THE POTENTIAL CONTRIBUTION OF CANADA’S FOREST SECTOR TO CLIMATE CHANGE MITIGATION

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Motivation and Outline

Can changes in forest management or the use of harvested wood contribute to emission reductions relative to a baseline, and help meet GHG reduction targets?

- Background
- Tools and Scenarios
- Analysis of mitigation potential
- Key messages
- Next steps
Canadian boreal forests and climate change mitigation


Carbon in Canada’s boreal forest — A synthesis

Mitigation analyses

Determine the mitigation potential of Canada’s forest sector

Time-series from GHG reporting (1990 – 2011) extended by projecting activity data (harvest, fires, planting, etc.) to 2050

Coarse spatial scale (39 spatial units, ~3 million stands, representing 230 Mha)

Mitigation is defined as the reduction of emissions from incremental activities, relative to a base line
Phase 2
Ecozone & Province/Territory
Systems’ approach to emission reductions

Increased harvest reduces need for other products (and vice versa) with the associated changes in emissions.

After Nabuurs et al. 2007 IPCC, AR4 WG III, Forestry
Mitigation analyses: Analytical framework

1. Changes in forest ecosystem emission reduction and increased removal due to strategies
   - NFCMARS and CBM-CFS

2. Changes in harvested wood emission reduction related to harvested wood products and bioenergy due to strategies
   - CBMF-HWP
   - Displacement factors

3. Changes in interactions with other sectors emission change through product displacement and substitution
   - Economics: net cost of emission reduction and increased removal due to strategies

References:

1. Stinson et al. (2011) Global Change Biology 17, 2227-2244
National Forest Carbon Monitoring, Accounting and Reporting System

One national system, many uses:

- Reporting past C dynamics
  - National GHG Inventory
  - State of Canada’s Forests
- Projecting future C dynamics
  - Scientific research
  - Policy development
  - International negotiations
- Develop climate mitigation and adaptation strategies
- Add projections to 2050 of mitigation activities and wildfire

http://www.ec.gc.ca/ges-ghg/
National-scale integration of forest C cycle data

- Forest inventory and growth & yield data
- Natural disturbance monitoring data
- Forest management activity data
- Land-use change data
- Ecological modelling parameters

CBM-CFS3
Canada’s managed forest emissions

Annual harvest 45 Mt C (165 Mt CO$_2$)
Assuming instantaneous oxidation of wood moved out of forest

Source: Updated after Stinson et al. 2011, NRCan 2012
Mitigation analyses: Analytical framework

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   - CBMF-HWP

3. Changes in interactions with other sectors emission change through product displacement and substitution
   - Displacement factors

4. Economics net cost of emission reduction and increased removal due to strategies
   - MEA-FCM

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i Stinson et al. (2011) *Global Change Biology* 17, 2227-2244

ii Kurz et al. (2009) *Ecological Modelling* 220, 480-504
Harvested Wood Products

Production approach

Commodities based on national statistics reported in FAO:
- Sawnwood (35 years)
- Other solid wood (35 years)
- Panels (25 years)
- Pulp and paper (2 years)
- Bioenergy (instant oxidation)

End-of-life (bioenergy, landfill)

Landfill (CO$_2$/CH$_4$ emissions)
Mitigation analyses: Analytical framework

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(4) Economics net cost of emission reduction and increased removal due to strategies

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Kurz et al. (2009) *Ecological Modelling* 220, 480-504

NFCMARS\textsuperscript{i} and CBM-CFS\textsuperscript{3}\textsuperscript{ii}
Substitution Benefits from Wood Use

- Displacement factor (DF) quantifies the amount of emission reduction achieved per unit of wood used in products (i.e. substitution)
- On average, we avoid 2 tons of C emissions for every 1 ton of C used in wood products.
- Substitution benefits of wood use for bioenergy typically < 1.
- Calculated DF for product categories used in this study

Source: Sathre, R. and J. O’Connor 2008 and 2010
Phase 2 Mitigation Analysis

Biogeosciences, 11, 3515–3529, 2014
www.biogeosciences.net/11/3515/2014/
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Quantifying the biophysical climate change mitigation potential of Canada’s forest sector

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Mitigation Analysis

Seven FM Strategies

1. Better Growth
2. Planting
3. Better Utilization
4. Clear cut harvest
5. Commercial thinning
6. Pre-commercial thinning
7. Harvest Less

Two HWP Strategies

1. Longer-lived products
2. Bioenergy Harvest
Key findings:
Some strategies result in more positive mitigation (or lessen the negative mitigation) when displacement is included.
**Key findings:** Combining FM and HWP strategies can result in higher mitigation potential.
**Key findings:**
The best mitigation strategy varies by region: a portfolio derived by choosing the strategy in each region that maximizes mitigation will be best nationally.
Key messages

- Design of climate change mitigation portfolios in the forest sector should be based on systems approach that accounts for changes in forest ecosystem C, C in HWP, and substitution benefits, relative to a base case.

- Some proposed mitigation activities are more beneficial than others, and no one strategy is best everywhere - the best strategy varies by region.

- Forest managers do not control use of wood – effective mitigation portfolios need to integrate forest management with wood use strategies.

- Substantial mitigation potential by 2050 if implementation of strategies starts soon.
Next Steps

- Conduct analyses with higher spatial differentiation (600 management units for 230 Mha)
- Identify most favourable forest management regions for forest-based bioenergy from harvest residues
- Explore the interaction of mitigation strategies with climate change impacts
- Quantify financial costs of mitigation options
- Explore institutional and financial arrangements to support forest sector mitigation
Thank-you!

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Displacement

Forest ecosystem C dynamics, Forest mgmt. activity emissions and LUC assumptions

Resource Extraction Emissions

Transportation Emissions

Manufacturing Emissions (Scope 1 and 2)

Final Assembly Emissions

Operational Emissions

End-of-life material handling Assumptions

Carbon Stored within the wood product(s)