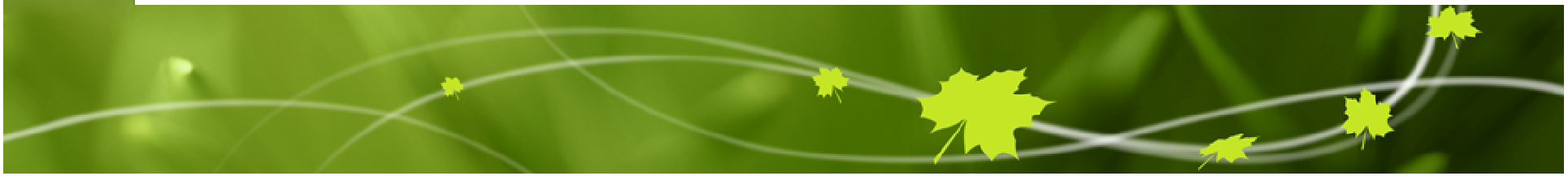
Environment Canada Environnement Canada

Canada

Boreal Ecosystem Research and Monitoring Sites (BERMS)

Anne Walker
Climate Research Division, Environment Canada

First Workshop on Canadian SMAP Applications and Cal-Val
October 6-7, 2009



The Boreal Ecosystem-Atmosphere Study (BOREAS)

What BOREAS Was

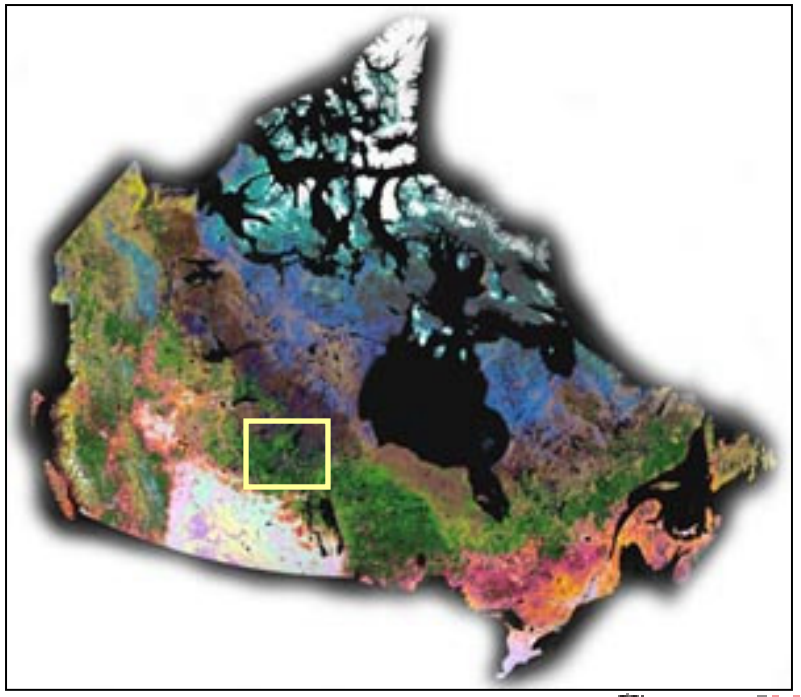
USA-Canada collaborative study of the role of boreal forest in global carbon budget and climate system, 1994 and 1996

What BOREAS Found

- **Modest carbon sink**
- **Sensitive to climate**

What BOREAS Missed

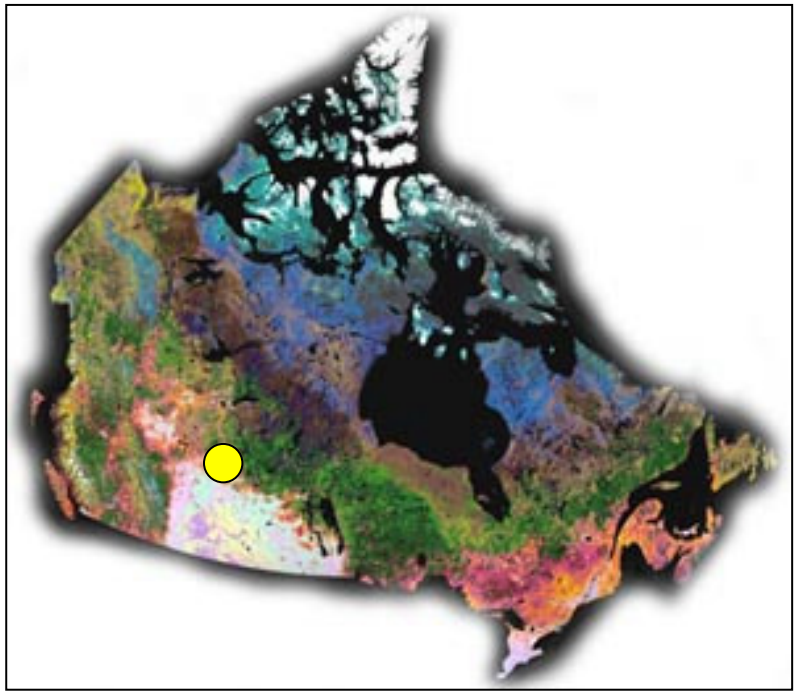
- **Complete annual cycles**
- **Inter-annual variability**
- **Role of disturbance**



The Boreal Ecosystem Research and Monitoring Sites (BERMS)

A collaborative venture of Environment, Natural Resources and Parks Canada and university partners, 1997 to present

- BOREAS southern study area
- complete annual cycles
- inter-annual variability, climatic controls
- role of disturbance
- became Fluxnet-Canada/ Canadian Carbon Program flagship flux station

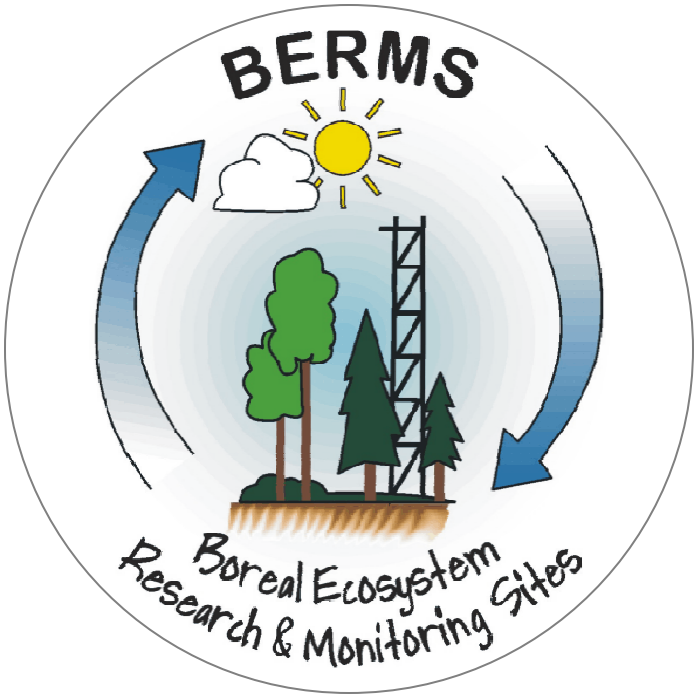


Environment Canada Environnement Canada

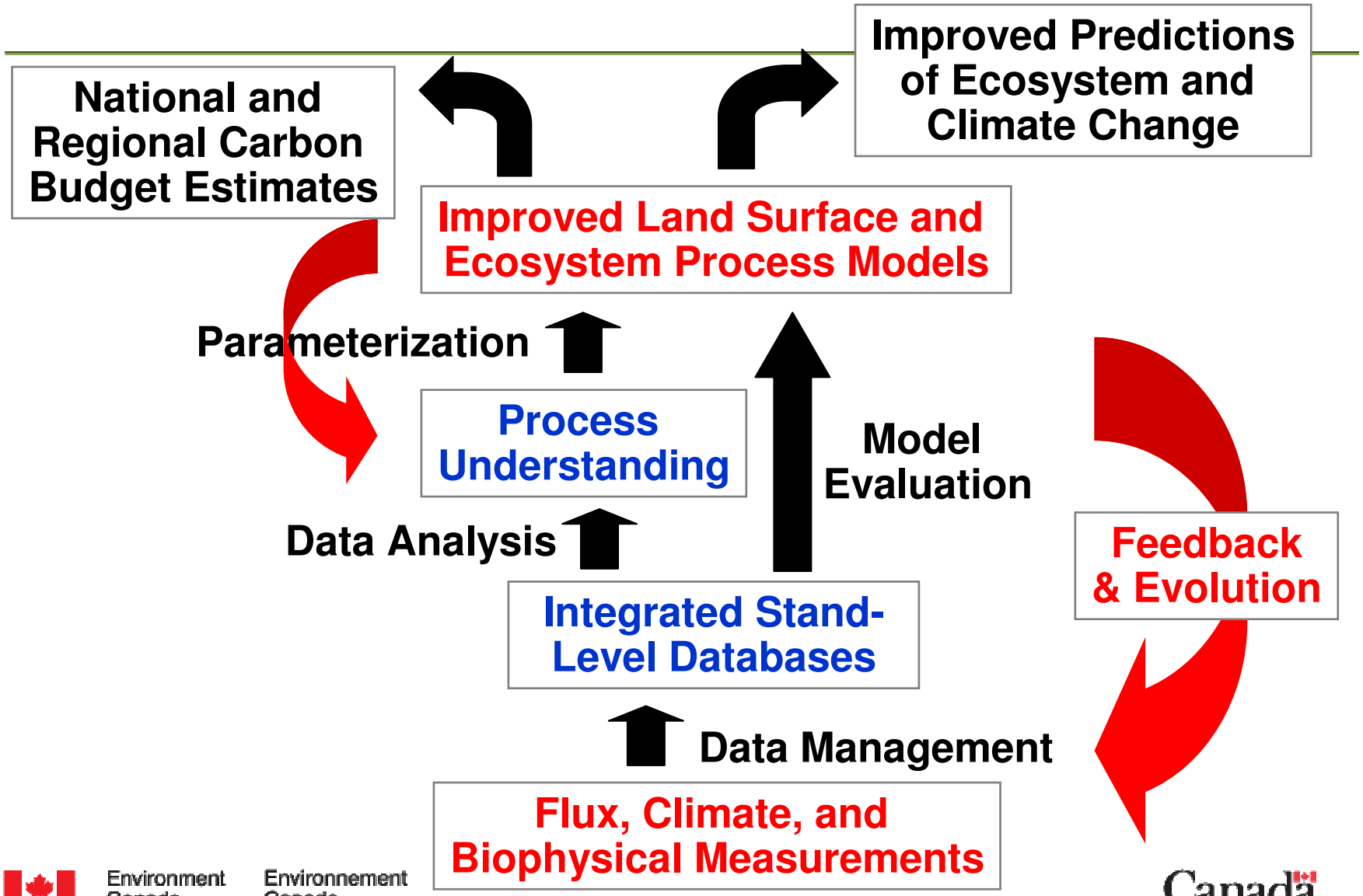
Canada

Objective

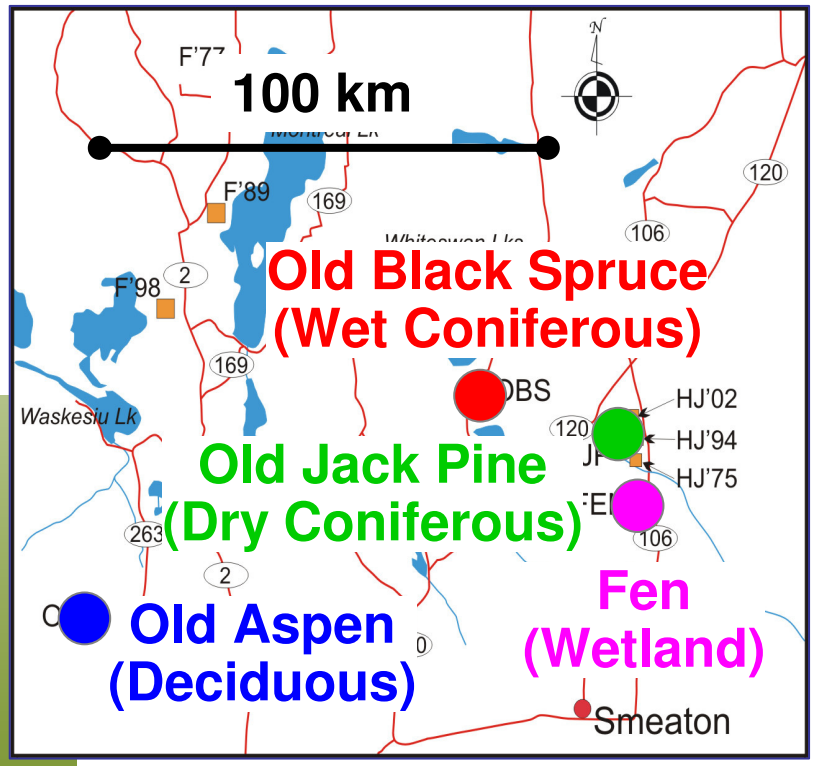
Understanding the influences of climate variability and disturbance on the carbon, water and energy cycles of the southern boreal forest



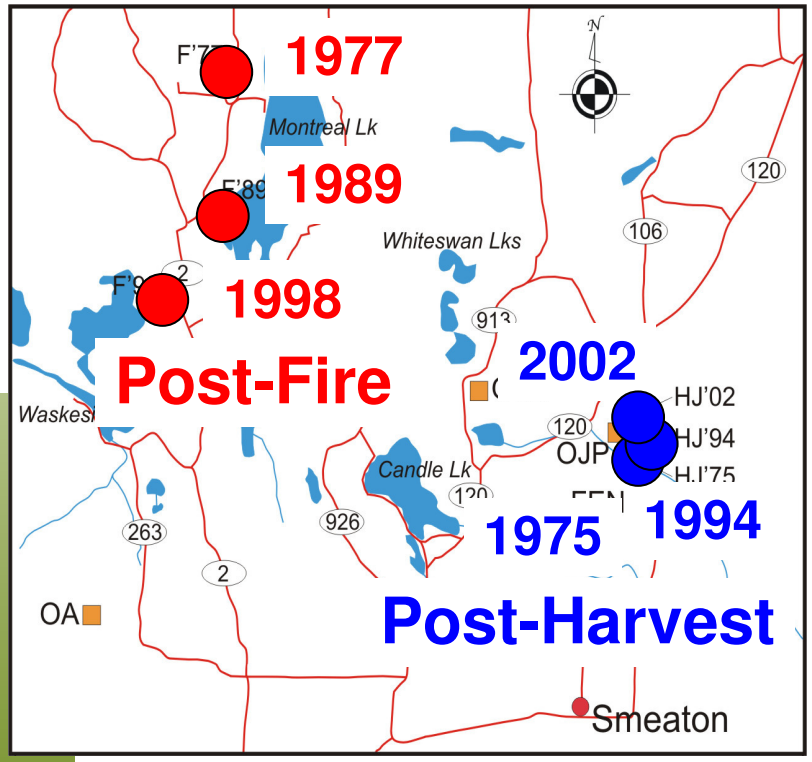
Why Flux Tower Networks?



BERMS Mature Sites



BERMS Disturbed Sites



Environment Canada Environnement Canada

Canada

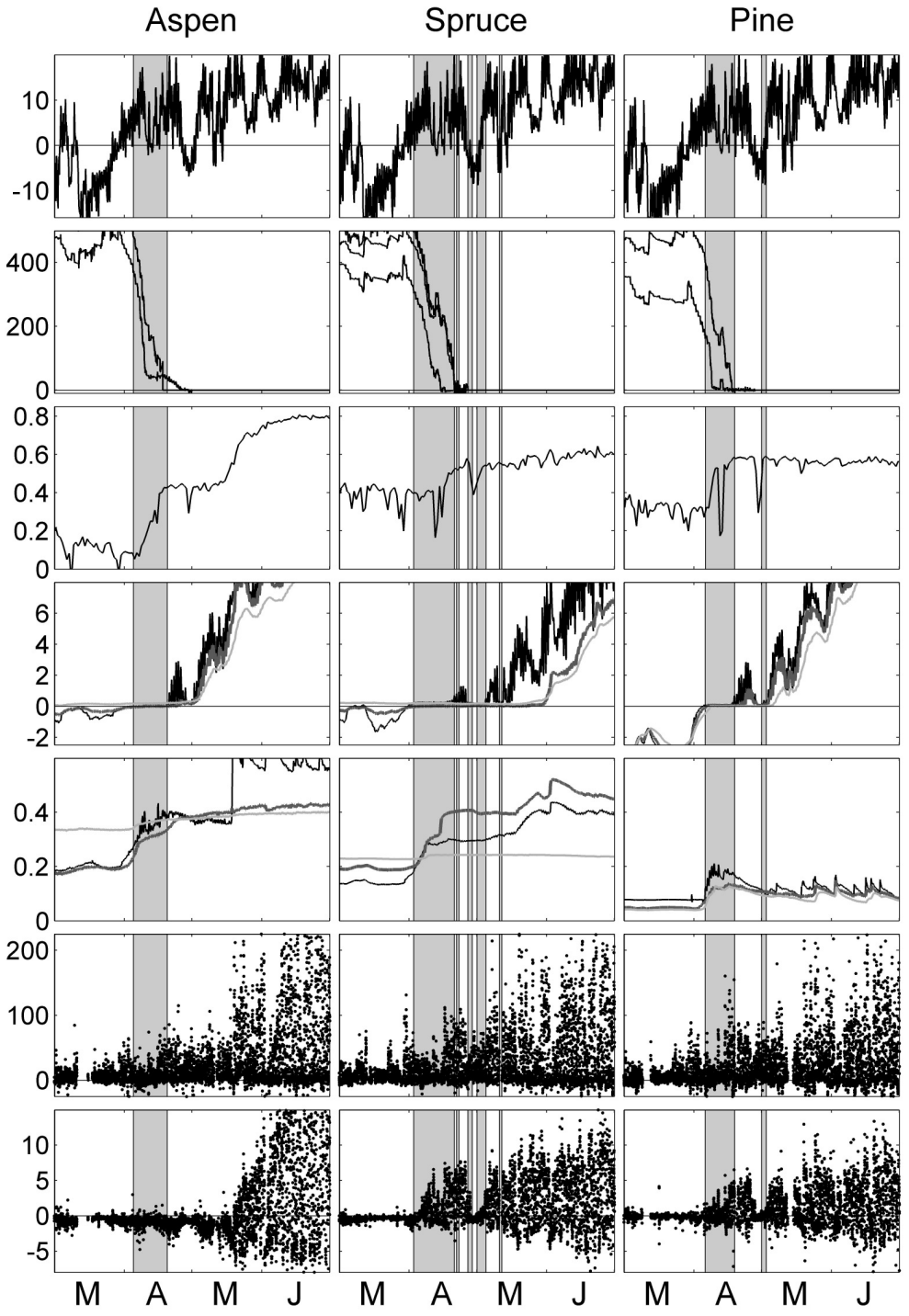
Flux and Climate Measurements at the BERMS Flux Towers

Fluxes:

- Radiation balance (net, up and down: shortwave, longwave, and photosynthetically-active)
- Sensible and latent heat fluxes, CO_2 flux, momentum flux
- Soil heat flux, soil CO_2 efflux

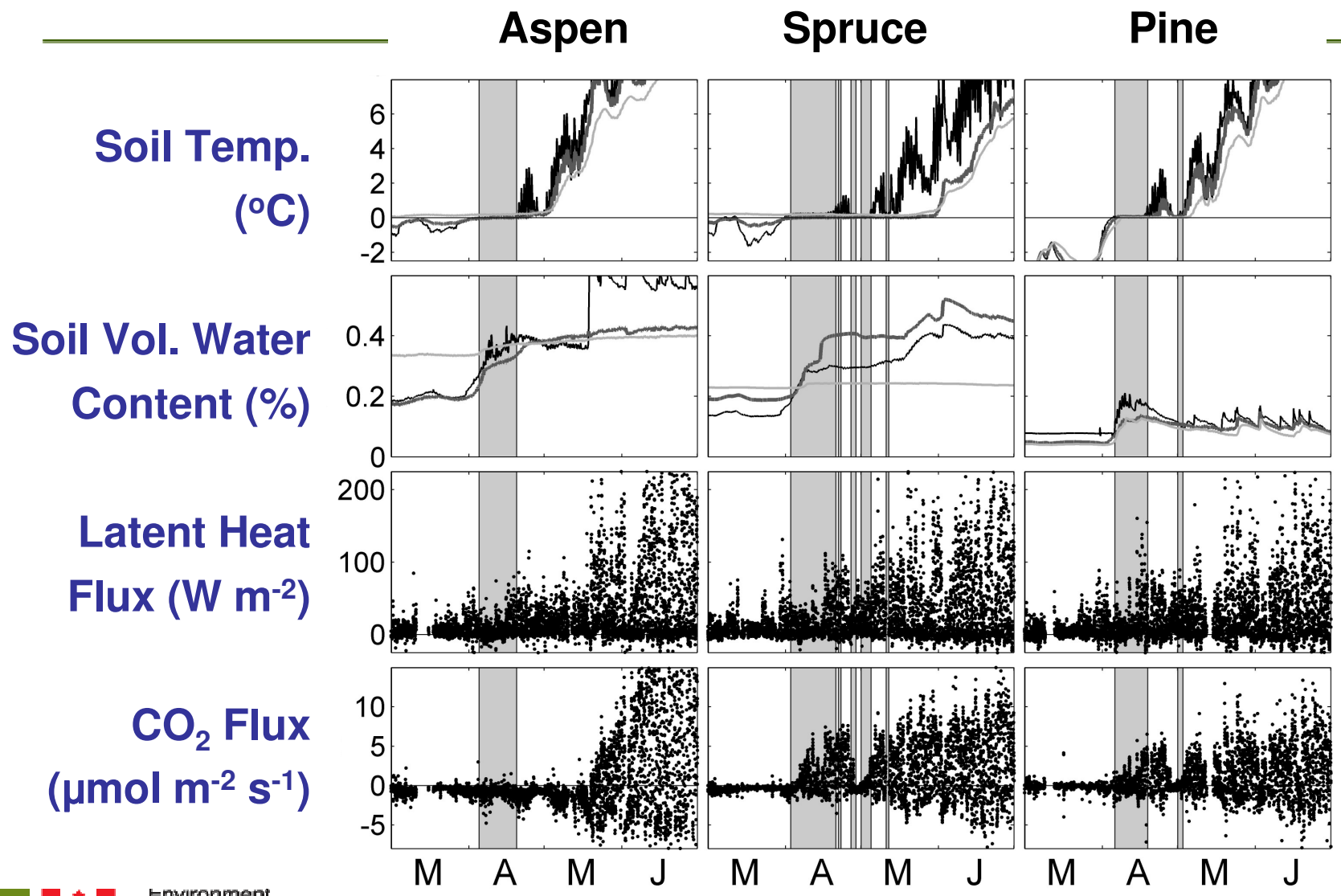
Climate:

- Air temperature, humidity & CO_2 profiles, wind speed, atmospheric pressure,
- Precipitation, snow depth
- Soil temperature profile, soil moisture profile, water table depth



Environment Canada Environnement Canada

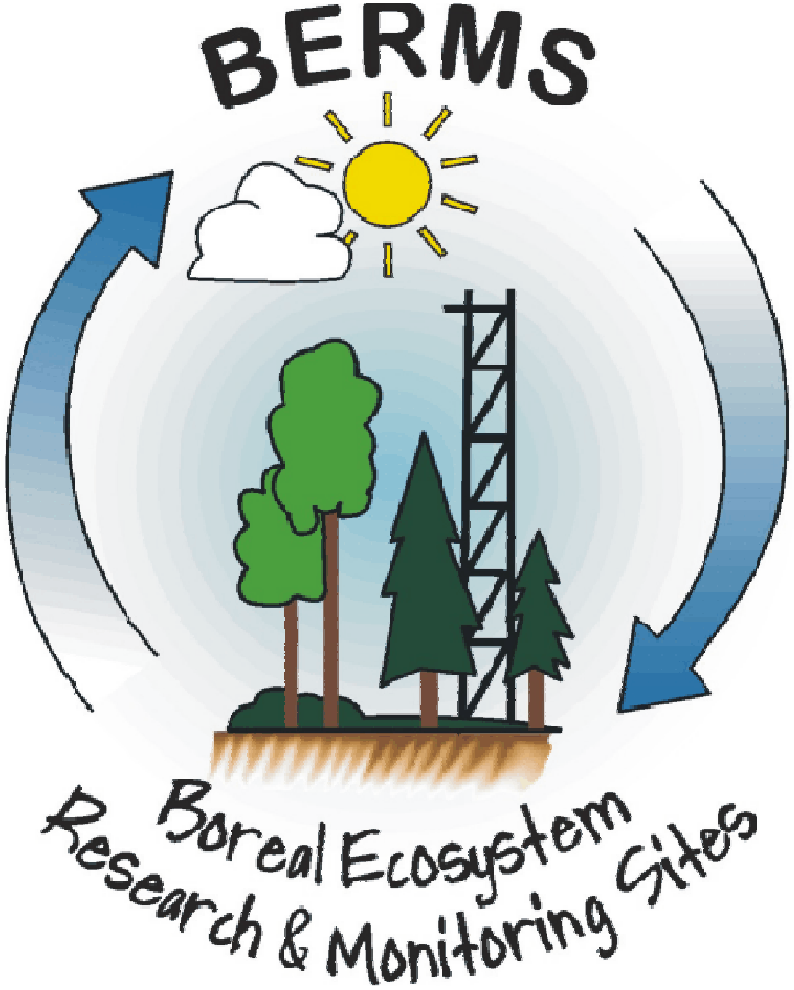
Canada



Environment Canada

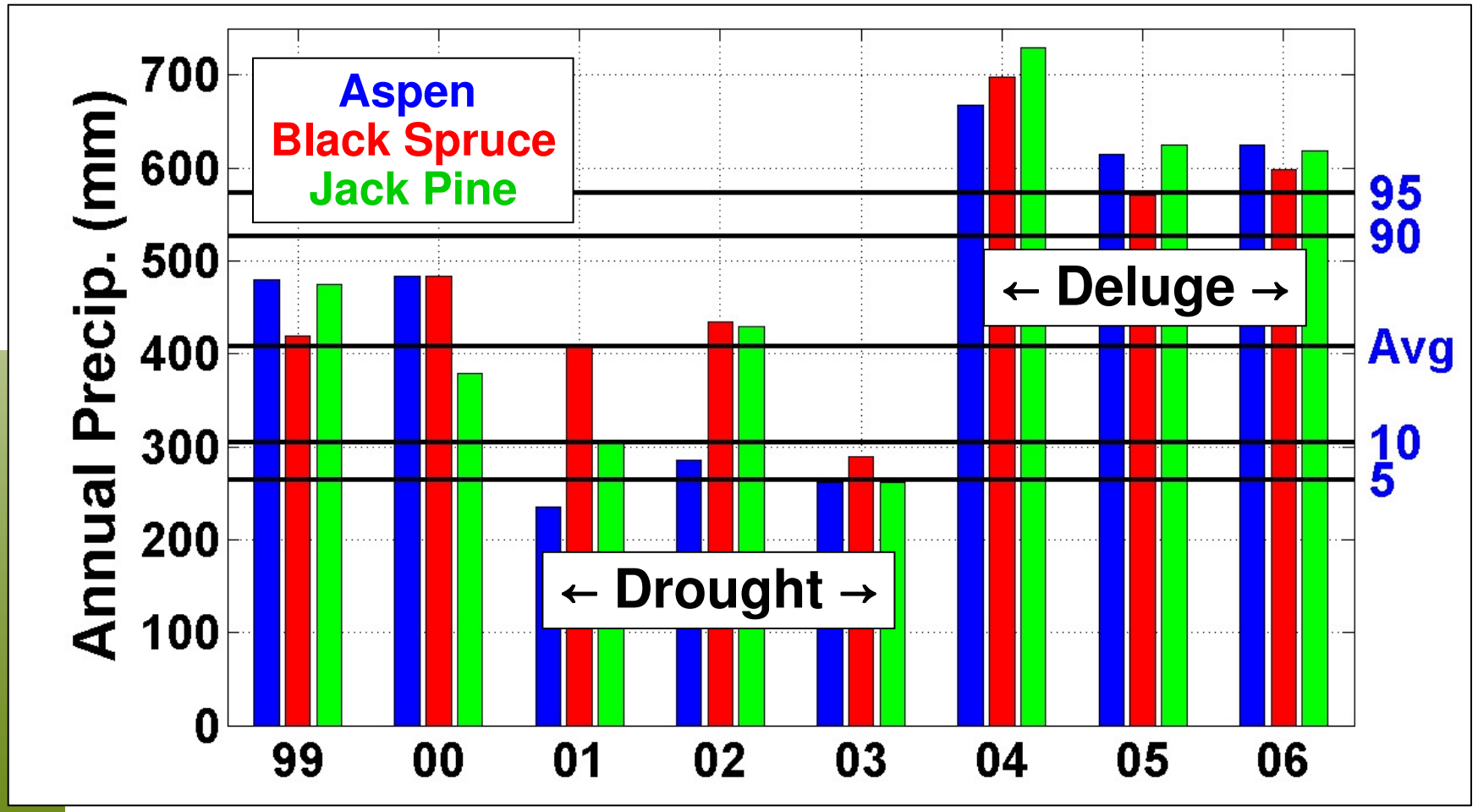
Canada

Highlights



Annual Precipitation 1999 to 2006

(The horizontal lines show percentiles from Prince Albert, 1900-2000)



Monthly Carbon Fluxes vs. Monthly Mean Air Temperature, Old Black Spruce 2000-2006

(Dashed lines are plotted when linear-regression $p \leq 5\%$)

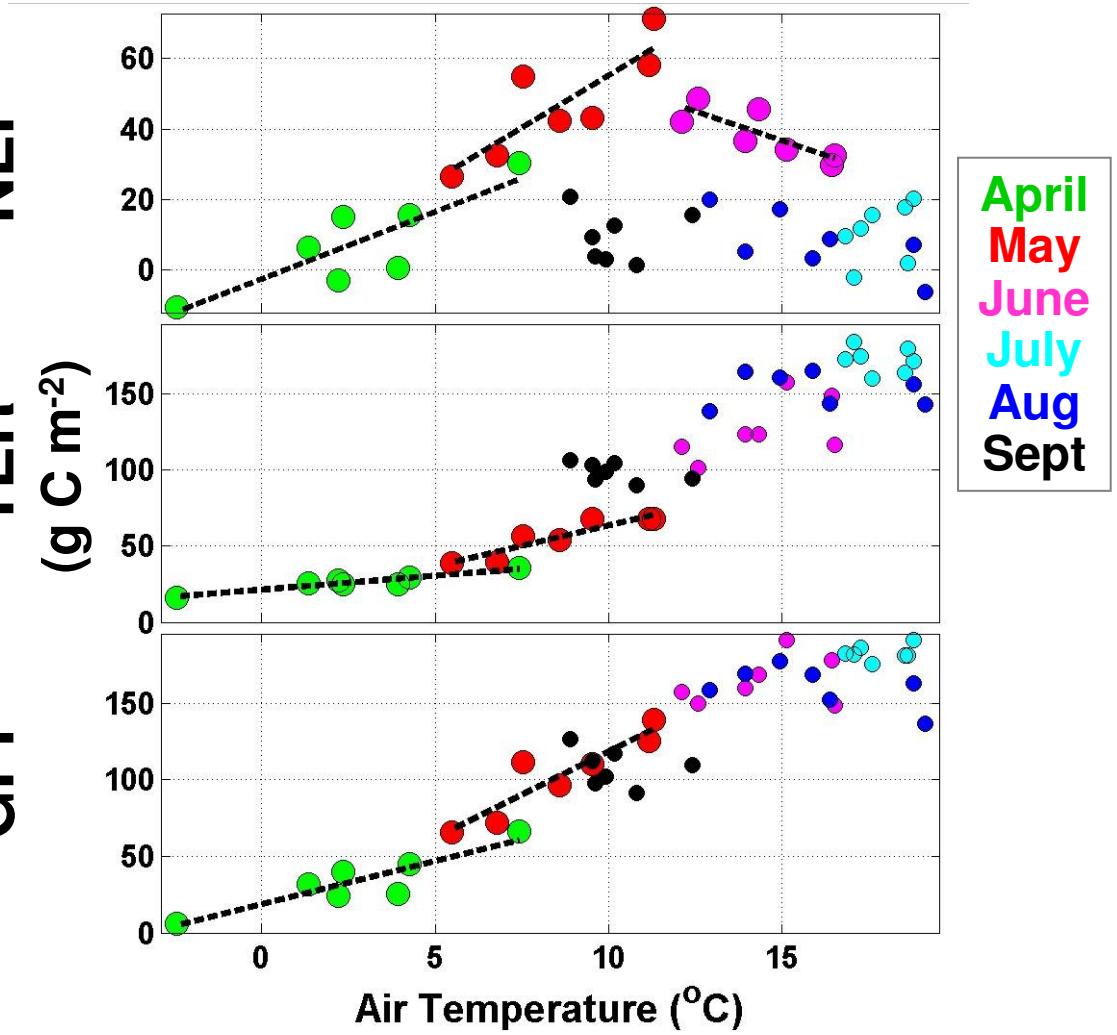
NEP Net Ecosystem Production

=

- TER Total Ecosystem Respiration

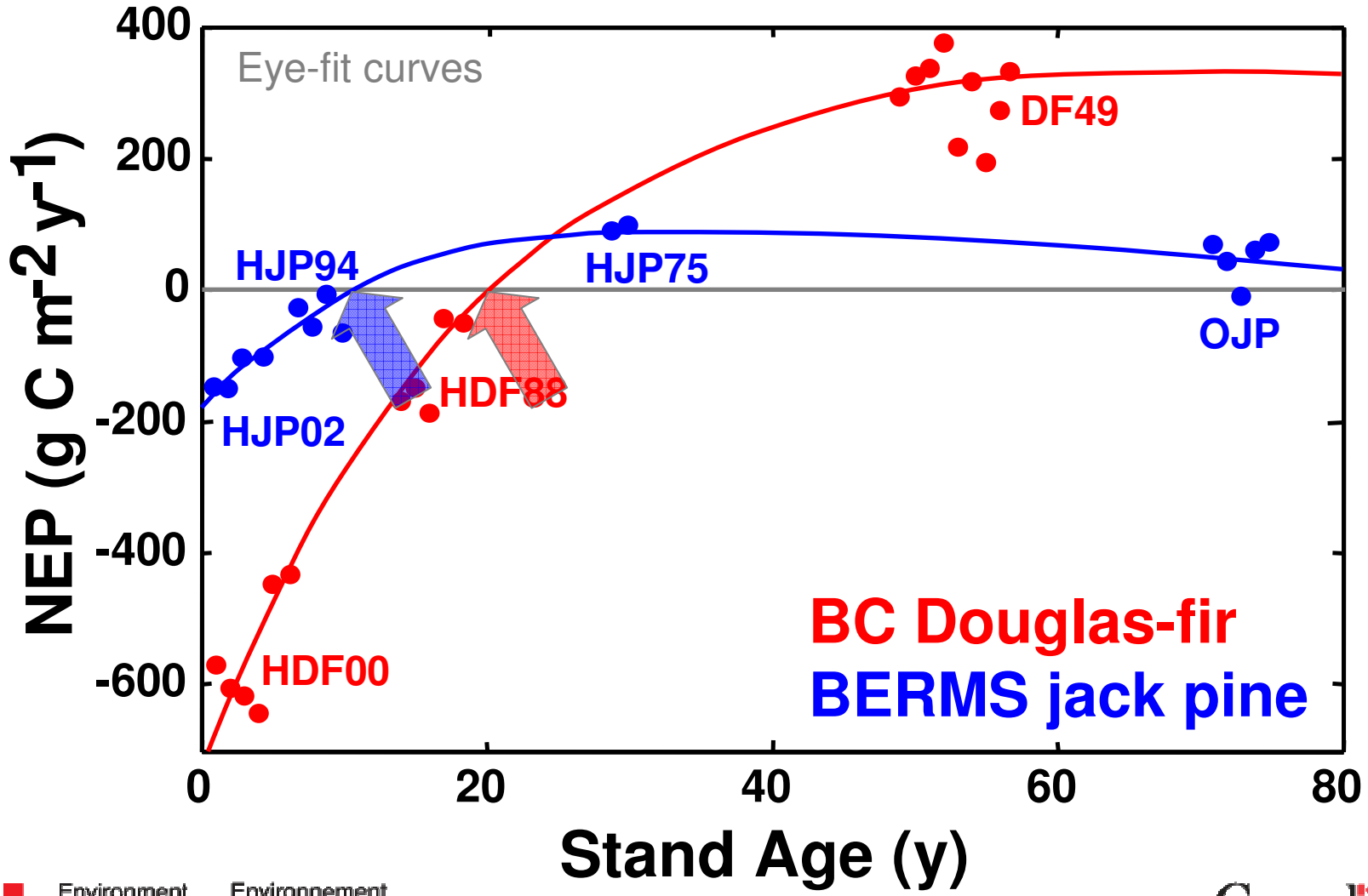
+

GPP Gross Primary Production (Photosynthesis)



Recovery of C Uptake Following Harvest

BC and BERMS Chronosequences

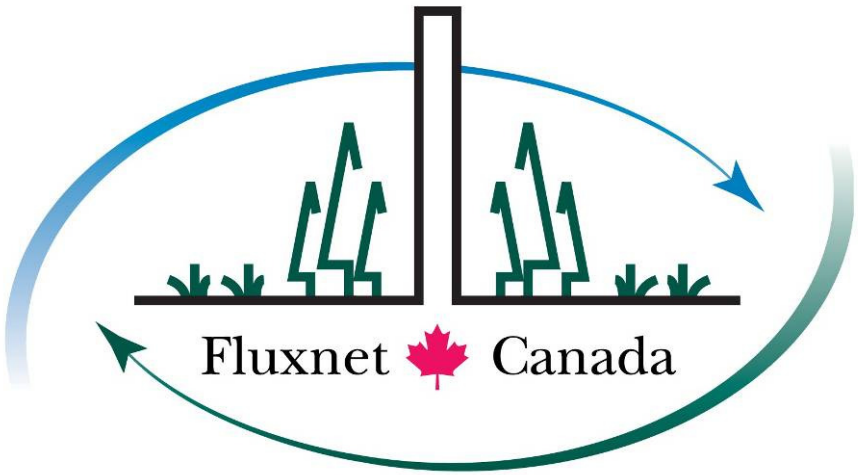


Environment Canada Environnement Canada

Canada

The Fluxnet-Canada Research Network 2002-2007

Understanding the influence of climate variability and disturbance on C cycling in Canadian forests and peatlands



Environment Canada Environnement Canada

Canada

The Canadian Carbon Program 2007-2010

Developing a scientific framework for reducing uncertainty in Canada's C budget

Linked to North American Carbon Program (NACP) strategy of top-down, bottom-up mutual constraint

Borden Forest Research Station (Southern Ontario)

- Carbon cycle research to improve carbon budget estimates for Canada through better understanding of ecosystem – atmosphere interactions, using ecosystem process studies and model development (including CLASS)
- Submission of quality-controlled, long-term data sets to national (Fluxnet-Canada) and international (FLUXNET) carbon flux data bases
- 2008: NH_3 flux work
- 2009: NSERC-funded stable isotope study with collaborators from Yale and Guelph Universities

http://www.msc-smc.ec.gc.ca/arqp/borden_e.cfm

Contact: Dr. Ralf Staebler

Environment Canada Environnement Canada