Characterizing Soil Carbon in Permafrost Regions and Its Vulnerability to Climate Change

14-15 February 2011
TCS Conference Center (Building 240)
Rooms 1404-1405
Argonne National Laboratory
Workshop Objectives

1. Evaluate existing data on soil C stocks in high-latitude permafrost regions

2. Explore issues related to developing an approach to obtain better information to support efforts to model and project the role of high-latitude ecosystems in a changing climate:
   - improve characterization of C stocks in spatially representative soils
   - develop methods that could integrate spatial variability with measures of potential decomposability for improved assessment and prediction of the magnitude and direction of regional soil C change
   - monitor decadal-scale changes and consequences for soil C storage at representative sites

3. Identify collaborative opportunities that integrate with and contribute to ongoing or planned efforts, both nationally and internationally
Workshop Deliverables

1. **Identification of existing databases on soil C in high-latitude permafrost regions**
   - data accessibility
   - database contents

2. **Assessment of the quality of existing databases**
   - spatial and temporal representation
   - data gaps and temporal monitoring needs
   - what is needed to eliminate gaps and to improve databases & monitoring efforts

3. **Development of a conceptual approach** for improving data, their extrapolation, and validation
   - identification of model needs for improving predictions – with regards to spatial representation, C forms, other data
   - recommendations of methods to identify and represent the complex spatial variability of soil C stored in permafrost region soils
   - evaluation of methods for predicting/monitoring the decomposability of C pools

4. **Eos article** highlighting workshop conclusions, that outlines
   - data gaps and needs
   - conceptual approach for improving the characterization of soil C pools in high-latitude permafrost regions – and their vulnerability to change
Workshop Structure & Goals

PRESENTATIONS (SESSION 1 – Monday 9:00-10:15 am)

*Existing soil carbon databases, content, and plans for expansion*

Moderator: Gary Michaelson

- Charles Tarnocai (Northern Circumpolar Soil Carbon Databases and the CAPP project) 25 min
- Jennifer Harden (Alaska Soil Carbon Database and plans for NASA’s ABoVE field campaign) 20 min
- Chien-Lu Ping (Depth distribution of carbon in databases/issues related to cryoturbation) 20 min
- Group discussion (Identify other US or international databases and plans) 10 min

OBJECTIVE 1

- Evaluate existing data on soil C stocks in high-latitude permafrost regions

DELIVERABLE 1

- Identification of existing databases on soil C in high-latitude permafrost regions
  - data accessibility
  - database contents
Workshop Structure & Goals

GROUP DISCUSSION (SESSION 2 – Monday 10:30 am-Noon)

Quality of existing databases, data gaps, and research needs

Discussion leaders: Steve Sparrow and Roser Matamala

- How well do existing databases represent spatial heterogeneity and variability at multiple scales?
  - What regions/systems are under-represented?
- What systems/sites have been monitored over time?
  - For how long and at what intervals?
  - What is the quality of these measurements and how representative are they?
  - Where should additional investments in monitoring be made and at what intervals?
- Which measurements are most critical?
  - What additional measurements would be desirable and why?
- What are the priorities for improved data gathering (in the context of reducing model uncertainties)?

DELIVERABLE 2

- Assessment of the quality of existing databases
  - spatial and temporal representation
  - data gaps and temporal monitoring needs
  - what is needed to eliminate gaps and to improve databases & monitoring efforts
Workshop Structure & Goals

PRESENTATIONS/DISCUSSION (WORKING LUNCH – Monday Noon-1:30 pm)

Logistical opportunities
Moderator:  Mike Miller
- Ted Schuur (NSF RCN on permafrost soil carbon and its vulnerability)
- John Krummel (Opportunities associated with Alaska gas pipeline project)
- Doug Sisterson (Mobile instrument facilities/logistics of remote data collection)

OBJECTIVE 3
- Identify collaborative opportunities that integrate with and contribute to ongoing or planned efforts, both nationally and internationally

DELIVERABLE 3
- Development of a conceptual approach for improving data, their extrapolation, and validation
Workshop Structure & Goals

OBJECTIVE 2

- Explore issues related to developing an approach to obtain **better information to support efforts to model and project the role of high-latitude ecosystems in a changing climate**:
  - improve **characterization** of C stocks in spatially representative soils
  - develop methods that could **integrate spatial variability with measures of potential decomposability** for improved assessment and prediction of the magnitude and direction of regional soil C change
  - monitor **decadal-scale changes and consequences** for soil C storage at representative sites

DELIVERABLE 3

- Development of a conceptual approach for improving data, their extrapolation, and validation
  - identification of model needs for improving predictions – with regards to spatial representation, C forms, other data
  - recommendations of methods to identify and represent the complex spatial variability of soil C stored in permafrost region soils
  - evaluation of methods for predicting/monitoring the decomposability of C pools
Workshop Structure & Goals

PRESENTATIONS (SESSION 3 – Monday 1:30-3:00 pm)

*Characterizing decomposability*

Moderator: Matt Wallenstein
- Gary Michaelson (Lab assessments of decomposability – chemical characterization & incubations) 20 min
- Mark Waldrop (Microbial communities and their role in determining decomposability) 20 min
- Vladimir Romanovsky (Permafrost dynamics and considerations for lab & field assessments) 20 min
- Ted Schuur (Field monitoring of carbon emissions – potential for using “natural” or experimental gradients to validate lab assessments) 20 min
- Group discussion and intro to breakouts 10 min

BREAKOUT DISCUSSIONS (SESSION 4 – Monday 3:05-4:30 pm)

*Assessing, predicting, and validating decomposability*

**Group 1 Lab-based assessments** Discussion leaders: Jen Harden and Matt Wallenstein
- What measures/methods could be used to evaluate/predict decomposability of different carbon forms in organic and mineral horizons?
- Can we relate predictive measures to pools used by SOM models?
- Can lab-based predictions of decomposability be evaluated/validated in the field?

**Group 2 Field-based assessments** Discussion leaders: Roger Ruess and Torre Jorgenson
- Can lab-based predictions of decomposability be evaluated/validated in the field?
- Could decadal-scale monitoring of representative systems be used to improve model predictions?
Workshop Structure & Goals

PRESENTATIONS (SESSION 5 – Tuesday 8:30-9:15 am)

Extrapolation
Moderator: Yongwon Kim
- Howard Epstein (Vegetation as an integrative indicator of change and where to sample at multiple scales) 15 min
- Torre Jorgenson (Spatial extrapolation of point scale measurements – value of large-scale transects and role of remote sensing) 25 min

GROUP DISCUSSION (SESSION 6 – Tuesday 9:15-10:15 am)

Extrapolation and Validation
Discussion leaders: Eugenie Euskirchen and Roger Ruess
- How well do existing databases represent spatial heterogeneity & variability at multiple scales?
  - What regions/systems are under-represented?
- What systems/sites have been monitored over time?
  - For how long and at what intervals?
  - What is the quality of these measurements and how representative are they?
  - Where should additional investments in monitoring be made and at what intervals?
- Which measurements are most critical?
  - What additional measurements would be desirable and why?
- What are the priorities for improved data gathering (in the context of reducing model uncertainties)?
Workshop Structure & Goals

GROUP DISCUSSION (SESSION 7 – Tuesday 10:30-11:15 am)

Logistics
Discussion leaders: Howard Epstein and Charles Tarnocai
- Are there opportunities to piggy-back onto other projects or activities?
- What are the logistical difficulties to be overcome?
- Should activity be limited to Alaska or North America?
- How/when should other countries be involved?

OBJECTIVE 3
- Identify collaborative opportunities that integrate with and contribute to ongoing or planned efforts, both nationally and internationally

GROUP DISCUSSION (SESSION 8 – Tuesday 11:15-11:45 am)

Eos article – concept and outline
Discussion leaders: Larry Hinzman and Julie Jastrow

DELIVERABLE 4
- Eos article highlighting workshop conclusions, that outlines
  - data gaps and needs
  - conceptual approach