



Ph. D Position: Economic benefits of integrating grasslands into crop rotations for perennial forage production in Quebec.

Summary:

The forage crop production sector remains a cornerstone of Quebec agriculture, directly supporting both the dairy and beef industries. However, recent data indicates a shift in cropping systems: between 2016 and 2020, hay acreage declined by approximately 8%, while silage corn acreage increased by 16%. This trend, also observed across Canada and the United States, raises concerns about the capacity of Quebec's forage sector to sustain its agronomic, economic, and environmental performance. These challenges are particularly significant as they align with the objectives of Quebec's Sustainable Agriculture Plan and the Canadian Agricultural Partnership for Sustainable Agriculture. Scientific literature clearly demonstrates that integrating grasslands into crop rotations significantly enhances ecosystem services, including carbon and nitrogen sequestration, reduced nitrogen losses, improved soil health, biodiversity conservation, and climate change mitigation. Recent findings further indicate that extending the duration of grasslands during crop rotations—particularly permanent grasslands—maximizes carbon gains compared to temporary grasslands. The multidisciplinary research project entitled "Assessing and Modeling the Benefits of Extending Grasslands in Crop Rotations for Perennial Forage Production in Quebec" aims to support both individual and policy decision-making (see Fisher et al. 2008; Tinch et al. 2019) by providing a quantitative assessment of productivity and economic gains derived from ecosystem services generated by the forage crop sector. Ultimately, the project seeks to contribute to strengthening the sustainability of Quebec's bio-food sector.

The overall objective of the project is to evaluate the agronomic, economic, and ecosystem benefits associated with integrating grasslands into crop rotations for perennial forage production in Quebec. Considering spatial heterogeneity as well as the diversity of forage farms and soil types, the project aims to demonstrate the crucial role of rotational grasslands in delivering ecosystem services. More specifically, the project builds upon previous work by Pellerin et al. (2015), Chantigny et al. (2017), MacDonald et al. (2011), Rochelle et al. (2004), as well as ongoing research on soil health, conservation, and economics in forage production systems. First, we will assess the effect of the proportion of grassland in crop rotations on soil carbon storage and soil health under different rotation schemes. Second, we will model and simulate the economic and ecosystem performance of each rotation scenario, drawing on studies such as Bamière et al. (2023), Lal (2014), and Hosseini-Yekani et al. (2024). This PhD project will primarily rely on the ecosystem services assessment framework for agricultural soils (e.g. Dominati et al. 2017; Garcia 2023; Channe 2025).

Ph. D Research Objectives: This Ph.D project aims to model, assess, and compare the economic performance of different grassland-based rotation systems in perennial forage production in Quebec. More specifically, the PhD aims to:

- Develop robust methods for the economic valuation of ecosystem services and design a mathematical programming model adapted to the farm level.
- Simulate and compare the economic performance of different rotation scenarios, accounting for spatial heterogeneity, soil types, and farm diversity.
- Propose suitable agricultural policy instruments to enhance the sustainability of the perennial forage production sector in Quebec.

Location: The selected candidate will be based at the Institut de recherche en agriculture et agroalimentaire (IRAA) of the Université du Québec en Abitibi-Témiscamingue (UQAT). The IRAA is located at UQAT's Témiscamingue Centre in Notre-Dame-du-Nord, approximately 45–60 minutes from the main campus in Rouyn-Noranda.

Financial Support: The selected Ph. D student will receive a scholarship of CAD \$25,000 per year for three years. Financial support for participation in conferences and scientific meetings is also provided.

Candidate Profile: The selected candidate must hold, or be in the process of completing, a master's degree (M.Sc.) in Agricultural Economics. Strong skills in critical thinking, synthesis, analysis, and academic writing are required. The ideal candidate should demonstrate initiative, intellectual curiosity, and a capacity for critical reflection.



Experience in empirical modeling, as well as in conducting surveys and structured interviews with key stakeholders, is considered an asset. Proficiency in quantitative analysis software such as R, Python, and GAMS is also desirable. The ideal candidate should be capable of working independently as well as effectively within multidisciplinary teams.

We strongly encourage applications from individuals belonging to underrepresented groups in research.

Project Start Date: January 2027

Contact Persons: Please submit a cover letter, curriculum vitae, and academic transcripts to:

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