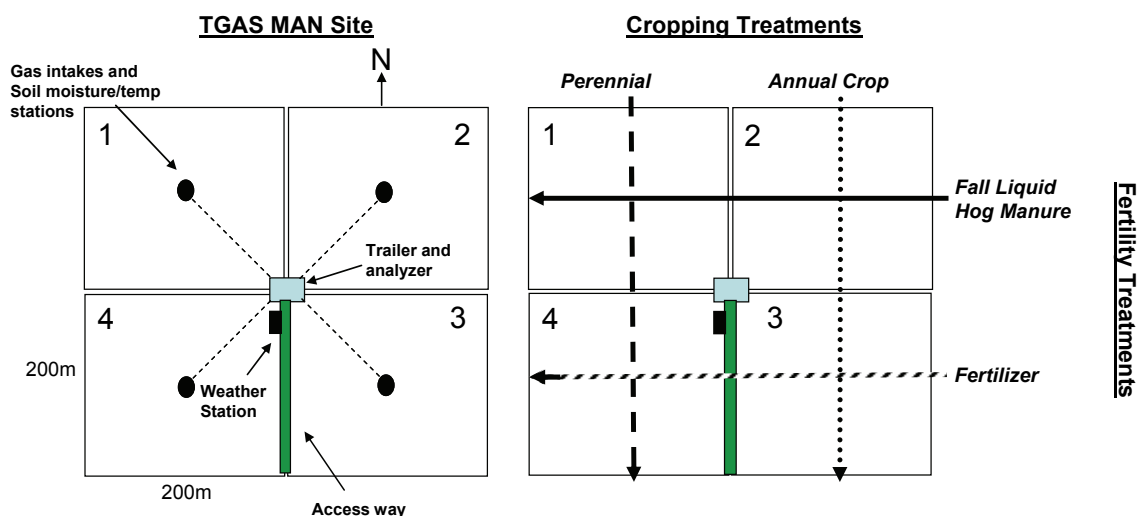


National Centre for Livestock and the Environment – Trace Gas Manitoba (TGAS MAN) Greenhouse Gas Field Emission Site

Goal – to provide a location in Western Canada determining soil greenhouse gas budget of perennial and annual cropping systems as affected by manure application.

What are the Issues?

- Our concerns about global climate change are caused by the observed and predicted increases in greenhouse gases in our atmosphere.
- The main greenhouse gases (GHG) of concern are **carbon dioxide** (CO₂), **methane** (CH₄) and **nitrous oxide** (N₂O).
- Agriculture is responsible for about 10% of Canada's total greenhouse gas emissions, but this includes more than half of the N₂O emissions, and about 1/3 of the CH₄ emissions.
- CH₄ is mostly from livestock, but nitrous oxide is mostly from losses from fields associated with our need to apply fertilizers and manure to maintain productivity.
- N₂O has a greenhouse gas potential that is 300 times more powerful than carbon dioxide.
- Reducing N₂O emissions saves money and benefits the environment.
- Biofuels are being relied upon as alternatives to petroleum fuel, which of perennial or annual crop feedstock best reduces GHG and improves soil health is unknown.
- Biofuel production is partly causing farmers to consider reducing their perennial acreage, this could have detrimental impact on GHG emissions and soil health.

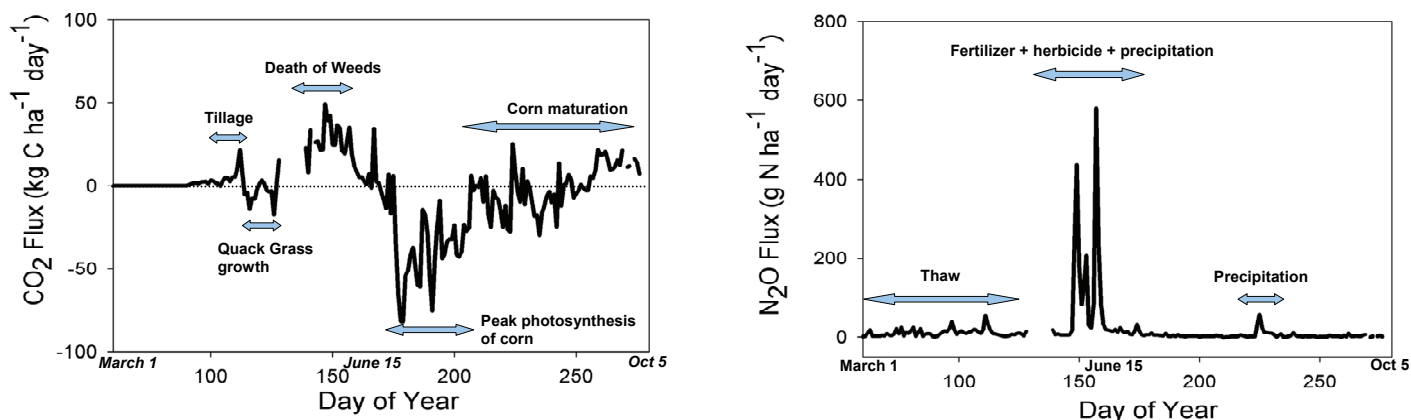


What are we doing?

- Quantify the emissions of N₂O CO₂: how does the emission relate to climate, soil type, cropping system and form of nitrogen application?
- Direct measurement method using tunable diode laser instrument: measure direct emissions from the field continuously.
- Experiment has 4 plots being factorial combinations of Crop (alfalfa/timothy-perennial, grain/oilseed-annual) and Fertility Source (liquid hog manure, fertilizer).
- Track GHG budgets and soil health for 5 years during perennial phase (first 3 years) and conversion phase of perennial to annual cropping (last 2 years).
- Determine rate of soil health increase with perennials and residual impact on soil health upon conversion to annual cropping.

National Centre for Livestock and the Environment –
Trace Gas Manitoba (TGAS MAN) Greenhouse Gas Study Site

Example of Results at the Research Site in 2006



The above figures show daily average fluxes of carbon dioxide (CO₂) and nitrous oxide (N₂O) at the TGAS MAN site for March through October 2006. Positive values represent a net gaseous flux from the soil-crop system into the atmosphere, negative values represent net uptake by the crop system. Events occurring during the period affecting both gases are indicated.

What will be the outcome?

- Continuous measurements tell us what is really happening: N₂O emissions are episodic with the high emissions occurring during fertilization and precipitation events.
- But what are the biological processes controlling this, and can we change them?
- Do perennial cropping systems reduce GHG emissions?
- How rapid are benefits of perennial cropping to GHG reductions and soil health?
- Does the benefit of perennial cropping carry into the conversion phase to annual cropping?
- This is the only site in western Canada where N₂O and CO₂ emissions are measured continuously from an agricultural field.

Who supports this research?

- Canada Foundation for Innovation for NCLE
- National Science and Engineering Research Council (NSERC) Discovery Grant Program and Canada Research Chair Program in Applied Soil Ecology
- NSERC graduate scholarship program

Personnel Training

- Aaron Glenn (Ph.D. candidate)
- Siobhan Stewart (M.Sc. candidate)
- Robert Janzen (summer student)
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