

# FROM WASTE LAND TO RETENTION ECOSYSTEM, A SUCCESSFUL LIVING LAB ADVENTURE

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## INTRODUCTION

New paradigm of agroecosystem living laboratories, integration of 3 components (McPhee et al., 2021):

- 1) Transdisciplinary approaches,
- 2) Co-development and innovation with stakeholders and participants, and
- 3) Monitoring and research activities on site.

### Project

Hydro-agricultural ecosystem co-designed and co-developed by the producer and participants from diverse disciplines to limit sediment transport to the Lake Saint-Pierre, a specific objective of the Living Lab Quebec (2019-2023).

Research activities were performed on site, with

- Technological showcase enhancing knowledge circulation among farmers



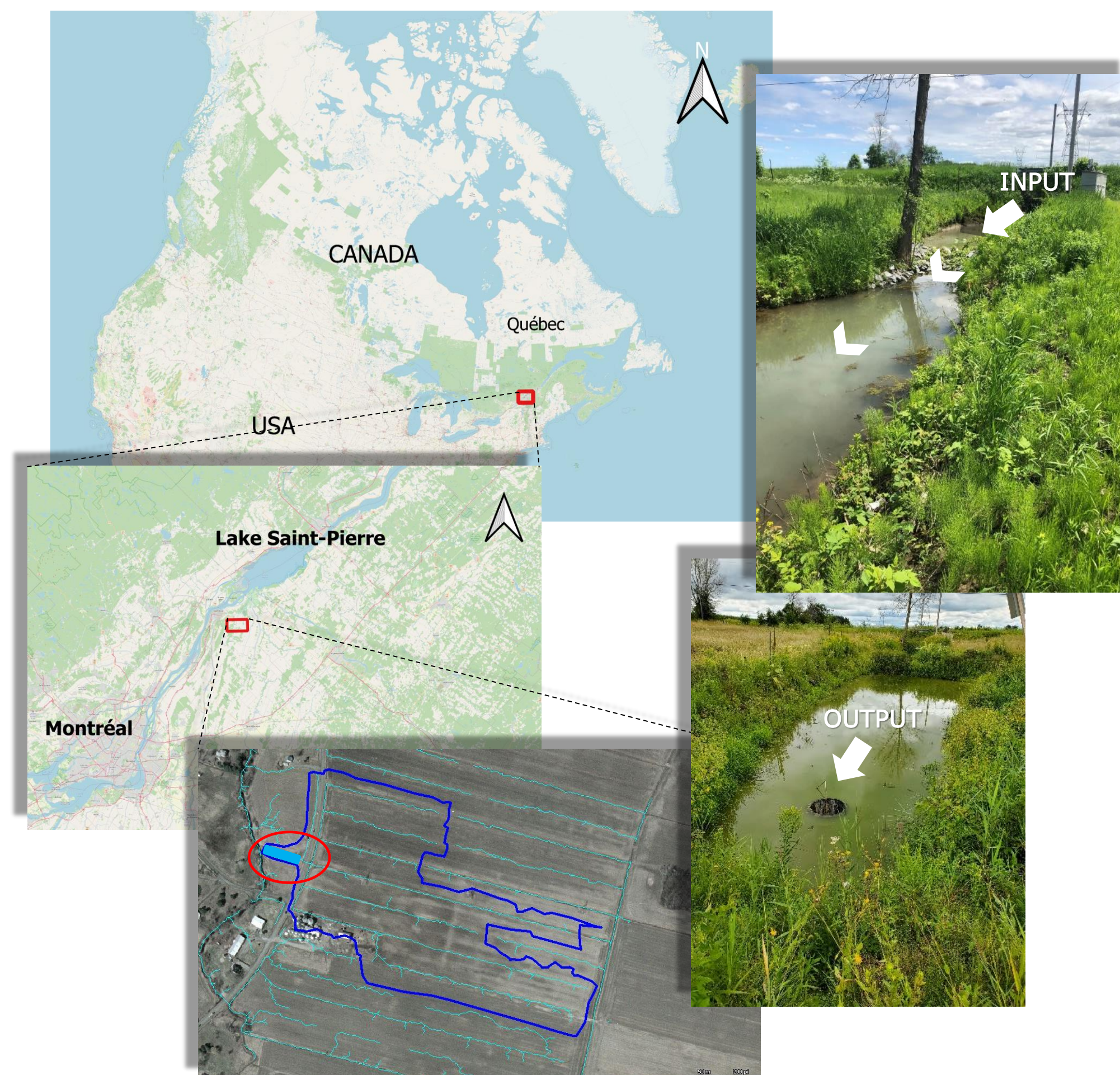
Paul Caplette, producer (Céréales Bellevue)



Pictures: UPA Montérégie

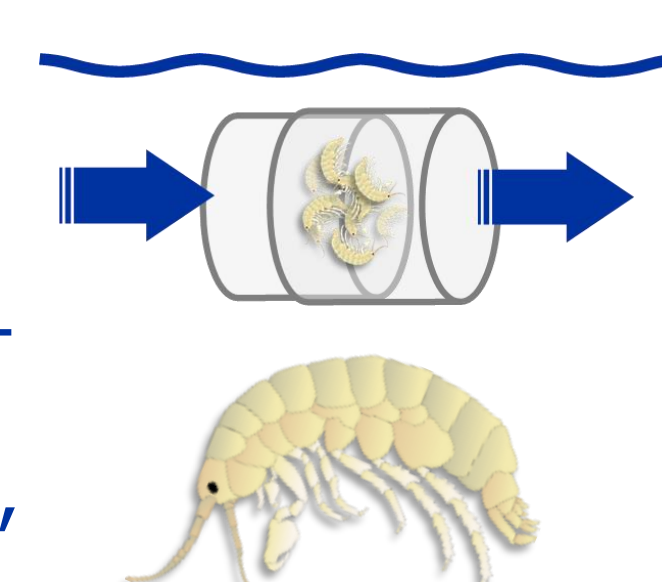
## OBJECTIVES

- 1) Present the ideation and co-development processes of this project, which became part of the Living Lab Quebec adventure, and
- 2) Highlight the scientific and the producer knowledges that supported the adoption of this beneficial management practice.



## METHODOLOGY

- INPUT and OUTPUT basins instrumented from October to late-November 2021, and from late-March to mid-November 2022.
- Water quality: N (total-N, NH<sub>4</sub>, NO<sub>3</sub>), P (total-P, DRP, DOP, TPP), total suspended sediments (TSS), pH, and electrical conductivity (EC).
- Pesticide analysis in surface water from late May to early August and from early September to late October 2022, and in sediments of the INPUT and OUTPUT basins in December 2021, May and November 2022 and June 2023.
- Surface water toxicity using amphipods (*Hyallela azteca*) caged in the INPUT and OUTPUT basins for 14 days, in June, July, August and October 2022.



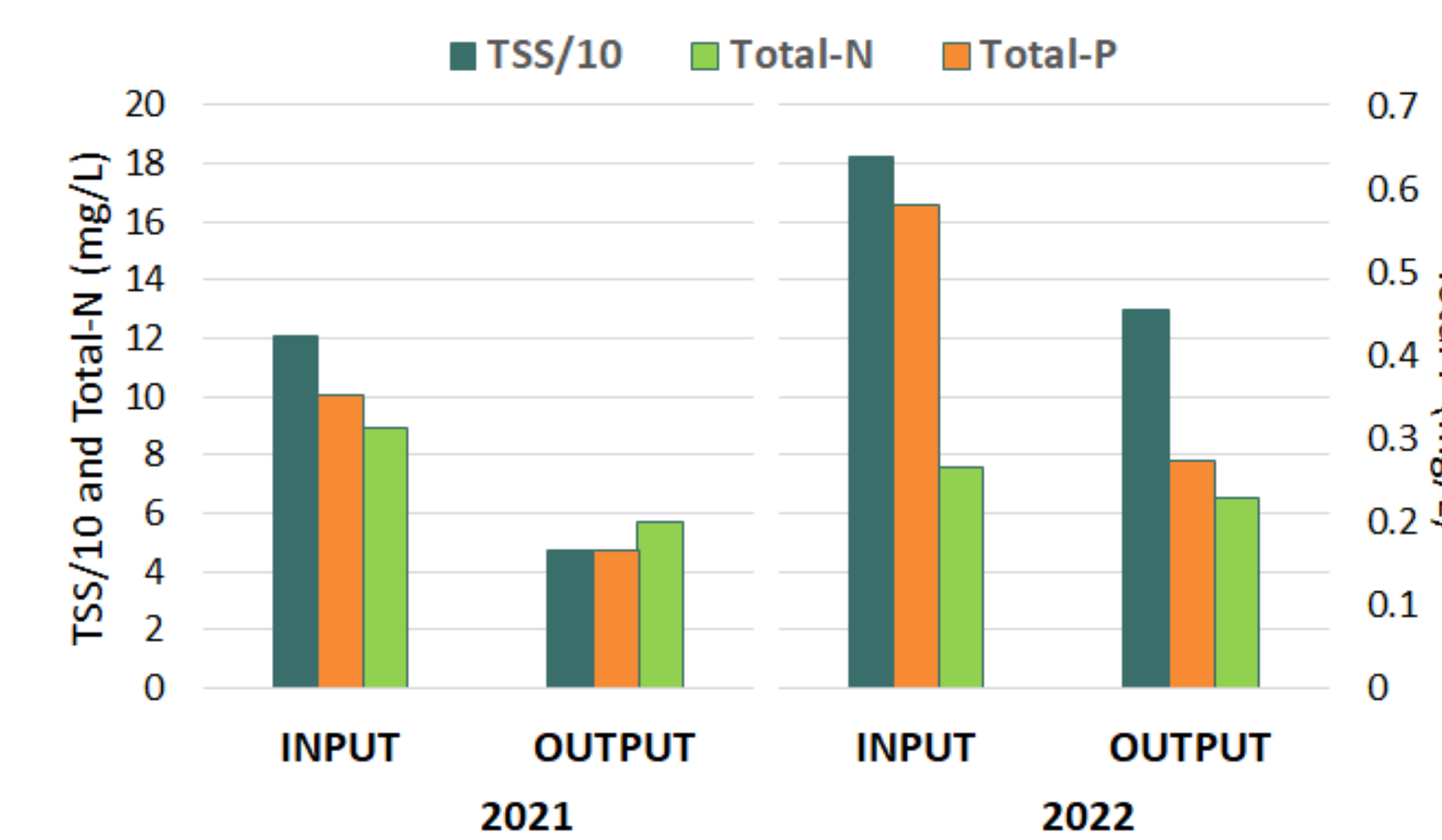
## LIVING LAB PROCESS

- 1) Iterative field meetings and co-development sessions, sketches of the system were exchanged, creation process accomplished with the support of agronomists and local advisors.
- 2) Scientists came later in the process to characterize the efficiency of the sedimentation pond. Part of Living Lab Quebec (2019-2023)!

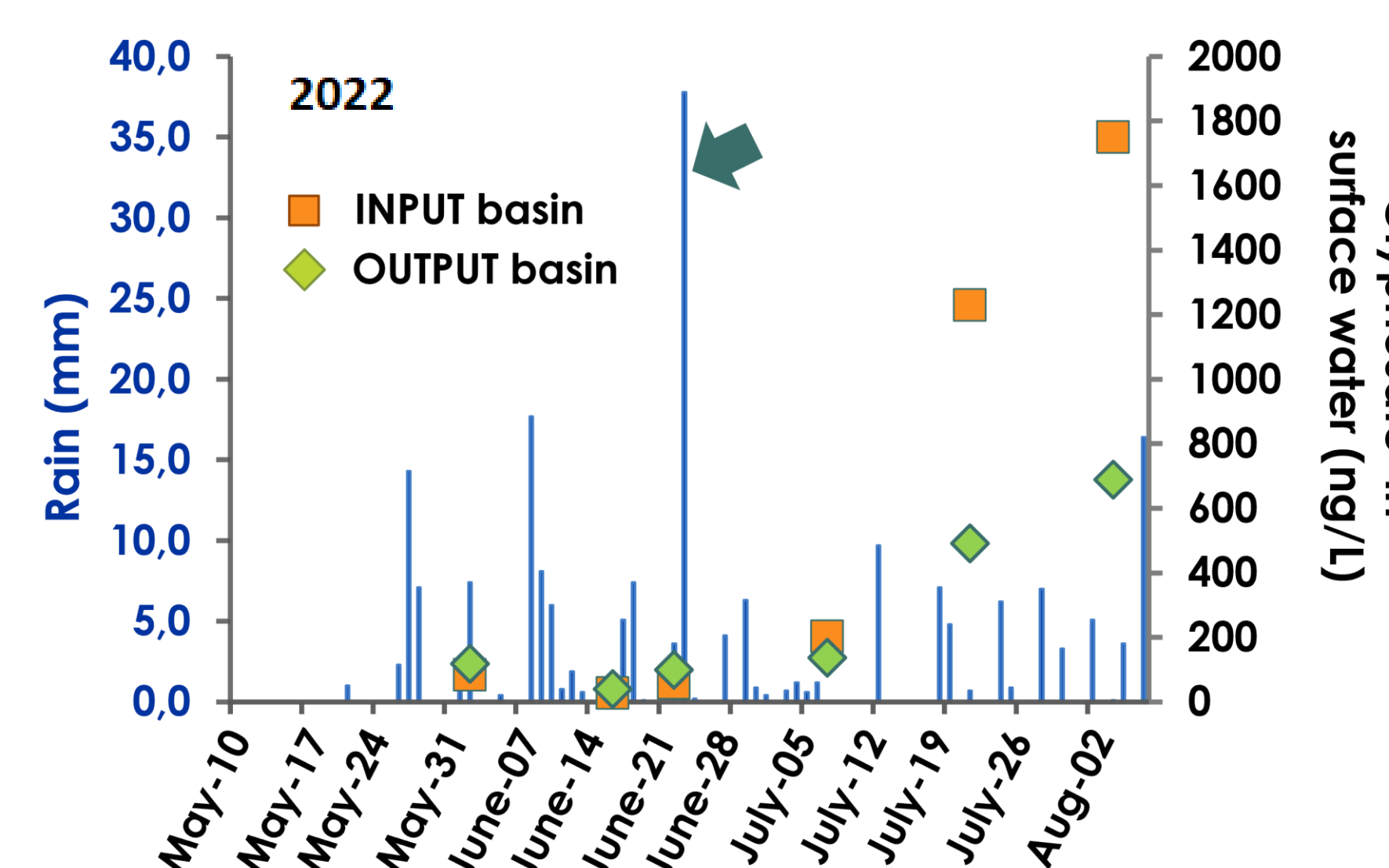


Pictures: UPA Montérégie

## Water quality



## Pesticides



## FINDINGS / DATA

- Positive effect on **water quality**, reducing:
  - TSS by about 3 (2021) and 1.5 (2022) times,
  - Total-P from 0.35 to 0.17 mg/L (2021) and 0.58 to 0.27 mg/L (2022),
  - Total-N from 8.91 to 5.67 mg/L (2021) and 7.56 to 6.57 mg/L (2022).
- More pesticides detected in the INPUT basin (30) compared to the OUTPUT basin (23). Herbicide (glyphosate, metolachlor, dimethenamid) concentrations in surface water reached lower levels in the OUTPUT basin relative to the INPUT basin, by July 2022 when flow decreased, and temperature increased.
- Higher concentrations of the herbicide glyphosate in sediments of the INPUT basin (160 to 20 000 ug/kg) compared to the OUTPUT basin (27 to 2 200 ug/kg). Same pattern observed for the degradation by-product of glyphosate (AMPA).
- Survival of caged amphipods was higher and more stable throughout the season in the OUTPUT basin (mean 86%; min-max 70-93%) compared to the INPUT basin (mean 61%, min-max 20-85%).

## CONCLUSIONS

- Preliminary results suggest that this constructed ecosystem is efficient in reducing the levels of nutrients and suspended sediments and may also dilute peak concentrations of pesticides, thus potentially improving downstream water quality
- The scientific knowledge gained through this living lab initiative will inform policy and contribute to the development of a regulatory framework that encourages the adoption of such innovation at a larger scale.