Alberta
Environment and Sustainable Resource Development

UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURAL, LIFE & ENVIRONMENTAL SCIENCES
Rangeland Research Institute

Are soil microbes mediators of carbon storage and greenhouse gas emissions in rangelands?

Also, in proceedings:
"Investigating the role of long-term grazing on plant litter decomposition"

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ALMA
Alberta Livestock and Meat Agency Ltd.

Grassland Carbon Workshop
14 April 2015
Edmonton, AB

Alberta Innovates Bio Solutions

Background: Grazing causes shifts in plant community and chemical composition

Needle-and-thread grass

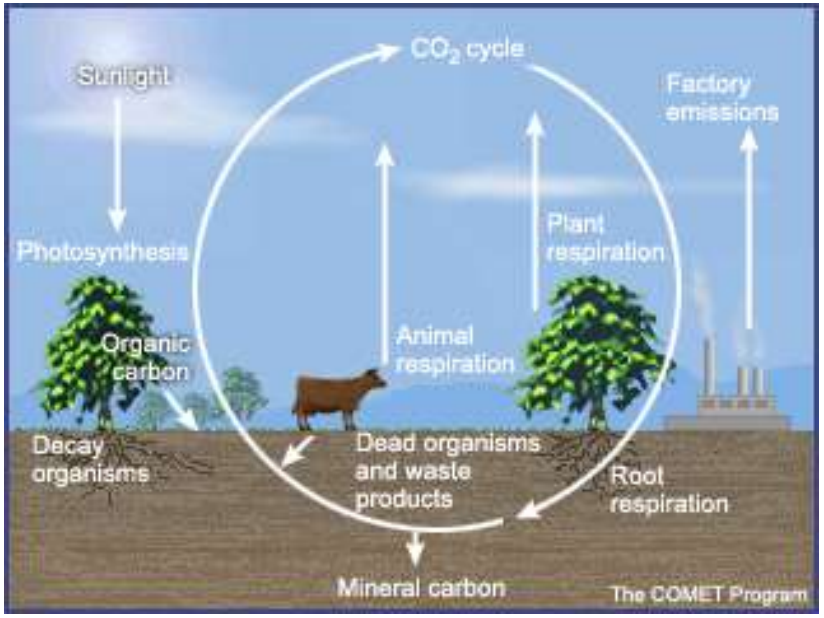
Grazing

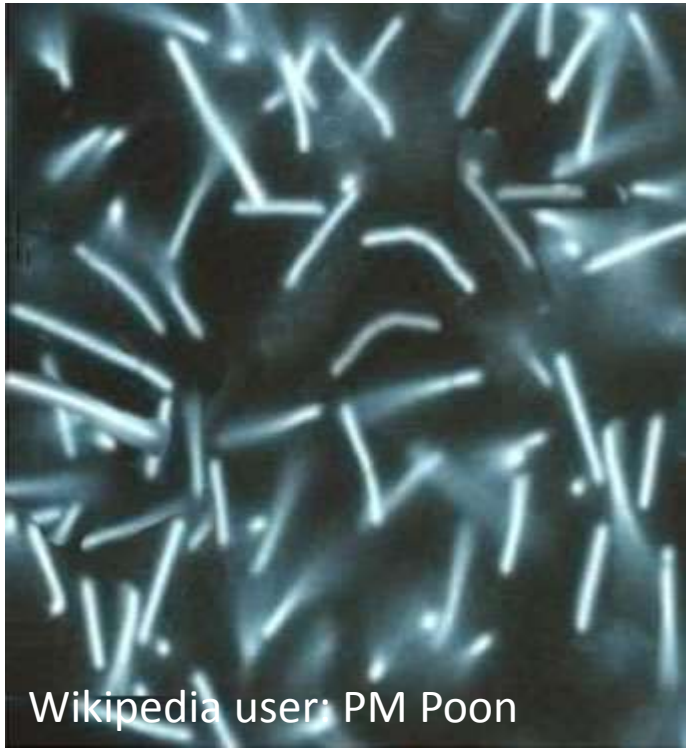
Blue grama

Lignin
Cellulose
C: N ratio

Background: Microbes breakdown litter and are critical to nutrient cycling

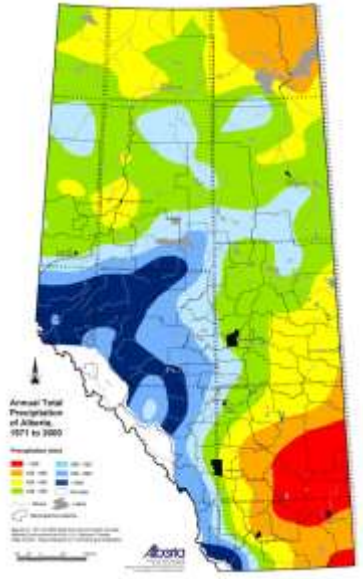
Fungi, bacteria and archaea can consume and release carbon and other nutrients, and the species in these groups are adapted to particular substrates and conditions





Background: Plant and microbial processes are also mediated by environment

- Alberta's grassland are within a range of climate conditions
- Temperature and moisture affect community, growth and activity
- Grazing can alter soil temperature and moisture

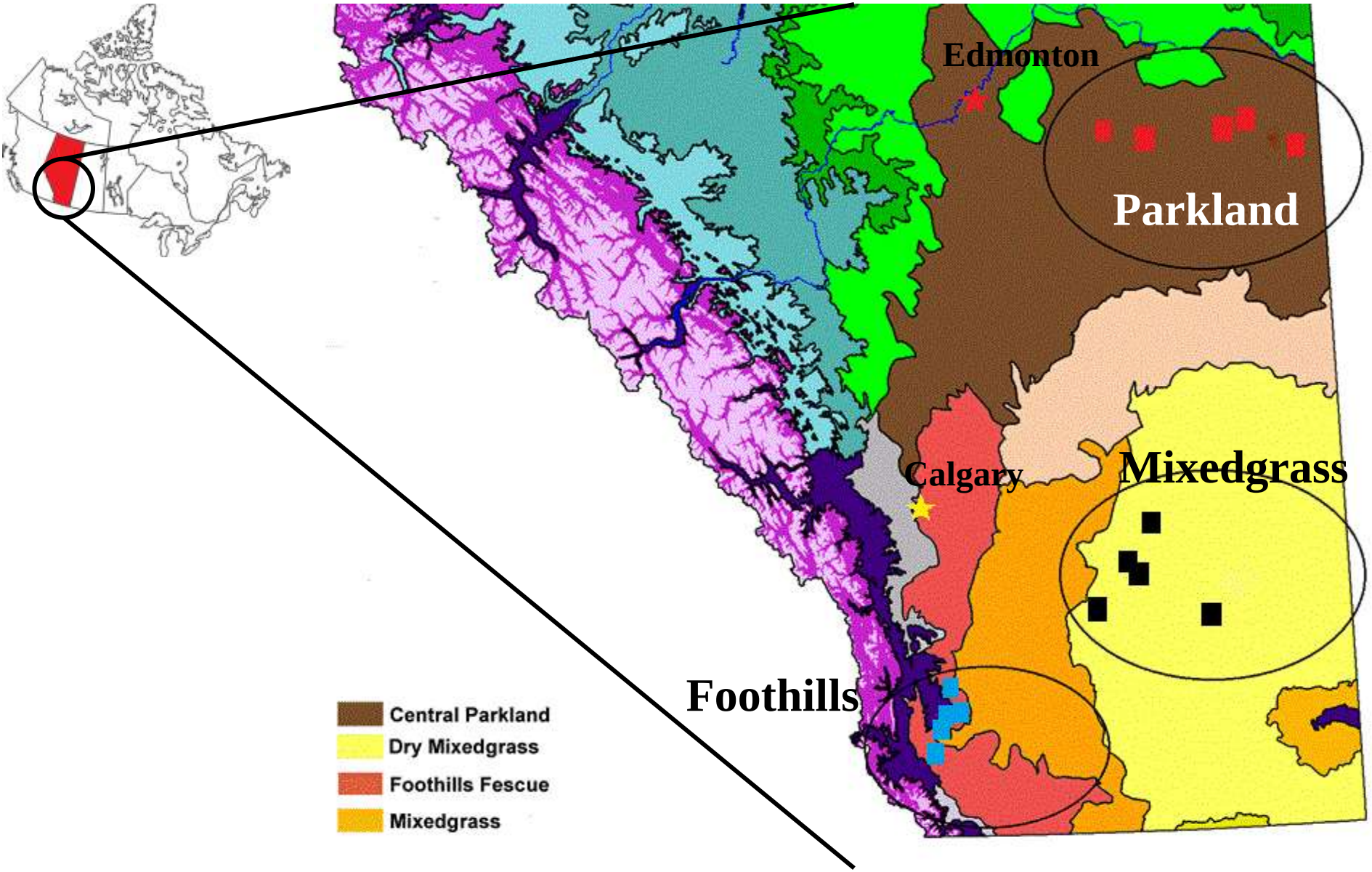


Objectives

Understand the role of grazing in controlling carbon and nutrient cycling, and GHG flux through its impact on the microbial community

- Decomposition
- Extracellular enzyme activity
- GHG flux
- Microbial community

Approach: Broad spatial coverage



Approach: Cattle exclosures

Grazed **Ungrazed**

Vegetation:

- Plant community composition
- Litter, root and shoot biomass
- lignin, C:N

Soils:

- pH, EC, OM, texture, carbon and nitrogen, organic matter, etc.
- Organic matter, total C and N
- Continuous soil temperature and moisture

Approach: Litterbags

- Different plant material:
  - Blue gramma
  - Kentucky bluegrass
  - Junegrass
  - Western wheatgrass
  - Needle-and-thread grass
  - Plains rough fescue
  - Foothills rough fescue
  - Natural site litter
- Collected after different time periods (1, 3, 6, 12, 18 months)
- Measure:
  - Mass loss
  - C:N ratios

Approach: GHG

- Measuring:
  - Carbon dioxide
  - Methane
  - Nitrous oxide
- Regular measurements through the growing season
  - More intensively in spring

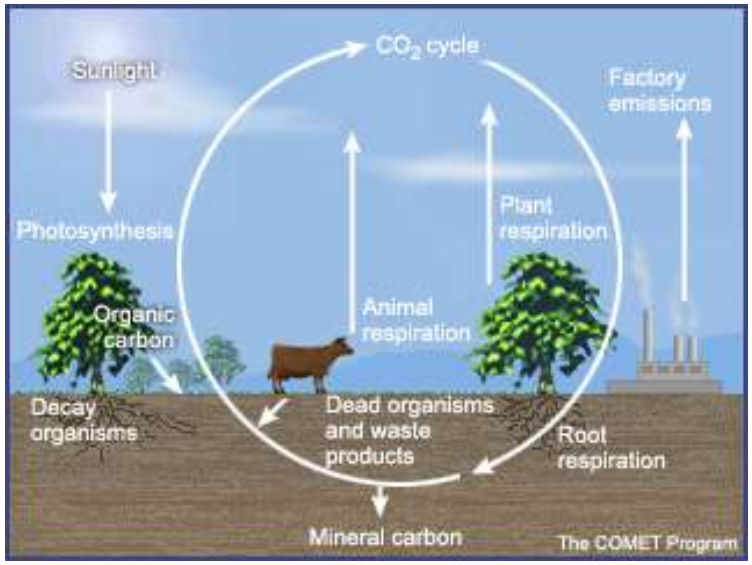
Approach: Microbial community

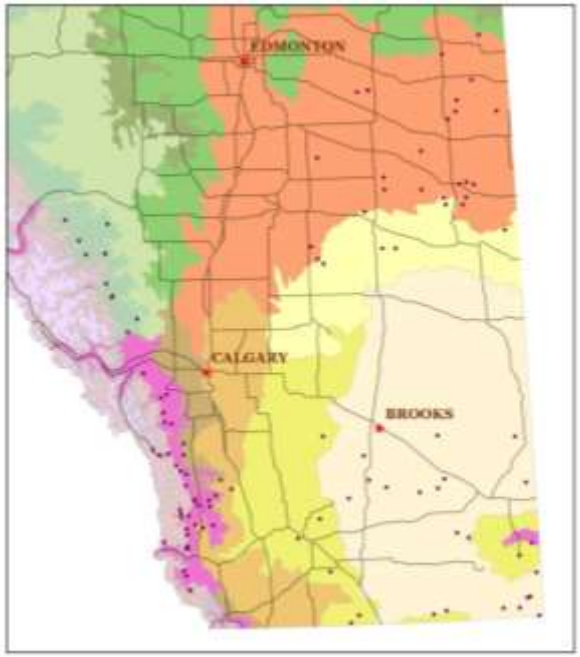
- Biomass estimates of fungi, bacteria and archaea in litter and soil
- Diversity of fungi, bacteria and archaea in litter and soil
- Extracellular enzyme activity at 0, 1, 3, 6, 12, 18 months

Outcomes

To understand where, when and how grazing can contribute to carbon storage and GHG reduction

- Large spatial coverage
- Long-term grazing exclosures
- Microbial component
- Comprehensive data set
  - Modelling
- Limited root data





A similar project:

Quantifying carbon sequestration and greenhouse gas emissions in planted shelterbelts, natural hedgerows and riparian woodlands in different soil-climatic zones in Alberta

- Comparing shelterbelts, hedgerows, aspen woodlands, pastures and croplands
- Very similar suite of GHG, carbon and microbial measurements

Agriculture and Agri-Food Canada

Agricultural Greenhouse Gases Program (AGGP)

Thank you