NIMBioS Investigative Workshop

Descriptive Title:

Integration of disturbance ecology and biogeochemistry to predict future dynamics of terrestrial carbon cycle under global change

Short Title:

Disturbance Regimes and Climate-Carbon Feedback

Workshop organizers:

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Project Summary

Disturbances have been recognized as a key factor affecting terrestrial biogeochemical processes but can be easily misinterpreted without considering the context of disturbance regimes. Many studies have been conducted to quantify impacts of individual disturbance events on ecosystem carbon processes. In general, one disturbance event, such as wildfire, usually triggers release of a large amount of carbon and then follows by recovery processes. It is important to recognize that any disturbance events happen in a context of disturbance regime in a region. If the disturbance regime does not change over time in a region (i.e., stationary), recovery processes after one disturbance event result in net carbon uptake that can fully compensate the carbon loss triggered by the disturbance event, leading to no net change in carbon balance over time. Similarly over space, the carbon loss triggered by the disturbance event in one area can be fully compensated by carbon gain by recovery in other areas in a region if regional disturbance regimes are stationary. Thus, disturbance impacts on biogeochemical cycles have to be interpreted in the context of disturbance regimes and their responses to global change.

Disturbance regimes can usually be characterized by disturbance frequency, severity, and extensity, and differ in different regions of the world. So far, the quantitative relationship between carbon-climate feedback and disturbance regimes has not yet been carefully explored. Climate change likely alters disturbance regimes (i.e., nonstationry). The nonstationary disturbance regimes trigger either net carbon releases from or uptake by terrestrial ecosystems, feeding back to climate change. Mathematical models are needed to quantify stationarity of disturbance regimes and their feedback to

global carbon cycles and climate change. This investigative workshop will bring together disturbance ecologists, biogeochemists, mathematicians, statisticians, and computer scientists to discuss various issues related to integration of disturbance ecology with biogeochemistry using mathematical and statistical approaches. The workshop will synthesize state-of-the-art information and identify future directions in the interface areas of disturbance ecology and biogeochemistry. It is anticipated that the workshop will lead to a NIMBioS Working Group to tackle more focused issues in this interface area.

Central Theme. Development of mathematical models that integrate disturbance ecology with biogeochemistry so as to predict future changes in disturbance regimes and their influences on carbon-climate feedback.

The possible dates for the workshop:

February: 13-15

Tentative workshop agenda

Day 1

8:00, Breakfast at NIMBioS

8:30, Lou Gross: Introduction of NIMBioS

8:50, Welcome – Maria Leite

8:55, Introduction of the issue and objectives of the workshop — Yiqi Luo

9:15, Introduction, each participant presents two slides about their research that is relevant to the workshop theme

10:15 Break

Session I: Challenges in mathematical integration of disturbance ecology and biogeochemistry

10:30, Keynote speech: Ecosystems under transition – David Schimel

11:10, A mathematical model of carbon content in ecosystems – Maria Leite

11:40, Mathematical challenges in biogeochemical research – Paul Moorcroft

12:10, Lunch

1:10, Group discussions (4 groups with ~10 people in each group) for 120 minutes
Charges: discuss challenging issues cross disciplines

3:30, Break

4:00, Group reports (10 minutes per group)

Session II: Disturbance and recovery

4:30, Characteristics of disturbances – Peter S. White

5:00, Models of forest and carbon sequestration management – Natali Hritonenko

5:30, General discussion

6:00, Reception

Day 2:

Section II: Disturbance and recovery – Continue

8:00, Breakfast at NIMBioS

8:30, Integrated analysis of disturbance and recovery – Jeff Hicke

9:00, Population and evolutionary dynamics – Jim Cushing

9:30, Keynote speech: Dynamics, Data and Climate – Christopher Jones

10:10 Break

Session III: disturbance regime shifts

10:40, Disturbance regimes and regime shifts – Lianhong Gu

11:10, Shifts in fire regimes in Artic Tundra and other regions -- Feng sheng Hu

11:40, Lou Gross leads general discussion

12:30 Lunch

1:30 –3:00, Poster session

3:00: Break

Session IV: State changes

3:30, Ecosystem states and their changes in tropical regions -- Carla Staver

4:00, The Peatland Ice Age Hypothesis – Samantha Oestreicher

4:30, Scaling up ecosystem dynamics and disturbance regimes – Jeremy Lichstein

5:00, Stability concepts and analysis - Alan Hastings

5:30, Charges in Day 3: each participant prepares a reflection powerpoint of 1-2 slides to present (up to 2 minutes) in Day 3. The slides should discuss which issues (or methods) you are interested in collaborating with your cross-discipline colleagues.

Day 3:

8:00, Breakfast at NIMBioS

8:30-10:00, Session V: Reflections by participants (2 minutes each) to talk about ideas they generated during the workshop.

10:00 Break

10:30, Identification of issues to be addressed by interdisciplinary teams in the future and organization of collaborative teams.

12:00, Adjourn