

Estimating Canadian Wildfire Carbon Emissions: Fuels and Burning Conditions



Bill de Groot
Canadian Forest Service



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GOFC-GOLD Fire IT meeting,
Canadian Space Agency,
Montreal, Feb. 7-9, 2005

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Montreal Lake Fire Burn 104 NBR Image

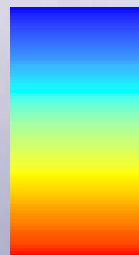
Landsat TM 37-22

Imaged: August 26/03

Orthorectification: CCRS

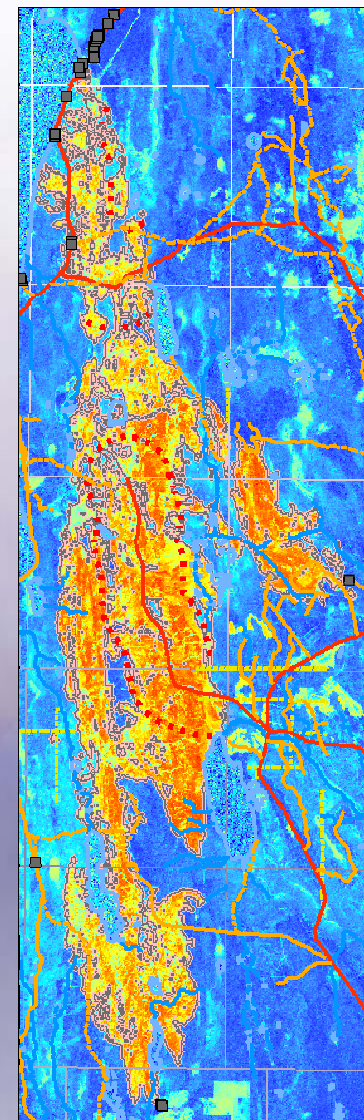
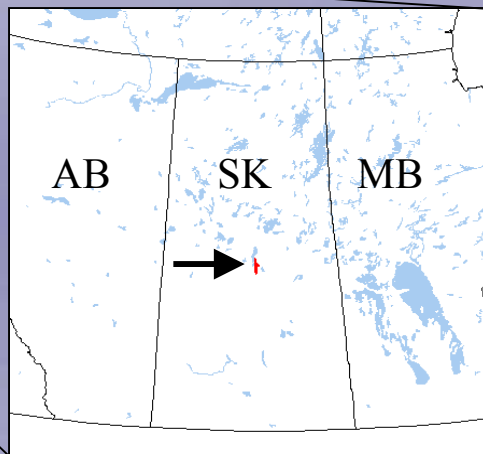
NBR range: 1.34

NBR



no burn : 0.780

high burn : -0.559



0 2.5 5 10 15
Kilometers



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Interpreting “Fire Severity”



Fire ‘severity’ is not the same as carbon emissions. It is possible to have high forest floor consumption (and carbon emissions) with little canopy damage (lower right).



Interpreting “Fire Severity”



This fire provides an example of high fuel consumption and low canopy damage.



Fire Intensity



Fire Intensity: 48 000 kW/m
Overstory Emissions rate: 11 t/ha C

This fire had more C emissions because of a high component of understory trees. Fuel load can be modeled from forest inventory data.



Fire Intensity: 53 000 kW/m
Overstory Emissions rate: 5 t/ha C



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Jack Pine: Crown Fire Carbon Emission Range



Forest Overstory

Carbon storage: 34-90 t/ha
Emissions rate: 3-11 t/ha
(10-25%)

***Total C Emission:
4-27 t/ha***



Forest Floor

Carbon storage: 2-28 t/ha
Emissions rate: 1-14 t/ha
(28-74%)



Effect of Different Fuel Types

Fire Weather Index = 17
for both fires



Jack pine

Fire Intensity: 950 kW/m

Carbon Emissions: 7 t/ha



Black Spruce

Fire Intensity: 13 400 kW/m

Carbon Emissions: 12 t/ha



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Carbon Emission Modeling Requirements

Fuels data

- **fuel type, fuel load**

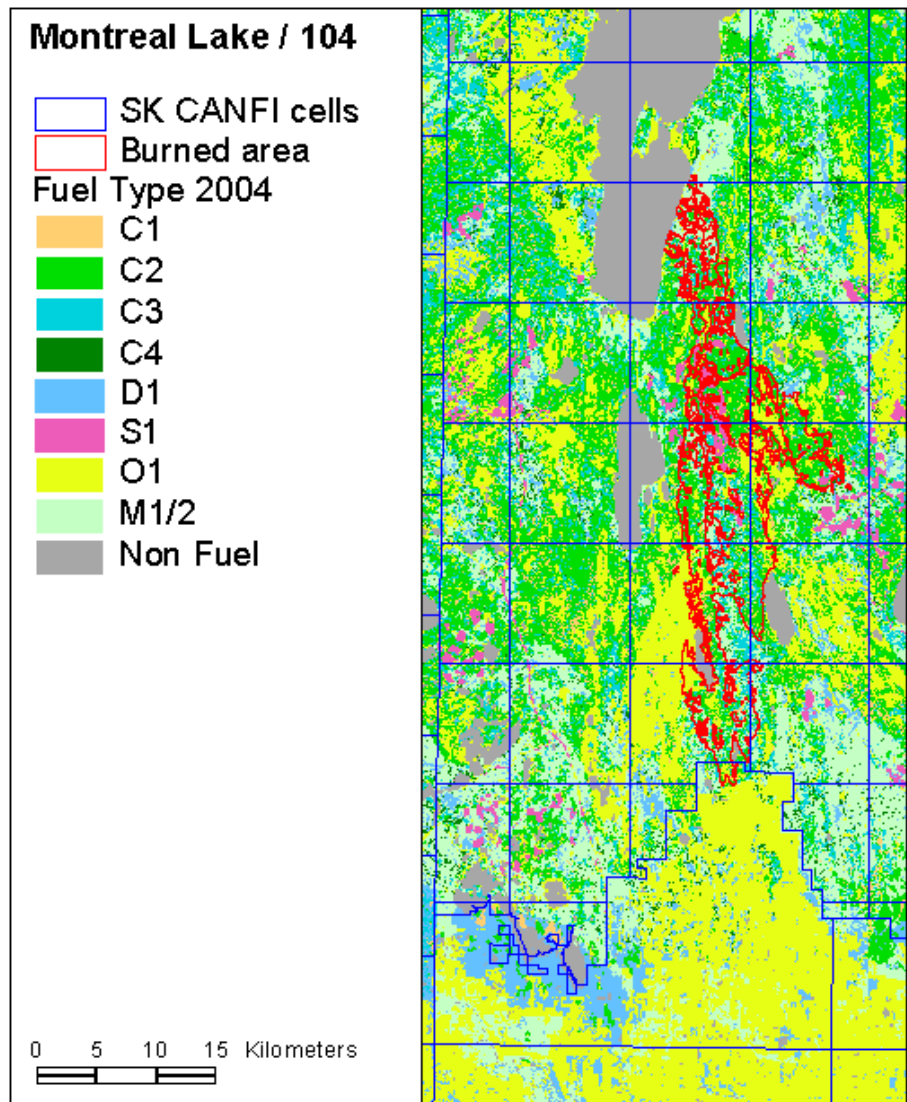
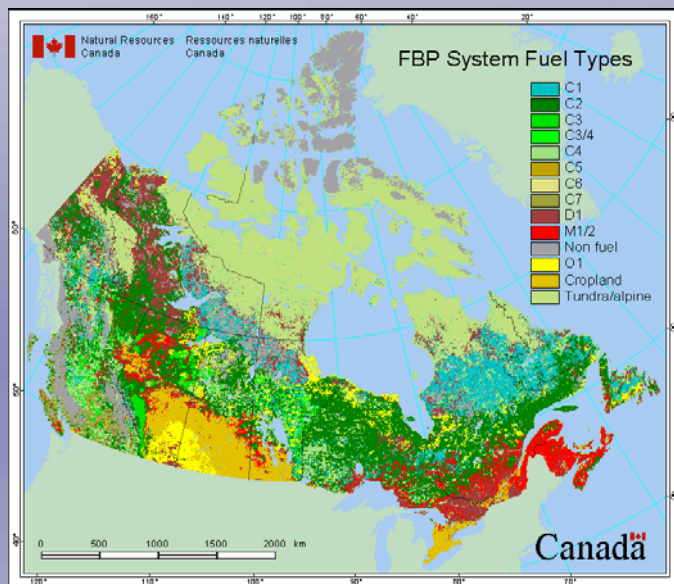
Burning conditions

- **FWI System data**



Fuel Type Data

- Provincial/Territorial forest inventory
- National Fuels Map (SPOT-VGT)



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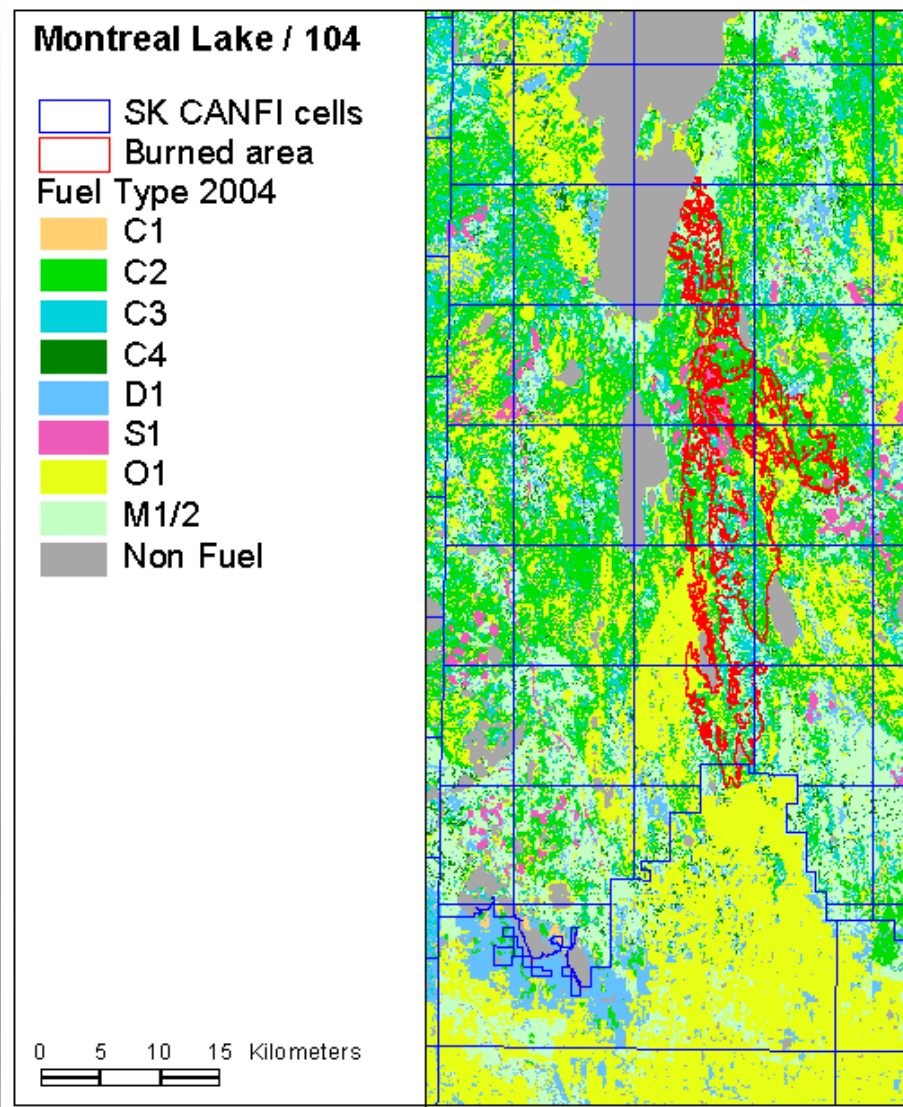


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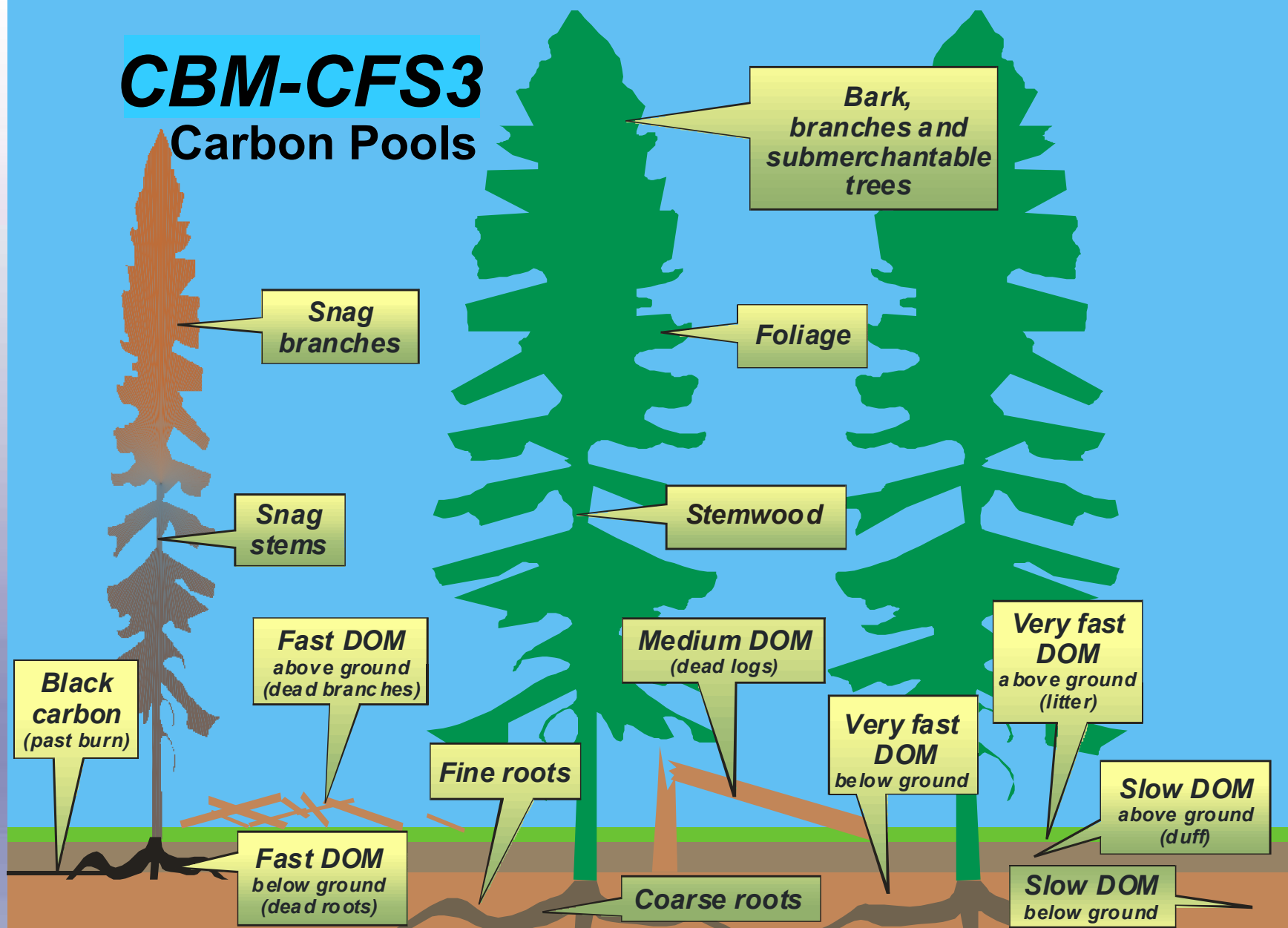
Fuel Load Data

- Provincial/Territorial forest inventory
- National Fuels Map (SPOT-VGT)
- Canadian Forest Inventory (CANFI)
- Carbon Budget Model for the Canadian Forest Sector (CBM-CFS3)

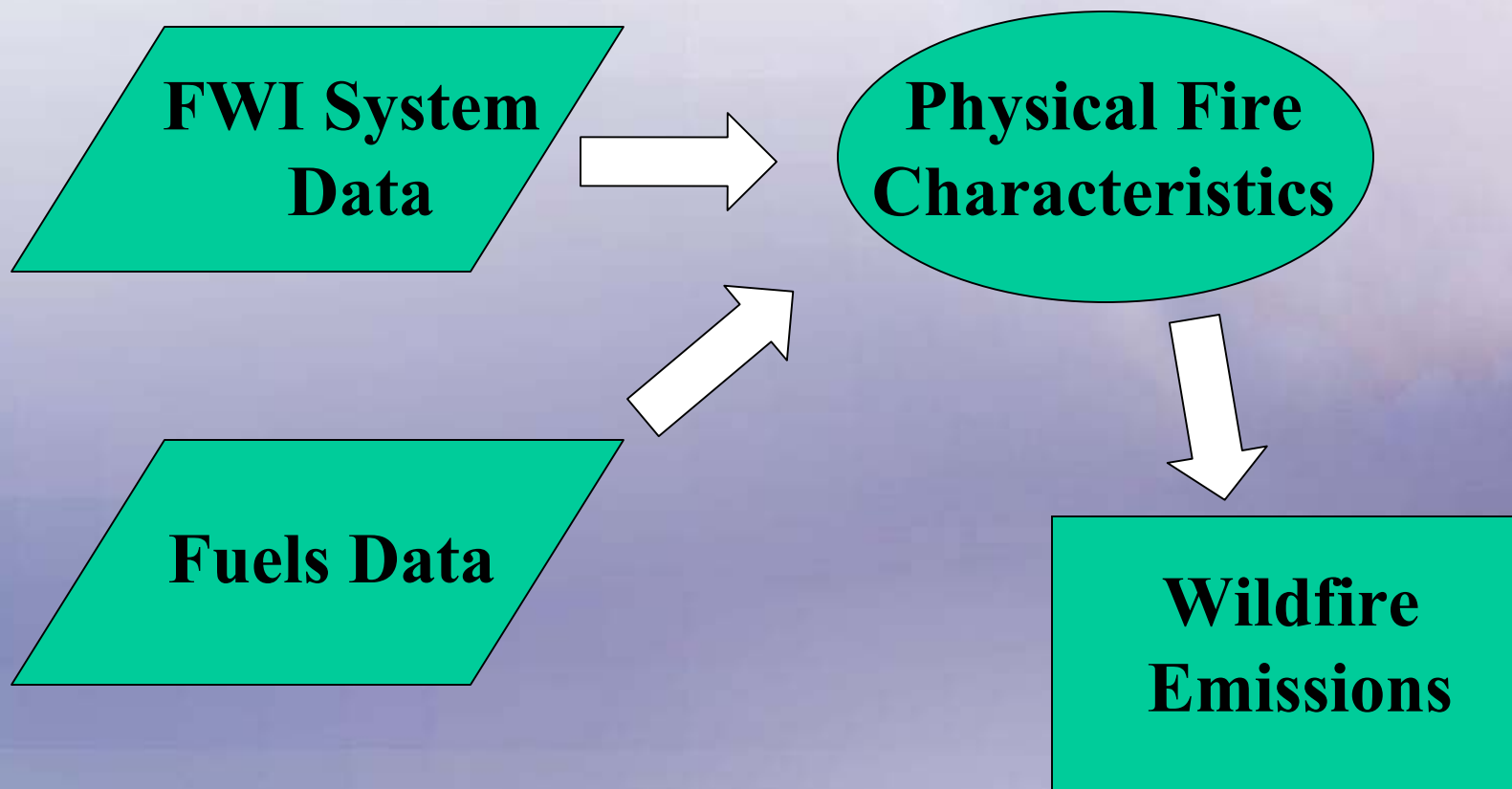


CBM-CFS3

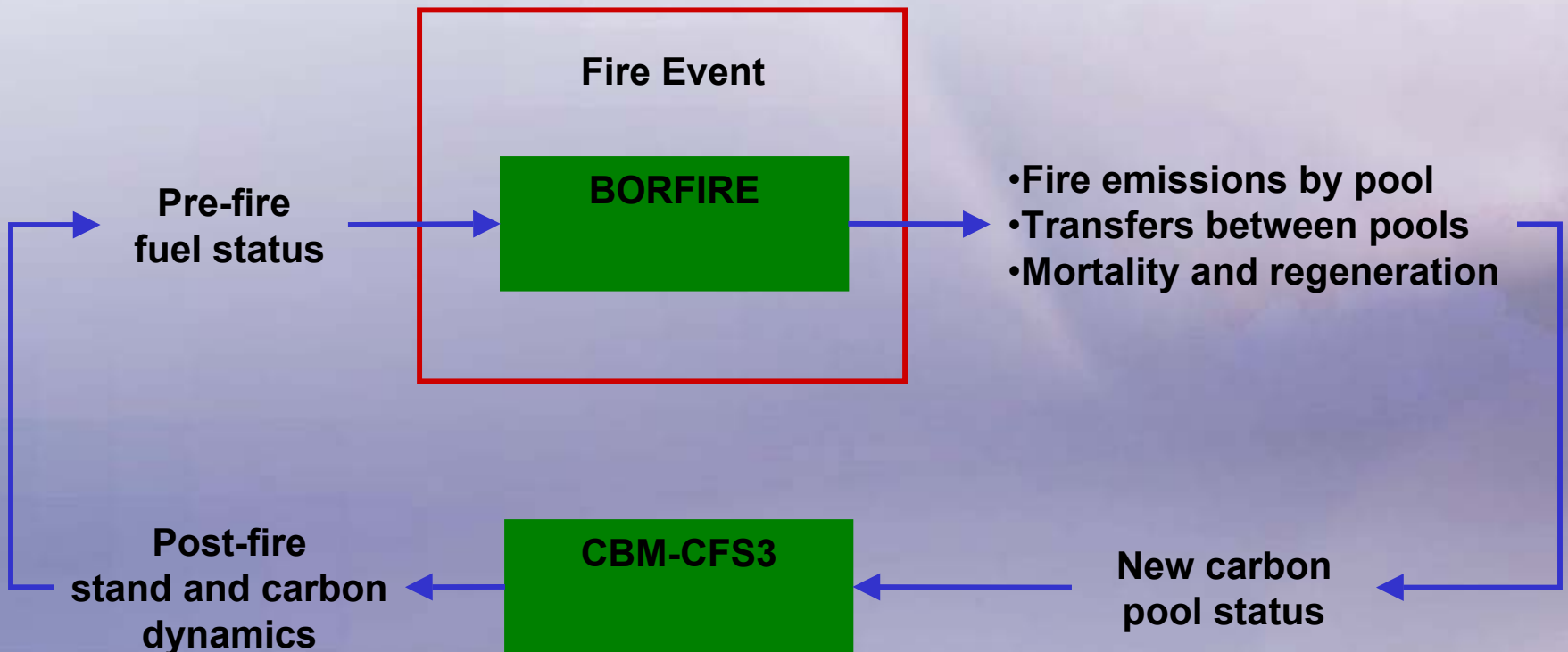
Carbon Pools



Boreal Fire Effects (BORFIRE) Model



Boreal Fire Effects Model (BORFIRE) and CBM-CFS3



Canadian Wildland Fire Information System

