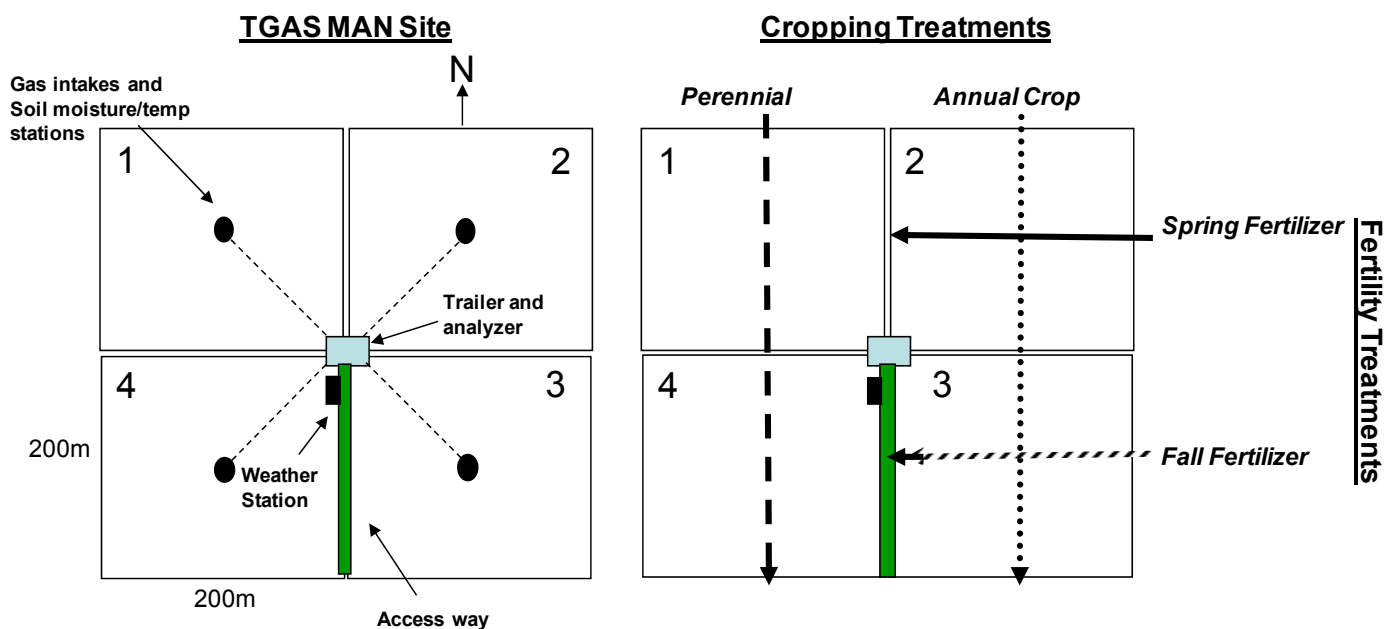


## Trace Gas Manitoba (TGAS MAN) Soil Greenhouse Gas Field Study

**Goal** – to provide a location in Western Canada determining whole-season and multi-year soil greenhouse gas budgets of cropping and management systems

### 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** (CO<sub>2</sub>), **methane** (CH<sub>4</sub>) and **nitrous oxide** (N<sub>2</sub>O).
- Agriculture is responsible for about 10% of Canada's total greenhouse gas emissions, but this includes more than half of the N<sub>2</sub>O emissions, and about 1/3 of the CH<sub>4</sub> emissions.
- CH<sub>4</sub> 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.
- N<sub>2</sub>O has a greenhouse gas potential that is 300 times more powerful than carbon dioxide.
- Reducing N<sub>2</sub>O emissions saves money and benefits the environment.
- Improved management of nitrogen such as spring application, banding, and slow-release products can reduce N<sub>2</sub>O emissions, but by how much?
- Crop selection choices impacts soil C sequestration. Perennial crops may store carbon and when included in rotations allow creation of GHG neutral production systems.



### What are we doing?

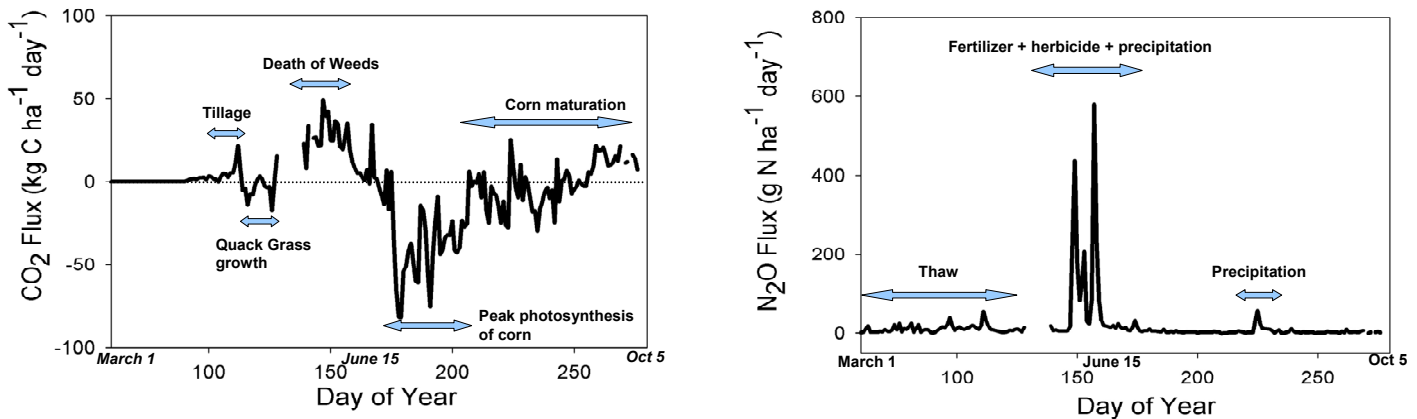
- Quantify the emissions of N<sub>2</sub>O CO<sub>2</sub>: how does the emission relate to climate, soil type, cropping system and form of nitrogen application?
- Direct measurement method using tunable diode laser instrument: measure direct emissions from the field continuously.
- Experiment has 4 very large plots being monitored since fall 2005. Annual plots have been in rotation of 2005-fallow, 2006-corn, 2007-faba, 2008-wheat, 2009-rape seed, 2010-barley,

### Trace Gas Manitoba (TGAS MAN) Study Site

2011-wheat. The perennial plots have been in rotation of 2005-fallow, 2006-corn, 2007-faba, 2008 through 2011-alfalfa/grass.

- Track GHG budgets and soil health during perennial phase (4 years) and conversion phase of perennial to annual cropping.
- Determine effect of anhydrous ammonia application in fall and spring on N<sub>2</sub>O emissions.

### Example of Results at the Research Site in 2006



The above figures show daily average fluxes of carbon dioxide (CO<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O) 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: N<sub>2</sub>O emissions are episodic with the high emissions occurring during fertilization and precipitation events, the annual rotation is losing carbon.
- But what are the biological processes controlling this, and can we change them?
- Does spring fertilizer application reduce emissions?
- Do perennial cropping systems reduce GHG emissions?
- Does the benefit of perennial cropping carry into the conversion phase to annual cropping?
- This is the only site in western Canada where N<sub>2</sub>O and CO<sub>2</sub> 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, Canada Research Chair Program in Applied Soil Ecology, Canadian Fertilizer Institute, Manitoba Rural Adaptation Council, the AAFC Agriculture Greenhouse Gas Program.

### Personnel Training

- Tek Sapkota Ph.D. candidate
- Jenna Rapai (technician)

### For more information, contact:

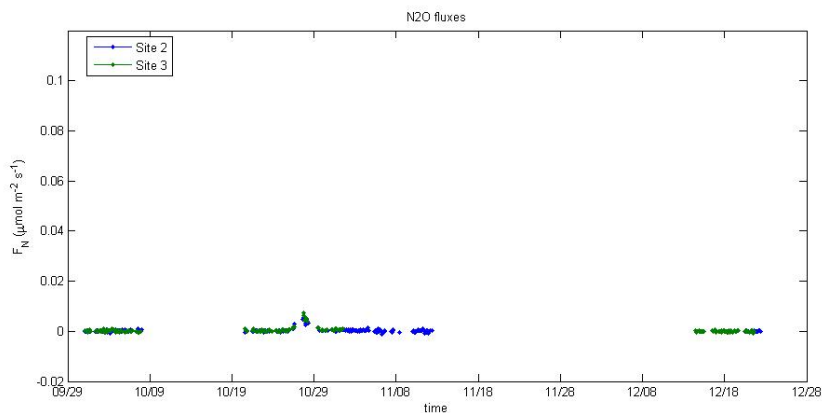
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visit <http://www.umanitoba.ca/afs/ncl/index.html>

Last Update: August 22, 2011

Fall 2010 N<sub>2</sub>O Emissions (Site 2=Spring application of ammonia; Site 3= Fall application)



2011 N<sub>2</sub>O Emissions (Site 2=Spring application of ammonia; Site 3= Fall application)

