Carbon Benchmarking in Alberta Grasslands

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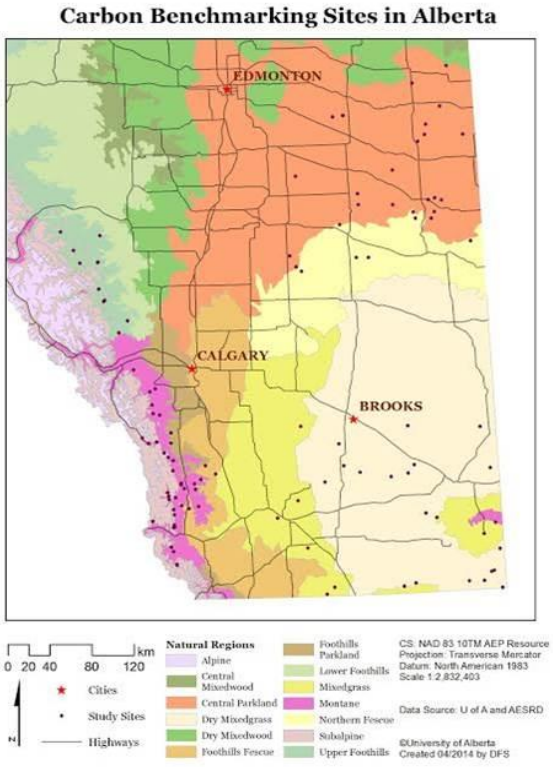
A team of researchers from across Alberta, including the University of Alberta, Agriculture and Agri-Food Canada, and Alberta Environment and Parks, recently completed a study evaluating the long-term effects of ongoing exposure to cattle grazing on EG & S derived from public lands at 114 sites. This investigation, supported by the Alberta Livestock and Meat Agency and the Provincial Rangeland Management Branch, provided unique insight into how grasslands across widely varying agro-climatic zones respond to livestock grazing, including changes in plant biomass, diversity, and carbon stocks. Grazing was associated with increased grassland diversity in areas with intermediate rainfall (i.e. Parkland and Foothills Fescue), and boosted grassland shoot and root biomass in wetter Montane environments of SW Alberta, a response that coincided with an increased presence of introduced plant species. The diversity of introduced plant species within grasslands of other regions appeared to be relatively unresponsive to grazing. Across all regions, long-term grazing tended to increase soil organic carbon mass, with considerable carbon stored in the surface organic mulch layer of grassland ecosystems. Notably, grazing was also associated with lower shrub cover in foothill grasslands and could be an important mechanism to help conserve grasslands threatened by shrub encroachment.



Study sites sampled covered a wide range of soil, climatic and vegetation conditions, including the Upper Foothills, Montane, Foothills Fescue, Aspen Parkland, and both the Mesic and Dry Mixedgrass.

Comparison of native grasslands with alternative agricultural land uses, such as introduced pasture and cropland, revealed the former had up to 1.6 times greater total carbon mass, improved soil structure, and a superior ability to deliver water during periods of moisture stress. The value of carbon currently retained in native grasslands of Alberta was estimated to exceed $ 9B. This value is derived using current market values for CO_2 based on compliance costs for large emissions and current areas of each land use. Conversely, the value of carbon already lost by past land use conversion is much larger at nearly double this figure.

In summary, results from this project highlight both the importance of native grasslands and the compatibility of livestock grazing in maintaining, and sometimes increasing, a variety of environmental goods and services, including forage production, biodiversity and ecosystem carbon storage. While mechanisms exist to reward crop farmers and feedlot operators to reduce their carbon footprint, currently there is no market mechanism for native grassland managers to benefit from enhanced carbon stocks. This study provides an improved baseline to inform regulators and policy makers on the role of grasslands in providing these EG & S, including directing future strategies for valuing existing carbon stores. For more information, contact Dr. Edward Bork (edward.bork@ualberta.ca).

Example of a long-term rangeland reference area used to examine the long-term effect of cattle grazing.

Native grasslands such as this plains rough fescue community appear critical in storing carbon and reducing greenhouse gases, particularly within surface mulch and organic matter enriched soil.

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Hewins, D.B., Lyseng, M.P., Schoderbek, D.F., Alexander, M., Willms, W.D., Carlyle, C.N., Chang, S.X., Bork, E.W. 2018. Grazing and climate effects on soil organic carbon concentration and particle-size association in northern grasslands. Scientific Reports 8(1336): DOI: 10.1038/s41598-018-19785-1.