Workshop: Climate Change Experiments in High-Latitude Ecosystems

Organizers: Stan Wullschleger and Larry Hinzman

Dates: October 13-14, 2010

Location: International Arctic Research Center, University of Alaska, Fairbanks

Sponsor: Oak Ridge National Laboratory and the Department of Energy, Office of Science, Biological and Environmental Research Program

Introduction: Boreal forests, or taiga, and arctic tundra have emerged as focal biomes for the study of climate change. These are among the largest and coldest of all biomes and are perceived by many as especially vulnerable to changes in temperature, elevated CO$_2$, and precipitation. Warming, in particular, is expected to be greatest in northern latitudes with consequences for tundra, taiga, and peat land ecosystems. Observational evidence suggests that warming of the Arctic is underway and there is growing concern that temperature increases are already affecting a broad array of physical and ecological processes in high-latitude ecosystems. Models also predict changes at regional to global scales; permafrost degradation and the northward expansion of shrubs into tundra represent important feedbacks on climate, both of which have the potential to cause rapid changes in the earth system.

Manipulative experiments can help understand the vulnerability of boreal and tundra ecosystems to climate warming and elevated CO$_2$ concentrations. Previous attempts to manipulate the environment of ecosystems in arctic and subarctic regions have focused on warming plant and soils at small spatial scales. Today, it is increasingly clear that manipulating the environment at the whole-ecosystem scale is required yet represents logistical and engineering challenges beyond those typically encountered in ecological research. New approaches will be required to address the questions being asked of the scientific community especially as we continue to move toward large-scale and long-term experiments.

In light of the many questions that surround the response of high-latitude ecosystems to global climate change, it is important that we focus on how experiments can address and resolve uncertainties regarding impacts and feedbacks. The workshop will highlight conclusions from observational studies and model simulations about the response of arctic ecosystems to a changing climate. Armed with that information we ask how manipulative experiments can best be designed to address issues related to ecosystem dynamics, permafrost degradation, soil carbon, landscape processes, and the many land-atmosphere feedbacks that are likely to arise as a result of global warming. This information will be discussed and evaluated in the context of a Department of Energy, Office of Science, Biological and Environmental Research sponsored Next-Generation Ecosystem Experiments (NGEE) project.
Deliverables:

- Recommendations based on observations, models, and previous field experiments as to the scientific questions and design criteria of future large-scale, long-term climate change experiments in the Arctic (all participants).

- EOS publication that highlights the workshop and summarizes the science needs and resource requirements for a possible temperature x CO₂ global change experiment in the Arctic (designated writing team).

- Plans for a follow-on workshop in early spring that would take recommendations and solicit input from ecologists, engineers, and architects as to the scientific needs and engineering challenges of executing a large, replicated climate change experiment in Alaska (all participants).
Climate Change Experiments in High-Latitude Ecosystems

International Arctic Research Center, University of Alaska, Fairbanks

Agenda

Wednesday, October 13, 2010

7:45 am: Vans pick up participants at Pike’s Waterfront Lodge hotel

7:45 to 8:30 am: Continental breakfast (International Arctic Research Center, UAF)

8:30 to 8:50 am: Welcome
- Workshop organizers: Stan Wullschleger and Larry Hinzman
- DOE Sponsors: Mike Kuperberg and others
- University representative: TBD

8:50 to 9:00 am: Statement of workshop goals and objectives – Stan Wullschleger

Plenary Presentations (Moderator, Larry Hinzman)
- 9:00 to 9:30 am: Dave McGuire, University of Alaska Fairbanks
- 9:30 to 10:00 am: Ted Schuur, University of Florida

Break: 10:00 to 10:15 am

Models (Moderator, Rich Norby)
- 10:15 to 10:40 am: John Walsh, University of Alaska Fairbanks
- 10:40 to 11:05 am: David Lawrence, National Center for Atmospheric Research
- 11:05 to 11:30 am: Bill Riley, Lawrence Berkeley National Laboratory
- 11:30 to 11:55 am: Peter Thornton, Oak Ridge National Laboratory

Lunch: Noon to 1:00 pm (Guest Speaker, Walter Oechel)

Observations (Moderator, Alistair Rogers)
- 1:15 to 1:40 pm: Matthew Sturm, CRREL
- 1:40 to 2:05 pm: Douglas Kane, University of Alaska Fairbanks
- 2:05 to 2:30 pm: Eugenie Euskirchen, University of Alaska Fairbanks
- 2:30 to 2:55 pm: Mikhail Mastepanov, Lund University, Sweden
- 2:55 to 3:15 pm: Break
- 3:15 to 3:40 pm: Mike Weintraub, University of Toledo
- 3:40 to 4:05 pm: Eric Kasischke, University of Maryland
- 4:05 to 4:30 pm: Mark Ivey, Sandia National Laboratory

Discussion: 4:30 to 5:00 pm

Dinner: 6:30 to 8:30 pm: Pike’s Waterfront Lodge (Dan O’Neill)
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Agenda

Thursday, October 14, 2010

7:45 am: Vans pick up participants at Pike’s Waterfront Lodge hotel

7:45 to 8:30 am: Continental breakfast (International Arctic Research Center, UAF)

8:30 to 9:00 am: Summary of recommendations from modeling and observation sessions

Experiments (Moderator, Cathy Wilson)

8:30 to 8:55 am: John Yarie, University of Alaska Fairbanks
8:55 to 9:20 am: Gus Shaver, Marine Biological Laboratory
9:20 to 9:45 am: Douglas Goering, University of Alaska Fairbanks
9:45 to 10:10 am: Steve Oberbauer, Florida International University
10:10 to 10:30 am: Break
10:30 to 10:55 am: Dustin Bronson, University of Wyoming
10:55 to 11:20 am: Craig Tweedie, University of Texas at El Paso
11:20 to 11:45 am: Robert Hollister, Grand Valley State University

Lunch: Noon to 1:15 pm

1:30 to 2:00 pm: Paul Hanson, Oak Ridge National Laboratory

Next-generation ecosystem experiments: NGEE Arctic

2:00 to 2:15 pm: DOE Program Manager
2:15 to 2:30 pm: Soil prototype – Stan Wullschleger, Oak Ridge National Laboratory
2:30 to 3:00 pm: Air warming simulations – Rod Linn, Los Alamos National Laboratory
3:00 to 3:20 pm: Power generation – Keith Lewin, Brookhaven national Laboratory

Discussions: All

Conclusions and path forward: Stan Wullschleger

Adjourn: Vans depart for Pike’s Waterfront Lodge hotel
Organizing Committee and Writing Team
Stan Wullschleger (ORNL)
Larry Hinzman (UAF)
Peter Thornton (ORNL)
Cathy Wilson (LANL)
John Walsh (UAF)
Dave McGuire (UAF)
Rich Norby (ORNL)

NGEE Science Advisors
Larry Hinzman (UAF)
Ted Schuur (UF)
Walt Oechel (SDSU)
Steve Oberbauer (FIU)
Hank Shugart (UVa)

Sponsor
Mike Kuperberg (DOE, Biological and Environmental Research)
TBD

Moderators
Larry Hinzman
Cathy Wilson
Rich Norby
Alistair Rogers

Speakers
Matthew Sturm (CRREL)
David Lawrence (NCAR)
John Yarie (UAF)
Douglas Goering (UAF)
Paul Hanson (ORNL)
Craig Tweedie (UTEP)
Steve Oberbauer (FIU)
John Walsh (UAF)
Peter Thornton (ORNL)
Douglas Kane (UAF)
Keith Lewin (BNL)
Alistair Rogers (BNL)
Gus Shaver (MBL)
Eric Kasischke (UMD)
Mark Ivey (SNL)
Rodman Linn (LANL)
Robert Hollister (Grand Valley State University)
Eugenie Euskirchen (UAF)
Bill Riley (LBNL)
Mike Weintraub (University of Toledo)
Dustin Bronson (University of Wyoming)
Torben Christensen (Lund University, Sweden)

Other Invitees
Jon Zufelt (CRREL)
Anna Wagner (CRREL)
Glenn Sheehan (BASC)
Bryan Travis (LANL)
Zack Suban (LBNL)
Daniel White (UAF)