The Kyoto Forest - Risks and Opportunities in Forest Carbon Credits [1]

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Introduction[1]

Using forests to generate forest carbon credits has a number of implications for forest management. It is a new way to look at the forest to generate income, but it is also produces a new set for risks to forest management. These include international competitiveness and potential linkage to the issue of forest certification. At present, the Kyoto forest is not the traditional forest, it is a new forest. However, what is and is not included in the forests and how to count carbon atoms is under international review. We may yet see the inclusion of the 'traditional' forest.

In this paper, I review the definition of the Kyoto forest and how it applies to Canada, and present some examples of potential gains and risks for forest management. This is followed by an assessment of a future expanded definition of the Kyoto forest and associated gains and risks.

The Kyoto Forest Rules

Much of what is the Kyoto forest is not what we call the Canadian forest. Canada has about 416 million hectares of forest land of which 290 million hectares are the managed forest, and about half this is commercially accessible. The Kyoto forest is forest created through human induced activity from 1990 on. Only a small fraction of the 416 million hectares is or will be Kyoto forest under the present definitions. The activities that create a Kyoto forest in Canada are RAD - reforestation, afforestation and deforestation.

Reforestation and afforestation are not as we know them in Canada. Afforestation in the Kyoto accord is planting trees where they never been, e.g. grasslands. Reforestation is planting trees where there has not been trees for many years, e.g., land cleared for farming many years ago. (This is what we would consider afforestation.) Consequently, normal forestry activities of harvesting and regeneration on the harvested land are not included. These activities are not creating more forest and further enhancing our ability to sequester carbon. However, it has been suggested that the Kyoto view of the forest benefits those who have treated their forest badly in the past and does not do much to encourage good resource management. Negotiations on future definitions of the Kyoto forest are ongoing and, as discussed later, the traditional forest may yet become part of the Kyoto forest.

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[1] In: Proceedings Greenhouse Gas Emissions Trading and Reduction in Alberta's Forest Products Industry, 15 June 1999, Whitecourt, AB, Boreal Woods Centre, Manning AB, tab 5, pp.1-5.

Deforestation has the same definition in Canada and in Kyoto. There are some groups who would like to broaden the definition to include normal forest harvesting, particularly of primary forests. Deforestation is a concern for Canada as it is a debit in the national carbon balance. It has been estimated that in the last decade the loss of forests to urbanisation, clearing for agricultural use, highways, power line rights of way, and permanent forest roads was about 700 km^2/yr. Permanent forest roads are a significant component of this area. If carbon accounting and carbon trading becomes a way of life for forestry, forest companies and provincial forest services may be required address the carbon loss due to deforestation for permanent roads.

Other aspects of the Kyoto forest to be worked out are carbon accounting and verification methods. We do not know if only the above-ground accumulation can be counted or whether below-ground component (roots) can also be include, though most work is assuming this. Accumulation of carbon in the soil through decay of trees is not yet in the equation. A Canada wide process to monitor the Kyoto forest will be expensive.

The **Clean Development Mechanism** allows existing forests in developing countries to be Kyoto forests. Carbon credits, obtained by sequestering carbon through enhancing forest growth, can be transferred to the developed country or company that is paying for the enhancement. Sequestration can be achieved by reforesting denuded land or by saving the forest from being logged. In the latter case, the project must ensure that it is not just transferring harvesting from one area to another. Companies exist to manage the projects and verify compliance.

Carbon Gains Through Forest Growth

Foresters quantify forests in terms of merchantable wood volume. Table 1 presents the conversion factors to go from cubic metres of merchantable wood to tonnes of carbon and tonnes of carbon dioxide. Also shown are the conversion factors to go from mechantable volume to total tree carbon (including branches, bark, stumps, tops and roots).

Table 1. Conversion of forests to carbon

- Wood density - 0.43 tonnes per cu m
- Carbon content - 50%
- 1 cu m merchantable wood ~ 0.2 tonnes of carbon
- Expansion factors for non-merch. material: 1.45 for above-ground (branches, bark, tops and stump); 0.35 for below-ground (roots)
- 1 cu m merchantable wood ~ total carbon in forest of 0.4 t C,
  ~ total carbon dioxide in forest of 1.4 t CO_2

The amount of carbon for credits depends on the area available to plant, species planted and their growth rate. Most of the potentially available areas will be on private land, such as marginal farmland, or land needing shelter belts. There will be constraints on species to be planted, particularly if the trees are to be grown for more than just carbon credits. Fast growing hardwoods give much greater growth than conifers in the first 20 years. However, suitable stock has to be available to plant. Some examples of carbon accumulation over time for conifer and hardwood species in a boreal environment are presented in Table 2.

Table 2. Examples of carbon accumulation in tree growth after planting on land that had not been forested for many years in a boreal environment. Soil carbon is not included, but roots are included. Values should be multiplied by 3.67 to get tonnes CO_2/ha.

	tonnes Carbon/ha above- and below-ground		
Year	Lodgepole pine	Aspen	Hybrid Poplar
5	0.1	0.4	15
10	0.4	1	45
15	1	2	70
30	15	20	95
50	65	65	----

Site preparation, planting and maintenance costs can be greater than $1000 per hectare for lodgepole pine, and triple this for hybrid poplar. These costs assume you do not have to buy the land and planting stock will be readily available. The first accounting period is 2008-2012; thus, planting needs to take place within the next few years and significant gains will only be achieved with fast growing hardwoods. Profitability depends on discount rates and the value of carbon, which is presently at $1 to $5/t, but may increase as we get nearer 2010. Costs will also be incurred through verification procedures, i.e., independent checks to ensuring the carbon is on the land. Accounting methods and verification procedures are being developed and companies are already offering certification services. Availability of land will depend on a variety of factors such as the financial viability under current use, competing uses (e.g., wildlife habitat), and tax structure.

After 50 years conifers provide significant sequestered carbon, but we have to assume that there will still be a market for carbon credits. In better growing environments, e.g. coastal BC, hybrid poplar production is double the values in Table 2, and Douglas-fir is over three times the value for lodgepole pine. There is greater opportunity for rapid growth in the U.S and further south, and thus greater return on investment. It seems

unlikely in Canada's climate that trees would be grown purely for carbon credits. This is an opportunity to receive income while waiting for trees to mature for harvest, or for the development of forest for recreational use or other non-timber resources. A risk is that large scale planting programs of fast growing species outside of Canada could significantly increase timber supplies 20 years down the road. Another risk to consider is what happens if the forest burns. If the owners have already sold future credits they would be responsible for replacing them. It has been suggested that owners of the forest sell about 50% of their carbon credits thus leaving some in reserve for unforeseen circumstances. How harvesting the future forest will be considered is not known. It assumed that the Kyoto forest becomes part of the existing forest. Currently, harvesting and regeneration are not included, so perhaps as long as the there is replanting and the land does not become deforested it disappears from the carbon accounting sheet.

The Future Kyoto Forest?

The International Panel on Climate Change (IPCC) has a committee of experts reviewing which components of the forest should be included and how to count all the carbon atoms. Canada is involved in this committee. The IPCC report should be available in a year or so to be considered by, and final rules adopted, at a Conference of the Parties to the Kyoto agreement. Some countries want to include regeneration of the existing forest after harvest. Other options include including forest that were established prior to 1990. These two options have the potential to produce large carbon gains for Canada. The Forest Sector and Sinks Tables, part of Canada's response to the Kyoto agreement, are assessing the potential gains and risks for Canada of these and other options.

Regeneration is something that must be done after harvest, so is this a risk free opportunity for carbon credits? Including the regeneration of forests harvested after 1990 means that we will probably have to account for emissions due to harvesting and the decay of forest products. The latter are already accounted for to some extent through inclusion emission from landfills in national carbon budgets. There will be a need to do life cycle accounting of forest products. However, long term storage of carbon in forest products provides a significant opportunity to offset emissions through growth of the new forest. The downside is that we will likely be required to account for decay of residues left on site after harvest. This was not the case in the examples presented above because it is assumed that those residues are long gone from the land. Thus, data in Table 2 need to be discounted for the decay. It may be 10 years or more before the rate of accumulation of carbon in tree growth is greater than loss through decay, and there is a net carbon sequestration on the site. It would be a further 10 years before the site has accumulated enough carbon to offset the net loss of carbon in the first 10 years. Regeneration is part of normal forest activities, thus the risk in doing such activities is minimal for a forest company and it may be worth the risk to incur extra costs that enhance future growth for more credits. In many situations, normal forestry activities are taking place on public land managed by forest companies under various forms of agreement. Who owns the carbon credits that may be produced on this land?

Forest fires are a risk that must be considered. If a forest that is being used for carbon credits burns, does that carbon have to be replaced before you can start accumulating any more credits? Another consideration in including regenerating forests for carbon credits is how to address biomass energy. Biomass energy is currently considered neutral because growth of the new forest sequesters carbon, thus offsetting emissions by burning. If we claim carbon credits for accumulation through regeneration, then it would be double counting to allow biomass fuels to be considered neutral.

Large amount of carbon dioxide are being absorbed by second growth stands. On a world wide basis this is about 25% of fossil fuel emissions. However, if these forest are allowed to be included at all, it likely only be through enhancing current growth, e.g. through fertilization and fire protection.

The one rule of a Kyoto forest that Canada wishes to avoid involves the inclusion of all forests in the carbon accounting for a country. This would mean that we could be debited for losses due to disease and fire in areas where we have no capability to manage.

Summary

The IPCC will report in a year or so on what aspects of forest growth could be included in the Kyoto forest and how to count the carbon atoms. It will be further year at least before the final rules are decided. Reforestation and afforestation, as currently defined by Kyoto, will be in these rules and are therefore low risk activities. However, growth rates for most areas of Canada mean that they will not provide a major windfall in carbon credits, but are an opportunity to bring in revenue whilst waiting for trees to mature for ‘normal’ forest use. The Clean Development Mechanism offers opportunities to Canadian companies to obtain carbon credits through sponsoring forest management activities in developing countries. Regeneration after harvest as a way to accumulate carbon credits may be included in future agreements. Regeneration is part of normal forest activities, thus the risk in doing such activities for generating carbon credits is minimal for a forest company.

The Kyoto agreement is not as perverse or illogical as it may seem. It an imperfect agreement that needs much of the details to be worked out. However, its main goal is to produce an enhanced accumulation of carbon through forest growth and thus ‘benefit the atmosphere’. Negotiations are on-going to make it more effective.