USING PLANT FUNCTIONAL TRAITS TO IDENTIFY PERFORMANT FORBS AND SHRUBS FOR WATER MANAGEMENT AND CARBON SEQUESTRATION

Guillaume Grégoire, Ph.D. agr
Bérenger Bourgeois, Ph.D.

Professeurs agrégés, Université Laval

Partenariat canadien pour une agriculture durable

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Presentation plan

- Project context
- Bioretention systems
- Plant functional traits
- Methods
- Project funding

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Project context

- Bioretention systems are increasingly used by municipalities across Canada
  - Growing market for nursery growers
- Since 2020: collaboration with Geneviève Pelletier (ULaval) and Sophie Duchesne (INRS) – water engineers
  - Monitoring stormwater management systems on-site (hydrology, environment, plants and growing media)
  - Partnership with 10 municipalities in Qc

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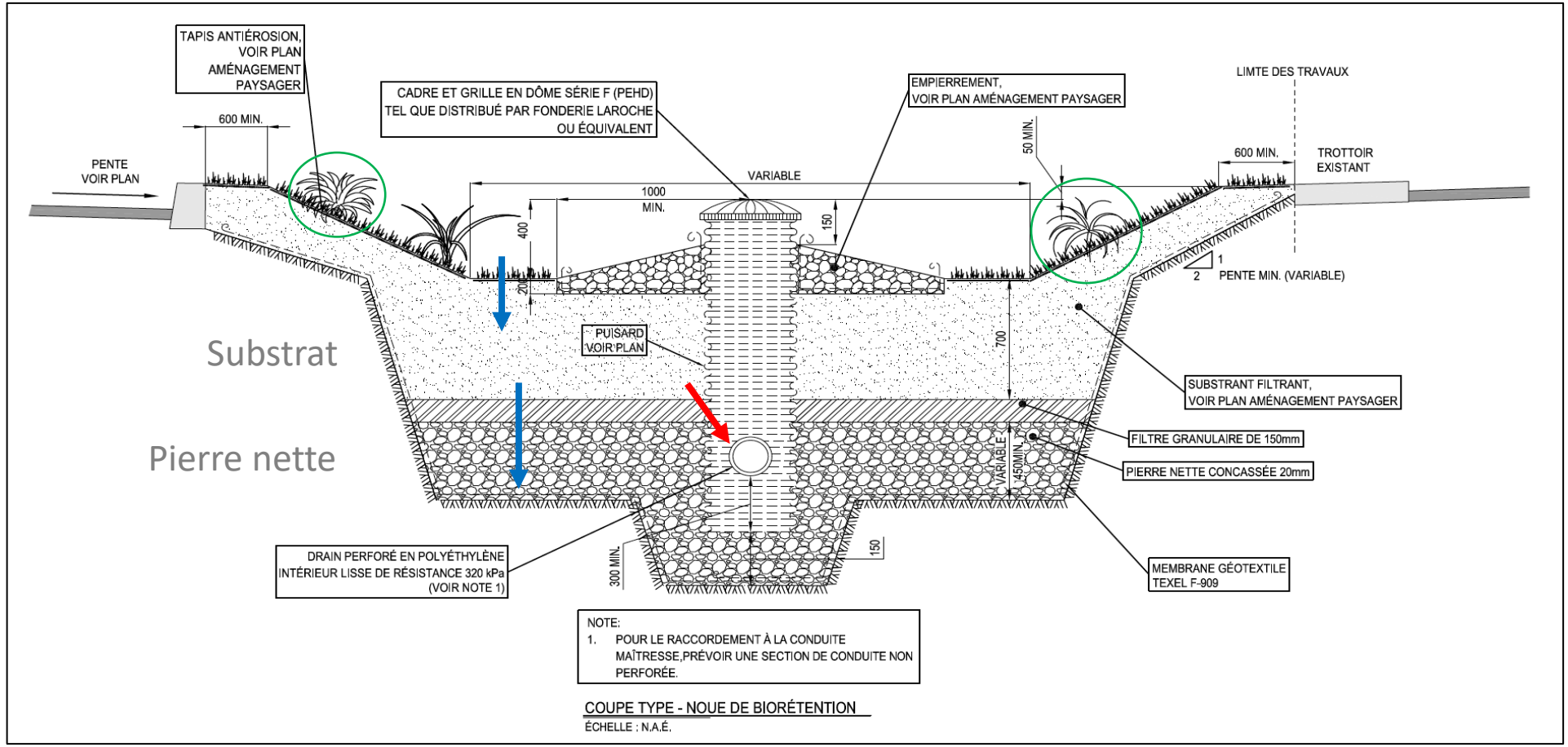
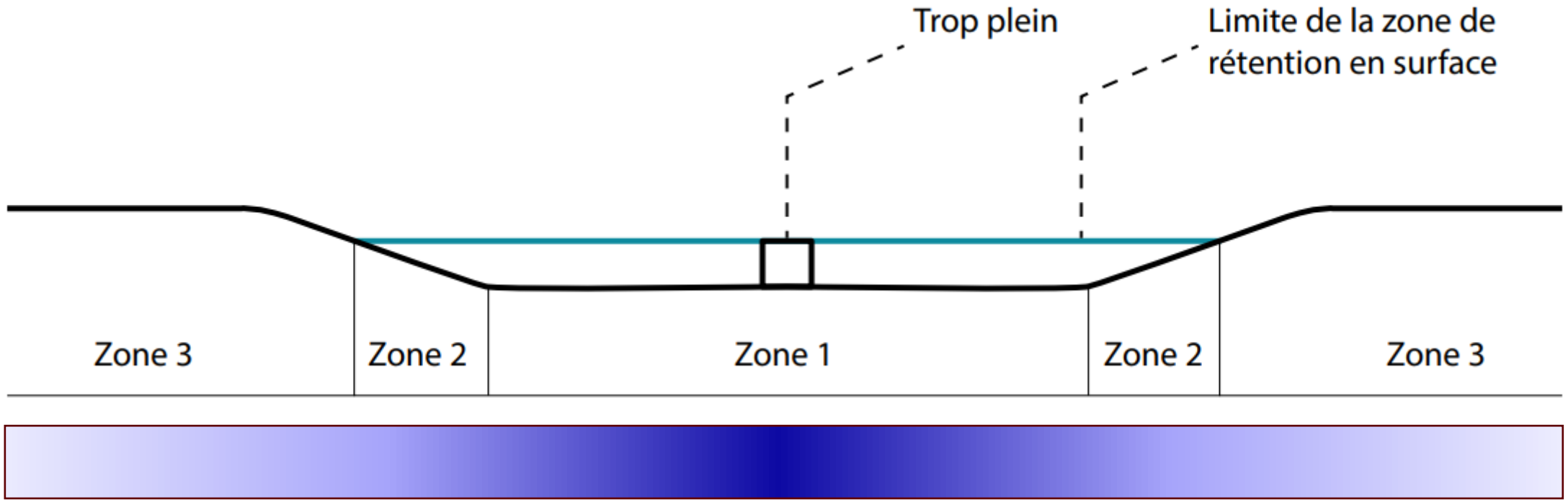
Project context

- Plant selection usually based on
  - Landscape architect experience
  - Ornamental considerations
  - Plant origin (i.e. native vs exotic)
  - Availability from growers
- Very little data on plant performance
  - High transpiration during rain events
  - Drought tolerance between rain events
  - Secondary benefits (carbon sequestration, cooling-down effects, aesthetics value, food and habitat for animals and insects, etc.)

Bioretention systems



Bioretention systems



(SQP, 2018)

Water availability:

High

Low

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Different types of bioretention systems

Cell

Swales

Rain gardens

Tree wells

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Functional traits

Definition:

measurable morphological, physiological, phenological, or behavioral characteristics of an organism that impact its fitness, survival, growth, and reproduction. They determine how organisms respond to environmental factors (response traits) and their influence on ecosystem processes (effect traits) (Diaz et al., 2013)

Examples:

- Specific leaf area (SLA)
    - Leaf area per dry mass unit (mm^2 / mg)
    - High SLA: thin leaves-> acquisition strategy : fast growth (rich environments)
    - Low SLA: thick leaves -> conservation strategy: stress tolerance (low resource environments)

Functional traits

- Functional approach: increasingly used for plants in natural habitats
  - Databases: TRY, TOPIC, GRooT
- Little data on cultivated plants
- Advantages:
  - Based on ecological functions instead of arbitrary aspects
  - Possibility to create plant communities with complementary functions
  - Can be used in different climates
  - Can help identify alternative plants in case of low availability

Methods (2025-2026)

- Litterature review to identify plants used in bioretention systems (ongoing)
  - Appendix B, Landscape Design Guide for Low Impact Development, Credit Valley Conservation. 2010
  - Société québécoise de phytotechnologie, Fiches techniques de la SQP. Les biorétentions. 2018
  - Carnet indigène les phytotechnologies, Aiglon Indigo. 2019
  - Répertoire de végétaux pour les infrastructures végétalisées – Version préliminaire Biorétention, Québec Vert. 2025
  - Past research projects @ULaval
- Growers and IQDHO consultations (done)
- Objective: identify 30 shrub and 30 forb species that have been used or have a good potential (ongoing)

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Preliminary lists

Shrubs

Zone	Species
Low	*Viburnum dentatum*
Variable by cultivar	*Spireae japonica*
High	*Rubus odoratus*
?	*Hydrangea paniculata*
Low	*Myrica gale*
Low	*Physocarpus opulifolius*
Low	*Aronia melanocarpa*
Low	*Hypericum kalmianum*
High	*Symporiocarpos albus*
Low	*Cornus stolonifera (cornus sericea)*
High	*Diervilla lonicera*

Forbs and graminoids

Zone	Species
High	*Achillea millefolium*
High	*Nepeta x faassenii*
?	*Chelone obliqua*
Variable by species	*Hemerocallis*
Low	*Iris sibirica*
Low	*Asclepias incarnata*
Low	*Verbena hastata*
Low	*Anemone canadensis*
High	*Aquilegias canadensis*
High/Low	*Symphyotrichum novae-angliae*
High	*Elymus canadensis*
Low	*Deschampsia cespitosa*
High/low	*Panicum virgatum*

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Methods (2026-2027)

- Measuring functional plants on species from list in:
  - Bioretention systems already in use
  - Growers fields
  - Plants grown in containers (for root traits)

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Methods (2026-2027)

- Functional traits to be measured:
  - Above-ground biomass (AGB)
  - Root biomass (RB), Ratio AGB/RB
  - Growth rate
  - Root length and fine root proportion
  - Leaves dry matter content
  - Wood density (shrubs only)
  - Specific leaf area
  - Leaves C:N ratio
  - Litter C content
  - Ashes C content

For a subgroup of species, traits will be measured in different cultivars

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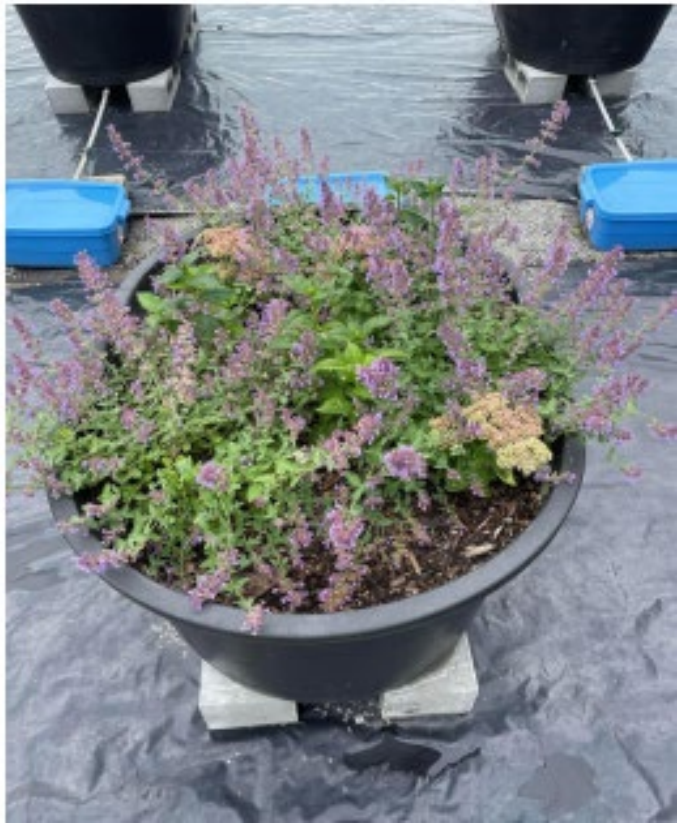
Methods (2027-2028)

- Greenhouse/high tunnel trials based on results from previous year
  - « Water » traits
  - « Carbon traits »
  - Mixed traits
- Measuring pant performance on
  - Water losses
  - Leaching
  - Carbon accumulation potential



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Project Funding

- Total budget of 446 000$
  - 67% AAFC
  - 33% partners
- Collaboration with IQDHO for KTT activities
- Project partners:

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Questions?

guillaume.gregoire@fsaa.ulaval.ca

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