2019 Water JPI Workshop on International Cooperation
Paris, June 25, 2019

Experience from Canada (2016 Water JPI LEAP Project)

Philippe Van Cappellen

Water JPI

LEAP
Legacies of Agricultural Pollutants: Integrated Assessment of Biophysical and Socioeconomic Controls on Water Quality in Agroecosystems

UNIVERSITY OF WATERLOO

Stockholm University

UNIVERSITY OF COPENHAGEN

UNIVERSIDADE DE COIMBRA

LEAP

Legacies of Agricultural Pollutants: Integrated Assessment of Biophysical and Socioeconomic Controls on Water Quality in Agroecosystems

LEAP – Legacies of Agricultural Pollutants

Integrated Assessment of Biophysical and Socioeconomic Controls on Water Quality in Agroecosystems

Lead institution:	University of Waterloo, Canada
Partners institutions:	Stockholm University, Sweden
	University of Copenhagen, Denmark
	University of Coimbra, Portugal

Website: https://uwaterloo.ca/leap

Eutrophication

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Growing food demands/increasing crop yields → agricultural intensification → increasing fertilizer applications → increasing nitrogen (N) and phosphorus (P) emissions → eutrophication water bodies

Lake Erie, Summer 2014

Eutrophication

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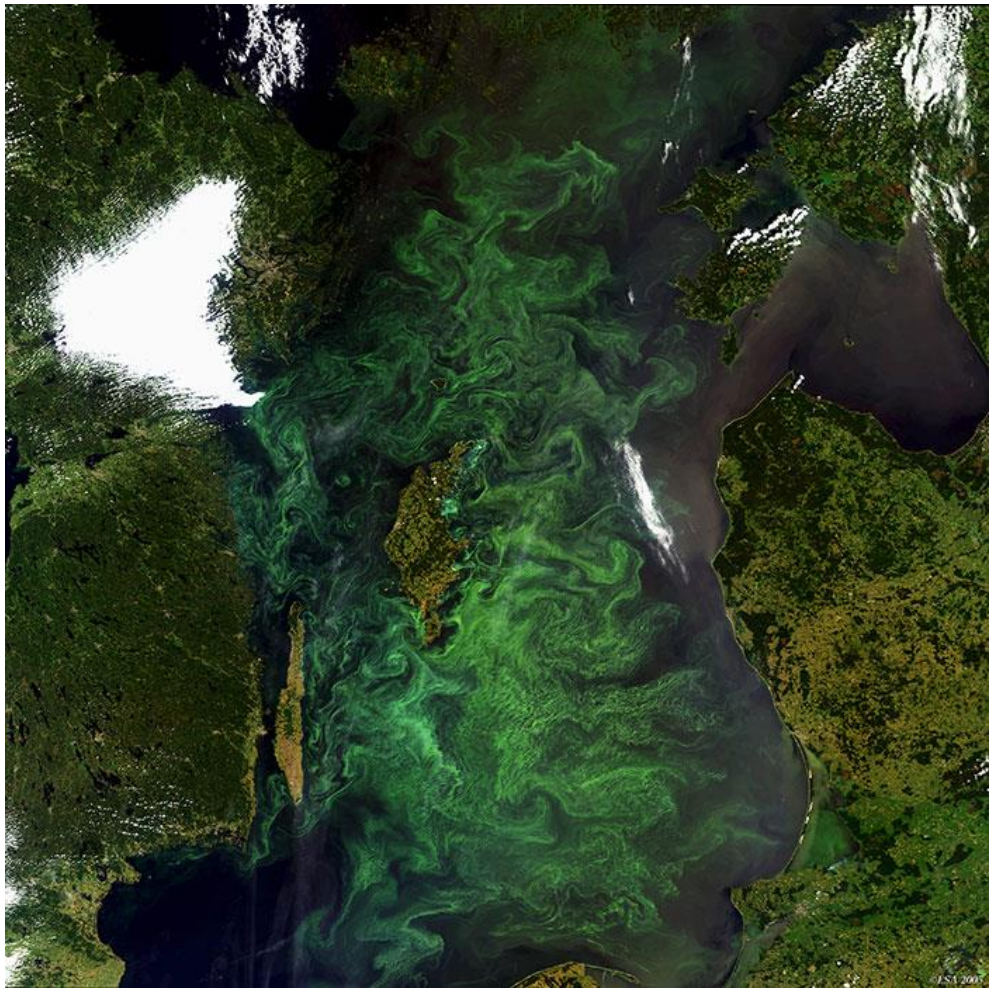
Harmful & nuisance algal blooms



Baltic Sea, July 2005

Food Security versus Water Security?

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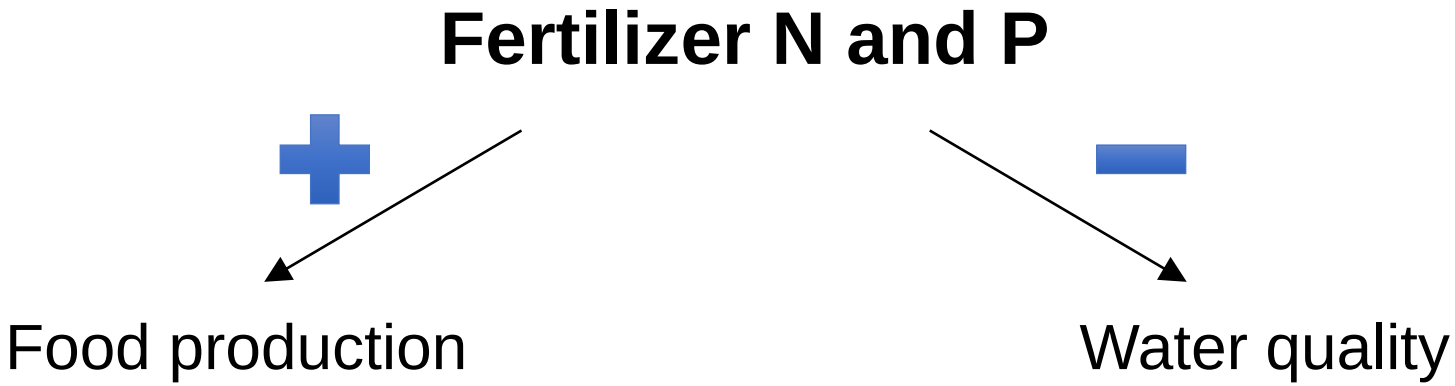
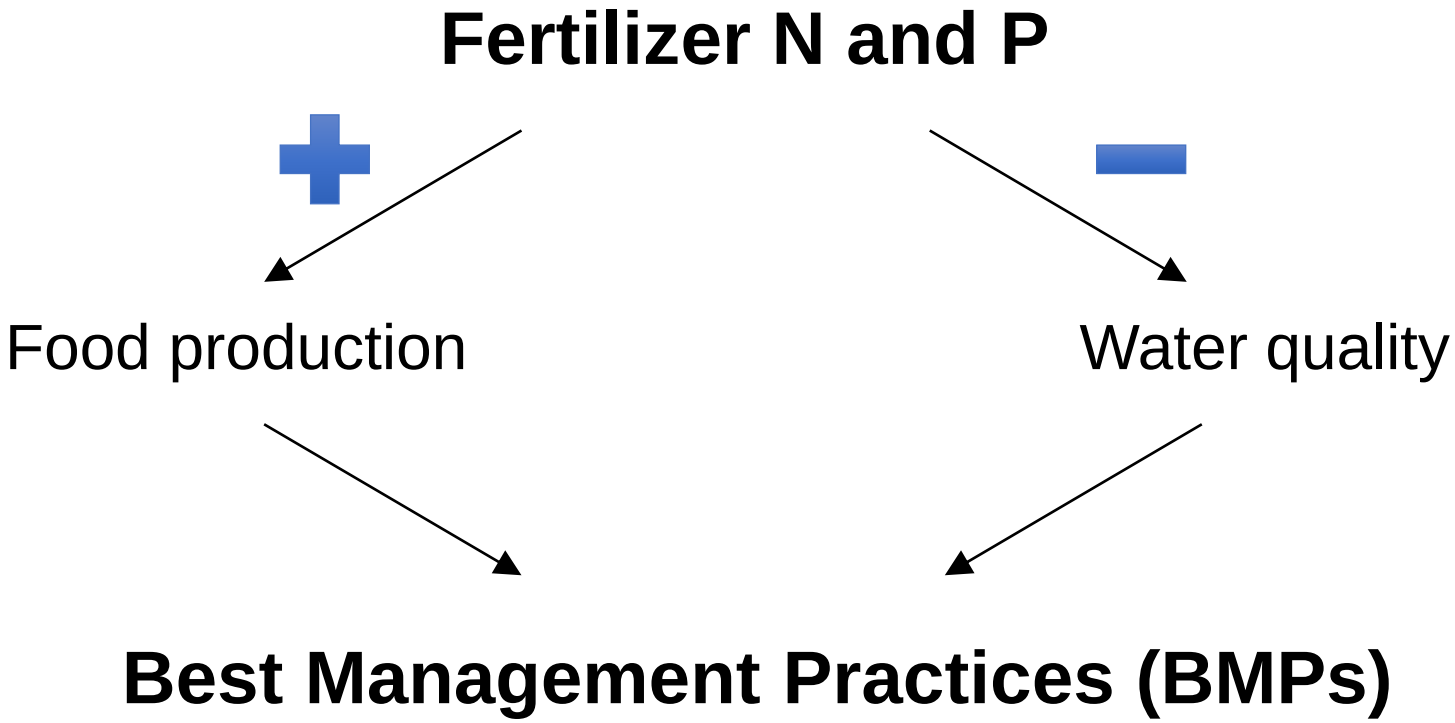


Food Security versus Water Security?



Nitrogen and Phosphorus Legacies

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Nutrient legacies in agricultural landscapes result in ***time lags*** between the implementation of BMPs and measurable water quality improvements.

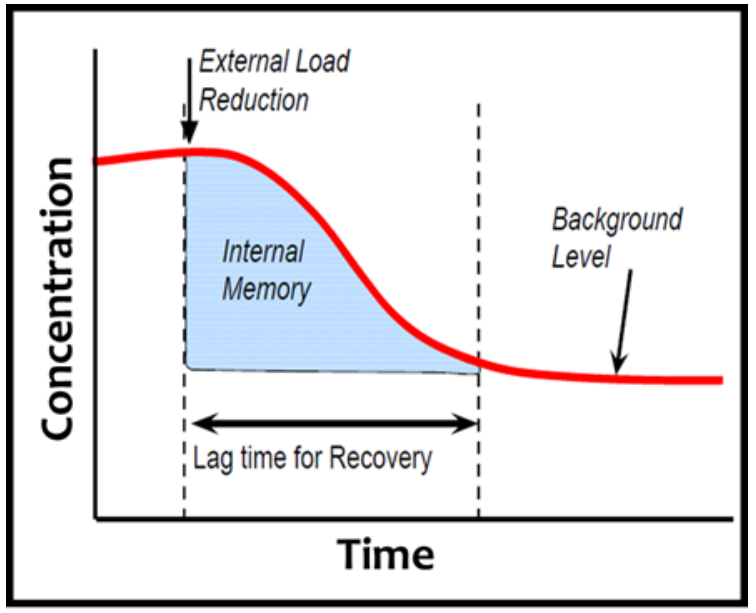

Figure adapted from Reddy et al. (2011)

LEAP: Overarching Questions

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- What is the distribution and fate of nitrogen and phosphorus legacies in agricultural landscapes?
- What is their impact on water quality? What will be their future trajectories?
- How do we account for nutrient legacies when assessing the performance of agricultural best management practices (BMPs)?
- How do we balance the social and economic trade-offs between short- and long-term costs, benefits and risks?

Exemplar Watersheds

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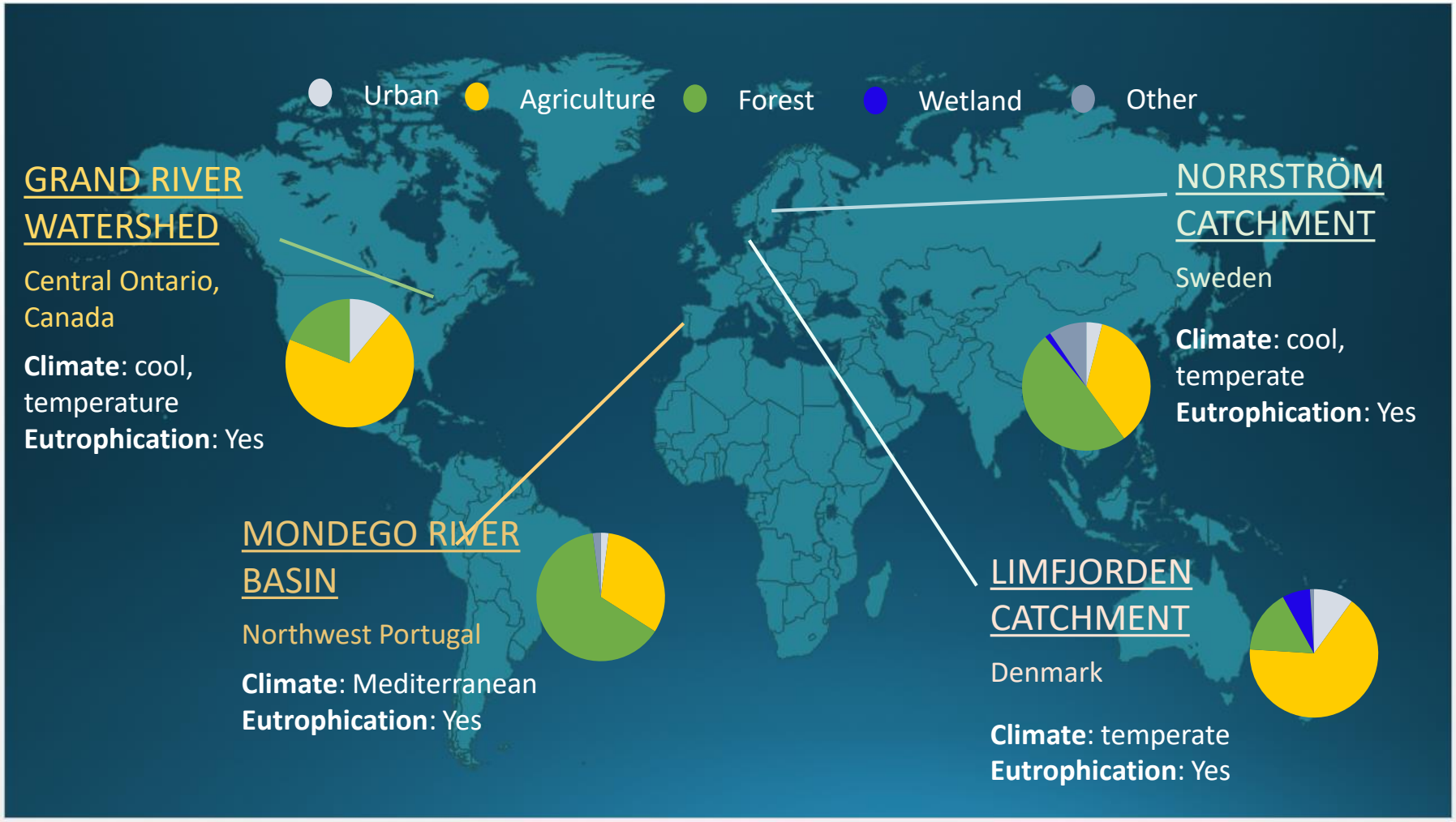

LEAP: International & Collaborative

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- **Shared (global) issue**
  - Water quality impacts of agriculture (focus on eutrophication)
- **Shared hypothesis**
  - Agricultural nutrient legacies delay water quality improvements
- **Shared end-goal**
  - Inform adaptive BMP portfolios that account for legacies
- **Shared toolbox**
  - Data acquisition and analytics, models, comparative analyses
- **Communication & student/staff exchanges**

Project structure

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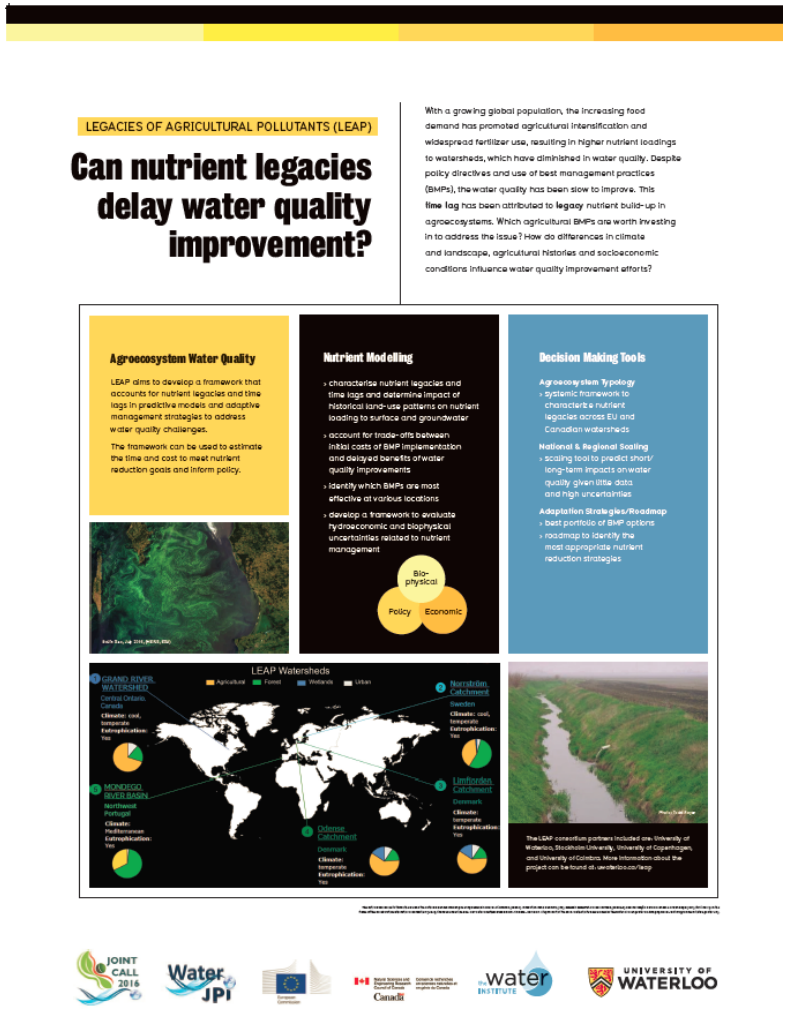
- **WP1: Framing, Coordination and Dissemination**
  - Task 1.1. Scientific framing of LEAP
  - Task 1.2. Knowledge co-creation and mobilization
- **WP2: Biophysical Analyses of Nutrient Legacies**
  - Task 2.1. Historical reconstruction of N and P budgets
  - Task 2.2. Incorporating legacies in watershed nutrient models
  - Task 2.3. Adaptation strategies: water quality benefits
- **WP3: Hydro-Economics of Agricultural Nutrient Legacies**
  - Task 3.1. Ecosystem services: classification and valuation
  - Task 3.2. Hydro-economic decision-support framework
  - Task 3.3. Adaptation strategies: cost-benefit analyses
- **WP4: Uncertainties and Risk Management**
  - Task 4.1. Nutrient legacies: ecological, social and economic uncertainties
  - Task 4.2. Integrating uncertainty and risk in agroecosystem management
- **WP5: Upscaling and Adaptation Portfolios**
  - Task 5.1. Agroecosystem typology
  - Task 5.2. Scaling up to national and regional scales
  - Task 5.3. Formulating adaptation portfolios



Shared Toolbox

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Biophysical analyses	Anthropogenic nutrient inputs (NANI, NAPI) Exploration of Long-tErM Nutrient Trajectories (ELEMeNT) Nutrient trajectories (past and future) Interactive outputs (maps)
Socio-economics analyses	Focus group interviews (Q-methodology) Choice-experiment surveys Ecosystem services valuation Cost-effectiveness analyses of BMPs
Decision support/ stakeholder engagement	Multi-criteria decision analysis (MCDA) framework Vulnerability and risk maps Infographics and policy briefs Stakeholder workshops

Example: Regional Nutrient Maps

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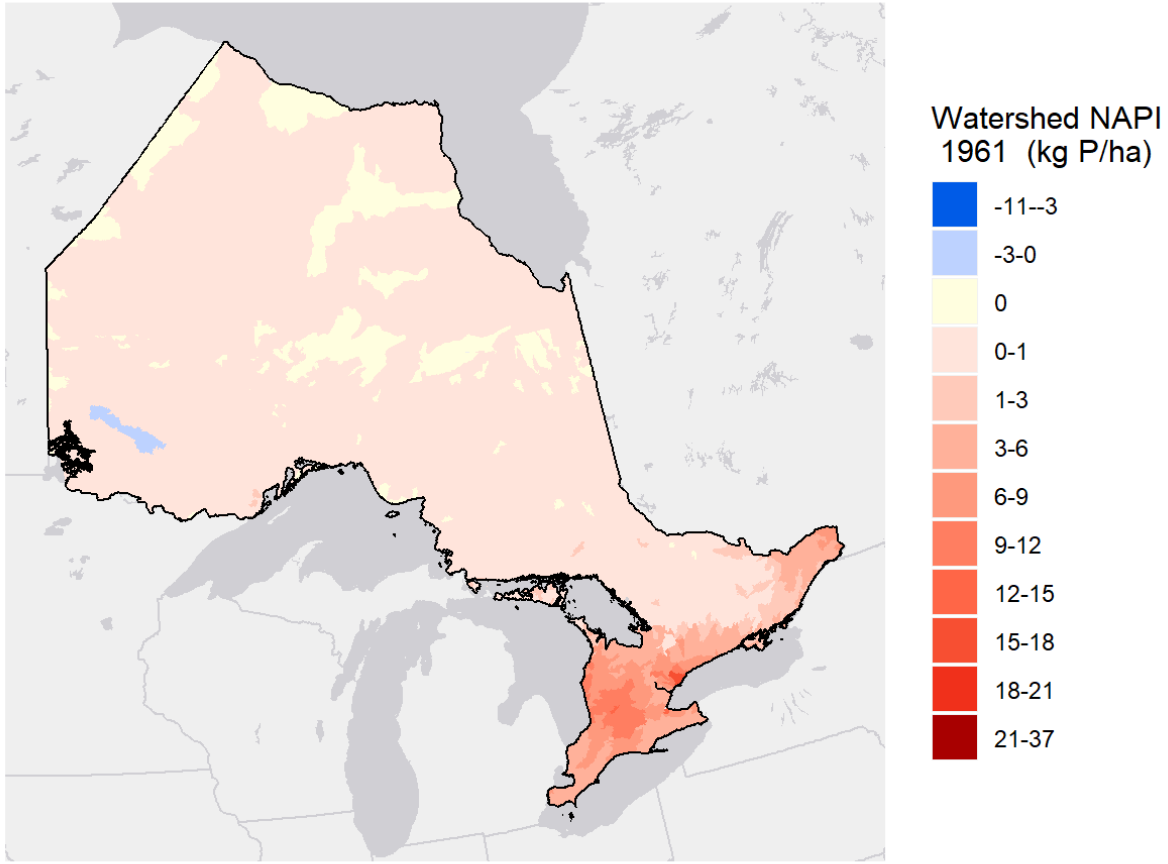

Historical phosphorus (P) inputs from 1961 to 2015 for the entire province of Ontario at a quaternary scale using the Net Anthropogenic Phosphorus Input (NAPI) modeling framework.

Example: Focus Group Interviews

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First round: public knowledge and perceptions about agricultural impacts on water quality (completed).
Second round: prioritization of water quality issues and acceptability of policy interventions (in progress).

Communication

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- Monthly to bi-monthly teleconferences
  - WP progress reports, upcoming activities, publications, news items, action list
- Annual consortium meetings
  - Coimbra, June 12-13, 2017 (kick-off meeting)
  - Niagara Falls, June 11-12, 2018
  - Copenhagen, June 19-21, 2019
  - Stockholm – June 2020
- Website (uwaterloo.ca/leap); LEAP Sharepoint site

Student/Staff Exchanges

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Name	Position	Affiliation	Visit to	Dates
Jan + Jerker	PDF+PI	Stockholm	Waterloo	March/April2018
Benoit	PDF	Stockholm	Chicago	March 2019
Tamara	MSc	Waterloo	Stockholm	April 2019
João	PDF	Coimbra	Waterloo	June 2019
Planned exchanges				
João	PDF	Coimbra	Waterloo	September/October 2019
Benoit	PDF	Stockholm	Waterloo	Fall 2019
Ruchi	PDF	Waterloo	Copenhagen	Spring 2020

Annual Meeting 3

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Copenhagen, June 19-21, 2019

Annual Meeting 3: Questionnaire

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- What is the added value to your research of participating in an international consortium?
- What are the main challenges and/or obstacles facing international research cooperation?
- Is there enough time, interest and funding to fully develop the international dimension of your research within LEAP?
- How can LEAP partners continue collaborating beyond the current funding cycle?
- How can local stakeholders benefit from international research initiatives and programs?
- How can the diversity of local conditions in the partner countries advance your research?

Some Answers …

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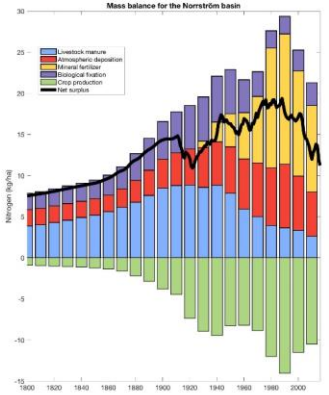
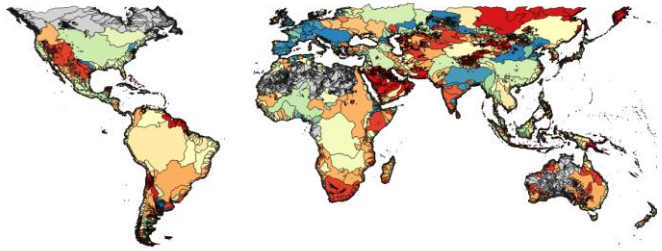
- “My experience with the research exchange was highly productive and inspired more creative approaches to my research. I believe this is a direct result of different cultures coming together to address larger problems.”
- “Maintaining long-term international collaborations require time and financing, both which are in short supply.”
- “The international dimension of my research developed over the course of a one-month research exchange. This was enough time to generate ideas and exchange knowledge for a sub-project that is resulting in its own publication.”
- “Some of us will surely continue collaboration on new projects and papers.”
- “Local stakeholders benefit from the broader perspectives provided by international collaborations. It is crucial, however, for the project researchers to cultivate local connections with stakeholders and to contextualize the collaborative research knowledge so that it addresses the stakeholders’ (local) needs.”
- “Comparative analyses among our different catchments help reveal broader trends, assess transferability of models (conceptual and quantitative), reveal limitations in approaches. In general, the more diversity can be captured by the research, the more impactful it is.”
- “Funding agencies should clearly formulate their expectations for international cooperation. To me, it is important that the time and effort devoted to joint international research yield tangible added value for the junior researchers involved.”

Thank You!





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