The pyrogeography of eastern boreal Canada from 1901 to 2012 simulated with the LPJ-LMfire model

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Collaborations :
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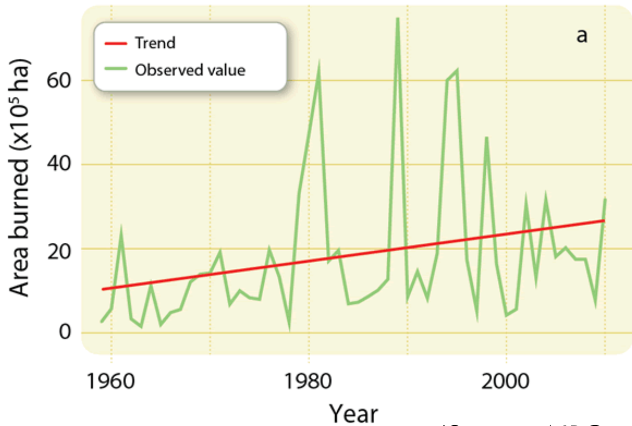
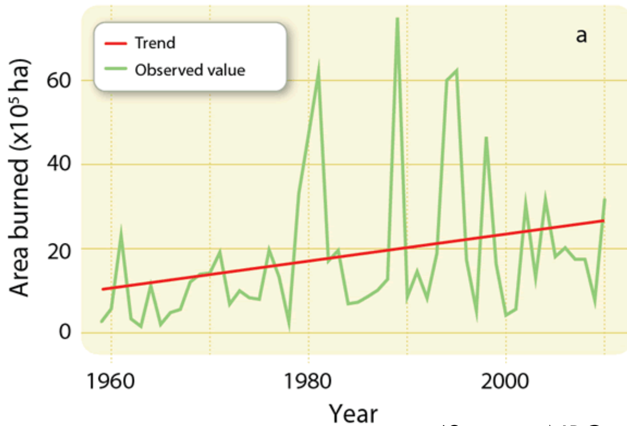
Wildland fires



(Source: NRCan)

Wildland fires

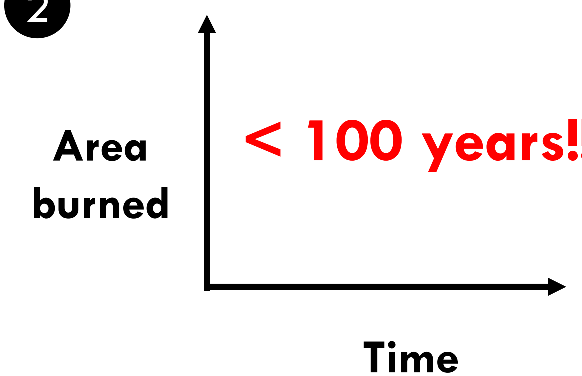


(Source: NRCan)

Some uncertainties…

1

2



Objective

In the past…

Improve knowledge of the global variability of the spatio-temporal pattern of fire regime.

For the future!

To improve the accuracy of predictions of fire risks, management of forest resources and planning for wildland fire evacuations.

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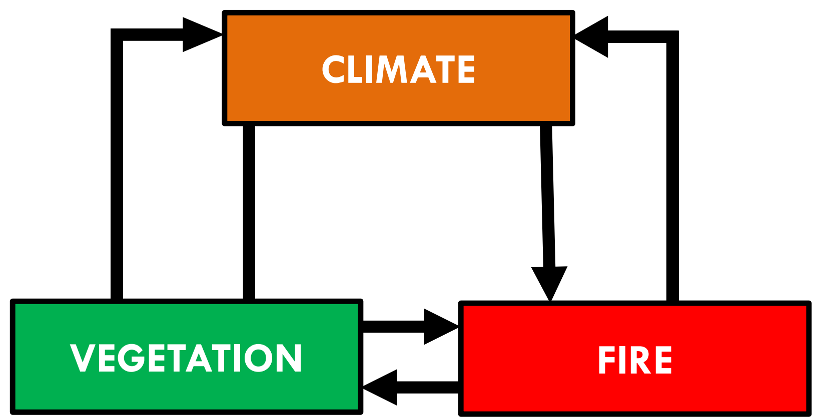
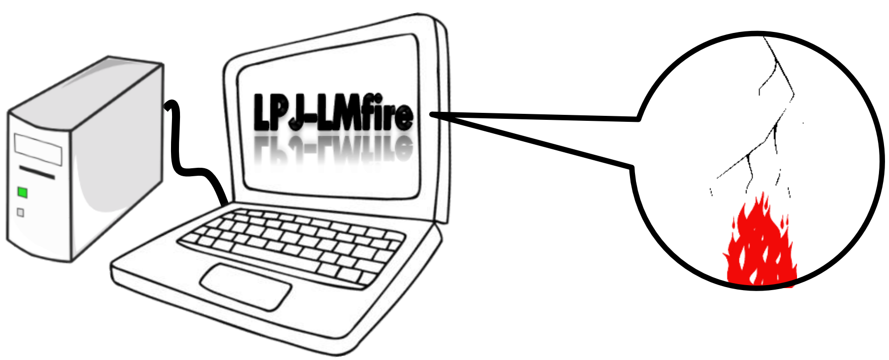


<u>The tool used:</u>

=

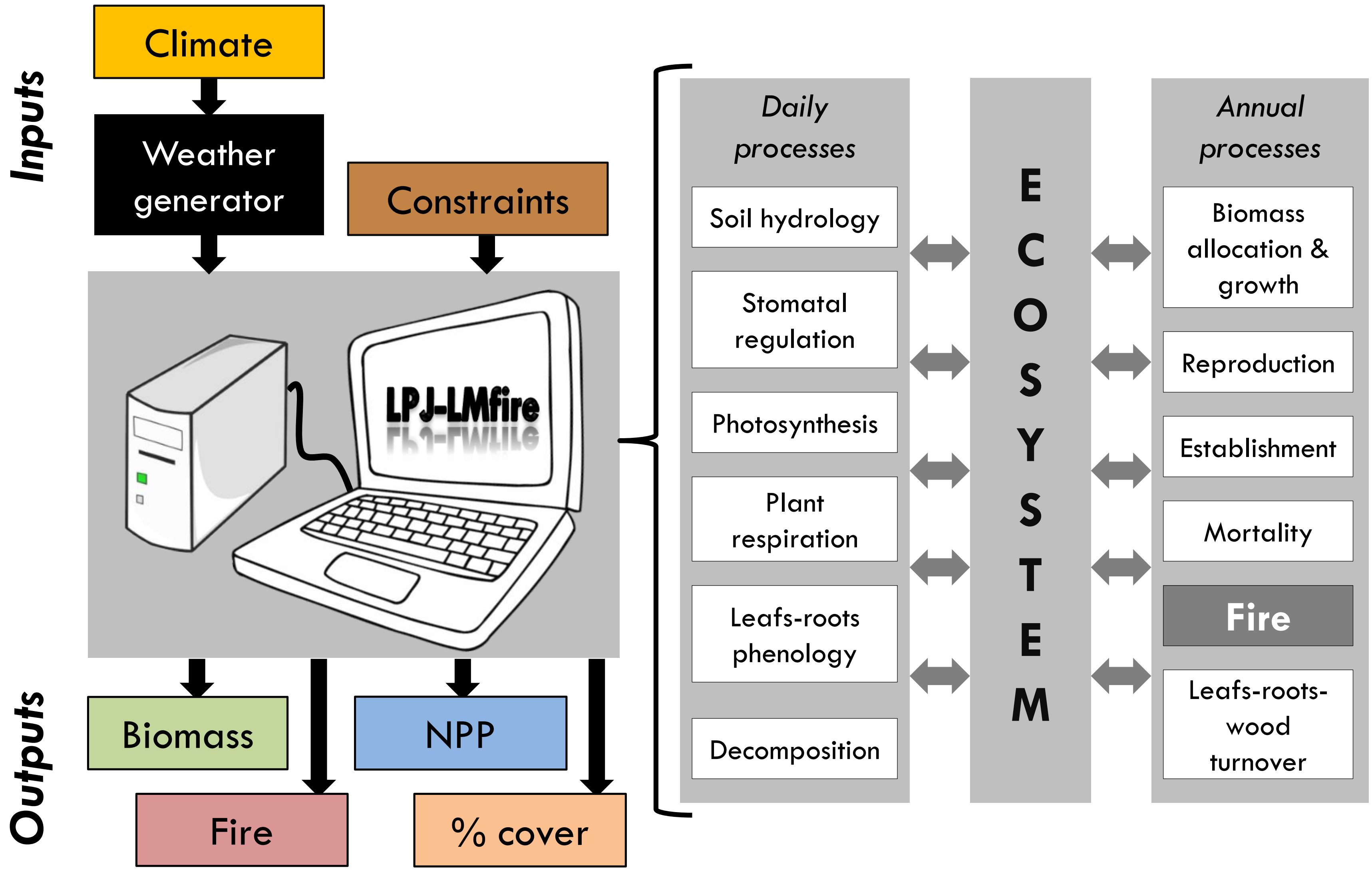


45% of fires ignited by lightning

represents…

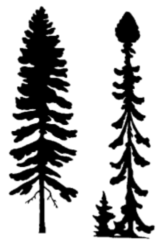
81% of areas burned

LPJ-LMfire


Inputs
Climate
Weather generator
Constraints
LPJ-LMfire
Outputs
Biomass
NPP
Fire
% cover
Daily processes
Soil hydrology
Stomatal regulation
Photosynthesis
Plant respiration
Leafs-roots phenology
Decomposition
E C O S Y S T E M
Annual processes
Biomass allocation & growth
Reproduction
Establishment
Mortality
Fire
Leafs-roots-wood turnover

Boreal parametrization

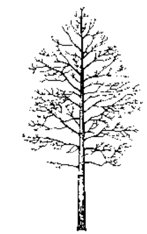
4 PFTs:



Picea

Abies

Pinus



Populus

<u>List of 54 parameters for each PFTs:</u>

Bioclimatic limits

Edaphic preferences

Morphology parameters

Growth parameters

…

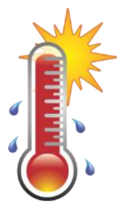
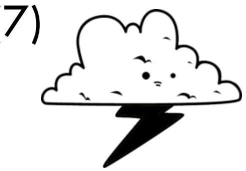
Methodology

Input datasets

(1901-2012)

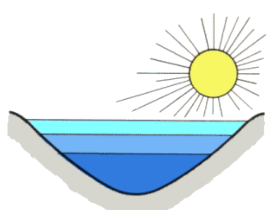
10 km x 10 km

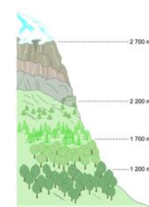
Climate = 7 variables

(1) (2)  (3) (4)  (5)  (6)  (7) 

Constraints = 4 variables

(1) 

(2) 

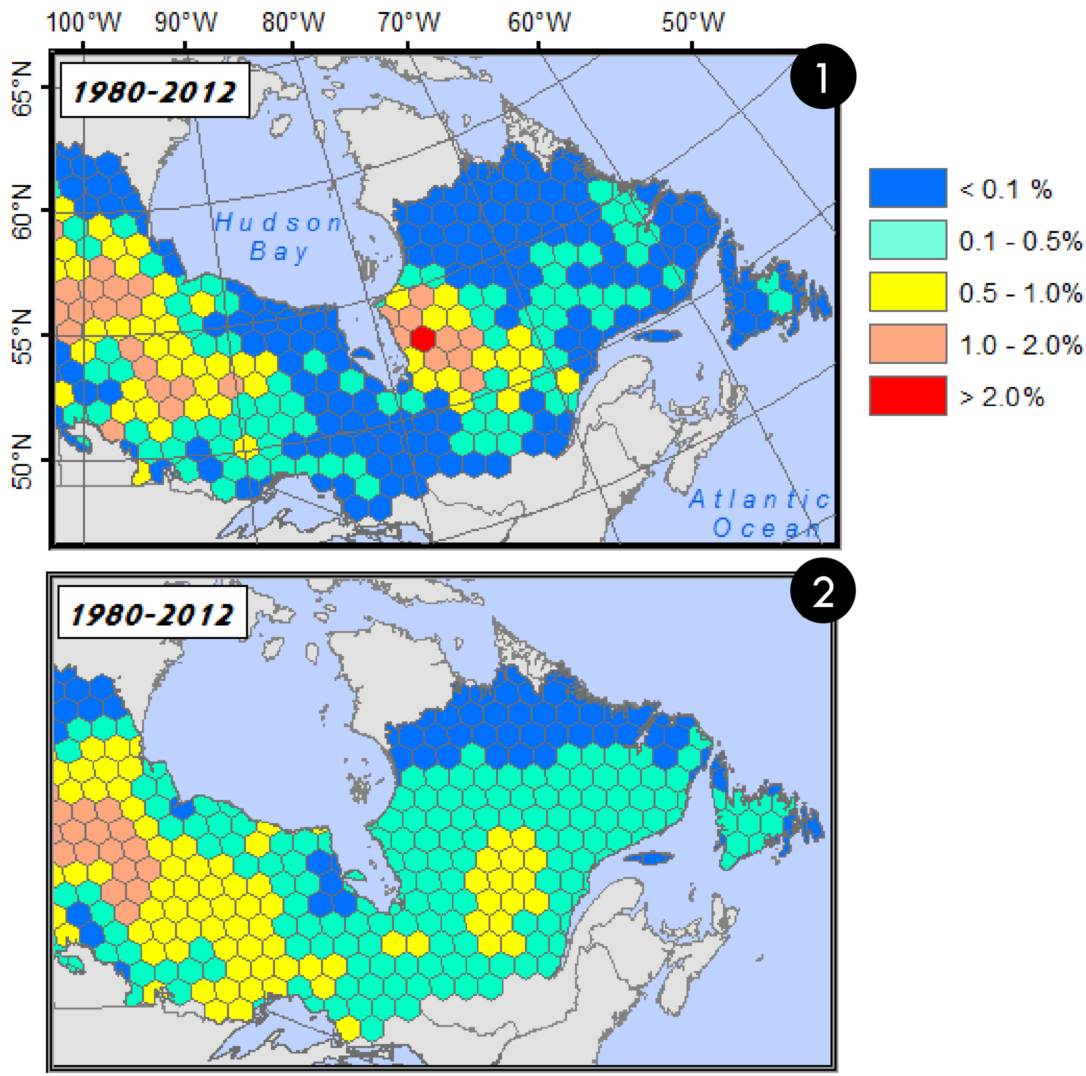
(3) 

(4) 

Fire validation (1980 – 2012)

OBSERVED
burn rates

SIMULATED
burn rates



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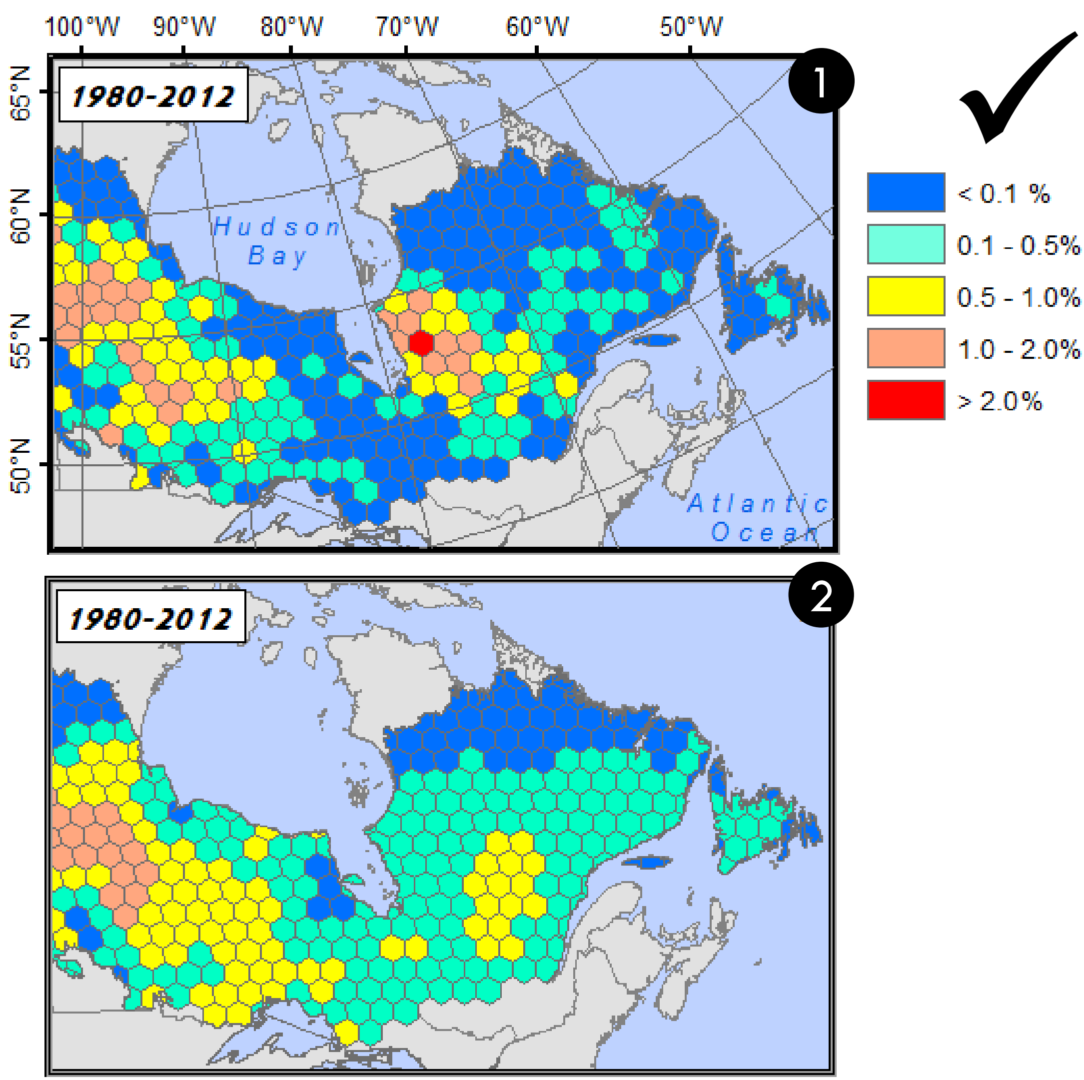

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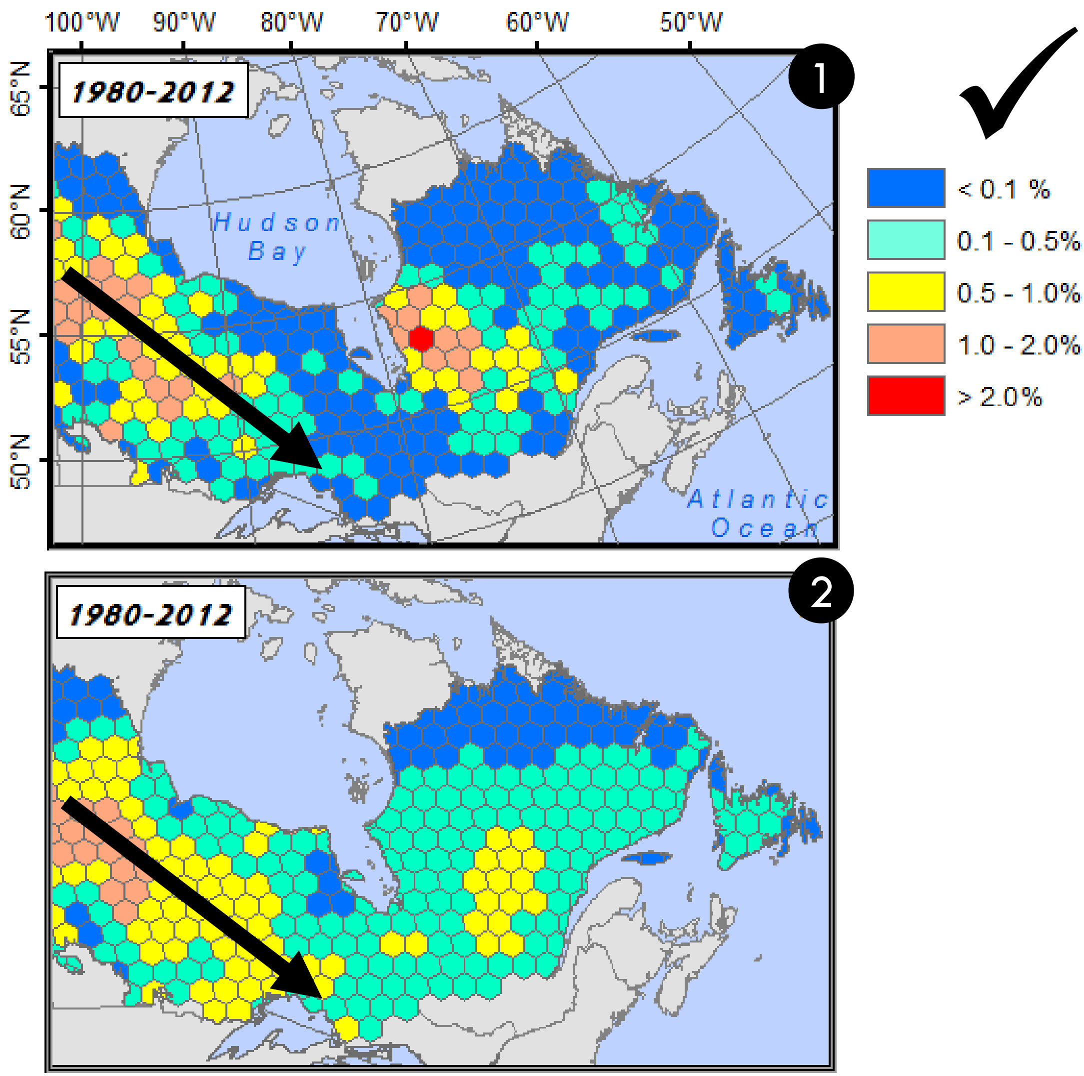

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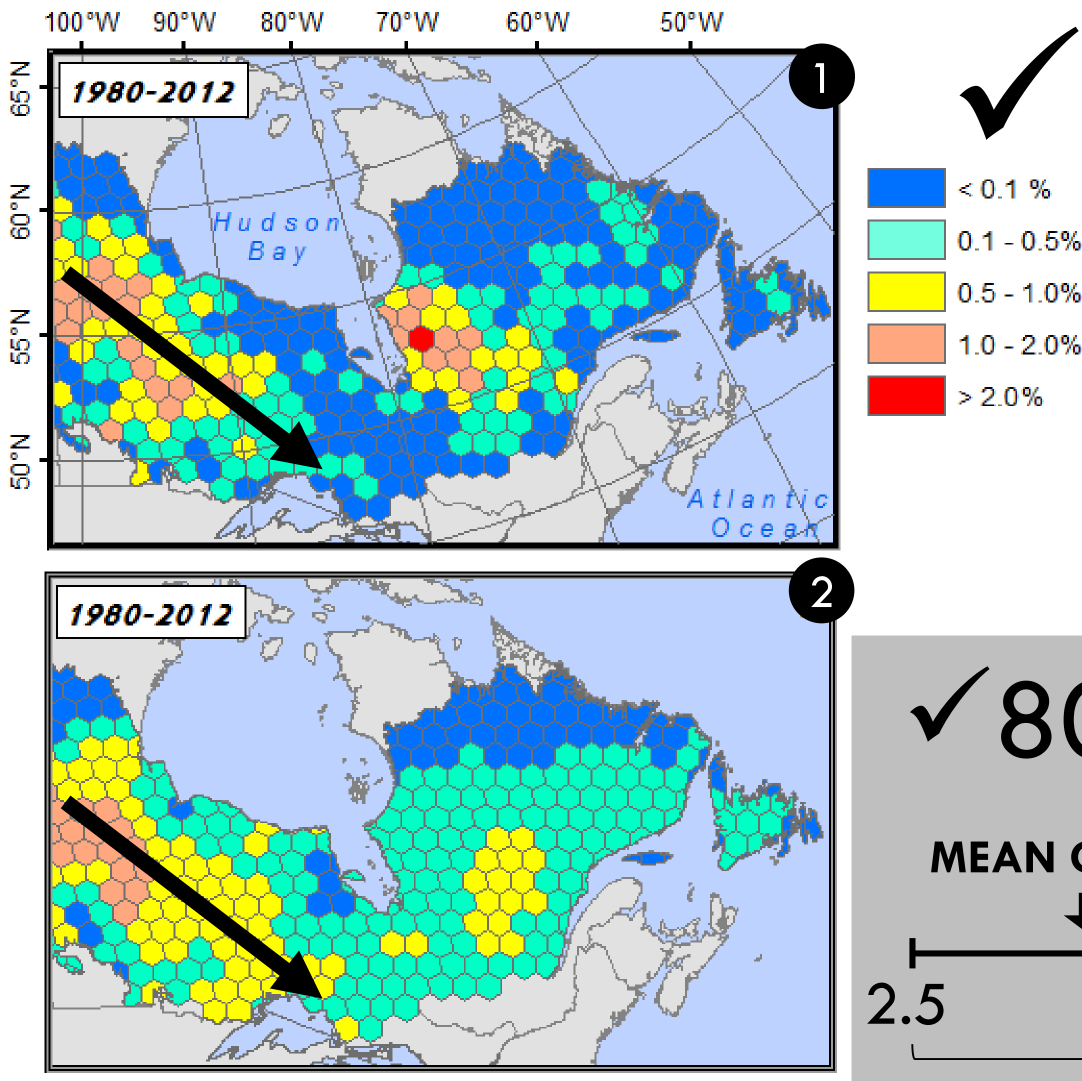


✓80%

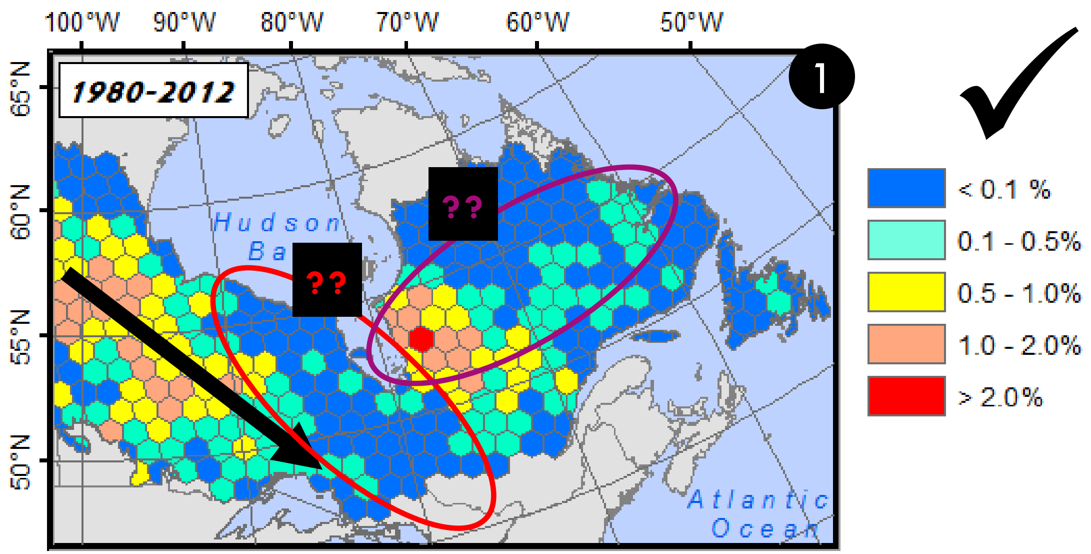
MEAN Observed

2.5 97.5

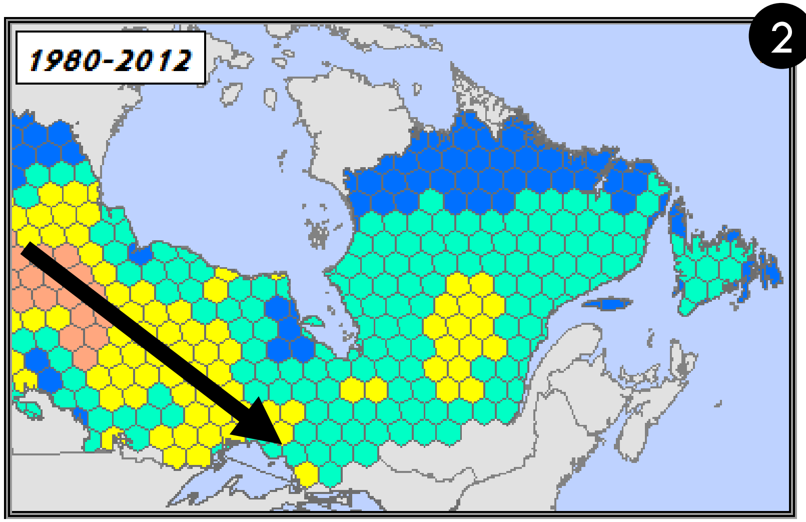
IC 95% Simulated

Fire validation (1980 – 2012)

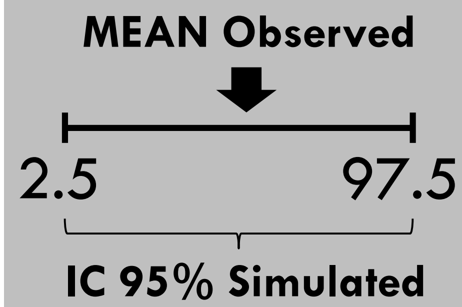
OBSERVED
burn rates



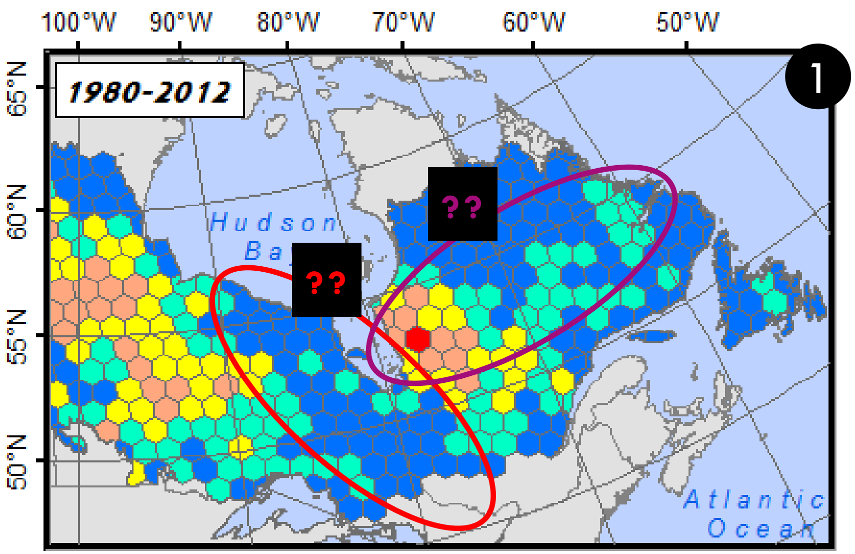
SIMULATED
burn rates



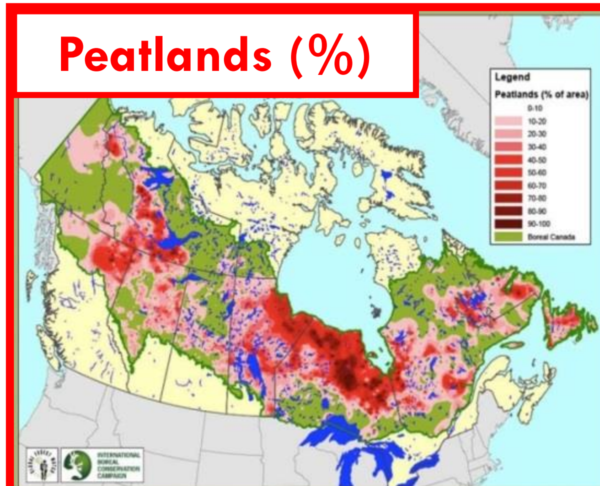
✓80%



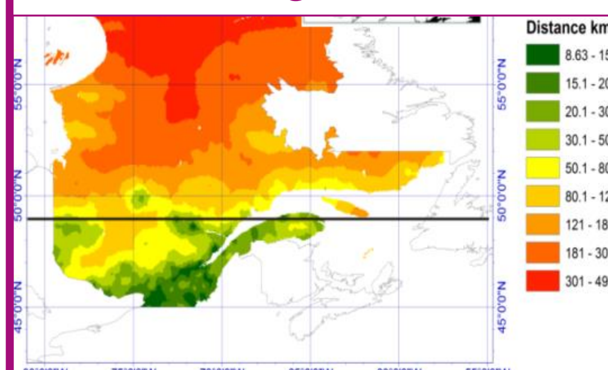
Fire validation (1980 – 2012)



Peatlands (%)

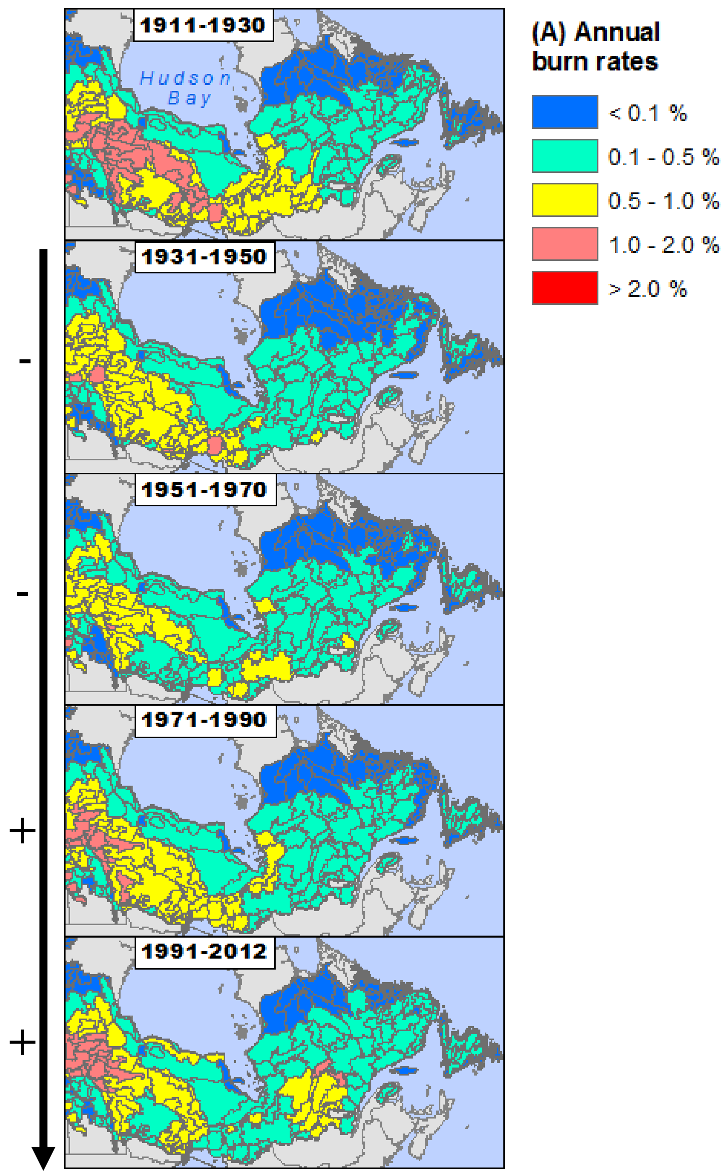


Distance (km) from meteorological stations

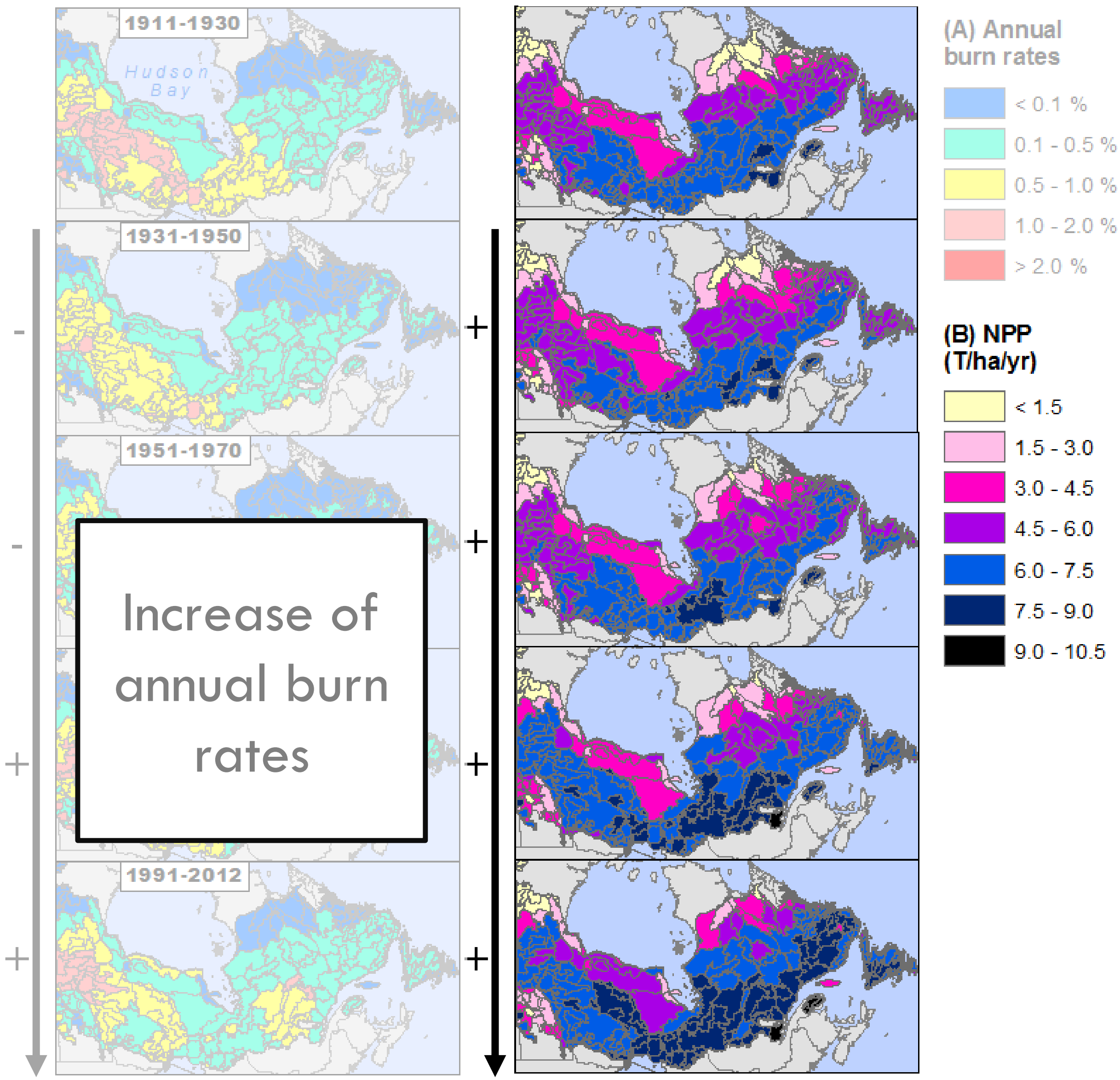


- **Peatland areas**
- **Low accuracy of input datasets**

LPJ-LMfire: FIRES

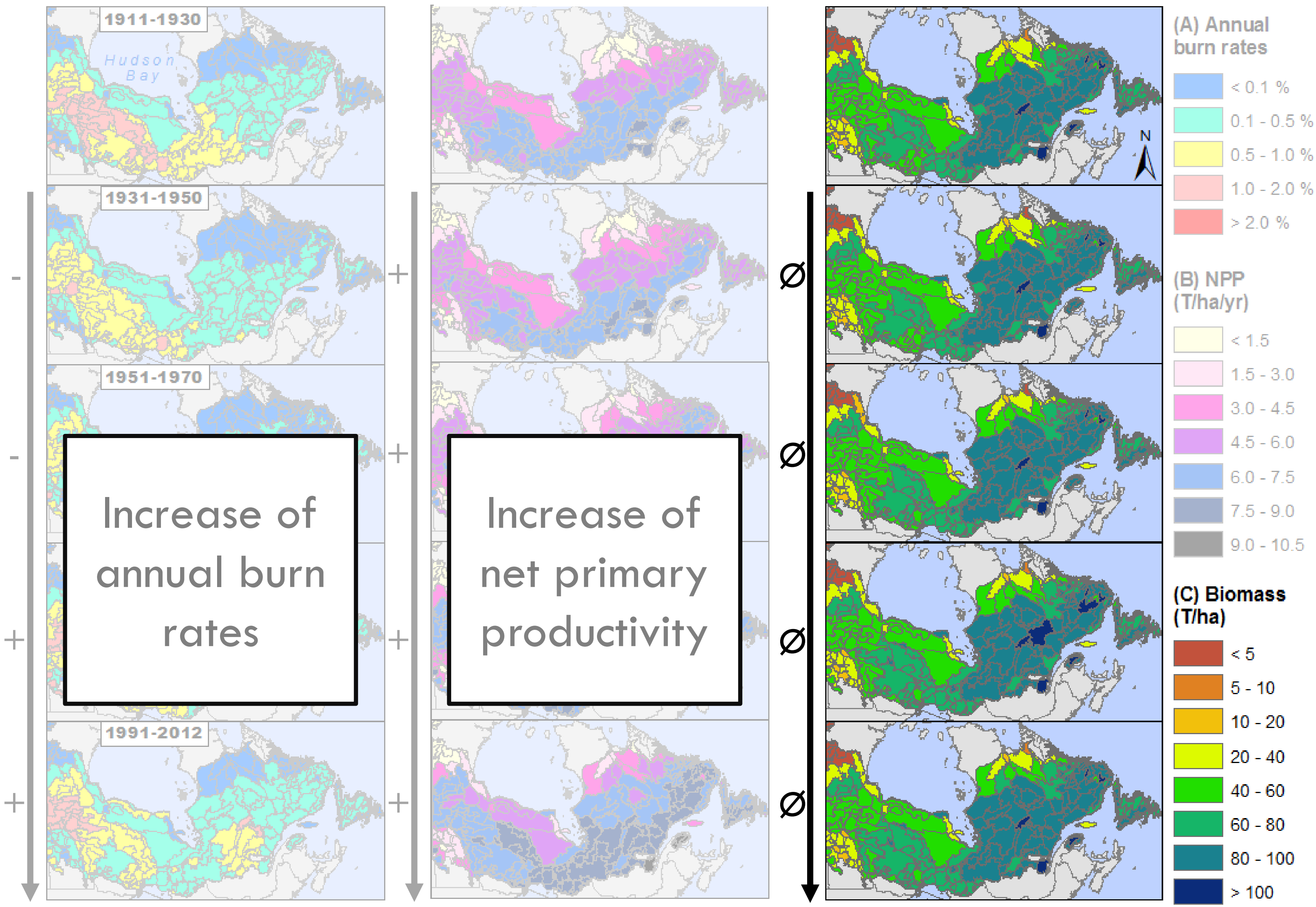


LPJ-LMfire: GROWTH



Results

LPJ-LMfire: BIOMASS



To keep in mind (1):

- LPJ-LMfire simulates correctly fires despite a smooth climate without extrem weather-climate events conducive to fires!

- Low accuracy of inputs datasets in northern areas;

- Some processes are not included in LPJ-LMfire (e.g. paludification);

To keep in mind (2):

- Forest management and fire suppression had limited impact on ‘natural’ fire regimes;

- The positive CO_2 fertilization effect on forest productivity was canceled out during the last century by a negative effect of fires.

Many thanks to:

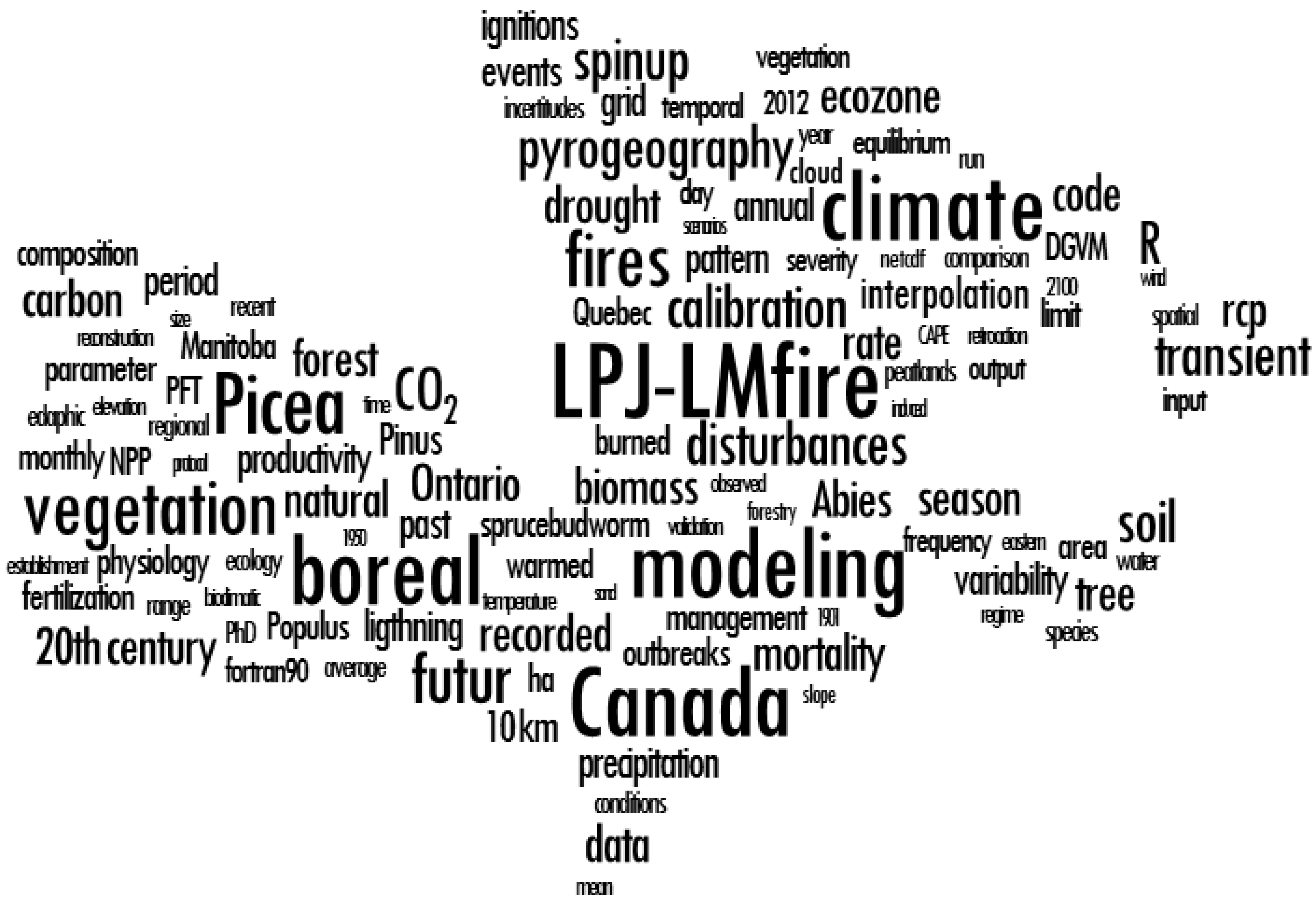
- My supervisors
- Professor **Jed Kaplan** from the University of Lausanne
- **Xiao Jing Guo**, biostatistician at the Laurentian forestry center
- Jeanne Portier, PhD student in my laboratory at UQAM
- Daniel Stubbs, scientific analyst at Calcul Quebec
- Mélanie Desrochers, professional research at forest research center in Montreal
- Our partners:

Modélisation de la Complexité de la Forêt

NEWFORESTS

CRSNG
NSERC

Questions?


ignitions
events spinup vegetation
incertitudes grid temporal 2012 ecozone
pyrogeography year equilibrium run
cloud
drought day annual climate code
scenarios
composition fires pattern severity netcdf comparison DGVM R
period wind
carbon recent interpolation 2100
size Quebec calibration limit spatial rcp
reconstruction Manitoba rate CAPE retroaction transient
parameter forest peatlands output
PFT Picea time CO_2 LPJ-LMfire input
edaphic elevation induced
regional Pinus burned disturbances
monthly NPP protocol productivity
Ontario biomass observed
vegetation natural forestry Abies season
past sprucebudworm validation soil
1950 frequency eastern area
establishment physiology ecology boreal warmed modeling water
variability tree
fertilization range bioclimatic temperature sand
management 1901 regime
PhD Populus ligthning recorded species
20th century outbreaks mortality
fortran90 average futur ha
slope
10km Canada
precipitation
conditions
data
mean