



**Wetlands as nature-based  
climate-change solutions:  
Quantifying carbon-capture  
potential while building a  
stronger green economy**

October 11, 2023



**Contract:** EDF-CA-2021i023

**Duration:** 5 years, (April 1<sup>st</sup>, 2022 – March 31<sup>st</sup>, 2027).

**Title:** Wetlands as nature-based climate-change solutions:  
Quantifying carbon-capture potential while building  
a stronger green economy.

**Status:** Signed, We're in year 2.

**Funders:** ECCC CAAF (Climate Change Awareness Fund)  
and partners.



# General Statistics

5 years (May 2022 – March 2027)

5 objectives

2 extension projects

13 institutions (to date)

20 Co-Pis (to date)

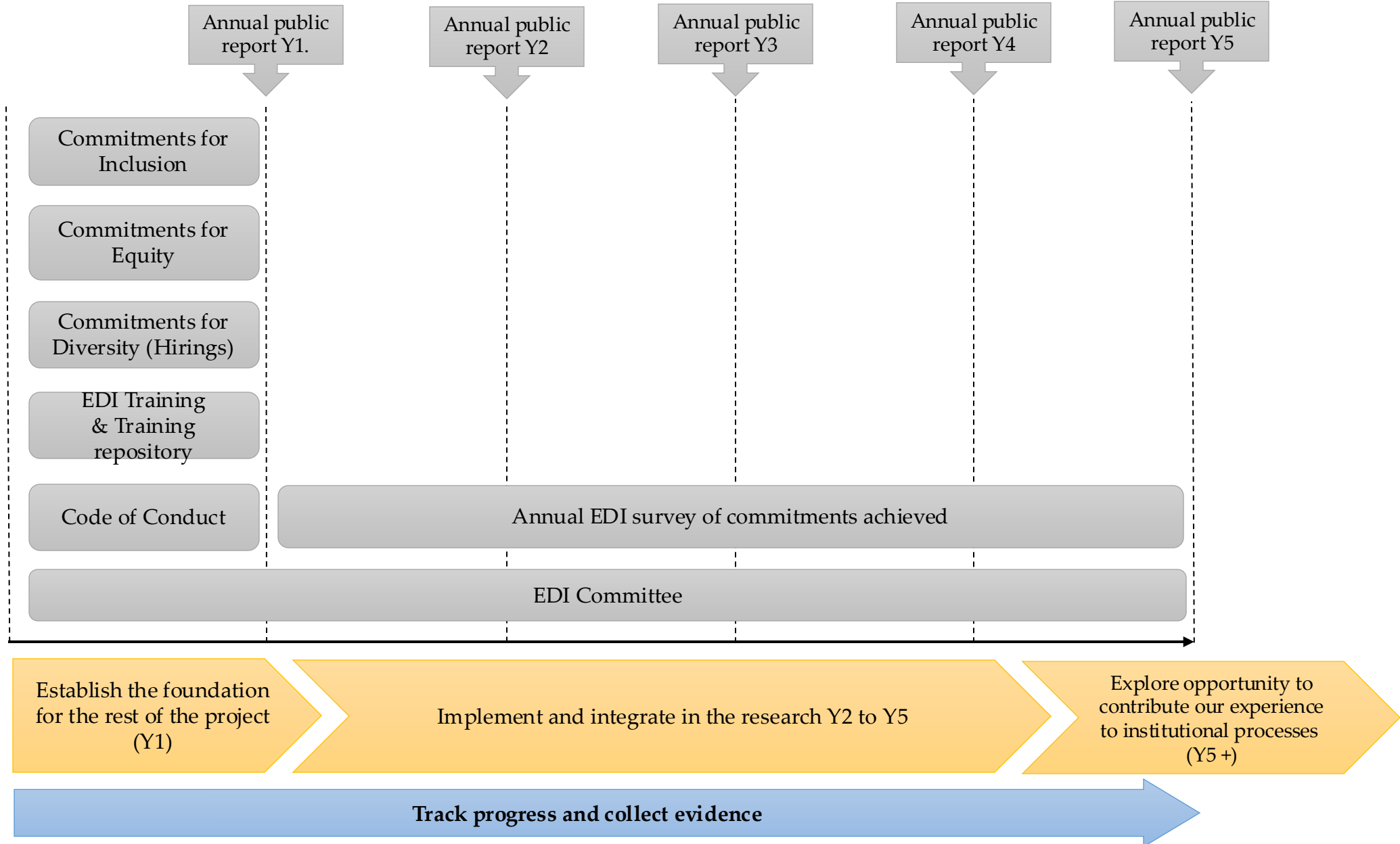
42 HQP (to date)





**WETLANDS**  
NATURE BASED SOLUTIONS

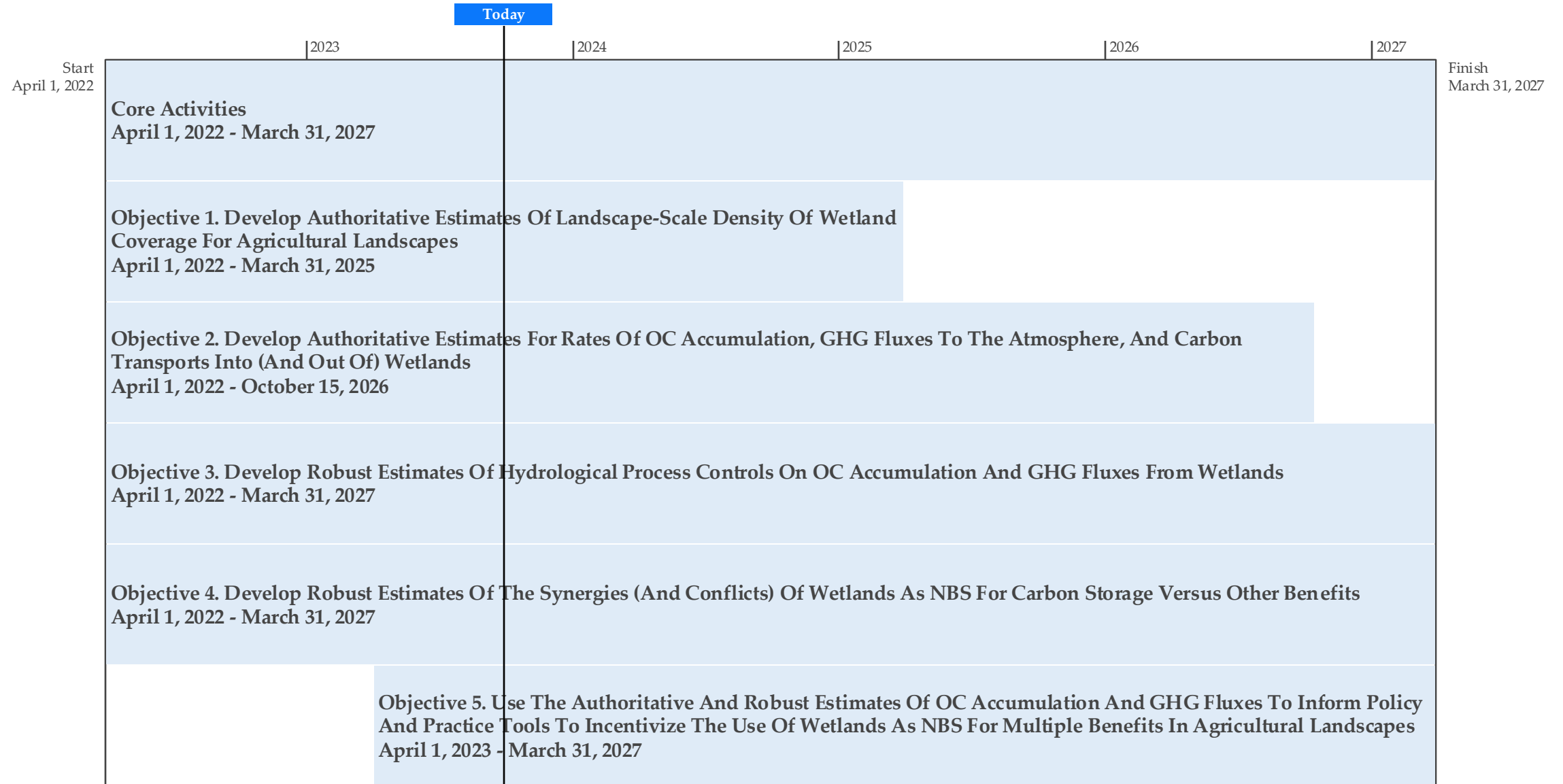
# EDI strategies





# 5 Objectives





**Objective 1.** Develop authoritative estimates of landscape-scale density of wetland coverage for agricultural landscapes.







Google Earth

Image © 2023 CNES / Airbus  
Image © 2023 Maxar Technologies

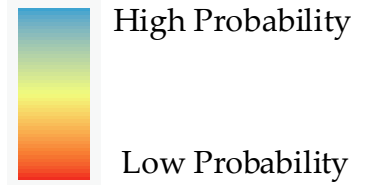
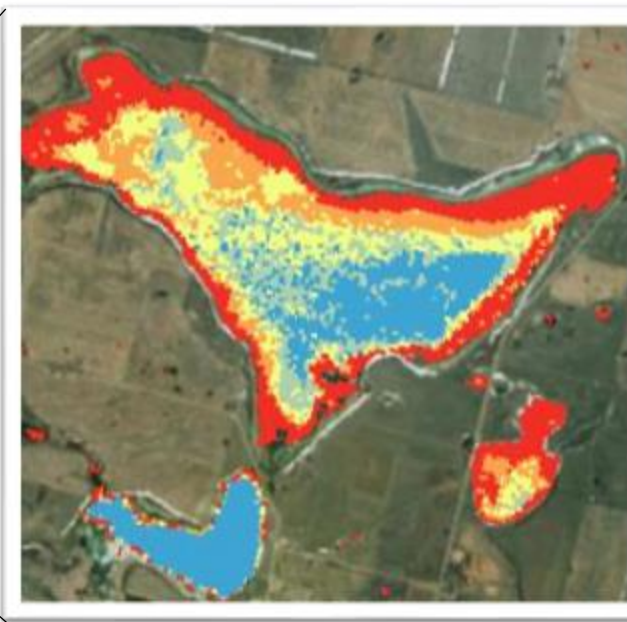


2 km

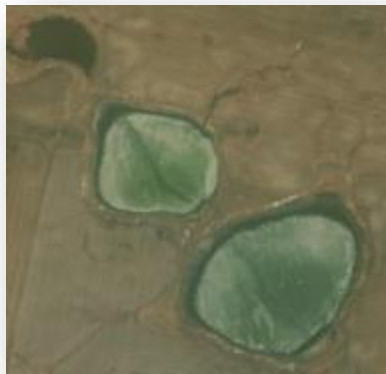




Probability of  
inundation  
(37 years)



probability of Inundation over 37 years



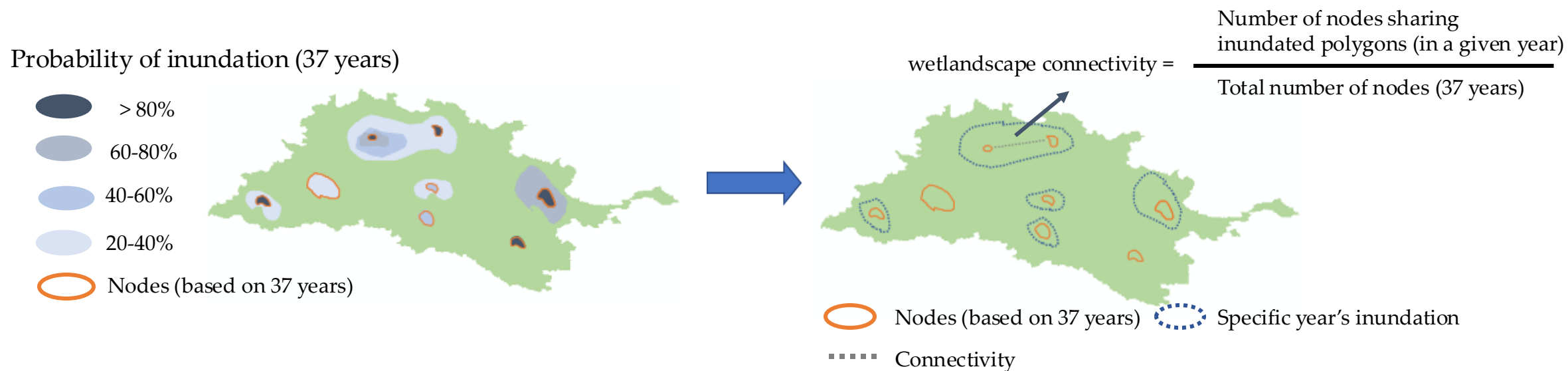
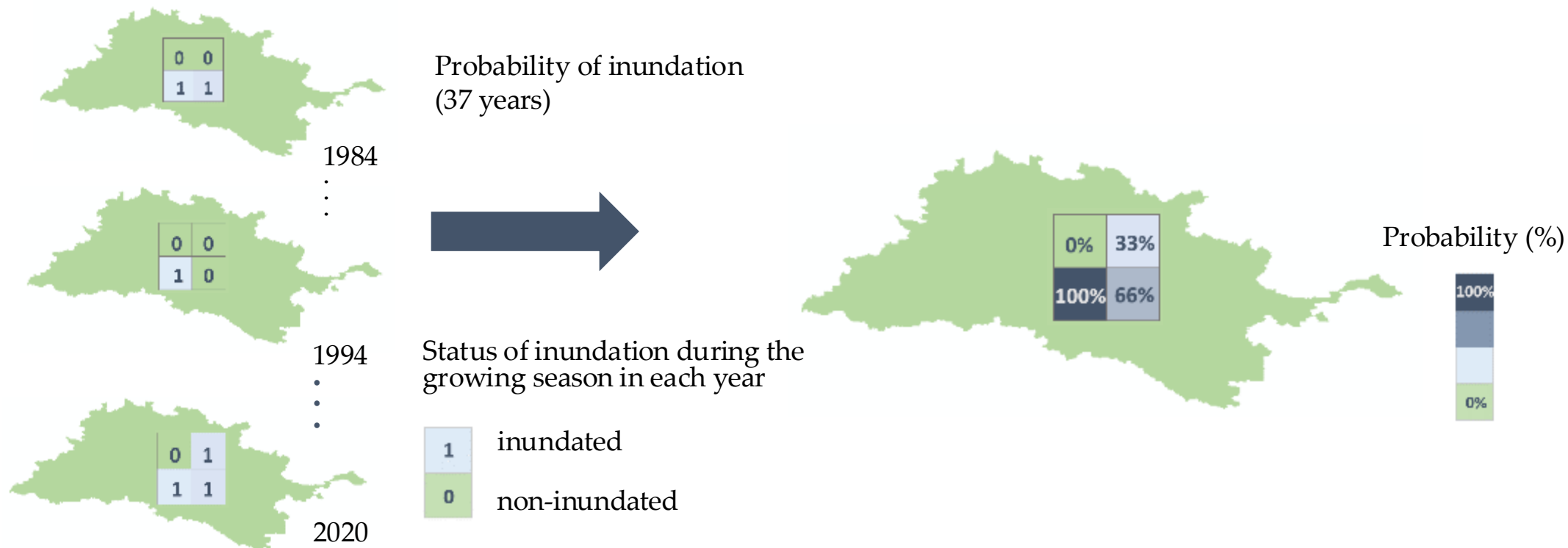
Base Map



Dry Year



Wet Year



**Objective 2.** Develop authoritative estimates for rates of organic carbon accumulation, GHG fluxes to the atmosphere.



National scale project focused on main agricultural regions of Canada.  
**8 Eddy Covariance Flux Towers** in western Canada,  
and **1+** in eastern Canada.

Monitoring of about 150 individual wetlands, including intact and restored wetlands.
















**Quantify GHG  
fluxes from  
wetlands in  
the Canadian  
PPR**



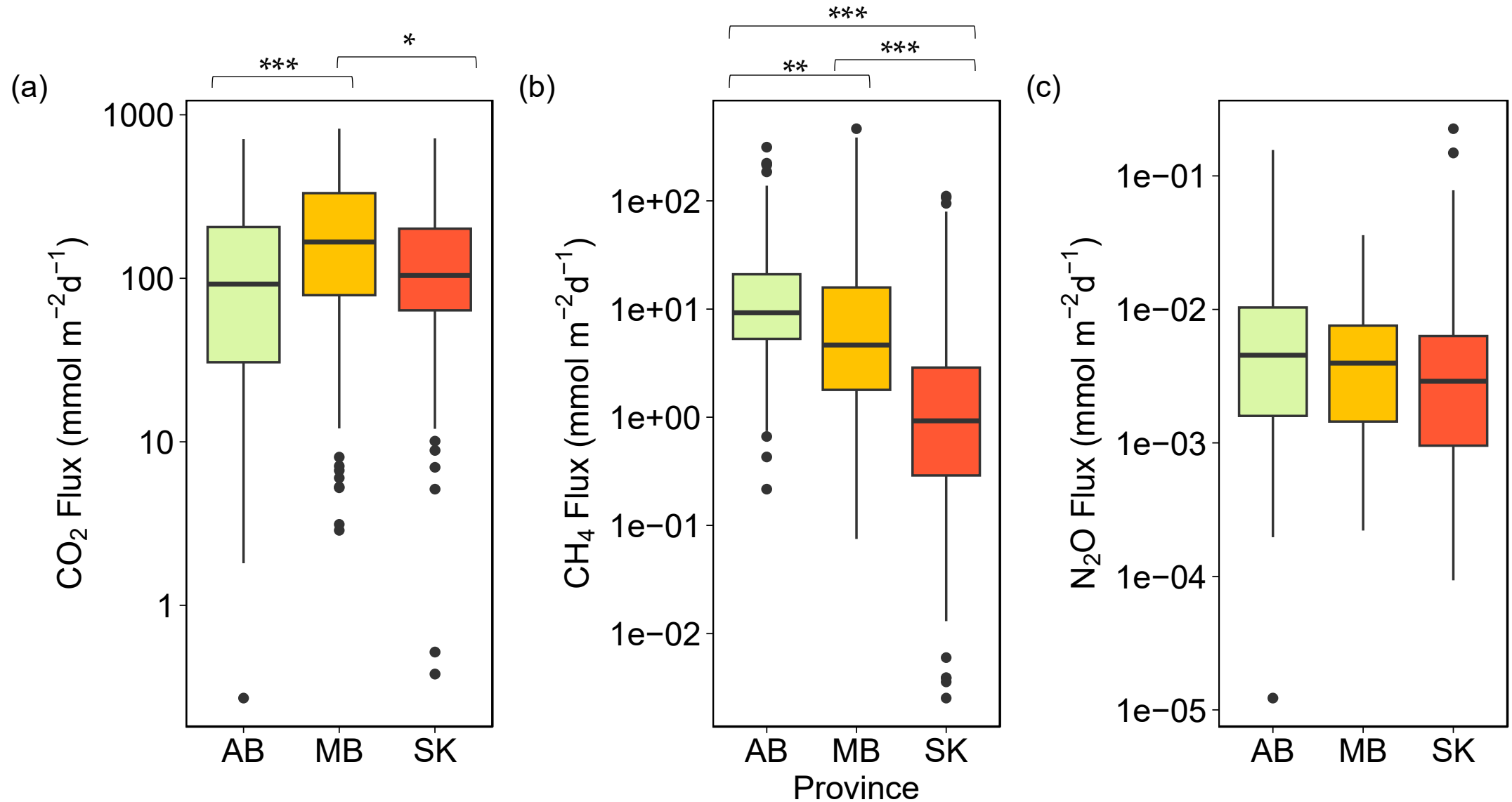
**What are the  
drivers of  
wetland GHG  
cycling in the  
PPR?**



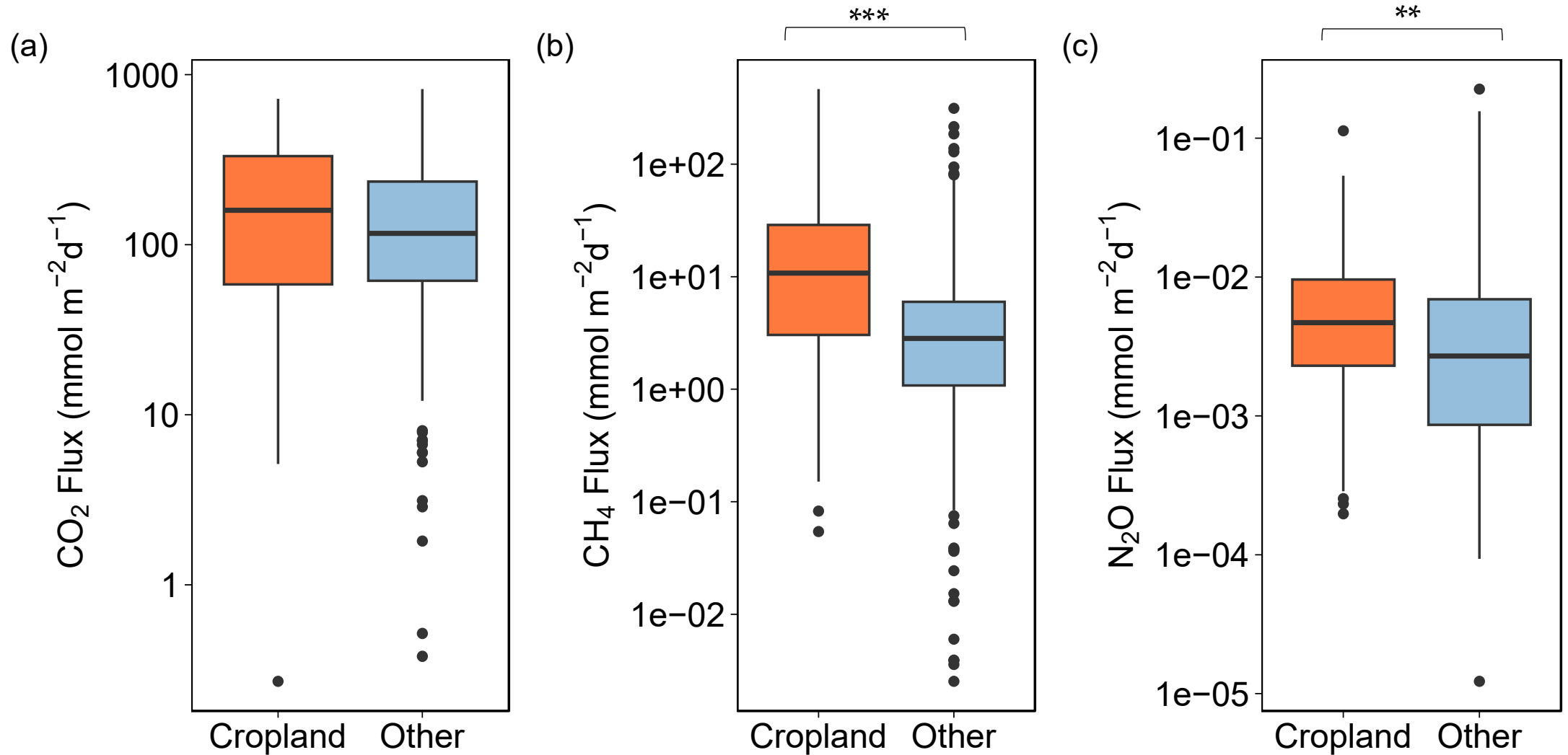
**Does land use  
impact  
wetland GHG  
fluxes?**



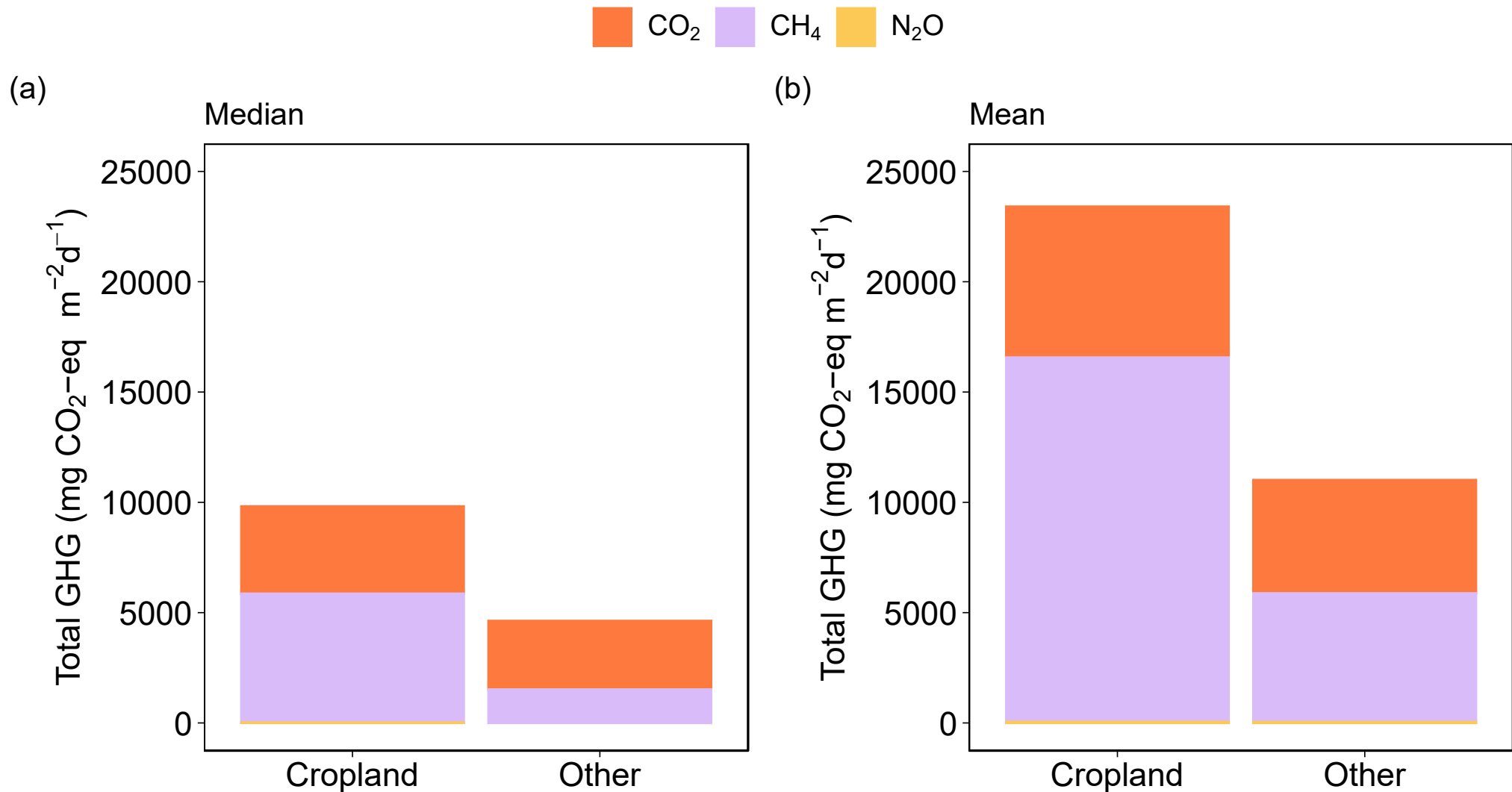
# CH<sub>4</sub> flux varies by province

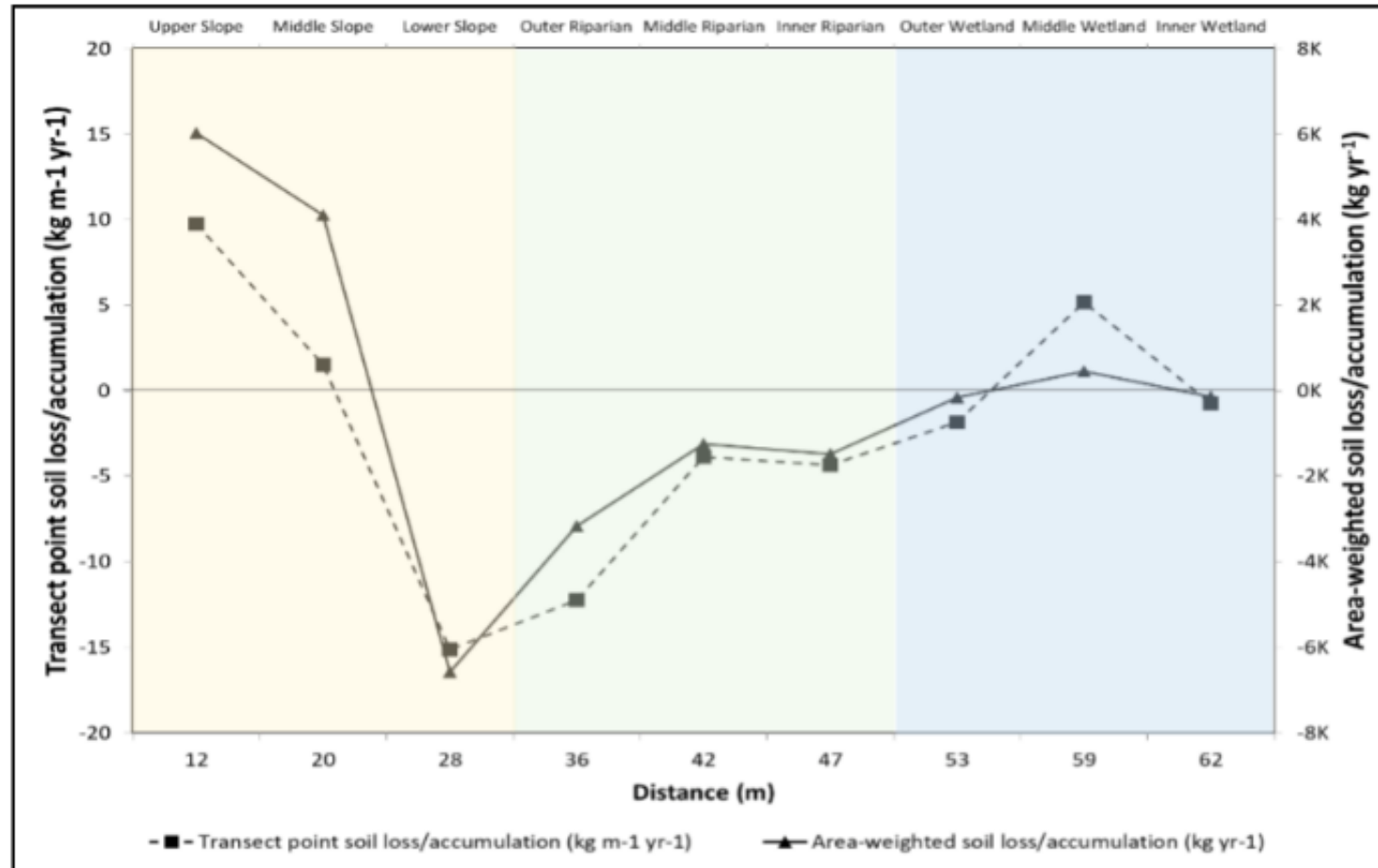


## Higher CH<sub>4</sub> fluxes in wetlands on cropland vs. grassland or pasture land



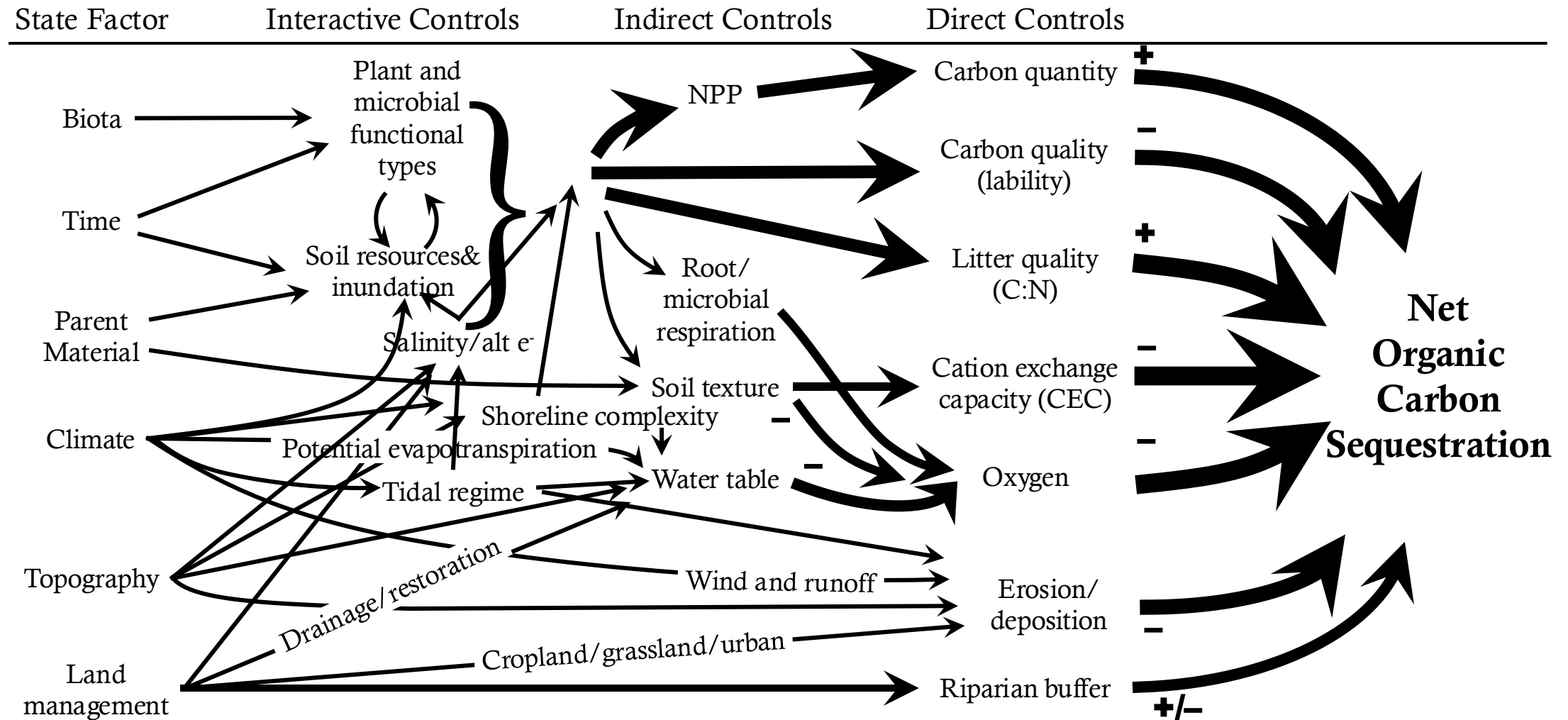
# Higher methane flux in croplands doubles the global warming potential compared to grassland/pasture land







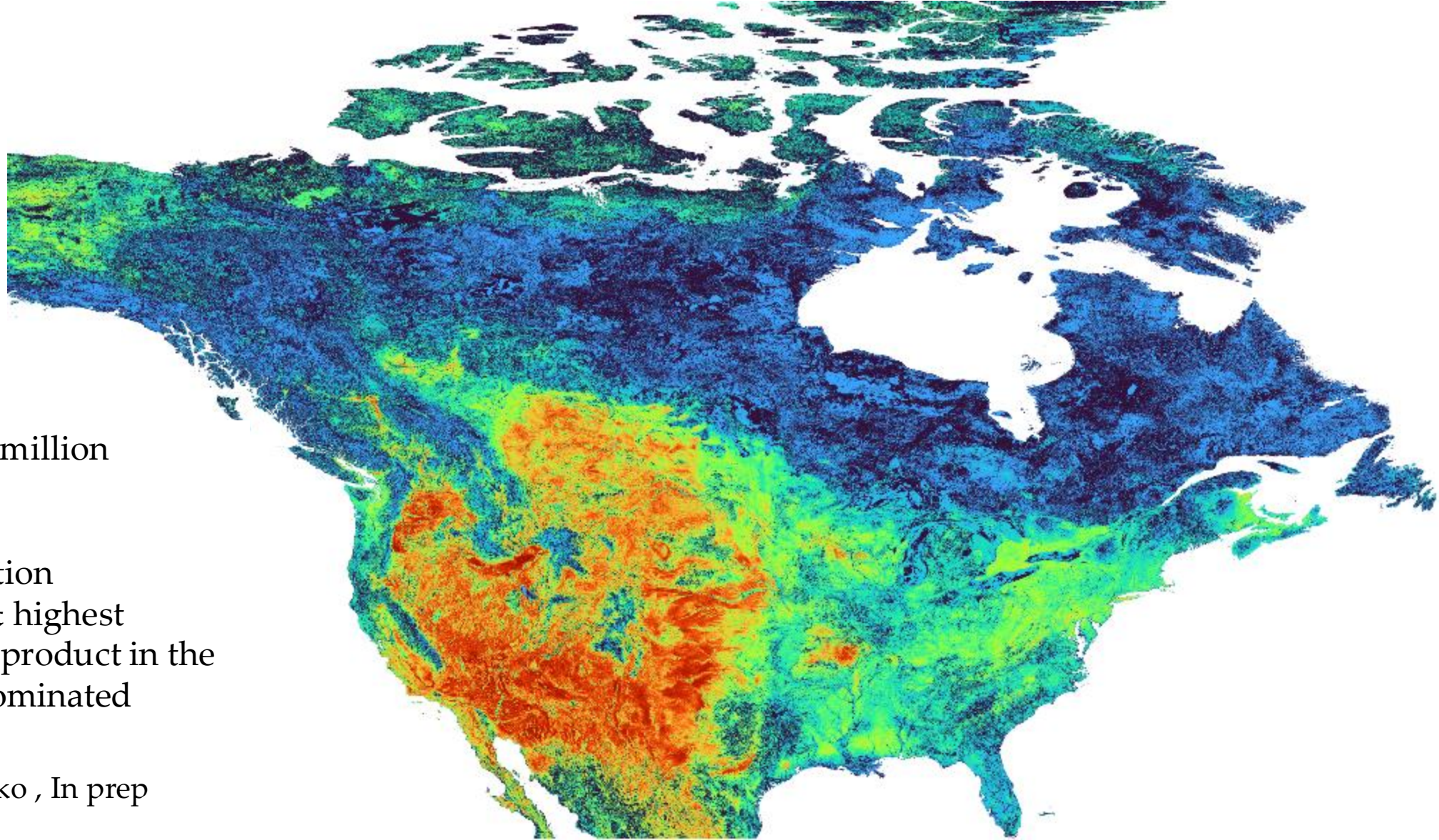
# LONG TERM CONTROLS ↔ SHORT TERM CONTROLS



Bansal S, Creed, IF et al. (2023). Practical Guide to Measuring Wetland Carbon Pools and Fluxes. Wetlands. [In press].

**Objective 3.** Develop robust estimates of hydrological process controls on organic carbon accumulation and greenhouse gas fluxes.

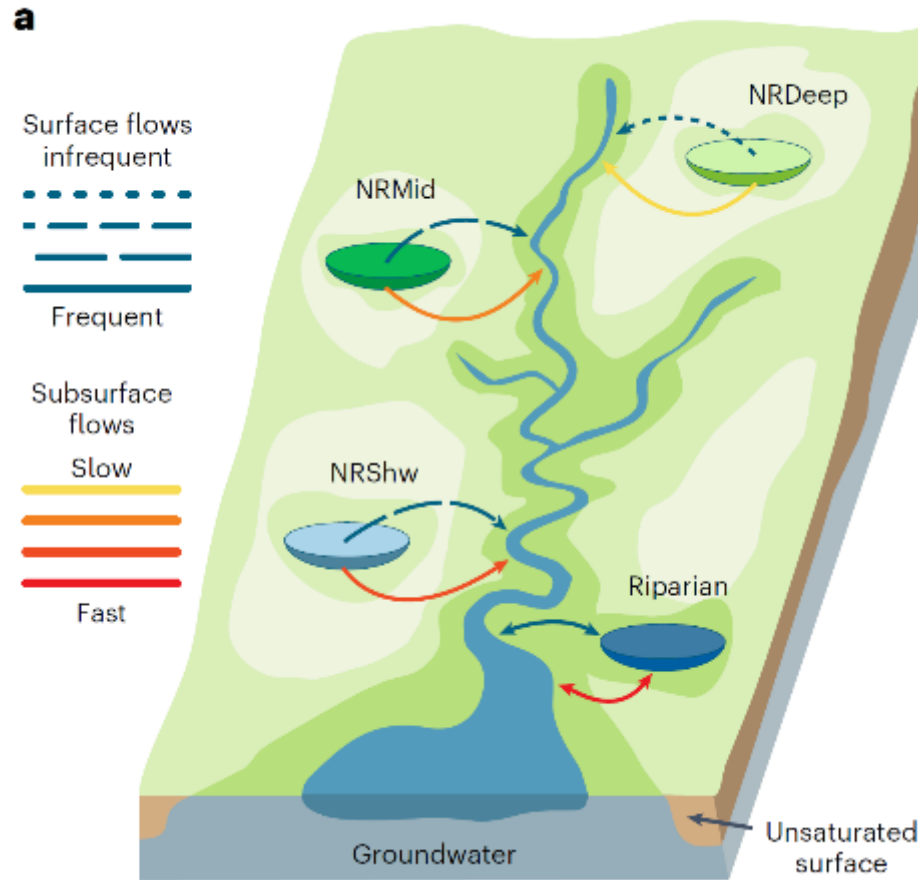
# Stable Groundwater Table Depth



- Using more than 20 million Observations
- Model: XGBOOST
- At 500-meter resolution
- The most accurate & highest resolution available product in the lake and wetland-dominated landscapes

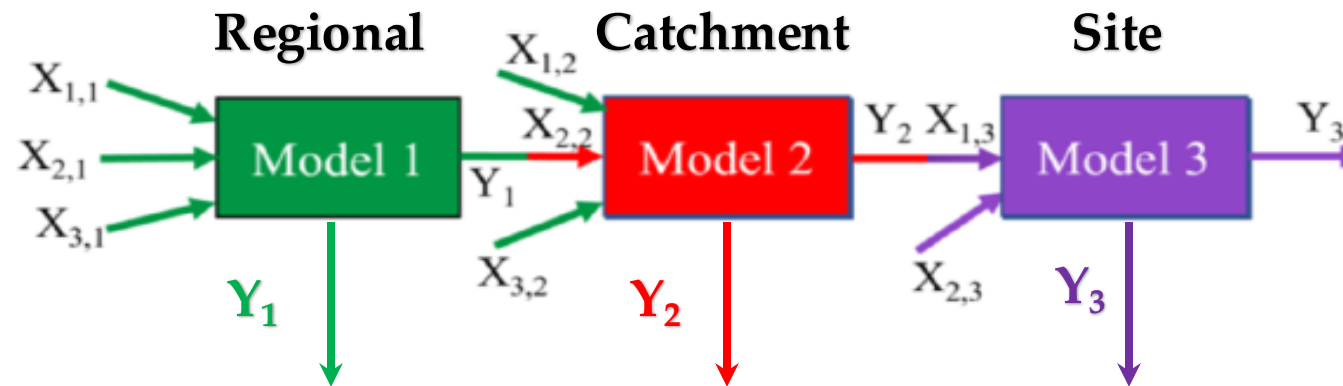
Janssen, Ameli, Jasechko , In prep

# Identifying & Calculating Quantitative Metrics for Mode, Transit Time, and Transit Length of hydrologic connections of wetlands





## Towards the Development of Ensemble Modelling Frameworks in Biogeochemistry:



**Objective 4.** Develop robust estimates of the synergies (and conflicts) of wetlands as nature-based solutions for carbon storage versus other benefits.

**Objective 5.** Use the authoritative and robust estimates of organic carbon accumulation and GHG fluxes to **inform policy and practice tools to incentivize the use of wetlands as nature-based solutions for multiple benefits in agricultural landscapes.**



## Objective 5.1 Establish wetland information network

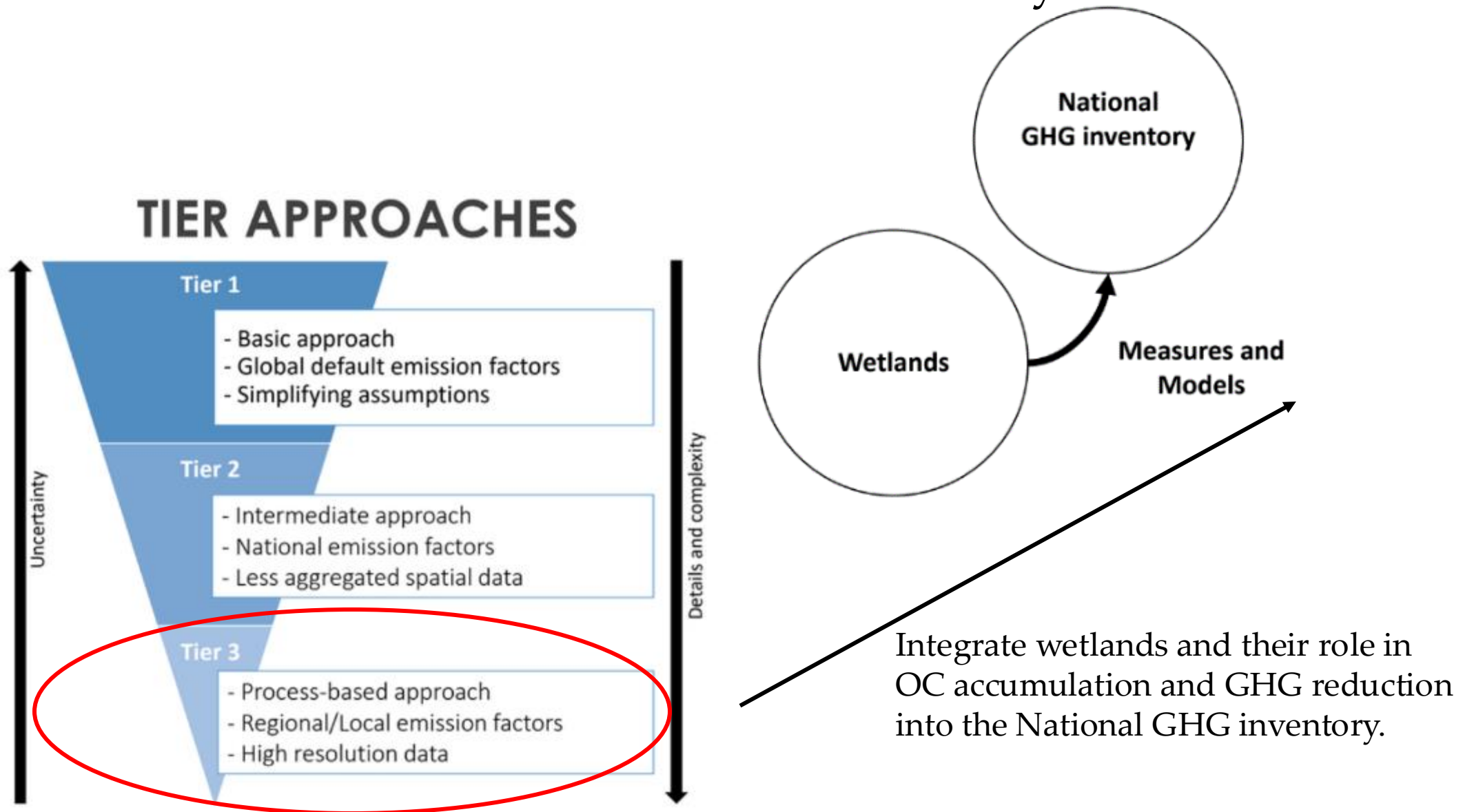
- CANWIN Repository to compile databases, protocols, information, guidelines, will be displayed in a public and openly accessible repository.
- Technical skills required (Application Developer)



Application  
Developer  
Job Posting  
being  
drafted



**Objective 5.2.** Integrate wetlands and their role in OC accumulation and GHG reduction into the National GHG Inventory.



**Objective 5.3.** Develop approaches to quantify agricultural impacts on wetland carbon storage and GHG emissions to enable farmers to make land management decisions that are consistent and quantifiable at the national scale.



Holos is a whole-farm model and software program that estimates greenhouse gas (GHG) emissions based on information entered for individual farms.

The main purpose of Holos is to test possible ways of reducing GHG emissions from farms and is available at no cost to users

5d. Provide the evidence needed to support national initiatives for nature-based climate solutions.

## Nature Smart Climate Solutions Fund

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## 5.4 Extension projects:

### Lake Winnipeg Watershed and Great Lakes-St. Lawrence River Basin

Identify the main **socio-economic drivers of wetland conversion** and projecting how these drivers might change the rates of wetland conversion, and the resulting GHG.

**Cost-effectiveness and cost-benefit analysis of protection, conservation, vs. restoration** of wetlands on agricultural lands as NbCS in the Great Lakes-St. Lawrence River Basin



# Wetland Assessments

Area covered by:

CAAF Wetlands as Nature Based Climate Solutions (green)

Lake Winnipeg Watershed Area covered by the first extension to the CAAF Wetlands as Nature Based Climate Solutions Project led by Patrick Lloyd-Smith, and John Pattison-Williams.

Great Lakes-St. Lawrence River Basin area\* covered by the proposed second extension to the CAAF Wetlands as Nature Based Climate Solutions Project led by

Roy Brouwer  
Jie He  
Ben DeVries  
Genèveve Ali  
George Arthonditsis

★ Cross fertilization of theories, methods, approaches

Source: Statistics Canada, Agriculture Division, Remote Sensing and Geospatial Analysis section, 2017. Agricultural Ecumene Boundary File – 2016.

<https://open.canada.ca/data/en/dataset/317bf695-b6e2-4b60-90a8-51cd3c3d3d64>

# Investigators on extension projects (one confirmed, one pending)



Irena Creed



Patrick Lloyd-Smith



John Pattison-Williams



Georgios Arhonditsis



Roy Brouwer



Jie He



Ben DeVries



Geneviève Ali

Socioeconomic addition for the  
**Lake Winnipeg Watershed**

Socioeconomic Analysis of the  
**Great Lakes-St. Lawrence River Basin**

## Objective 5.5. Inform Canada's proposed National Index On Agri-food Sustainability

# National Index on Agri-Food Performance



Index in progress

## Canada's National Index on Agri-Food Performance

A growing coalition of private-public partners are working pre-competitively to develop an integrated picture of sustainability for Canada's agri-food sector from food production to retail.

Why Canada needs this Index

How can I get involved?

The diagram consists of a central dark grey diamond with the text "Canada's agri-food sustainability indicators". Surrounding this diamond are four white squares, each with a colored border: a green border for "ENVIRONMENT" (top-left), a blue border for "ECONOMIC" (top-right), a blue border for "HEALTH & FOOD SAFETY" (bottom-left), and a gold border for "SOCIETAL WELL-BEING" (bottom-right).

# Key Performance Indicators (Year 1)

Performance Indicator	Unit of Measure	Target Quantity	Actual Quantity	Status
Number of communication activities or products delivered to knowledge users. (These can include publications, including scientific journal publications, conference or other presentations, seminars with knowledge users, publication in professional magazines, etc.)	# of activities	5	Publications: +6 Publications in progress: +2 Presentations: +15 Meetings: +40 Grants: 7	✓
Number or evidence of tools, data sets, technologies, models, and/or methodologies developed as a result of project activities. (In lieu of a discrete number of items developed, evidence of progress will need to be provided during required reporting cycles).	# of items developed	1	1(*)	✓
Evidence of use of the data, tools, and models in the Canadian wetland information repository	# of downloads of data, tools, or models on an annual basis	0	0	✓
Evidence of the training of Highly Qualified Personnel (HQP)	# of HQP trained (including those who are paid directly from the project and those who join through other funding)	10	30	✓





# Challenges



- Institutional agreements take longer than expected.
- Agreements between institutions and unions can affect budgeted expenses for unionized technicians (e.g., 7-9% increase in staff salaries).
- HQP hiring of international students.
- HQP funding periods do not align with ECCC contract periods.
- How and when to engage non-government organizations.



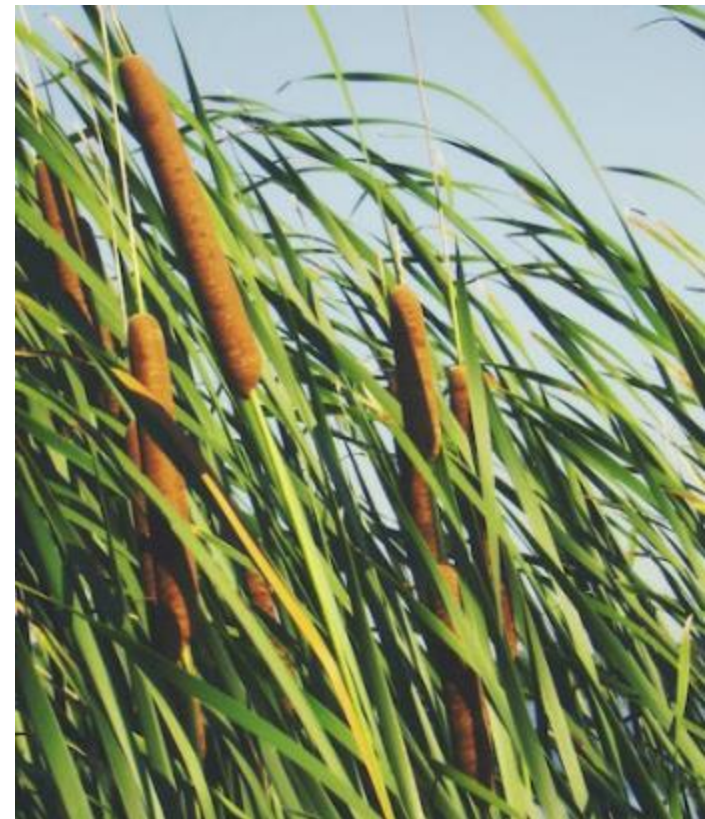
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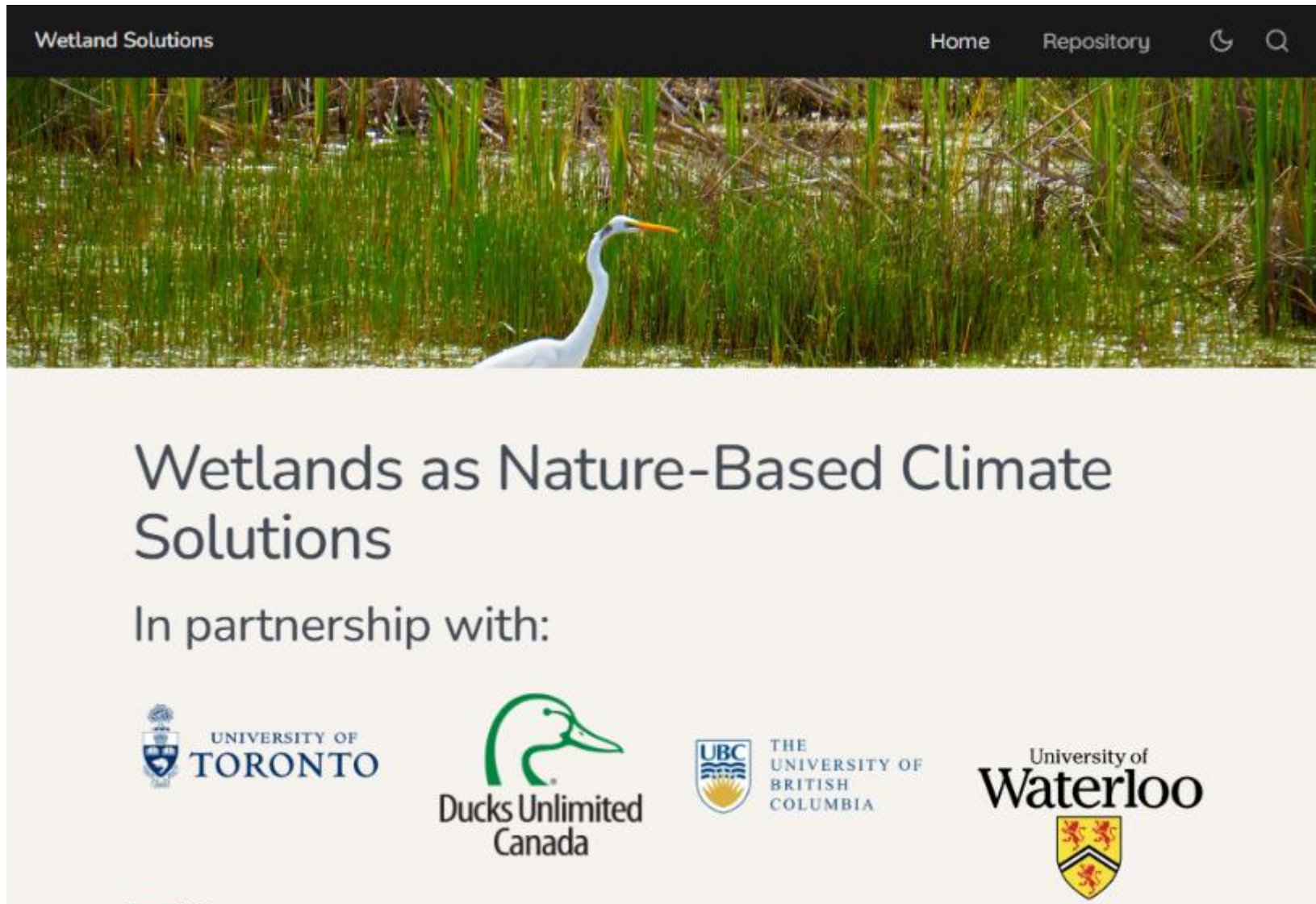
Pascal Badiou:

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Website: [wetlandsolutions.org](https://wetlandsolutions.org)



# Co-investigator Institutions



This project was undertaken with the financial support of the Government of Canada.

Ce projet a été réalisé avec l'appui financier du gouvernement du Canada.



# Partner organizations

- ECCC, Environment and Climate Change Canada
- AFOLU, Agriculture, Forestry and Other Land Use
- AAFC, Agriculture and Agri-Food Canada



Canadian Forage and Grassland Association



