trading market, this can mitigate risks of long-term projects while providing necessary financial mechanisms for investment. Developing pools that provide a mix of short- and long-term tradable credits can help to smooth the flow of credits to approach "real time" crediting. In addition, by aggregating projects, such as the afforestation initiatives of hundreds of landowners, the risk that any particular project might fail is mitigated and the transaction costs of producing tradable credits can be reduced due to economies of scale.

It should also be noted that several insurance companies are developing products that can insure the tradable credits investors in FCM projects expect to receive against negative performance due to the factors described above.

D.3 FCM Mechanisms and Infrastructure

D.3.1 Carbon Accounting

Canada's obligations under the Kyoto Protocol are national, and the country has the ability to distribute its obligation domestically, although that determination has yet to be made in Canada. Canada can also create an emissions trading program that could include tradable credits generated from FCM projects to facilitate progress towards its commitments. FCM thus presents

a challenge to Canada in that it will likely be measured both on a landscape and at a project level. Accounting methodologies for both are likely to be quite different as they are dealing on different spatial scales, yet project accounting will need to feed into national accounting in order to prevent double-counting.

While there are a number of models in place for measuring the flow of carbon, either within a forest as a whole or at the project level, none have yet been formally adopted under the Kyoto Protocol. This area is the subject of extensive research, and a number of consultancies are also developing expertise with the practical aspects of measurement concepts in the field. The Intergovernmental Panel on Climate Change (IPCC) has been requested to develop Good Practice Guidance Guidelines, as well as methods to estimate, measure, monitor and report changes in carbon stocks resulting from LULUCF activities. The IPCC will produce its guidelines by late 2003, and both national and project accounting for FCM in Canada will need to be consistent with the guidelines. In the meantime, deciding how to "do the math" is a continued impediment to developing FCM management projects.

Guidelines alone will not equip Canada to account for FCM on a national basis, and a number of key mechanisms need to be put in place. National accounting of FCM will be undertaken by the Government of Canada (Canadian Forest Service and Environment Canada) in partnership with provincial and territorial governments. Canada's current National Forest Inventory has been deemed inadequate for this purpose. The Canadian Forest Service (CFS) has made a preliminary determination of the main components of an overall carbon monitoring and measuring system, which include:

- a new National Forest Inventory to provide consistent assessment of the extent, state and sustainable development of Canada's forests in a timely and accurate manner, particularly measurements of deforestation;
- an upgraded Carbon Budget Model of the Canadian Forest Sector (CBM–CFS2) to be developed for use at the operational, regional and national scales to ensure consistency of analyses; and,
- development of methods to monitor and track forest changes due to ARD, harvest and natural disturbances.

The CFS is currently developing forest carbon accounting tools that:

- employ standard accounting methods for carbon stock change reporting;
- are compliant with international guidelines for accounting, transparency and verifiability;
- incorporate best available science and data;
- are consistent across a range of spatial scales;
- will be user-friendly and publicly available; and,
- will generate results that are consistent with national analyses.

Should emission trading of tradable credits from FCM projects take place in Canada, proponents will need to ensure that their measurement protocols are consistent with the international and national accounting policies in development for the tradable credits to be legitimate. There has been a proliferation of pilot FCM projects worldwide, including some in Canada (see Appendix 5). In the absence of a standard set of requirements, each of these projects has adopted its own method of carbon accounting based on the expertise and experience of project proponents. As international rules emerge, some adjustment in these calculations may need to be made. This is another factor in the risk of early investment in FCM. One of the experiences offered by those who have been engaged in pilot FCM projects is that project accounting should be

handled at the landscape or entity level rather than at the stand level. This approach should facilitate integration of FCM project accounting with national accounting.

D.3.2 Calculating Tradable Credits at the Project Level

FCM proponents will need to address a variety of accounting issues in designing their initiatives and in projecting the increase in carbon sinks to be secured, including:

- avoiding leakage;
- establishing a baseline; and,
- developing reliable estimates of increases in carbon sinks.

D.3.2.1 Leakage

Enhancing or protecting the carbon stored on a site provides no net benefit if it simply results in a proportional increase in the amount of carbon removed from other sites. This is the concept of "leakage." The creation of protected areas provides a simple example of the concept. In this case, if a forest is protected to preserve its pool of carbon, and demand for forest resources is not reduced, then pressure on surrounding forests is expected to increase as the same amount of fibre must be secured from a smaller landbase. The carbon in the protected forest may be conserved, but doing so may increase the amount of carbon removed from a neighbouring site — thus the carbon has "leaked" out of the project.

Addressing leakage in an FCM project means placing that project within a landscape context. Increasing a carbon sink through a particular project should lead to a similar increase in the carbon sink on the landscape. After all, buyers are looking for "additional" activities that provide a real increase in carbon benefits (see D.1). An FCM proponent should not be able to create tradable credits from a project if the proponent is also contributing to a corresponding reduction in carbon stocks or emissions elsewhere on the landscape.

D.3.2.2 Baseline Determination

A baseline is the starting point for comparative measurement and verification of targeted actions in the forest. For example, if two tonnes of CO_2 equivalent existed on a site in the base year 1990, the increase or reduction in carbon stocks on the site is calculated from this two tonne baseline. To satisfy requirements for additionality, the calculation of tradable credits from FCM projects must be based on the difference between the carbon stocks on the landbase and the stocks that would have been in place in the absence of the initiative. A key factor in baseline determination will be the need to integrate project accounting with national accounting. The Kyoto Protocol requires FCM accounting to commence with the start of the activity or the start of the first commitment period, whichever is *later*. Even though 1990 is the reference date for determining targets under the Kyoto Protocol, this means that carbon stock changes that have taken place between 1990 and 2008 are not recognized and are ineligible for creating RMUs or tradable credits.

At the project level, determining the baseline for AR is fairly straightforward as both entail a change in land use. Developing the baseline for FM projects is more complicated since it is not clear how the incremental increase in the carbon sink generated by the project will be differentiated from all of the other actions of the proponent that contribute to the carbon sink. Some argue that FCM baselines should be static (i.e., the carbon stock on the site at the initiation of the project) and others that it should change over time (e.g., the carbon stock on the site at a given time adjusted for the estimated carbon stock that would have been on the site in the absence of the project). At present, there is no clear guidance as to which approach FCM proponents should adopt.

D.3.2.3 Accuracy of Estimates

One of the principal challenges in predicting the change in carbon stocks to be secured through an FCM project is increasing the reliability of estimates. Currently, the effect of forest management practices is measured by growth and yield tables, but for many of the options available through FCM such yield tables do not exist. Educated guesses are made at forest management growth increases compared to unmanaged stands that in some instances are imprecise. It is also difficult to separate human-caused impacts from site and non-anthropogenic effects. As discussed in Section D.3.1, new tools are in development that will enhance the reliability of forecasts, but until they are in place FCM proponents will need to deal with the current uncertainty surrounding estimates.

D.3.3 Monitoring and Verification

Measurement is an ongoing process as the size of a forest carbon sink will fluctuate over time and, as discussed in D.3.2.3, there is a large degree of uncertainty in current estimates of performance. As FCM is a long-term exercise, the uncertainty of future carbon stocks increases in proportion to the duration of FCM activities. At the national level, monitoring is fairly straightforward as once land is entered into Canada's accounts under Articles 3.3 and 3.4 of the Kyoto Protocol it must remain there for all future accounting periods; therefore, all FCM lands will be monitored continually. At the project level, though, more aggressive monitoring will be required to compare progress against projections, whether tradable credits are applied in real time or amortized through long-term averaging.

The difficulty of monitoring will depend on the type of FCM initiative. It will likely be much easier to monitor large AR projects, in which plantations are established on a defined landbase, than to provide certainty about the marginal increase in carbon stocks that has come about through enhanced FM on the landbase. And the challenges of monitoring performance when millions of trees are planted disparately across a large geographic area (as in a pool of A projects undertaken by private landowners) are even more daunting. And, as lands on which FCM projects must enter the national accounting system, some argue that monitoring should continue beyond the life of the project, especially if the owner is to be held liable for future changes to the carbon stocks on the land. Monitoring of FCM projects can thus be a costly and complicated undertaking.

Further, if the FCM proponent wishes to secure tradable credits from the initiative, independent verification of performance may be required to enhance investor confidence. How this is to be done (and who will do it) is not yet clear, although should an emissions trading program that includes FCM be established in Canada it is likely that verifiers will emerge and standard protocols for verifying tradable credits will be developed. In the meantime, a number of consulting firms are undertaking preliminary work in this area, many following up on their experience with emissions trading of NO_x and SO_2.

While monitoring and verification of tradable credits will be required for emissions trading to take place, the burden of monitoring and verification should not be so great as to diminish the value of tradable credits or create a barrier to investment in FCM. Currently, CO_2e.com estimates that FCM projects must produce a minimum of 50,000 tonnes of CO_2 equivalent annually to keep the transaction costs of projects reasonable.

D.3.4 Research and Technology Development

Workshop #3 of the Pollution Probe Forest Carbon Management series produced numerous recommendations regarding priorities for FCM research and technology development (see Section A.4 and Appendix 4). Workshop participants concluded that there was a need to:

- **support research** to better understand the effects of climate change, natural disturbance and human activities on carbon stocks and greenhouse gas emissions in Canada's forested lands; and,
- **support research** to develop sustainable technologies and implementation strategies for enhancing forest carbon stocks and for measuring carbon stock changes.

It is clear that if forest sinks are to be effective and credible contributors to combating climate change, then investment in research and technology will be required to meet both of these objectives.

In addition to work being carried out by the federal and some provincial governments, there are a number of other agencies active in this area. BIOCAP (www.biocap.ca) is a national not-for-profit research foundation that has been charged with facilitating and supporting university research to determine how Canada can use its vast biological resources (including agriculture and forestry) to help manage greenhouse gas emissions, generate renewable energy and contribute to a dynamic and sustainable rural economy. BIOCAP organized Workshop #3 and is developing a university research agenda based, in large part, upon the workshop's output. The federal government has also launched the Sustainable Development Technology Fund, which may provide a source of funding to projects that would develop and share intellectual property on FCM.

D.3.5 Registration of Tradable Credits

There is no mandatory reporting protocol for greenhouse gas emissions management in Canada. Most companies and governments report their performance through either the Voluntary Challenge and Registry (www.vcr-mvr.ca) or Ecogeste (www.menv.gouv.qc.ca/air/changement/ecogeste.htm). At present, these are simply compendia of the information provided by members of performance against their own action plans.

Recently, the World Resources Institute and World Business Council for Sustainable Development released *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (www.ghgprotocol.org), which was tested extensively by companies worldwide and which the proponents hope will influence the development of reporting mechanisms.

Proponents of FCM projects in Canada will need a place to register their tradable credits. Expansion of one of the existing mechanisms to undertake this responsibility will likely be more effective than creating a new entity.

D.3.6 FCM and Emissions Trading

Although Canada has the ability to develop a domestic emissions trading mechanism to help it meet its Kyoto Protocol targets, no such mechanism has been established. Obviously, it is difficult to design projects in the absence of agreed upon protocols for what constitutes a tradable credit and how it is to be measured, monitored and verified. There have been two early initiatives to pilot emissions trading in Canada to provide some policy guidance and practical learning in this area.

GERT, the Greenhouse Gas Emission Reduction Trading pilot (www.gert.org), is a partnership among governments, industry, labour and environmental groups designed to:

- provide all participants with practical experience in emission reduction trading;
- assess environmental and economic benefits of emission reduction trading;
- test and evaluate the technical, administrative and legal elements of an emission reduction trading system;
- maximize involvement of the private sector by emphasizing the use of business principles to achieve environmental and economic objectives;
- encourage identification and joint investment in GHG emission reduction, avoidance and/or sequestration activities; and,
- help build the foundation for a possible future emission reduction trading system.

PERT, the Pilot Emission Reduction Trading project (www.pert.org), is an Ontario-based initiative designed to address air quality issues in that province. Its original focus was on NO_x and VOC, with SO_2 and CO_2 added in 1997. PERT has now evolved into Clean Air Canada Incorporated and has expressed interest in taking the lead in developing an Emissions Reduction Trading mechanism for Canada.

The National Air Issues Coordinating Committee — Climate Change (made up of federal, provincial and territorial government representatives) has established a Domestic Emissions Trading Working Group (DETWG) that is investigating the implementation of such a system in Canada. The DET system would be a closed cap and trade system in which participants are provided with a mandated cap on their GHG emissions and given the opportunity to trade amongst themselves to achieve their caps on a flexible and cost-effective basis.

There are four basic elements of DET implementation:

- the issuance of a limited number of tradable permits by government;
- the allocation of permits by the government to participating entities;
- the trading of permits to establish market price and inform decisions to abate and buy/sell permits; and,
- compliance mechanisms, which include monitoring of emissions and the submission of permits to government equal to the emissions produced in the period, with penalty provisions for non-compliance.

One component of the DET system under consideration is an entity/project-based emission removal/reduction credit trading (ERT) system that involves the creation of credits at uncovered sources (those not part of a closed cap and trade system) and the introduction of provisions in the closed cap and trade system that allow the use of these credits for compliance purposes. FCM tradable credits would fall under the ERT provisions. At a February 1, 2002 workshop the DETWG examined how a wide range of activities, including FCM, may be treated in an ERT system. A Forest Sector breakout group identified many of the issues discussed in this report as current impediments to the pursuit of FCM opportunities. Further information on the DETWG can be obtained at: http://www.nccp.ca/NCCP/national_process/working/index_e.html.

Aside from the eligibility of tradable credits from FCM initiatives within a domestic emissions trading system, a major issue to potential producers and buyers of these credits is their ability to be traded internationally. Under the Kyoto Protocol, Canada can trade RMUs that are surplus to its requirements to other Parties to the Kyoto Protocol. If Canada allows tradable credits from FCM projects to be sold offshore, though, it reduces the amount of RMUs that FCM can provide to Canada. As tradable credits need to be fungible, restricting their use to domestic purposes also restricts their value. International trading of tradable credits produced through FCM has proven controversial in other countries, and if FCM is to be a component of emissions trading Canada will need to resolve this issue in order to attract investment in FCM.

D.3.7 Institutional Structures and Capacity

A final infrastructure issue that needs to be addressed in furthering FCM in Canada is capacity. This can be dealt with on two levels. In terms of human resources, personnel will be required at all levels who are conversant in the currency of carbon. At present, understanding of the implications of the Kyoto Protocol for Canada's forests rests with relatively few individuals. More trained project managers, brokers, investors, verifiers and policy analysts will be required. Secondly, if Canada is to take full advantage of the opportunities for FCM it will require enhanced financial and technical capacity. Investment must flow to projects and technology must be developed and applied to assist with all aspects of project implementation, from enhancing carbon uptake to cost-effective monitoring and verification. An impediment to afforestation and reforestation projects, for example, may be the availability of suitable seed or seedlings.

Section E — A Proposed Path Forward

Given the amount of effort required to establish FCM policies, mechanisms and infrastructure, Canada is not yet positioned to demonstrate leadership in implementing FCM domestically, despite its lead role in ensuring that FCM was legitimized as a GHG emissions mitigation strategy through the Kyoto Protocol. At the same time, there is increasing interest among Canadian stakeholders in utilizing the opportunities FCM provides to both increase forest carbon sinks and to achieve other social, economic and environmental objectives. And if there is to be an Emissions Removal/Reduction component of a Domestic Emissions Trading program that includes forest sinks, Canada needs to move quickly to ensure that tradable credits from FCM projects are available to investors.

A credible FCM program must be based on sound policy and regulations, and associated management standards. Like all voluntary initiatives intended to contribute to government environmental policy objectives, FCM initiatives will need to be designed carefully to be credible and effective. A critical factor in the success or failure of such initiatives will be the extent of policy and regulatory support for the undertakings. And as we are still learning about FCM, some initiatives will fail, or at least fail to live up to expectations, so tolerance for failure must be built in to any mechanisms designed to further FCM in Canada.

Participants in the Pollution Probe Forest Carbon Management workshop series offered numerous and creative ideas for how FCM opportunities should be pursued in Canada. Whether FCM is limited to national accounting in Canada, or whether tradable credits from FCM projects can be a part of an emissions trading program, many participants in the Pollution Probe FCM workshop series expressed a sense of urgency that Canada has to move more quickly on the associated opportunities, especially as we are now almost halfway toward the commencement of the first commitment period of the Kyoto Protocol. There was a sentiment among workshop participants, expressed particularly strongly at Workshop #5, that the development of policies, mechanisms and infrastructure in support of FCM would benefit from more practical learning. Due to the limited awareness and understanding of FCM, a hallmark of debates is the constant intermingling of the decisions that are required to further FCM and the details respecting the implementation of those decisions. It is clear that if Canada is to take full advantage of FCM, an enabling framework must be put in place relatively quickly even if the details of how the framework might operate are not fully resolved.

The following is an outline of the required framework based on the discussions during the workshop series, in particular the output of Workshop #5: *Designing a Credible Mechanism for Forest Carbon Management*.

E.1 Securing Government Commitment to Forest Carbon Management

The Government of Canada and provincial and territorial agencies need to clearly articulate the role that FCM will play in Canada's greenhouse gas emissions management strategy in order that proponents of FCM can be provided with the broad policy context within which to plan their initiatives. Ratification of the Kyoto Protocol (and thus the Marrakech Accords) would provide immediate certainty. If ratification is not likely to occur in the short term, or if an alternate approach to addressing climate change is to be pursued, this should not preclude the provision of

direction or guidance to proponents of FCM (i.e., the Government of Canada could state that its objective was to implement FCM as per the terms of the Kyoto Protocol regardless of when or whether the Kyoto Protocol is ratified by Canada). Such direction should also include consideration of the role of forest management initiatives under Article 3.4 as delaying that decision until 2006 leaves little time for new initiatives to be undertaken prior to the first commitment period.

Further, the Government of Canada must also provide an early indication of whether tradable credits from FCM will be eligible for inclusion in an ERT component of a domestic emissions trading system. As the first commitment period approaches, more and more Canadian GHG emitters will be seeking offset opportunities. The sooner a signal can be sent that FCM initiatives are appropriate investments (or not) the better for all concerned.

Should tradable credits from FCM become eligible for any emissions trading program that may be forthcoming, the federal government could send a strong signal to FCM proponents by clearly defining the potential of FCM, particularly the potential value of tradable credits that might be available through FM (i.e., the value of the difference between business as usual on lands selected to be part of the "managed forest" and the FM cap imposed on Canada) and through afforestation and reforestation in Canada. This could help proponents determine more realistic cost curves for FCM activities and clarify the potential return on FCM investments.

E.2 Learning by Doing — Support for Pilot Projects

As might be expected, some participants in the workshop series wished to see the emphasis on developing the "rules' for FCM while others wanted to initiate action and work out the rules based on experience.

Obviously, both clear rules and early action are required and they are inter-related. Canada has very few examples of how to implement FCM. We need to know what works and what doesn't. This is particularly important if tradable credits from FCM are to be eligible for emissions trading, but it is also necessary to test the impacts of differing incentives or policy approaches in enhancing carbon sinks. The learning provided through FCM pilot projects will contribute to the resolution of some of the seemingly intractable policy debates.

Due to the scope and complexity of FCM, a variety of pilot projects are required, undertaken in a wide range of forest types and including different forms of land ownership. Some projects may be undertaken specifically to enhance carbon sinks, some may enhance sinks as a by-product of other objectives and still others may serve purely scientific purposes (e.g., application of R&D or the development of models). As good FCM projects will provide multiple benefits, the opportunity exists for pilot projects to engage a broad range of partners.

For FCM pilot projects to produce maximum results, they will need to comply with a standard protocol, and the learning gained from them must be disseminated, both among pilots and between the pilots and other components of Canada's GHG emissions reduction strategy. The establishment of a formal network of pilots may be warranted, but at the very least the individual projects will need to be coordinated in some fashion.

One approach to this would be for the federal and provincial/territorial governments to mandate a new or existing organization to take on that task (the "FCM Coordinator"). This could be an independent agency, nongovernmental organization or consulting firm. The FCM Coordinator would develop criteria or protocols governing the establishment of pilot projects, and (potentially) the characteristics of a tradable credit, and would coordinate projects and

monitor their activities. Mechanisms for minimizing the transaction costs of developing pilots will also be required. Learning from the pilots would be shared and communicated externally. The FCM Coordinator must be transparent and inclusive with a need for balance and accountability. Linkages to policy and scientific initiatives related to agricultural soils and other land use sinks should be explored. In parallel to the policy and logistical work of the FCM Coordinator, a mechanism will need to be established to further the science of FCM in a cost-effective manner. This could be accomplished through the establishment of a committee or subgroup of the FCM Coordinator or it could be undertaken by a partner organization, such as BIOCAP.

An alternate approach would be for each province or territory to administer pilot projects within their borders, aggregating increases in carbon sinks and sharing the benefits with those licensees or landowners that contribute to FCM either through the provision of tradable credits or some other mechanism. This approach would simplify the ownership question, although it would create complications in determining the allocation of tradable credits. A provincial approach, though, could also facilitate pooling of projects, reducing risk. Should this approach be pursued, of course, there will still be a need for federal-provincial/ territorial coordination to ensure that standards are consistent across Canada.

E.3 Provision of Increased Policy Certainty to FCM Pilots

FCM pilots cannot wait for the resolution of all policy questions and, indeed, pilots themselves are expected to contribute to the resolution of many of those issues. Until those issues are resolved, through, interim direction must be provided to the proponents of FCM pilots, particularly in the following areas.

E.3.1 Ownership of Tradable Credits

If no emissions trading of FCM tradable credits takes place, all FCM activities on private and Crown land will contribute to the creation of RMUs and will be owned by the Government of Canada (or the provinces and territories depending on resolution of the allocation issue (See D.2.1). If emissions trading of FCM tradable credits is to take place, ownership or the tradable credits becomes an issue. As mentioned earlier, resolving the issue of ownership of tradable credits on private land is relatively straightforward. The more complex issue is establishment of ownership of tradable credits generated through R or FM on Crown lands. The federal and provincial/territorial governments must provide some direction on this issue to FCM pilots and the approach must be consistent across Canada. This argues for a statement from the Canadian Council of Forest Ministers (or a joint statement from those provinces in which FCM is most likely to take place), outlining the manner in which ownership will be addressed.

In establishing ownership, it must be clear that guidance is needed regarding the ownership of the asset (tradable credits) and any liability (emissions) both in the short-term (during the life of a project or contract) and in the long-term (once a project or contract terminates).

E.3.2 Establishment of a Baseline

In determining the increase in carbon stocks generated by a particular FCM pilot and the associated amount of tradable credits (if any), a standard and recognized approach to the establishment of a baseline is required. While most would agree that what is to be measured is the change in carbon stocks resulting from intervention, there is no agreement on how to calculate the baseline against which the increment is measured. Canada's reporting obligation under the Kyoto Protocol does not begin until 2008.

As discussed in Section D.3.2.2, accounting for FCM is to begin with the onset of the activity or the start of the first commitment period, whichever is later. For FCM pilots, an earlier baseline could thus be established for learning purposes, but the proviso would be that it will be the carbon stocks on the site in 2008 that provide the baseline for calculation of RMUs and the creation of subsequent tradable credits. FCM pilots will also need to determine whether the baseline should be an absolute amount or calculated using assumptions about what would have happened in the absence of the intervention. Decisions will need to be made about whether the baseline will be static or adjusted on an annual basis to reflect performance against expectations.

E.3.3 Risk Management

Where an FCM pilot is testing the performance possible using certain techniques or resulting from certain incentives, the issue of risk is minimal — one of the things that is being assessed is the risk of failure. Where proponents of FCM pilots intend to produce tradable credits, though, they need some assurance that the tradable credits they produce will actually be recognized in the marketplace. The surest approach to this is to have governments assume some of the risk and liability of approved projects by standing behind the tradable credits they produce. It may also be possible for a large forest company to provide this form of assurance, but in the current policy environment this would likely also require some form of government assurance in order for the forest company to undertake the risk.

Other instruments to reduce risk that may need to be considered include pooling projects rather than allowing each pilot to trade credits independently. Further, negotiating insurance on behalf of all approved pilots may be more cost- effective.

Finally, if governments do sanction tradable credits arising from FCM pilots, they must address the long-term risk post-2012. This argues for the exploration of instruments, such as conservation easements, to ensure that once lands enter into the national accounting system there is a mechanism to ensure that they continue to contribute to Canada's objectives.

E.4 FCM Research and the Development and Application of Technology

As discussed in Section E.2, one role of a program of FCM pilots would be to enhance research on FCM issues and to develop and/ or test the impacts of new technologies. There should thus be a strong scientific component to pilots, not the least of which should be the development of sound, science-based protocols for measuring, monitoring and modeling changes in carbon stocks that are in compliance with emerging international and national guidelines.

This is not to argue that all pilots should be field laboratories. Some sites within a pilot program may be oriented exclusively to applied research, with the learning from those sites influencing FCM on similar sites in the program. Some sites may be selected as test sites for new techniques or technologies or as a field research laboratory to generate the calibration parameters that will be incorporated into national inventory-based models of carbon stock change associated with specific FCM treatments. Other sites may not contribute directly to research and technology at all, but may be more focused on resolving other FCM issues.

As the emphasis of FCM pilots is on learning, though, pilots should be designed in such a way as to further our understanding of FCM to the greatest extent possible.

E.5 Provision of Incentives

In addition to addressing the priority policy questions described in E.3, governments can provide additional incentives to the proponents of FCM pilots, justified by the multiple benefits good projects provide. This will be particularly important if the focus of pilots is on contributing to RMUs, as opposed to creating tradable credits. If the increased carbon stocks produced by pilots does not result in a revenue stream, then one would question why it would be undertaken.

Due to the accounting procedures adopted under the Kyoto Protocol, deforestation is considered to be an immediate emission of carbon into the atmosphere and thus carries undue weight in calculating a carbon budget. As stemming deforestation is a sensible strategy, even in the absence of concerns about climate change, and since much deforestation will occur on private lands and thus will likely cancel Canada's RMUs at no cost to the landowner, programs to provide incentives to minimize deforestation could be tested as FCM pilots.

In developing FCM pilots, the potential policy barriers that may compromise the initiative should be identified. For example, a particular regulation developed prior to recognition of carbon as a forest value may unduly constrain an FCM project. If a net benefit can be secured by exempting the project from the requirements of the regulation, then consideration should be given to negotiation of an alternative approach to securing the desired benefits for specific application to the pilot project.

The international dimension of FCM also needs to be considered. Investors in FCM can secure credits through projects all over the world. Providing incentives to encourage those investments to remain in Canada enables Canada to secure not only the RMUs and potential tradable credits, but also all the other benefits of FCM projects that might otherwise be realized by other countries.

E.6 Measurement, Monitoring and Verification

Due to the number of concerns expressed about the uncertainty, risk and permanence of carbon sinks, the credibility of FCM pilots is paramount. Central to that credibility will be a standardized protocol for measuring and monitoring changes in carbon stocks on the landbase. While there will be an obvious need to reflect the current accounting rules of the Kyoto Protocol, any accounting system established must be robust to the evolving science and policy environment. Monitoring processes must incorporate provisions to address uncertainty and should continue post-verification to ensure that the projected level of carbon is stored on the landbase.

FCM pilots should be subject to independent verification to validate the measurement and monitoring systems in place and the results that they are producing. Once an acceptable accounting protocol has been implemented, verification could be undertaken by existing accounting/auditing firms accredited by the FCM Coordinator. The potential of synergy with existing programs of forest certification merits exploration.

E.7 Tradable Credit Registration and Trading

Where FCM pilots are to contribute to the evaluation of the role of FCM in emissions trading, a number of additional steps are required. Once the performance of an FCM pilot has been verified, the tradable credits associated with its performance need to be validated by a separate body, likely the FCM Coordinator. Ownership of the tradable credits needs to be registered with an appropriate registry, likely through an existing program, such as VCR Inc.

Depending on the number of participating sites and the interest of buyers, it may be possible to initiate some pilot trades in order to test the feasibility and cost-effectiveness of

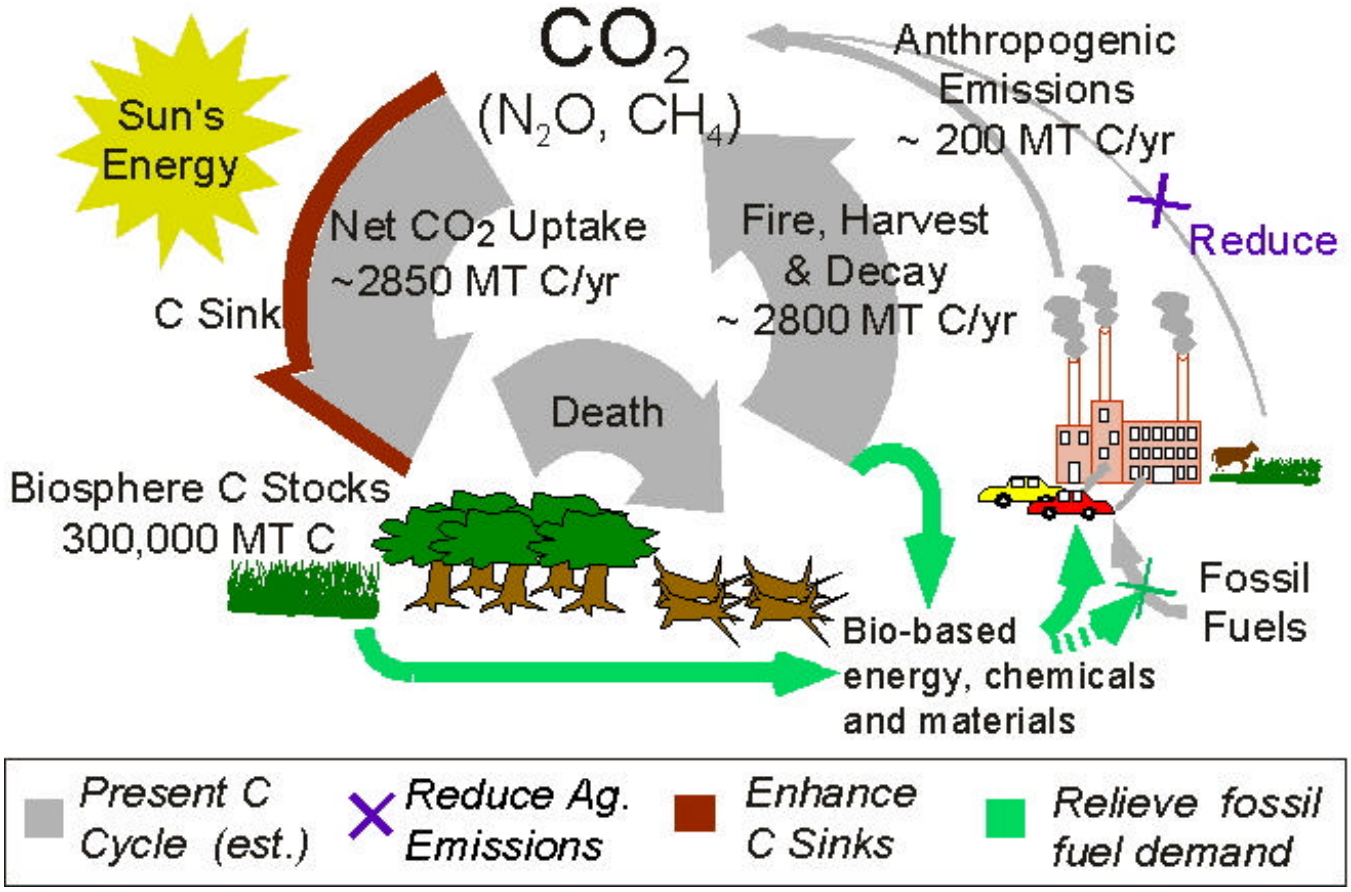
FCM as a generator of tradable credits. Implementing an emissions trading system prior to the first commitment period will enable Canada to fully understand the complexities of operating such a system and to refine it to enhance its effectiveness prior to the beginning of accounting under the Kyoto Protocol.

Depending on the range of pilots, trading could provide information about the relative costs of producing a tonne of CO_2 equivalent under various scenarios, identifying which ones offer most promise either for generating RMUs or tradable credits. Actual pilot trades may also provide a better understanding of the transaction costs of differing FCM initiatives, again enabling investment in either creating RMUs or tradable credits to be targeted more effectively.

E.8 Outreach

Finally, one of the principal purposes of FCM pilots is to generate learning. The FCM Coordinator should gather the experience of FCM pilots and disseminate information both among projects and between the pilots and external sources. For FCM to be truly effective in Canada, greater understanding and awareness of its potential for enhancing carbon stocks and delivering other social, economic and environmental benefits must be engendered.

Appendix 1: The Canadian Carbon Cycle



Source: BIOCAP

Appendix 2: Articles 3.3 and 3.4 of the Kyoto Protocol

Article 3.3 of the Kyoto Protocol states:

The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I. The greenhouse gas emissions by sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.

In article 3.4, the Kyoto Protocol states:

Prior to the first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol, each Party included in Annex I shall provide, for consideration by the Subsidiary Body for Scientific and Technological Advice, data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change, the advice provided by the Subsidiary Body for Scientific and Technological Advice in accordance with Article 5 and the decisions of the Conference of the Parties. Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990.

Appendix 3: Excerpt from Draft Decision -/CMP.1 Land Use, Land-Use Change and Forestry
(FCCC/CP/2001/13/Add.1)

The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol,

Affirming that the implementation of land use, land-use change and forestry activities included under the provisions of the Kyoto Protocol shall be consistent with the objectives and principles of, and any decisions taken under, the United Nations Framework Convention on Climate Change and its Kyoto Protocol,

Having considered decision -/CP.6 adopted by the Conference of the Parties at the second part of its sixth session,

1. *Affirms* that the following principles govern the treatment of land use, land-use change and forestry activities:

(a) That the treatment of these activities be based on sound science;
(b) That consistent methodologies be used over time for the estimation and reporting of these activities;
(c) That the aim stated in Article 3.1, of the Kyoto Protocol not be changed by accounting for land use, land-use change and forestry activities;
(d) That the mere presence of carbon stocks be excluded from accounting;
(e) That the implementation of land use, land-use change and forestry activities contributes to the conservation of biodiversity and sustainable use of natural resources;
(f) That accounting for land use, land-use change and forestry does not imply a transfer of commitments to a future commitment period;
(g) That reversal of any removal due to land use, land-use change and forestry activities be accounted for at the appropriate point in time;
(h) That accounting excludes removals resulting from (i) elevated carbon dioxide concentrations above their pre-industrial level; (ii) indirect nitrogen deposition and (iii) the dynamic effects of age structure resulting from activities and practices before the reference year;

2. *Decides* that Good Practice Guidance, and methods to estimate, measure, monitor and report changes in carbon stocks and anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from land use, land-use change and forestry activities, as developed by the Intergovernmental Panel on Climate Change, shall be applied by Parties, if decided in accordance with relevant decisions of the Conference of the Parties and the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol;

3. *Decides* that anthropogenic greenhouse gas emissions by sources and removals by sinks shall be accounted in accordance with the annex to this decision and reported in annual inventories and reviewed in accordance with relevant decisions relating to Articles 5, 7 and 8 of the Kyoto Protocol, and in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, any future elaboration of these guidelines, or parts of them, and any good practice guidance on land-use change and forestry in accordance with relevant decisions of the Conference of the Parties and the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol;

4. *Adopts* the definitions, modalities, rules and guidelines relating to land use, landuse change and forestry activities under Articles 3, 6 and 12 of the Kyoto Protocol contained in the annex for application in the first commitment period.

Annex — Definitions, modalities, rules and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol

A. Definitions

1. For land use, land-use change and forestry activities under Article 3.3 and 3.4, the following definitions shall apply:

(a) "Forest" is a minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest;

(b) "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources;

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

(d) "Deforestation" is the direct human-induced conversion of forested land to nonforested land;

(e) "Revegetation" is a direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here;

(f) "Forest management" is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

(g) "Cropland management" is the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production;

(h) "Grazing land management" is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

B. Article 3.3

2. For the purposes of Article 3.3, eligible activities are those direct human-induced afforestation, reforestation and/or deforestation activities that meet the requirements set forth in this annex and that started on or after 1 January 1990 and before 31 December of the last year of the commitment period.

3. For the purposes of determining the area of deforestation to come into the accounting system under Article 3.3, each Party shall determine the forest area using the same spatial assessment unit as is used for the determination of afforestation and reforestation, but not larger than 1 hectare.

4. For the first commitment period, debits resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be greater than credits accounted for on that unit of land.

5. Each Party included in Annex I shall report, in accordance with Article 7, on how harvesting or forest disturbance that is followed by the re-establishment of a forest, is distinguished from deforestation. This information will be subject to review in accordance with Article 8.

C. Article 3.4

6. A Party included in Annex I may choose to account for anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from any or all of the following human induced activities, other than afforestation, reforestation and deforestation, under Article 3.4 in the first commitment period: revegetation, forest management, cropland management, and grazing land management.

7. A Party included in Annex I wishing to account for activities under Article 3.4, shall identify, in its report to enable the establishment of its assigned amount pursuant to Article 3.7 and Article 3.8, the activities under Article 3.4, it elects to include in its accounting for the first commitment period. Upon election, a decision by a Party will be fixed for the first commitment period.

8. During the first commitment period, a Party included in Annex I that selects any or all of the activities mentioned in paragraph 6 above shall demonstrate that such activities have occurred since 1990 and are human-induced. A Party included in Annex I shall not account for emissions by sources and removals by sinks resulting from activities under Article 3.4, if these are already accounted for under Article 3.3.

9. For the first commitment period, accountable anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from cropland management, grazing land management and revegetation under Article 3.4, shall be equal to anthropogenic greenhouse gas emissions by 'Debits': where emissions are larger than removals on a unit of land. 'Credits': where removals are larger than emissions on a unit of land. sources and removals by sinks in the commitment period, less five times the anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from these eligible activities in the base year of that Party while avoiding double accounting.

10. For the first commitment period, a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3.3, may account for anthropogenic greenhouse gas emissions by sources and removals by sinks in areas under forest management under Article 3.4, up to a level that is equal to the net source of emissions under the provisions of Article 3.3, but not greater than [8.2] megatons of carbon times five, if the total anthropogenic greenhouse gas emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3.3.

11. For the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3.4, after the application of paragraph 10 above and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix to this decision, times five.

12. A Party may request the Conference of the Parties to reconsider its numerical values as contained in paragraph 10 and in the appendix to paragraph 11, with the view of the Conference of the Parties recommending a decision for adoption to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Parties, no later than 2 years prior to the beginning of the first commitment period. Such a re-consideration shall be based upon country specific data and the elements of guidance and

consideration in footnote 5 to paragraph 11. These shall be submitted and reviewed in accordance with relevant decisions related to Articles 5, 7 and 8 of the Kyoto Protocol, and in accordance with the *Revised 1996 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories*, any future elaboration of these guidelines, or parts of them, and any good practice guidance on land use, land-use change and forestry in accordance with the relevant decisions of the Conference of the Parties.

E. General

16. Each Party included in Annex I shall, for the purposes of applying the definition of "forest" as contained in paragraph 1 (a) above, select a single minimum tree crown cover value between 10 and 30 per cent, a single minimum land area value between 0.05 and 1 hectares and a single minimum tree height value between 2 and 5 metres. The selection of a Party shall be fixed for the duration of the first commitment period. The selection shall be included as an integral part of its report to enable the establishment of its assigned amount pursuant to Article 3.7 and 3.8 in accordance with decision -/CP.6, and shall include the values for tree crown cover, tree height and the minimum land area. Each Party shall justify in its reporting that such values are consistent with the information that has historically been reported to the Food and Agriculture Organization of the United Nations or other international bodies, and if they differ, explain why and how such values were chosen.

17. For the first commitment period, and subject to other provisions in this annex, the additions to and subtractions from the assigned amount of a Party pursuant to Article 3.7 and 3.8, shall be equal to anthropogenic greenhouse gas emissions by sources and removals by sinks measured as verifiable changes in carbon stocks, and non-carbon dioxide greenhouse gas emissions during the period 1 January 2008 to 31 December 2012 resulting from afforestation, reforestation and deforestation under Article 3.3 and forest management under Article 3.4, that have taken place since 1 January 1990. Where the result of this calculation is a net sink of greenhouse gases, this value shall be added to the assigned amount of that Party. Where the result of this calculation is a net source of greenhouse gas emissions, this value shall be subtracted from the assigned amount of that Party.

18. Accounting of anthropogenic greenhouse gas emissions by sources and removals by sinks resulting from land use, land-use change and forestry activities under Article 3.3 and 3.4, shall begin with the onset of the activity or the beginning of the commitment period, whichever comes later.

19. Once land is accounted for under Article 3.3 and 3.4, all anthropogenic greenhouse gas emissions by sources from and removals by sinks on this land must be accounted for throughout subsequent and contiguous commitment periods.

20. National inventory systems under Article 5.1 shall ensure that areas of land subject to land use, land-use change and forestry activities under Article 3.3 and 3.4 are identifiable, and information about these areas should be provided by each Party included in Annex I in their national inventories in accordance with Article 7. Such information will be reviewed in accordance with Article 8.

21. Each Party included in Annex I shall account for all changes in the following carbon pools: above-ground biomass, below-ground biomass, litter, dead wood, and soil organic carbon. A Party may choose not to account for a given pool in a commitment period, if transparent and verifiable information is provided that the pool is not a source.

Appendix 4: FCM Research Needs Identified at Workshop #3 — Enhancing, Quantifying and Verifying Forest Carbon Stock Changes: Kyoto and Beyond

Workshop #3 in the Pollution Probe Forest Carbon Management series was organized by BIOCAP to consider "Enhancing, Quantifying and Verifying Forest Carbon Stock Changes: Kyoto and Beyond." The intention of this workshop was to identify the science, technology and social science needs for FCM in Canada and to begin to develop a research agenda, principally for the university community. The workshop brought together approximately 60 participants, including researchers from government and universities, consultants and representatives of forest companies, the federal and provincial governments and environmental NGOs. The following FCM research needs were identified.

A4.1 Research to Inform Policy Decisions and Provide Direction to the Research Community

A4.1.1 A Need for Direction and Clarification

Identifying research gaps and priorities, especially in the area of economic analysis and policy options is limited by the lack of a clear direction from policy makers regarding fundamental questions, such as whether there will be a carbon trading system in Canada, the role of the private and public sectors in efforts to enhance forest carbon stocks, and the extent of the "managed forest." Without better definition of the key public policy questions, it will be difficult to set research priorities.

A4.1.2 Research Areas for Social Sciences Related to Enhancement of Carbon Stocks

- economic and political-economic analysis of incentive systems and credit systems;
- relationships between accounting rules, incentive systems and outcomes, carbon offsets, timber supply, other forest values, co-benefits, etc.; and,
- qualitative and quantitative international comparative analysis of uncertainty and risk related to areas such as modeling, incentives, credit systems, etc.

A4.2 Research to Measure and Model Forest Carbon Stock Changes

A4.2.1 Tools for Integration and Modeling

- assess 'components' of the problem and determine the best available data / methods / models to address these, thereby defining major research needs;
- develop validation and verification framework to plan data collection and integrate research, possibly using AEAM (Adaptive Environmental Assessment and Management) process for the national carbon accounting framework, including:
  - decision makers and scientists to ensure integration
  - development and review of the tools and systems used to conduct scenario analysis and identify knowledge needs
  - periodic (annual?) review of the modeling approach and the national carbon accounting framework;

- develop modeling tools for spatial scaling of C cycle from stand level to national level;
- develop strategy for assessing the impact of Afforestation, Reforestation and Deforestation activities on net C stock changes, and understand the level of uncertainty that is involved.

A4.2.2 Model Runs Predicting Forest C Stock Changes Under Various Scenarios

- inventory-based models of forest C stock changes are required for scenarios that include combinations and interactions of the following time, scales and process variables:
  Time:
  - past (esp. 1990)
  - present
  - first commitment period (2008–12)
  - second commitment period (2013–17)

  Scale:
  - stand
  - management unit
  - regional
  - national

  Process Variables:
  - climate change
  - natural disturbance
  - forest management activity
  - age class;
- the inventory-based models and the input data and parameters must be made available for use by researchers in universities and industries;
- the uncertainty of the model predictions must be assessed;
- decision and sensitivity analyses to determine implications of "improved data" or improved process representation on the precision or reliability of the inventory-based model, and ultimately on the quality of the decision making, carried out by Decision Analysts and possibly involving a 1–2 year project that should be started immediately;
- economic models assessing costs, benefits and risks associated with the key scenarios modeled above;
- comparison of models (process vs. stock-based), improvement of process parameterization in stock models, validation of process models against inventory models run in the past, comparisons of responses to future scenarios of climate change and comparison of responses to management; and,
- improved measurements of the GHG concentrations across Canada, and use of this information to obtain insights into the relative ability of the biosphere to take up and release GHGs.

A4.2.3 Informing, Testing and Calibrating the Inventory-Based Model

- improved growth and yield curves (including C stocks in biomass and dead organic matter) for young stands, stands managed by thinning, genetically-improved stocks, second growth, etc.;
- understand the factors and processes (including climate, natural and human disturbance) affecting fluxes to and from, and changes in the pools of living biomass and dead organic matter (DOM, including litter, coarse woody debris (CWD), fine woody debris (FWD), soil C, and peat) in forest ecosystems across Canada, including:
  - a network of flux towers and forest sites representing major ecosystem types on which continuous measurements are made of CO_2, H_2O and energy fluxes and the data analyzed to understand the basis for inter-annual variations
  - associated with the sites of continuous flux measurements, a number of temporary flux measurement sites representing natural or human disturbances
  - measurement of carbon stock

changes in living biomass and organic C pools at these flux sites and at other sites across Canada
- from the previous assessment, what pools must be measured and what pools can be assumed to be stable in various ecosystems and with various scenarios;
- develop less expensive, more flexible alternatives to the existing eddy flux measurement for quantifying seasonal and annual carbon fluxes and C stock changes in forest ecosystems;
- assess how chronic exposure to atmospheric N deposition or elevated atmospheric CO_2 affects the C cycle of Canada's forests; and,
- carry out full carbon accounting and life cycle analysis of greenhouse gas impact associated with afforestation activities on abandoned farm lands, or conversion of agricultural lands into urban development.

A4.2.4 Developing Cost-Effective Strategies For Detecting Land-Cover Change

- improve algorithms for using Remote Sensing data to detect land cover change (including identification of tree species) for assessing Afforestation, Deforestation and Reforestation since 1990, or for detecting lands affected by fire or severe insect infestations.

A4.3 Research to Enhance Forest Carbon Stocks

A4.3.1 Will Afforestation Activities Mitigate or Exacerbate Climate Change?

- through measurements and models, assess the effects of afforestation activities on the albedo, and its ultimate influence on global climate, including consideration of region, species, sun angles and integration with global circulation and climate models

A4.3.2 Explore or Develop 'New' Technologies for Enhancing or Preserving Forest Carbon Stocks

- explore and develop new technologies for enhancing or preserving forest Carbon stocks, including:
  - use of plant growth regulators
  - tree selection or improvement
  - improved health and vitality of seedlings for improve revegetation
  - improved tree nutrition (fertilization (N, P, micronutrients, etc.), mycorhizal inoculation, etc.)
  - control of forest pests

A4.3.3 Impacts of Human Activities on Forest Carbon Stock Changes

- how effective are our disturbance control practices for fire and insects in preserving or enhancing forest C stocks and will more fire protection increase significantly the risk of fire in future years?
- model/sensitivity analysis to identify practices currently used that can have the largest impact on C storage, at local to national levels.
- identify characteristics of a forestry/ agroforestry ecosystem that can optimally store C, with periodic intervention, including above and below ground biomass, dead organic matter (soil), GHGs, and also including effects of disturbance on carbon balances and impacts of suppression/management.

A4.3.4 Assessment of Other Costs and Benefits of Human Activities in Forest Ecosystems

- test landscape level effects of increasing productivity on a sub-set of forest sites, therefore decreasing harvesting pressure on other sites and conserving mode C at the landscape level;

- assess effects of Forest Carbon Management on timber supply; and,
- develop a Forest Carbon Management 'decision support system' that would draw on a wide range of perspectives, including C storage, biodiversity, economics, social acceptability, risk, liability and longevity of products.

A4.3.5 Towards Implementation of Additional Forest Carbon Management Practices

- examine acceptability in the market place (economics) and in society at large (public) of current and potential forest management practices, at both local and national levels, including identifying specific barriers and ways to overcome them;
- economic analysis of policy barriers and subsidy-incentive programs;
- economic analysis of carbon credits defined and rules for trading as they affect adoption of new technologies; and,
- explore issues of ownership, insurance and liability for C stock.

Appendix 5: Examples of Forest Management Initiatives with a Carbon Component

A5.1 International Forest Carbon Management Projects

Examples of forest protection initiatives include:

- the Noel Kempff Climate Action Project, is a 30-year, carbon offset project co-funded by American Electric Power, PacifiCorp, BP Amoco, The Nature Conservancy, Friends of Nature Foundation and the Government of Bolivia (www.unfccc.de/program/aij/aijact99/bolusa02-99.html); and,
- the Rio Bravo Carbon Sequestration Pilot Project in Belize, which is a conservation and management area on 260,000 acres of mixed lowland, moist subtropical broadleaf forest. The project reduces, avoids and mitigates an estimated 2.4 million metric tons of carbon through prevention of deforestation and sustainable forest management and reforestation (www.unfccc.de/program/aij/aijact98/blzusa01-98.html).

Both of these are projects under the Kyoto Protocol's Joint Implementation mechanism.

Numerous small scale afforestation initiatives have been launched in the past few years, including:

- a partnership between Tokyo Electric Power Company (TEPCO) and New South Wales Forests to plant 1000ha of forests in the year 2000 and a total of 10-40,000ha over the next 10 years depending on developments under the Kyoto Protocol. Should the anticipated carbon credits not materialize, TEPCO still owns the resulting fiber, reducing its downside risk (www.forest.nsw.gov.au/navigation/active_frame.asp?bodypath=/publication/forest_facts/greenhouse/default.asp).
- the Klinki Forest Project in Costa Rica which will convert 6,000 ha of pastures into farm forests (primarily using Klinki pine) over six years and will involve hundreds of farmers.
- Project CARFIX, in Costa Rica, expects to sequester over 2 million tonnes of carbon by afforesting 5,533 ha, managing sustainably 20,502 ha and regenerating 10,670 ha. The project will involve over 2,000 farmers and will cost US$ 5.5 million.
- In Guatemala, CARE is planting 12,000 ha of community woodlots (mostly pine and eucalyptus) and 2,880 km of live fencing as part of a larger project that includes the promotion of agroforestry on 60,000 ha and the construction of terraces to protect 2,000 ha of slopes. The World Resources Institute calculates that this project will sequester 16.3 million tonnes of carbon over 40 years. It will cost US$ 14 million.
- the Oregon State University, the Russian Federal Forest Service and others launched the Saratov Afforestation Project (RUSAFOR-SAP) in 1994. Three sites totaling 500 ha in Saratov Oblast are expected to sequester 200,000 tonnes of carbon at a cost of US$ 500,000.
- Utilities have invested in some afforestation projects across the USA. The Oklee Tree Project is a partnership between agricultural agencies, universities and power companies in Minnesota which subsidized the planting of 1,200 ha on Conservation Reserve Program lands. The UtiliTree Carbon Company is a consortium of 40 electrical utilities that have banded together to fund carbon sequestration projects, including afforestation.

- American Forests is the originator of the Global Re-Leaf program, which claims to have planted 7 million trees and offers planting opportunities to GHG emitters in return for carbon credits. Mobil recently committed to plant 500,000 trees through the program. Through its new Climate Re-Leaf initiatives, American Forests suggests that 116 million hectares of land is available for afforestation in the USA, and it is working with state governments to promote afforestation on those lands.

A5.2 International Afforestation Programs

Many afforestation programs have been initiated for reasons other than carbon sequestration.

- The USA's 1996 Farm Bill, which provides for several programs that provide incentives to landowners to afforest lands or to better manage forested lands. Under the *Forestry Incentives Program*, the federal government pays 65% of the costs of tree planting and stand improvement to a maximum of $10,000 per year provided the landowner agrees to maintain practices for at least 10 years.
- The Irish government has been promoting tree planting by farmers as a means of developing a forest industry for the country. 82% of Ireland's forests are planted, representing approximately 6.5% of the country's area. From 1990 to 1997, 143,090 hectares were afforested (17,886 ha/yr), 71,880 ha by farmers (8,985 ha/yr).
- The Government of Argentina, and many of its provincial governments, intend to stimulate planting of large stands of pine, eucalyptus and auracaria by offering tax breaks and subsidies for investors in plantations. The federal Argentine government will reimburse a foreign or national plantation owner between US$ 400 and US$ 600 per ha of plantation, which will cover the cost of plantation establishment (including labour and planting stock), or up to 80% of land costs. Although carbon sequestration is not a stated objective of the program, it is recognized as a side benefit.
- Forestry Joint Ventures are marketed aggressively in New Zealand as business investment opportunities. Brokers secure land for afforestation on behalf of their clients and manage the timber planted there. Private investors provide funding to support the planting and tending of the trees. The landowner provides the land and the profits are shared among the three entities in an agreed-upon way.

A5.3 Canadian Afforestation Programs

While Canada has not undertaken any afforestation programs specifically to address climate change, the country does have considerable experience in related initiatives. In addition to the examples presented in the text, there have been a wide variety of domestic programs (examples drawn from Sinks Issue Table Options Report).

- The Prairie Farm Rehabilitation Administration has long been providing free seedlings and technical assistance to qualifying landowners in Saskatchewan, Alberta and Manitoba for the establishment of shelterbelts. Participants pay for the transportation of seedlings to their property. An estimated 17% of the farms in Saskatchewan and Alberta have participated in this program and have planted an estimated 58,000 ha. The 1997 report of the Auditor General of Canada indicated that it is not clear how PFRA monitors the planting and performance of trees provided under the Shelterbelt program, so there is no indication how many of the planted trees have survived.

- In British Columbia, Forest Renewal BC is embarking on a Small Woodlands Program that has an afforestation component. The program will focus on the provision of technical assistance and extension services and may include financial assistance.
- The Saskatchewan government is currently undertaking a study to explore the potential of agroforestry in that province, which will include an examination of incentives to landowners.
- Ontario passed the *Woodlands Improvement Act* in 1966, which allowed the Minister to enter into an agreement with a private landowner to provide assistance in reforestation and stand improvement. Under a WIA agreement, the landowner committed to maintaining the land in forestry for 15 years and was required to purchase any necessary planting stock at a nominal cost. The owner also stood to receive a tax rebate on the managed lands. The agreement was not registered to title, allowing the landowner a free hand in selling the property. In return, Ministry of Natural Resources staff prepared a work plan, estimated costs of prescribed forestry practices, and either provided or paid for the work to be undertaken. The WIA was responsible for the afforestation of at least 52,000 ha and was oversubscribed in that MNR did not have the capacity to answer all the requests for participation.
- The Canadian forest products industry has undertaken some afforestation projects as a means of augmenting fibre supply. All of the examples provided are hybrid poplar plantations. Domtar has 2,200–2,500 ha in small plantations in eastern Ontario. MacMillan Bloedel has afforested 3,900 ha in Canada and USA, although the company established to manage this project is currently up for sale. ALPAC expects to plant 20-25,000 ha in Alberta. Scott Paper has been promoting afforestation since the 1950s and currently has approximately 2,000 ha of hybrid poplar on owned or leased land in British Columbia, for which it is paying approximately $2,500 in direct costs and a further $375/ha for land opportunity costs.
- NGO-led afforestation programs in Canada largely centre on urban forestry and tree-planting. The Tree Canada Foundation (TCF) has planted 67.3 million trees in six years (only 9 million in the last two) in partnership with a range of agencies, mostly communities, across Canada. In 1997/98, TCF planted 5.4 million trees on a budget of $3 million. In that year, the federal government provided $1.9 million in funding support with the balance of TCF's funding being raised from sponsors. For the next three-year period, federal funding will be reduced to $1 million per annum. TCF has been offering carbon "credits" to some of its sponsors, notably TransCanada Pipelines, which has supported the planting of 5.5 million trees. In calculating the credit, TCF assumes a 70% survival rate of the sponsored trees.
- Scouts Canada has an extensive tree-planting program that is used as both a program activity and a fund-raising initiative. This program planted 4 million trees in 1998 and claims a 75% survival rate.

Appendix 6: Actions of Canadian Stakeholders in Forest Carbon Management

Although Canada has been a leading advocate for the eligibility of FCM under the Kyoto Protocol, caution has been the hallmark of domestic efforts over the past five years with many stakeholders either unaware of the opportunities presented by the Kyoto Protocol or content to await the results of negotiations before committing to action.

A6.1 Policy Responses by the Federal and Provincial Governments

The subject of forests as carbon sinks was considered by two of the "issue tables" created under the National Climate Change Process (Sinks and Forest Sector). A joint working group of the two tables looked at reforestation, afforestation and deforestation (ARD) issues in Canada, attempting to quantify the potential impacts of each and to identify the opportunities for Canada. As many aspects of the Kyoto Protocol were still in negotiation during this process, the conclusions of the two tables are influenced by that uncertainty; however, the processes provided much valuable information about Canada's prospects in moving forward on ARD issues. The Options Papers produced by the two tables can be obtained from www.nccp.ca/NCCP/national_process/issues/sinks_e.html#options and www.nccp.ca/NCCP/national_process/issues/forest_e.html.

In Saskatchewan, Saskatchewan Environment and Resource Management (SERM) has worked with SaskPower to develop a reforestation and forest protection project under the GERT (see Appendix 8). Information can be obtained at: www.gert.org/listings/t4.htm.

The federal and provincial governments, through the Canadian Council of Forest Ministers, have also introduced the Forest 2020 program. Designed to address the timber supply issue through the establishment of fast-growing plantations to reduce pressures on natural forests, Forest 2020 also has a carbon sinks component. Information can be obtained at: www.nrcan.gc.ca/ccfm/forest2020/index_e.html.

The Prairie Farm Rehabilitation Agency (PFRA) has long promoted the establishment of shelterbelts and has recently begun to examine the contribution that they may make as carbon sinks (http://www.agr.ca/pfra/shbpub/shbpub.htm).

A6.2 Canadian Forest Industry

A number of Canadian forest products companies have begun to explore FCM opportunities. Alberta-Pacific Forest Products (Al-Pac) has established an afforestation program intended to provide the company with 400,000m^3 of fibre annually. The driver for the initiative is timber supply, but Al-Pac is cautiously experimenting with carbon sequestration contracts with GHG emitters (www.alpac.ca/Fibre_Enhancement/PoplarFarms&Woodlots.htm). Several other companies are experimenting with afforestation or reforestation initiatives, largely centred on future timber supply. Domtar is one of the few forest products companies to investigate the carbon impact of FM initiatives, with the company's proposals focusing on juvenile spacing and pest control.

A significant impediment for those companies that have tried to get ahead of post-Kyoto forest carbon management opportunities is the lack of policy and

infrastructure to enable them to secure recognition for their initiatives. The rules for crediting broader GHG emissions reductions initiatives in Canada are still in their infancy and many of the players involved in that process have little knowledge of forests and forestry. Consequently, the Canadian forest products industry and potential investors in FM activities are largely taking a "wait and see" attitude.

A6.3 Canadian NGOs

While many US and international NGOs have actively promoted FCM initiatives, principally forest protection projects in tropical forests, Canadian conservation and environmental NGOs have been relatively silent on the issue of forest sinks domestically.

Recently, the David Suzuki Foundation and West Coast Environmental Law Association released a report entitled *Taking Credit: Canada and the Role of Sinks in International Climate Negotiations* (www.davidsuzuki.org/Publications/Climate_Change_Reports/default.asp#Taking). Other Canadian NGOs, such as World Wildlife Fund Canada and the Canadian Nature Federation, have some experience with international conservation projects with an FCM component. Ducks Unlimited Canada has recently released a proposed *Conservation Cover Incentive Program for Canada* (www.ducks.ca) which recognizes the carbon sinks benefits of such activities.

A6.4 FCM Research Needs

BIOCAP (www.biocap.ca) is a national not-for-profit research foundation that has been charged with facilitating and supporting university research to determine how Canada can use its vast biological resources (including agriculture and forestry) to help manage greenhouse gas emissions, generate renewable energy and contribute to a dynamic and sustainable rural economy.

The Sustainable Forest Management Centre of Excellence, based out of the University of Alberta, has a significant program of research related to forests and climate change (sfm-1.biology.ualberta.ca/english/home/index.htm).

The Canadian Forest Service also has an extensive research program related to forests and climate change and plans to base much of its future work out of the Pacific Forestry Centre in Victoria (www.nrcan.gc.ca/cfs-scf/science/resrch/climatechange_e.html).

A6.5 Investing in Forest Carbon Management

A small number of financial and investment firms have begun to explore opportunities for their clients relating to FCM. Most of these firms have established environmental practices that address risk management or emissions trading and are extending these activities into the area of greenhouse gas emissions management.

Canadian GHG emitters, to date, have evinced little interest in FCM in Canada. One reason is the comparatively high cost of FCM domestically compared to investments offshore due to cheaper land and faster growth rates in other countries. Another is that the rules regarding investments through Joint Implementation or the Clean Development Mechanism provide a little more certainty. Some companies, such as Suncor and Nexen, have invested in Joint Implementation projects, such as the Rio Bravo initiative in Belize (see Appendix 3). Ontario Power Generation is engaged in a number of projects related to biodiversity conservation, including reforesting the Oak Ridges Moraine area. While these have a carbon component, carbon is not the driver of the initiatives. TransCanada Pipelines, in partnership with the Tree Canada Foundation, has sponsored the planting of 5.5 million trees across the country, sequestering an estimated 1.2 million tons of carbon.

Appendix 7: ARD Estimates for Canada from the Sinks Table Options Paper

The following tables are excerpted from the Option Paper of the Sinks Issue Table of the National Climate Change Process. The full report can be obtained from www.nccp.ca/NCCP/national_process/issues/sinks_e.html#options.

A7.1 Deforestation Estimates

Deforestation Estimates for Major Sectors (CO_2 emissions from above-ground biomass)

Source	Low–High Estimate (ha per year)	Low–High Estimate (Mt CO_2 per year)	Provinces Where Likely to be Most Significant
Agriculture	10,300–30,800	2–6	BC, AB, SK, ON
Forestry	21,600–21,600	4	BC, ON, NB, NS
Urban development	3,600–3,600	1	BC, AB, ON, PQ
Transportation	1,200–1,200	0.2	
Recreation	<100–500	<0.1	AB
Mining and petroleum	10,900–12,700	1–2	PQ
Electricity generation	7,000–10,100	1	
TOTAL	**54,600–80,500**	**9–14**	

Source: NCCP Sinks Table Options Paper

A7.2 Estimates of Afforestation Potential

Afforestation area and cost estimates for Canada

Province/Region	Available area (ha)	Annual planting area (ha/year)[1]	Average Annual Establishment Costs ($ million/yr)[2]	Cost/ha ($/ha)
British Columbia	250,000	17,000	17.67	1,060
Prairies	750,000	50,000	59.00	1,180
Ontario/Quebec	108,000–360,000	7,200–24,000	10.80–36.00	1,500
Atlantic Provinces	15,000–42,000	1,000–2,800	1.50–4.20	1,500
National	**1,123,000–1,402,000**	**75,200–93,800**	**89.00–116.87**	**1,185–1,246**

Summary of Afforestation Actions[1]

Action	Annual Planting Target[2] (Ha/yr)	Planting Period	Total Planting Ha	Cost Effectiveness[3] 1997$/t CO_2e		Carbon Sequestration[4] Mt CO_2e	
				2008–2012	2000–2050	2010	2000–2050
Fast-growing plantations	10,000	5 years	50,000	22.2	na[5]	1.31	na[5]
Prairie shelterbelts	13,000	15 years	169,000	140.7	3.7	0.15	29.0
B.C. block plantations	13,000	15 years	169,000	452.5	2.4	0.04	35.2
Prairie block plantations	20,000	15 years	260,000	114.6	3.0	0.37	71.4
Eastern block plantations	15,000	15 years	195,000	144.9	2.3	0.22	68.6
TOTAL			**843,000**			**2.08**	

Source: Sinks Issue Table Options Paper

1. The sequestration and cost-effectiveness estimates for the first commitment period are considered to be of low confidence. Other estimates are considered to be of medium confidence.
2. All planting starts in 2001. With the exception of the fast-growing species action, all planting ramps up to the annual planting target by 2005. For the fast-growing species action, full annual planting starts in 2001.
3. The costs include planting and maintenance costs only. Not included are the cost of protection and the transaction costs associated with afforestation programs and carbon measuring, monitoring and verification systems. Also not included are revenues from the harvest and use of the tree, and the value of environmental benefits.
4. Only above- and below-ground tree biomass carbon is included in the net sequestration estimates for the fast-growing plantation action and the Prairie and B.C. actions. The Eastern Canada actions also include soil and non-tree biomass carbon. Emissions from the use of fossil fuels in planting are accounted for in the estimates.
5. For the fast-growing species action, the assumption is that harvesting, if it occurs, will happen at age 13 to 15 years and the area is replanted. Over the 2000–2050 period, the net carbon sequestration will then depend on how harvesting of afforested areas and carbon in the resulting forest products are treated in the Protocol.

Appendix 8: Saskatchewan Carbon Offset Project

The following is a brief summary of a partnership effort between SaskPower and Saskatchewan Environment and Resource Management (SERM)

Description

The project has two components:

- approximately 3,300 ha of Not Satisfactorily Restocked (NSR) land will be planted with white spruce in eastern Saskatchewan (i.e., sequestration); and,
- 200,000 ha of forest will be removed from FMA AAC through the provincial Representative Areas program (i.e., emissions avoided). Any resulting credits are sold to SaskPower.

Calculations

1. Sequestration Component

- assuming 90-year rotation
- Project Case — White spruce plantation, carbon sequestration based on MAI data from SK yield curves
- Baseline Case — natural succession, low-density aspen stand yield curve
- Soil C assumed to be stable — no change in land use
- Used long-term average accounting
- Deductions for effects of fire (7.5% over rotation) and insects (0.2% per year)
- Long-term net (Project–Baseline) carbon sequestration of *ca.* 115,000 tonnes carbon over 90 yr rotation

2. Emissions Avoided Component

- Project scenario: areas removed from FMA landbase as part of the Provincial Representative Areas Program
- Baseline
  - what would have happened in absence of the agreement?
  - how much and when would harvesting have occurred?
  - needed to project harvest schedule over 80 years
  - used age class distribution and assumed harvest when mature
- Starting point: determine carbon pools for existing forest
  - accounted for carbon pools: LFH, CWD, understory, tree, softwood products, hardwood products
  - used BOREAS Auxiliary Site and CFS data
  - difficulty in obtaining appropriate data
- Calculated how pools changed over time
  - including slash decomposition, regeneration of harvested stands and storage in forest products
- Determined net C change as Project minus Baseline
- Difference is C credit
- Risk: Carbon deducted for fire and insects
  - Fire: Deducted 15% of total volume — based on long-term TSA and fire history for FMAs
  - Insect: Historical CFS data indicates about 0.5% per year for SBW and FTC
- Leakage: Reserves represent real and permanent removal from AAC
  - high level of current volume allocation in SK — fully committed
  - companies cannot harvest outside their FMA

Additional Issues

- Additionality
- Data quantity and quality
- Technical capacity in organizations
- Ownership — carbon vs. credit
- Crown land — FMA allocations
- Authority — who says you can do this?
- Credit schedule: *ex ante* vs.*ex post*. incremental crediting, long-term averaging
- Prediction accuracy, measurement accuracy, incentive?
- Time horizon: 100 years, multiple rotations or ???

Lessons

- essential to have standard methodology for measurement and accounting
- need clarity on policy (e.g., credit for early action)
- mixture of science and policy — will always have some subjective elements

Appendix 9: Securing Private Landowner Participation in Afforestation

Information presented in this appendix is adapted from the presentation of Byron Grundberg delivered at Workshop #4 and available at www.pollutionprobe.org/whatwedo/Kyoto.html.

1. Landowner Attitudes (Results of Environics Survey)

1.1 Obstacles to Conserving or Increasing Forested Land

- need land for other purposes (29%);
- expense (25%);
- time and effort required (18%); and,
- knowledge or skills (5%).

1.2 Response to Tree Planting Incentives (Percent landowners and average area willing to plant)

- no incentives = 25% (7.7 ha);
- free seedlings + planting cost covered = 42% (7.7 ha);
- free seedlings + planting cost + $25/ha/yr = 45% (11.7 ha); and,
- free seedling + planting cost + $125/ha/yr = 47% (24.7 ha).

1.3 Small and Non-Farmer Landowner Surveys

- small landowners more likely than large landowners to express interest in planting trees (47%);
- likely to respond to incentives (93%);
- area they would consider planting small (< 2 ha) even with incentives; and,
- non-farmers more likely to define stewardship as “voluntarily conserving natural environment.”

2. Desirable Characteristics of an Afforestation Program

Will address obstacles to tree planting:

- opportunity cost;
- expense;
- time; and,
- labor.

Will address market concerns

- inadequate returns;
- a transparent market; and,
- opportunity for individual participation.

A program should be flexible enough to accommodate multiple objectives of landowners (one size does not fit all).

3. Potential Approaches to Private Land Afforestation

3.1 90:10 Silviculture Incentive Program

- public agency covers 90% of planting cost and the landowner provides 10% in cash or sweat equity;
- landowner “owns” the plantation and does not sign any binding agreements;
- Quebec/ N.B. experience — 3000 ha/year (>99% retention over 20 years); and,
- little or no “track record” on prairies.

3.2 Private Woodlot Management Programs

- private industry contributes to cost of plantation establishment;
- landowner grants “first right of refusal” to sell fibre to contributing agency;
- successful example — Domtar in eastern Ontario; and,

- similar programs haven't attracted many owners in N.S and N.B.

3.3 Land Rental

- rent private land at market rate (e.g., Al-Pac hybrid poplar program);
- leaseholder owns fibre and carbon credits; and,
- only suited to fast growing plantations.

3.4 Hybrid Program

- covers cost of plantation establishment and annual rental to landowner (e.g., Environics survey);
- rent doesn't apply to full rotation; and,
- ownership of fibre and carbon credits negotiable (perhaps landowner retains fibre, but investor retains carbon credits).

3.5 Carbon Conservation Easement

- public money contributes to cost of planting;
- landowner signs binding agreement to maintain the plantation for some term or sells or donates a "carbon conservation easement" for the same purpose; and,
- landowner owns fibre at end of contract or receives annual or lump sum payment for conservation easement.

3.6 Landowner Financed

- landowner bears all costs associated with afforestation; and,
- landowner sells "carbon credits" and owns fibre.

Prairie Afforestation — Theoretical Response to Incentives

Incentive	Area	Cost	Incremental Cost	Incremental Area
None	270,241 ha	n/a	n/a	n/a
Costs	454,000 ha	$1180	—	68%
Costs + $10/ha	739,127 ha	$1680	42%	62%
Costs + $50/ha	1,629,730 ha	$3680	120%	120%

Source: Byron Grundberg