Grazing System Effects on Carbon Sequestration & Storage, Greenhouse Gas Emissions & Biodiversity in Canadian Prairies

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Study Rationale

The temperate grasslands of North America rate amongst the most threatened, yet least protected biomes globally. Agricultural conversion and industrial development have substantially reduced the extent of native grasslands, while unsustainable livestock systems continue to compromise ecosystem health, goods and services. Natural and sustainably managed grassland ecosystems, on the other hand, hold enormous potential for sequestering and storing carbon as well as safeguarding biodiversity. As such, they are critical towards building climate change resilience and addressing two major global crises: the biodiversity and climate crises.

The Agricultural Greenhouse Gases Program (AGGP) is a 5-year research study that aims to evaluate the carbon sequestration and storage potential of Adaptive Multi-Paddock Grazing (AMP) compared to a spectrum of alternative grazing systems (Fig.1). AMP grazing is characterised by intensive, short-duration grazing pressure across a relatively small paddock, combined with an extensive biomass recovery period. This modified rotational grazing system mimics the dynamics of natural bison-grazed prairie grasslands towards more sustainable practices.

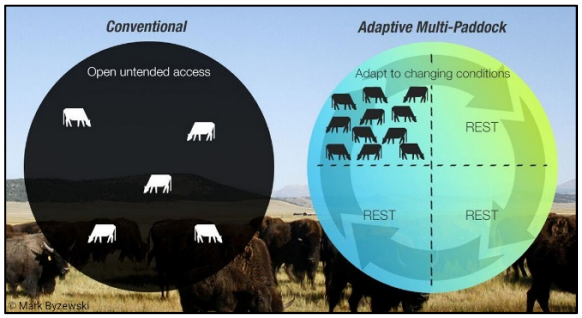

Figure 1. Illustration of Adaptive Multi-Paddock Grazing.

The ultimate goal of this project is to develop provincial level carbon quantification protocols for use in the carbon offset market for grazed and pastured grasslands in Canada. Such schemes would recognize the atmospheric carbon reduction benefit of improved grazing practices and incentivise the long-term conservation of threatened grassland ecosystems.

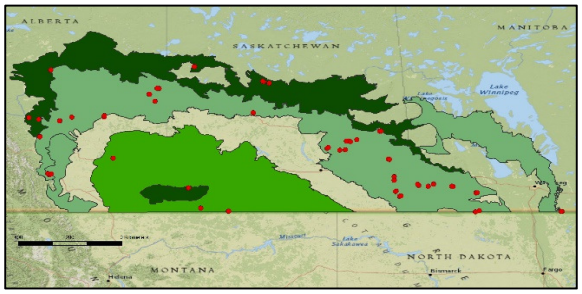

Figure 2. Map of study ranches across the Canadian prairies.

Materials and Methods

Biophysical and grazing management data have been collected from over 60 livestock-grazing ranches over the past three field seasons by an interdisciplinary team of researchers at the University of Alberta, and supported by external collaborators. Ranches are distributed throughout the Canadian prairies, spanning gradients in climate, soil, vegetation and land management (Fig. 2). We used a paired design, whereby AMP ranches were matched with more conventional grazing neighbours. Measured variables include soil carbon stocks and accrual rates, greenhouse gas emissions and albedo, water infiltration rates, above- and below-ground plant biomass, enzyme activity, microbial community and function, and avian biodiversity. Data analyses are currently underway.

Acknowledgements

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