Can you C the grassland?

E. McGeough, Dept. of Animal Science,

B. Amiro, Dept. of Soil Science
National Centre for Livestock and the Environment

• A **multidisciplinary, team-based, whole-system** approach towards finding solutions and creating opportunities within agricultural production **systems**

• It is:
  – research, education, training and public engagement based on whole systems in agriculture
  – people and partnerships
  – needs driven, outcomes oriented
Beneficial Management Practices for GHG Mitigation from Agroecosystems, with Emphasis on Cow-Calf Non-confinement Production Systems in Western Canada

*Agricultural Greenhouse Gas Program: 2011-2015*

- U. Sask: S. Kulshreshtha
- U. Waterloo: G. Dias
- + many collaborators
Net CO₂ exchange and carbon budgets of a three-year crop rotation following conversion of perennial lands to annual cropping in Manitoba, Canada.

Methods

• Eddy covariance flux towers were used to measure net ecosystem production over three adjacent agricultural fields in Manitoba, Canada,

• 2009 to 2011

• Two fields were converted from long-term perennial hay/pasture to annual cropping, while the third field served as a control.
  – Field 1: oat-canola-oat rotation,
  – Field 2: hay-oat-fallow rotation.
  – Field 3: hay/pasture (control)
Cumulative NEP for a Hay Field over 3 Consecutive Summers

2009
Rain: 280 mm
Mean T: (16.7° C)

2010
Rain: 248 mm
Mean T: (16.5° C)

2011
Rain: 166 mm
Mean T: (20.5° C)

C gain

C loss
Flux towers show C gain by hay and C loss by annual crops in Manitoba (Net C including harvest: Positive is C gain)

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Biome Production (g C/m²/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>200</td>
</tr>
<tr>
<td>2011</td>
<td>-100</td>
</tr>
</tbody>
</table>

Note: 2011 was a drought
Greenhouse Gas fluxes from a backgrounding steer operation

- Brandon Research Centre: 100 steers; bale grazing, summer pasture, swath grazing; 12 months; CO$_2$, CH$_4$, N$_2$O fluxes measured using micrometeorology method
Canadian Beef Cattle Production Survey: Data being used to identify GHG Beneficial Management Practices

1009 producers surveyed

The Survey:

• Basic information on the production system.
• Feeding management.
• Grazing management (winter and summer).
• Seasonal feeding areas.
• Feeding management in barns and feedlots.
• Manure handling, storage and application.
• Use of shelterbelts.
## Preponderance of management practices for harvested perennial forages

<table>
<thead>
<tr>
<th>Pasture management</th>
<th>Perennial</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legume content (% of sward)</td>
<td>42 (n=757)</td>
<td>0.9</td>
</tr>
<tr>
<td>Fraction (%) of forage-production land on each operation (n=866) used to produce:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hay,</td>
<td>73</td>
<td>1.1</td>
</tr>
<tr>
<td>silage</td>
<td>7</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Preponderance of summer pasture management practices for tame, native and annual-crop pastures

<table>
<thead>
<tr>
<th>Pasture management</th>
<th>Tame pasture (n=323)</th>
<th>SE</th>
<th>Native pasture (n=367)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous grazing (% of operations)</td>
<td>25</td>
<td>2.4</td>
<td>35</td>
<td>2.5</td>
</tr>
<tr>
<td>Pasture rested (% of operations)</td>
<td>16</td>
<td>2.0</td>
<td>31</td>
<td>2.3</td>
</tr>
<tr>
<td>2-3 paddocks (% of operations)</td>
<td>21</td>
<td>2.3</td>
<td>16</td>
<td>1.9</td>
</tr>
<tr>
<td>3-4 paddocks (% of operations)</td>
<td>37</td>
<td>2.6</td>
<td>18</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Sheppard et al. (2015), CJAS. 95:1-17
Trace Gas Manitoba (TGAS MAN)

Continuous simultaneous measurement of CO₂ and N₂O over agricultural land.

Numerous publications and collaborations with topics ranging

- N₂O fluxes
- CO₂ fluxes
- Crop rotation contribution to fluxes
- Legume crops
- Residue decomposition
- Modelling of N₂O
Greenhouse gas intensity of six yearling to finish beef systems in Ireland

- Grass silage is the basal diet for winter feeding on farms in Ireland and a key constituent of finishing diets
- Variability in ensilability and quality, interest in whole-crop alternatives
- 12 mo – finish beef systems
- Grass silage, corn silage, whole-crop wheat silage, high grain diets
- Carbon footprint with and without Land Use, Land Use Change
- Economic assessment of finishing strategies
Questions?