

A 'Synoptic' Approach to Carbon Benchmarking in Alberta Grasslands

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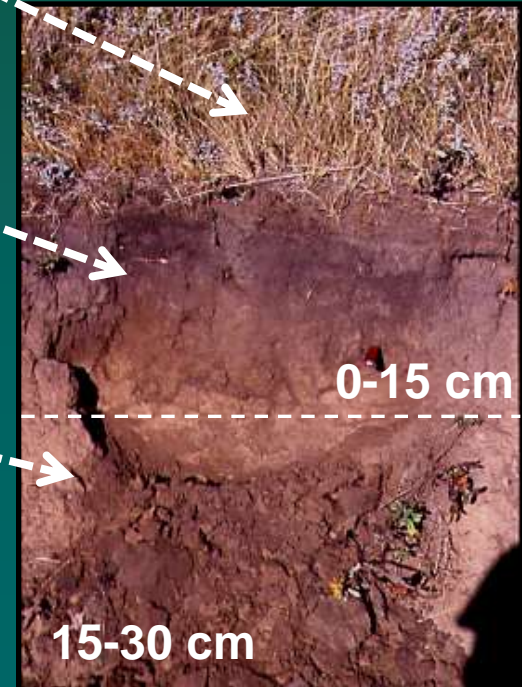
The logo for the Government of Alberta, featuring the word "Alberta" in a stylized, cursive font.

Environment and Sustainable
Resource Development

The logo for the Alberta Livestock and Meat Agency (ALMA), featuring the word "ALMA" in large, bold, orange capital letters, with "Alberta Livestock and Meat Agency Ltd." in smaller orange text below it.

Study Objectives

- 1) Quantify the size of C pools in Alberta grasslands
- 2) Differentiate among C stores in various compartments:
 - Vegetation (litter, mulch, shoots & roots)
 - Soil organic matter (including size fractions)
 - Inorganic C

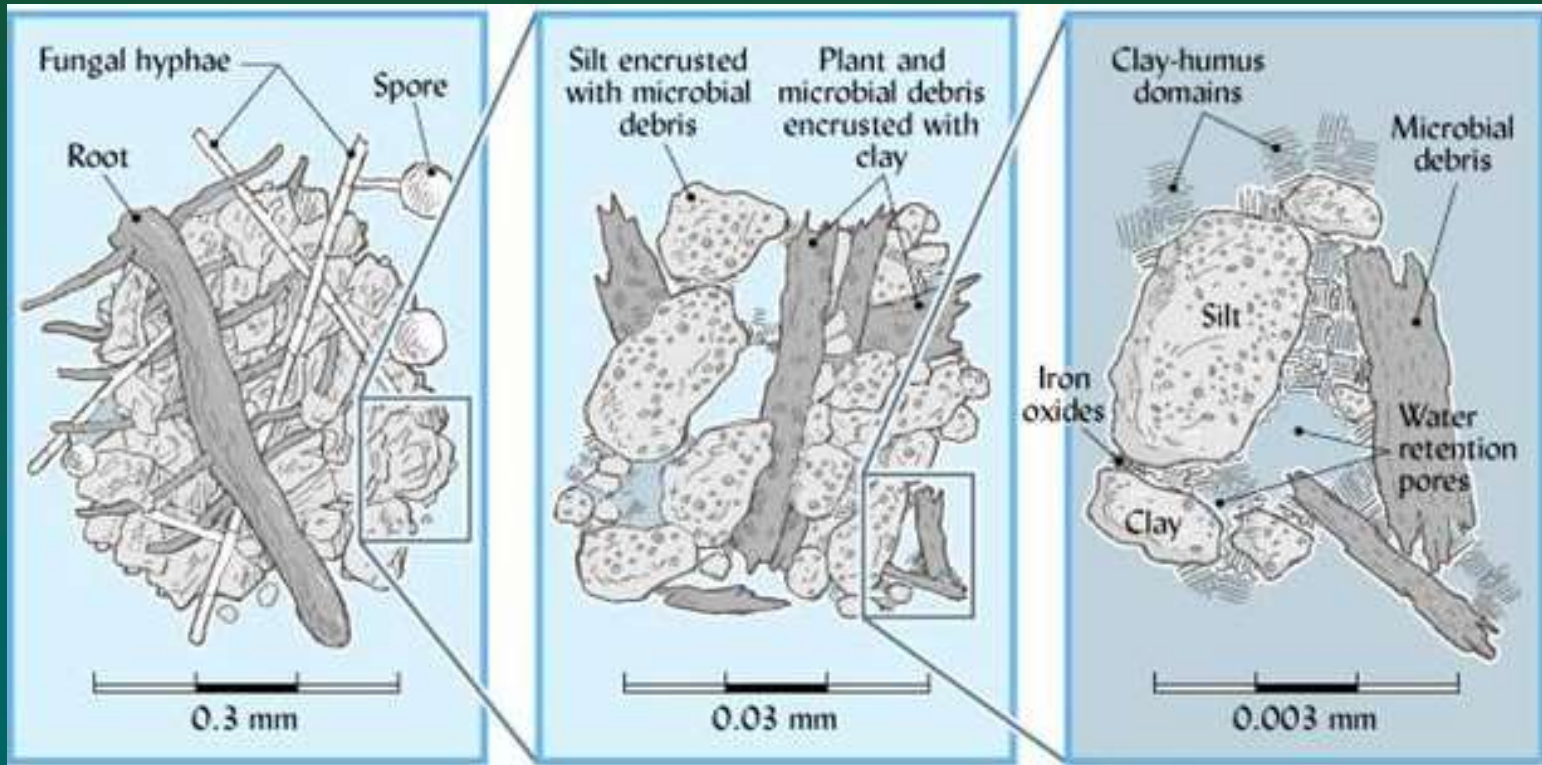


Particle Size & Carbon Protection

Macro-aggregates
(less stable C)

Micro-aggregates

Primary Particles
(more stable C)



From Brady & Weil, *Elements of the Nature and Properties of Soils*, 2nd edition.

Study Objectives (cont.)

- 3) Interpret the size and stability of C pools based on inherent soils, climate, vegetation composition, etc.



Mixedgrass



Aspen Parkland



Foothills Fescue



Montane



Study Objectives (cont.)

4) Determine whether C stores differ with land use:

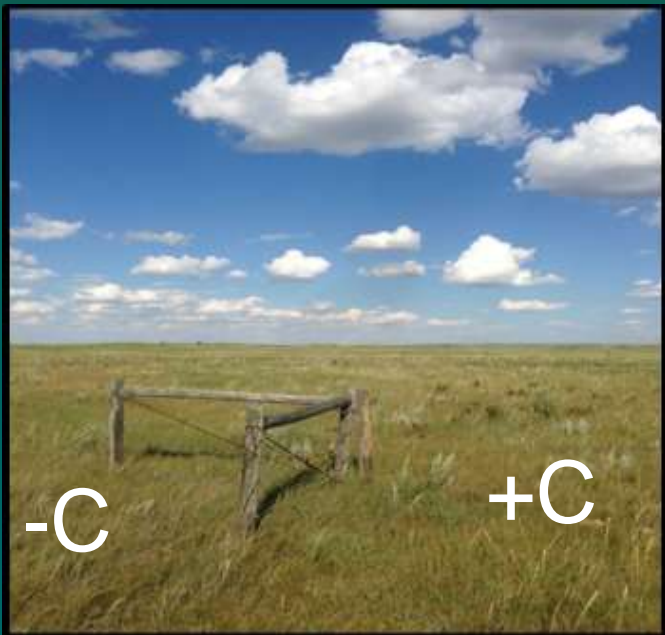
- Exposure to long-term cattle grazing
- Specific land use (native VS tame pasture VS annual cropland)



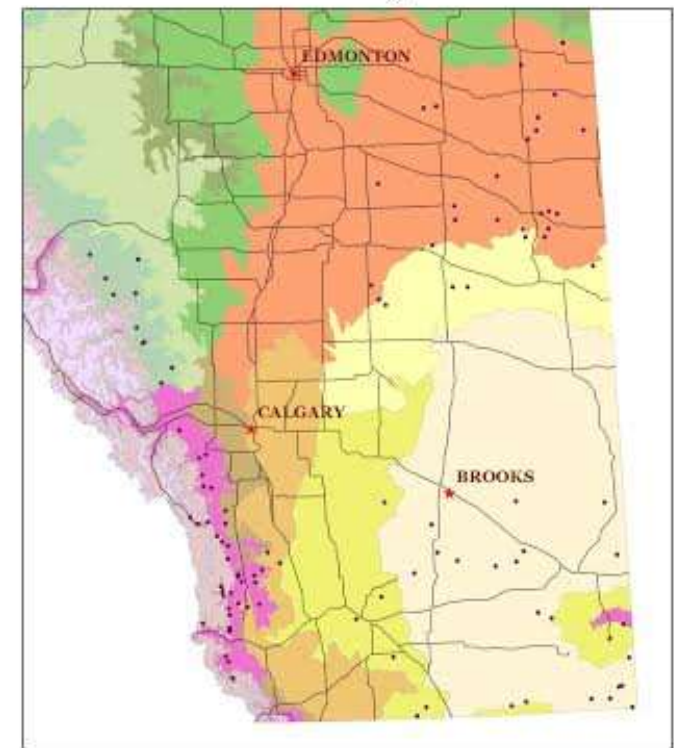
Experimental Design

Comparison of grazed & non-grazed (fenced) areas at 115 locations across Alberta (quasi 'synoptic' coverage)

- Paired design (+/- cattle)
- Long-term monitoring sites (AESRD)



Carbon Benchmarking Sites in Alberta



0 20 40 80 120 km

★ Cities
● Study Sites
— Highways

Natural Regions

Alpine	Foothills Parkland
Central Mixedwood	Lower Foothills
Central Parkland	Mixedgrass
Dry Mixedgrass	Montane
Dry Mixedwood	Northern Forest
Foothills Forest	Schubert
	Upper Foothills

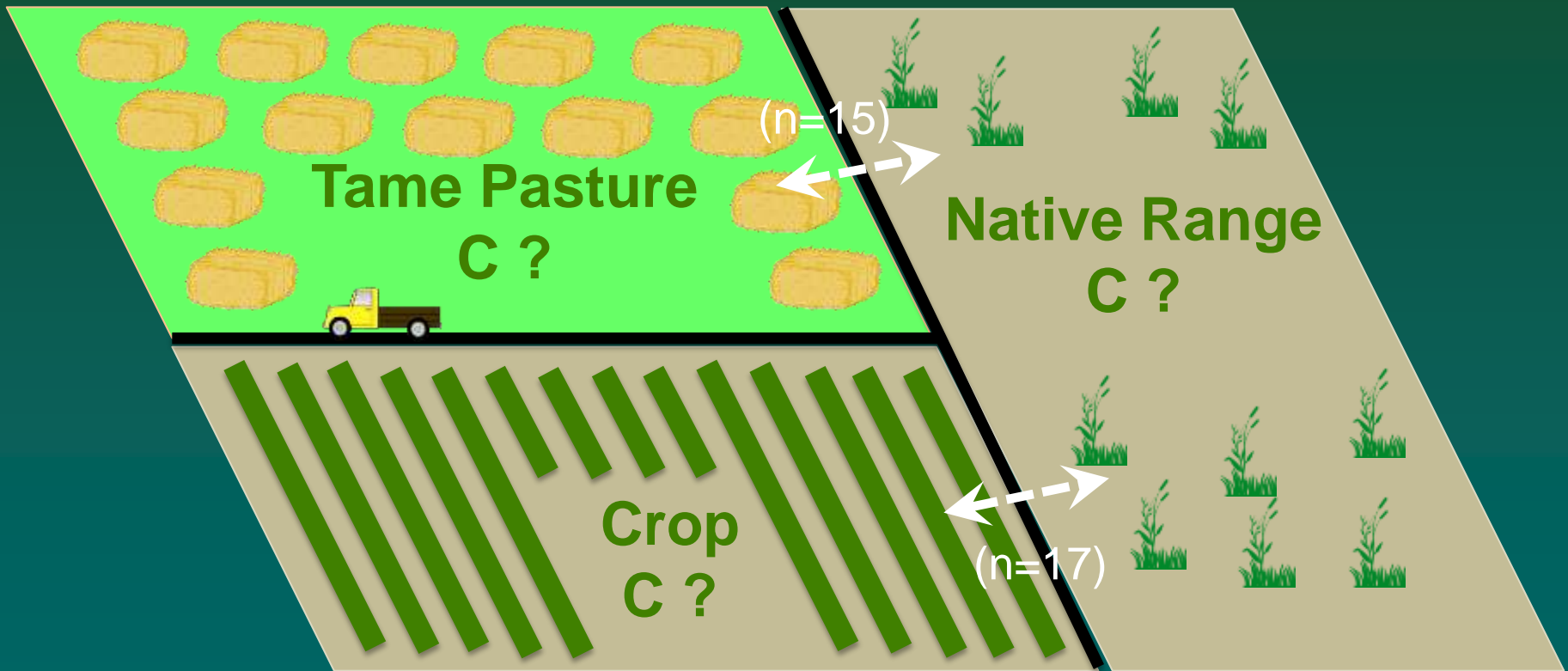
CS: NAD 83 10TM AEP Resource
Projection: Transverse Mercator
Datum: North American 1983
Scale 1:2,832,405

Data Source: U of A and AESRD

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Experimental Design (cont.)

At select locations, we are also comparing native grassland with neighboring tame pasture and cropland



➤ 7 sites with a “3-way” comparison

Specific Measures

Vegetation 'Profile':

- Composition, including richness & diversity (AESRD)
- Shoot mass (by growth form) and C/N concentration (AAFC)
- Litter/mulch biomass & C
- Belowground (root) mass & C

Soil 'Profile':

- Total soil OM & C/N concentration
- OM Fractions (0-15 cm depth)
- Bulk density (specific mass adjustment of C)
- Inorganic C (pH > 6.4)
- Texture, pH, salinity
- Other ecosite conditions

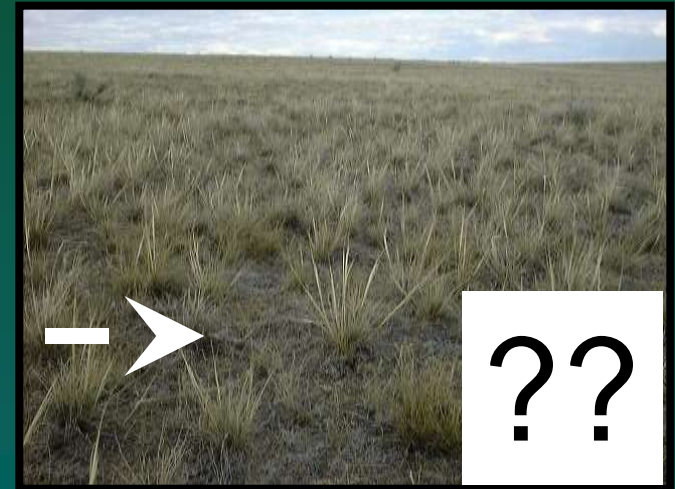


Why Measure Carbon in Grassland?

- Current policies reward crop farmers (for “new” carbon), even though perennial grasslands may hold substantially more C (30-50%) in comparison



“Reduced tillage”



“Reduced days on feed”



Why Measure Carbon in Grassland?

- Goal is to obtain a better understanding on the role of grasslands in storing and protecting C, including the presence of cattle grazing (potential spatial links to Provincial Grassland Vegetation Inventory)
- Improved baseline data should be useful for guiding future carbon policy programs (e.g. CCEMC)



Limitations

1) Sacrificed deep sampling of the soil profile for more widespread geographic resolution ('synoptic')

- Will address the soil depth information gap using data from PFRA lands in Saskatchewan (data on soil C down to 1 m)

Mixedgrass



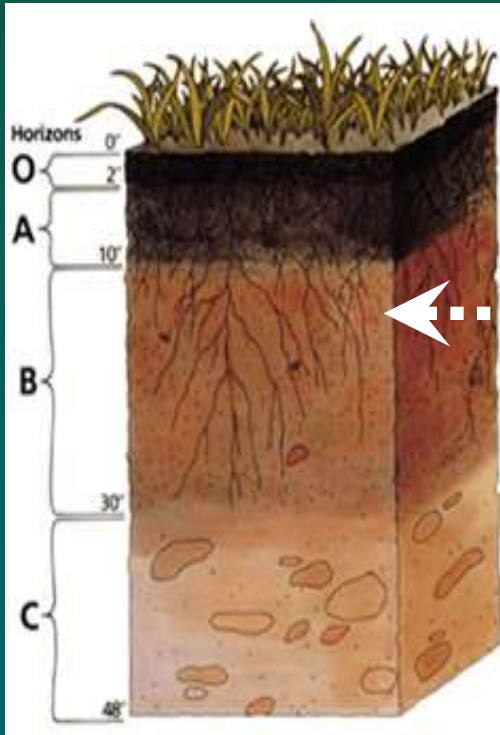
&

Parkland



Limitations

- 2) Detailed stocking rate data are lacking under these 'grazing treatments' (+C vs -C only)
- 3) Specific mechanisms on how grazing may alter C pools remain unclear



Opportunities

- This work will be linked to other studies on GHG emissions, litter decomposition, and various defoliation regimes/grazing systems, etc.
- Results will strengthen our collective understanding of how grasslands contribute to the EG & S of carbon storage



Questions ...

