

CFS Activities Relevant to ABoVE

(Maximum 2 page)

1. Project Title
National Forest Carbon Monitoring Accounting and Reporting System (NFCMARS): Science, Synthesis and Reporting
2. Investigators (include email). a) Project Lead; b) CFS collaborators, c) external collaborators (individuals/institutions)
Carbon Accounting Team: Senior Scientist: Werner Kurz Scientists: Celine Boisvenue, Juha Metsaranta, Cindy Shaw, Carolyn Smith CFS collaborators: numerous External collaborators: numerous
3. Project Description (200 words maximum)
NFCMARS includes the infrastructure, databases, and tools to provide annual information for estimating, report and document GHG emissions and removals in Canada's forests and harvested wood products (HWP). IPCC Guidelines require that countries identify, quantify and reduce uncertainties as far as is practicable: activities include updating forest inventory information, improved representation of natural disturbances and climate impacts on ecological processes, and a HWP model. The core model of NFCMARS is the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3). Several scientific activities are currently ongoing, aimed at creating improved modelling systems and tools, including: (1) Improved representation of climate impacts on tree growth, mortality and GHG balance. (2) Strategies to Assimilate Remote Sensing Estimates of Forest Productivity into CBM-CFS3 (3) Improved representation of dead organic matter and soil carbon dynamics in CBM-CFS3. (4) Spatially-Explicit Simulation of Canada's Forest Carbon Budget (5) Integrating ground observations into remote sensing based estimates of forest characteristics.
4. Timelines and current funding (level and source)
The improvement and maintenance of NFCMARS and its core model CBM-CFS3, as well as the use of the system for conducting science and policy analysis, is an

ongoing CFS activity

5. Reference (1-2 key publication, website)

<http://www.nrcan.gc.ca/forests/climate-change/carbon-accounting/13087>

- i. Smyth CE, Stinson G, Neilson E, Lemprière TC, Hafer M, Rampley GJ, Kurz WA (2014) Quantifying the biophysical climate change mitigation potential of Canada's forest sector. *Biogeosciences* 11:3515-3529
- ii. Kurz, W.A., C. Shaw, C. Boisvenue, G. Stinson, J. Metsaranta, D. Leckie, A. Dyk, C. Smyth and E.T. Neilson. 2013. Carbon in Canada's Boreal Forest – a synthesis. *Environmental Reviews* 21: 260-292
- iii. Shaw, C.H., A.B. Hilger, J.M. Metsaranta, W.A.Kurz, G.Russo, F. Eichel, G. Stinson, C. Smyth, M. Filiatrault. 2014. Evaluation of simulated estimates of forest ecosystem carbon stocks using ground plot data from Canada's National Forest Inventory. *Ecological Modelling* 272: 323-347.
- iv. G. Stinson, W.A. Kurz, C.E. Smyth, E.T. Neilson, C.C. Dymond, J.M. Metsaranta, C. Boisvenue, G.J. Rampley, Q. Li, T.M. White, D. Blain. 2011. An inventory-based analysis of Canada's managed forest carbon dynamics, 1990 to 2008. *Global Change Biology* 17:2227-2244.

6. ABoVE question being mainly addressed (please highlight)

1. How are environmental changes affecting critical ecosystem services - natural and cultural resources, human health, infrastructure, and climate regulation - and how are human societies responding?

Canada's NFCMARS is used to answer critical questions about forest management options for mitigating climate change.

2. What processes are contributing to changes in disturbance regimes and what are the impacts of these changes?

NFCMARS is currently used as an integrating mechanism for assessing some of the impacts of changes in disturbance regimes on C/GHG balance, as well as other potential ecosystem services derived from forests (e.g. habitat, forest products (biomass, lumber, pulp, etc.))

3. What processes are controlling changes in the distribution and properties of permafrost and what are the impacts of these changes?

Canada's NFCMARS does not currently cover the unmanaged forest area in Canada's north, and thus cannot give comprehensive estimates of the C/GHG balance of the whole of Canada's forests. This is a key uncertainty that is being addressed in currently activities aimed at developing next generation models and tools

4. What are the causes and consequences of changes in the hydrologic system, specifically the amount, temporal distribution, and discharge of surface and subsurface water?

Estimates of soil C dynamics for peatlands and organic soils in Canada's NFCMARS are highly uncertain. Improved representation of hydrological conditions would be critical

5. How are flora and fauna responding to changes in biotic and abiotic conditions, and what are the impacts on ecosystem structure and function?

Canada's NFCMARS is currently being improved to better account for faunal responses (e.g. changes in forest productivity and mortality rates, changes in the distribution of forest and non-forest ecosystems, changes in tree species distribution, etc.). The system can also be used to analyze tradeoffs with respect to managing forests for carbon relative to other values like wildlife habitat.

6. How are the magnitudes, fates, and land atmosphere exchanges of carbon pools responding to environmental change, and what are the biogeochemical mechanisms driving these changes?

Canada's NFCMARS provides estimates of all of these.

7. Linkages with ABoVE:

- a. Data being collected/generated
- b. Expected key benefits and potential challenges from collaborating

with ABoVE

c. Ongoing and / or interest in future involvement in ABoVE

- a. Generates spatially referenced estimates of C/GHG dynamics for Canada's managed forest, including climate mitigation potential of various forest management options.**
- b. Key benefit is improved representation of unmanaged forest area, which contains significant amounts of peatland and permafrost affected soils for which estimates are presently highly uncertain**
- c. Continued interest in being involved, particularly in the areas mentioned in point (b), in addition to the use of ground data to evaluate various remote sensing based data products which could be used as replacements for the forest inventory data currently used, if it could be demonstrate that they could be well enough validated to meet requirements for international reporting and policy analysis.**