A ‘Synoptic’ Approach to Carbon Benchmarking in Alberta Grasslands

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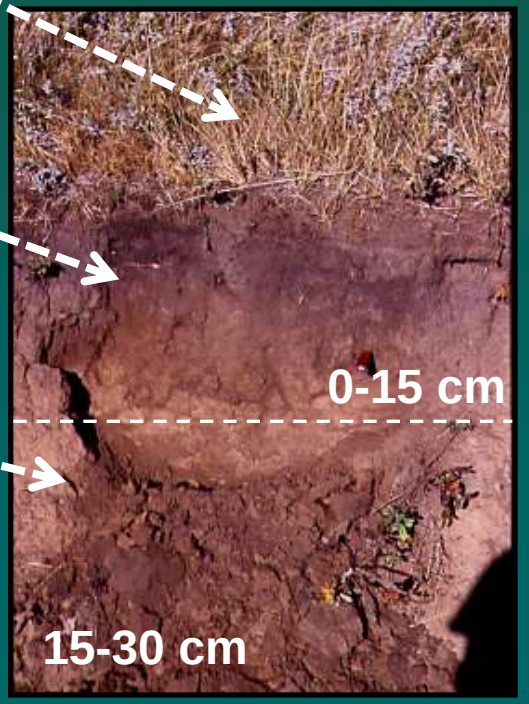
Study Objectives

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

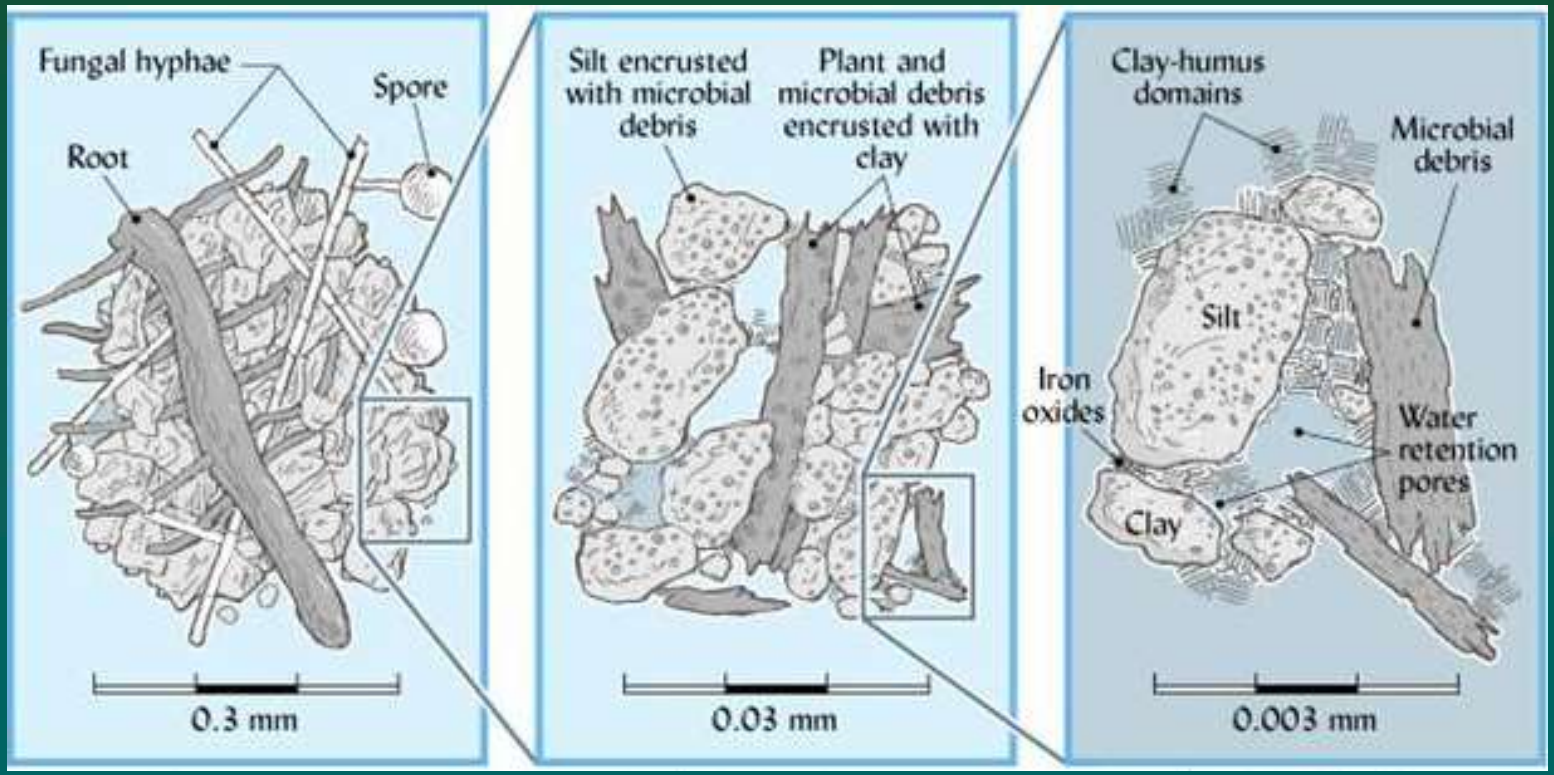


Particle Size & Carbon Protection

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.

Study Objectives (cont.)

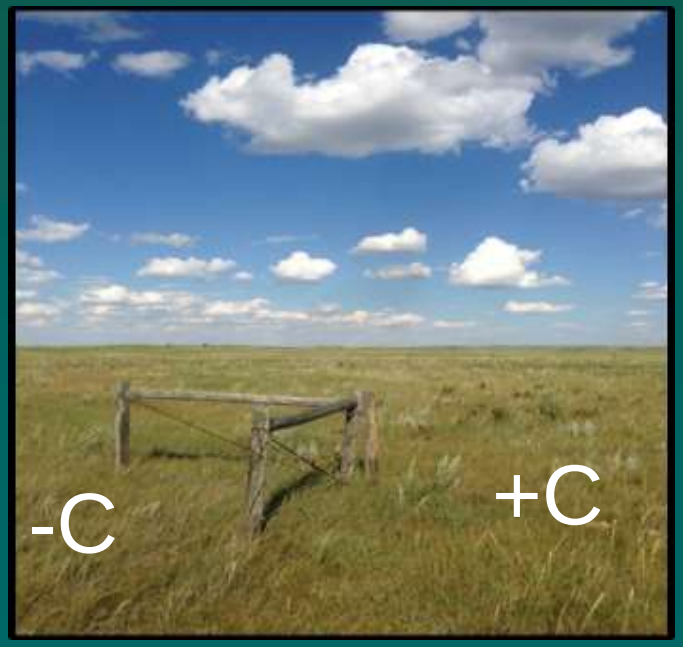
4) Determine whether C stores differ with land use:

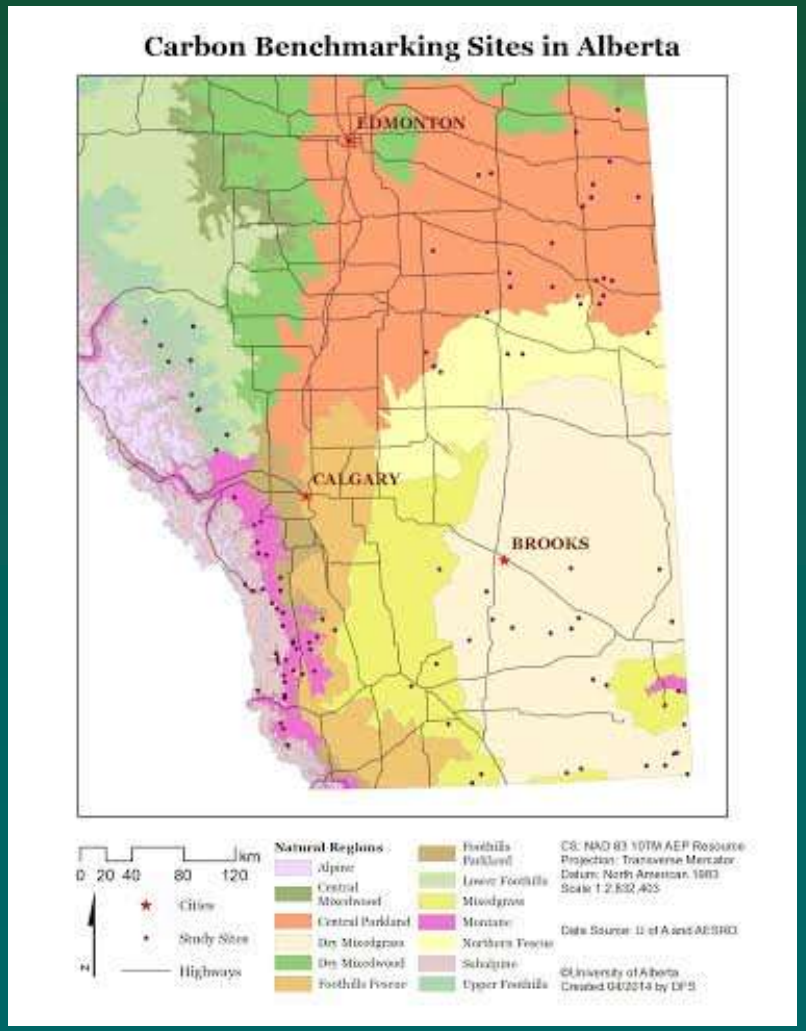
- Exposure to long-term cattle grazing
- Specific land use (native VS tame pasture VS annual cropland)

Experimental Design

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

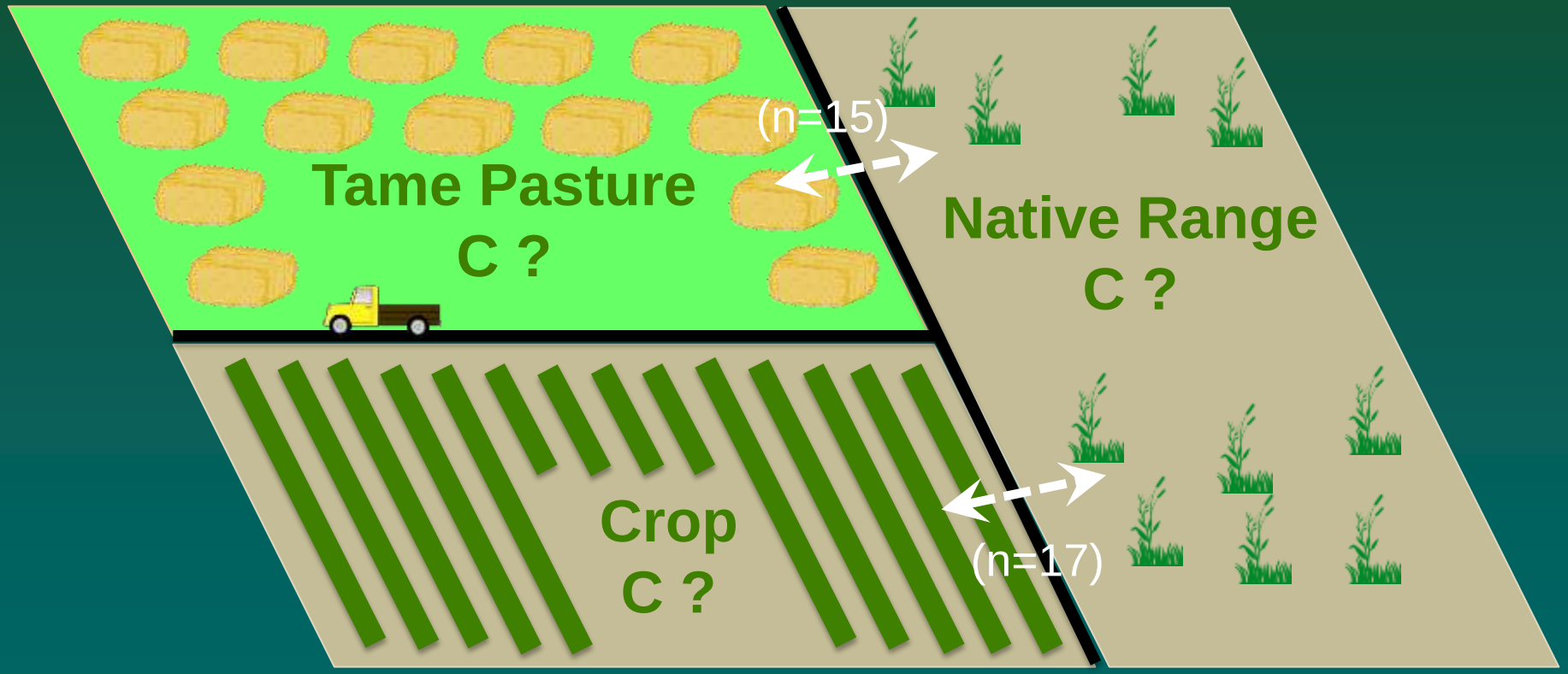
- Paired design (+/- cattle)
- Long-term monitoring sites (AESRD)





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

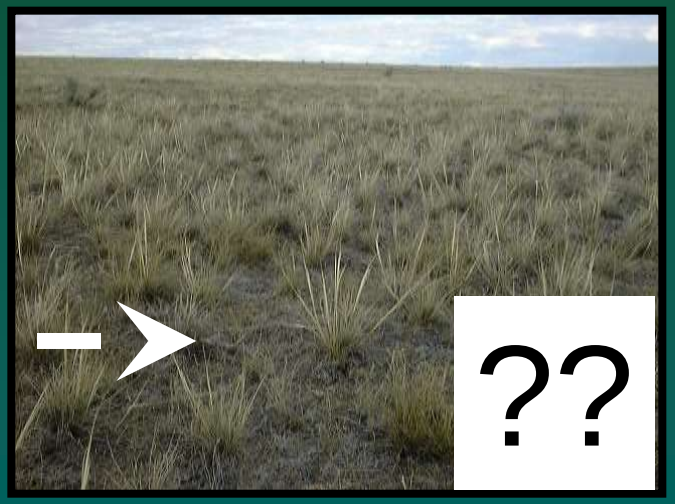
Soil 'Profile':

- 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')

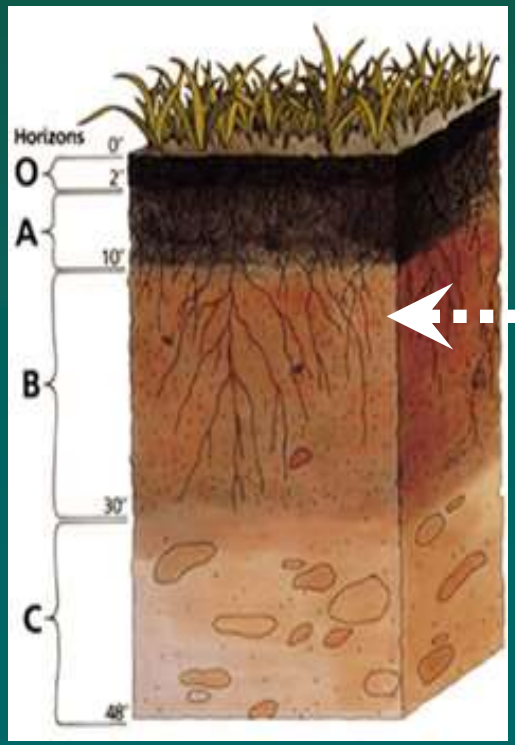
- Will address the soil depth information gap using data from PFRA lands in Saskatchewan (data on soil C down to 1 m)

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 …