NASA’s Arctic-Boreal Vulnerability Experiment

Eric S. Kasischke, Daniel J. Hayes: Co-Chairs: ABoVE SDT
Diane Wickland: NASA Headquarters
Peter Griffith: NASA Carbon Cycle and Ecosystems Office
Libby Larson: AAAS Science Policy Fellow, NASA HQ
What is ABoVE?

• A large-scale study of environmental change in Western North America and its implications for ecological systems and society

• NASA is planning its next major field campaign for Western Canada and Alaska, based on the ABoVE concept:
  1. developing a fuller understanding of ecosystem vulnerability to climate change in the region, and
  2. providing the scientific information required to develop options for societal responses to the impacts of these changes.
The ABoVE Study Region provides the opportunity to carry out research across gradients of landscapes and ecosystems that are unique to the Arctic/Boreal Region.
Timeline

• Oct 2008 – NASA Terrestrial Ecology Program Solicits Proposals for Scoping Studies to define future field campaigns
• Feb 2009 – NASA Funds VuRSAL Scoping Study
• Oct 2010 – ABoVE Scoping Study Report submitted to NASA
• Oct 2011 – ABoVE Scoping Study report review completed and NASA decides to move forward
• Jul 2012 – Workshop convened to further refine ABoVE science questions
• Feb 2013 – NASA selects Science Definition Team (SDT) to produce ABoVE Concise Experiment Plan
• Apr 2013 – NASA funds five pre-ABoVE projects to develop data products presumed to be of high relevance for ABoVE science
• Early 2014 – ABoVE Concise Experiment Plan completed
• Mid 2014 – Initial solicitation of proposals by NASA for ABoVE research. (ABoVE Concise Experiment Plan will serve as a resource to guide the development of this solicitation.)
Overarching Science Question

How vulnerable and resilient are ecosystems and society to environmental change in Arctic and boreal regions?
Overarching Science Objective

To understand how complex interactions are controlling landscape transitions in Arctic-boreal ecosystems and how these changes are impacting human societies within and beyond this region.
Focus Areas

Land/Atmosphere Feedbacks

Flora/Fauna Dynamics

Soil Carbon Cycling

Hydrologic Processes

Permafrost Dynamics

Disturbances

Policy/Management Decisions

Societal Impacts/Responses

Ecosystem Services
Permafrost Thaw

Climate Warming

Infrastructure / Transportation; Water & Habitat; Carbon Sequestration

Infrastructure Investment
Water & Wildlife Management
Climate Policy

Feedbacks
Tier 2 Science Questions

1. How are environmental changes in the ABR affecting *natural and cultural resources* and climate regulation, and how are *human societies* within and beyond the region responding?

2. How are *disturbance regimes* in ABR changing and what processes are controlling those changes?

3. What are the changes in the distribution and properties of *permafrost* in the ABR and what is controlling those changes?

4. What are the changes in the spatial distribution of *water*, and the amount and timing of *water discharge* in the ABR and what is controlling those changes?

5. How is the magnitude and fate of *soil organic carbon* pools in the ABR changing, and what are the processes controlling the rates of those changes?

6. How are ABR *flora and fauna* responding to changes in biotic and abiotic conditions, and what are the impacts on ecosystem structure and function?

7. How do *complex interactions* affect the trajectory of ecosystem structure and function and ecosystem services in the ABR?
Tier 2 Science Questions and Objectives

*How are disturbance regimes in ABR changing and what processes are controlling those changes?*

Objectives:
(a) Determine the controls on the spatial and temporal patterns of the primary natural disturbances in the ABR (fire, insects/pathogens, rapid permafrost thaw)
(b) Understand the consequences of variations in disturbance regimes for ecosystems and landscapes
What NASA-supported research activities will be carried out?

• Development and validation of information products from **remote sensing** observations (spaceborne and airborne)

• Collection of ground-based data from **field studies** (provide information to address critical uncertainties, including ecosystem processes and human-environment interactions, validation of remote sensing products)

• **Modeling** activities (model development and validation, use of models for diagnosis and prognosis)

• Integration, analysis, and **synthesis**
Due to the lapse in federal government funding, this website is not available. We sincerely regret this inconvenience.

For information about available government services, visit USA.gov.

Este sitio web no se está disponible durante el cierre del Gobierno. Lamentamos profundamente las molestias que esto pueda causar.

Visite GobiernoUSA.gov para informarse sobre los servicios gubernamentales disponibles durante el cierre del Gobierno.
Climate change in the Arctic and Boreal region is unfolding faster than anywhere else on Earth, resulting in reduced Arctic sea ice, thawing of permafrost soils, decomposition of long-frozen organic matter, widespread changes to lakes, rivers, coastlines, and alterations of ecosystem structure and function. NASA’s Terrestrial Ecology Program is in the process of planning a major field campaign, the Arctic Boreal Vulnerability Experiment (ABoVE), which will take place in Alaska and western Canada during the next 5 to 8 years. ABoVE will seek a better understanding of the vulnerability and resilience of ecosystems and society to this changing environment.

ABoVE Announcements

- 16th International Boreal Forest Research Association (IBFRA) Conference: October 7 to 10, 2013 [Go to website]
- Fall 2013 Relevant AGU Sessions
  Due Date for Abstracts: August 6, 2013
- ARCUS Workshop on Needs in Arctic Research Support and Logistics: October 7 to 9, 2013 in the Washington, D.C. area [Go to website]

Where Are We Now?

- The ABoVE Science Definition Team is currently preparing a concise experiment plan which will serve to guide NASA’s solicitation for the ABoVE science team sometime in 2014. The second face to face meeting will be in Fairbanks, AK mid July 2013.
- Working groups are being developed to manage Data, Logistics, etc.
- In July 2013 the ABoVE Support Office travelled to Fairbanks, Toolik Lake and Barrow, Alaska evaluating existing site infrastructure and logistics support resources. [Overview]
- Check out the NGEE Blog featuring our visit to Barrow.

NASA News

Arctic Sea Ice Update: Unlikely To Break Records, But Continuing Downward Trend. [Go to article]
August 23, 2013

Earth Observatory Image of the Day "At the Intersection of Clouds and Smoke" [Go to article]

In late August, the next phase of site visits will take place...
### NASA pre-ABoVE Funded Research Projects

<table>
<thead>
<tr>
<th>Project Lead</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carroll, Mark</td>
<td>Carroll–01: Determining the Extent and Dynamics of Surface Water for the ABoVE Field Campaign (view)</td>
</tr>
<tr>
<td>Loboda, Tatiana</td>
<td>Loboda–01: Long–Term Multi–Sensor Record of Fire Disturbances in High Northern Latitudes (view)</td>
</tr>
<tr>
<td>Munger, J. (Bill)</td>
<td>Munger–03: Development of a Data–Assimilation Framework for Integrating 25 Years of Surface and Airborne observations to assess patterns of net CO2 exchange from Arctic Ecosystems (view)</td>
</tr>
<tr>
<td>Walker, Donald (Skip)</td>
<td>Walker–01: Recovery and Archiving of Key Arctic Alaska Vegetation Map and Plot Data for Long–Term Vegetation Analyses (view)</td>
</tr>
<tr>
<td>Zhang, Tingjun</td>
<td>Zhang–02: Remotely–Sensed Active Layer Thickness (ReSALT) Product Derived from InSAR Data Over North American Arctic Regions (view)</td>
</tr>
</tbody>
</table>
Geospatial Gallery

Disturbance

MAP Canada Fire History
REST Alaska Fire Area History
REST Canada Fire Area History
Alaska Insect Forest Damage...
Alaska Insect Forest Damage...
Strategic Vision for Development

Key steps in developing the ABoVE Concise Experiment Plan

• Insure that questions and objectives for ABoVE are consistent with those of other organizations
• Identify ongoing and planned monitoring activities being conducted by other organizations
• Identify partnerships/collaborations with other organizations in the ABoVE study domain
• Determine the research that needs to be carried out that will be funded by NASA
To be successful, ABoVE must coordinate with research and monitoring activities being carried out by a broad coalition of national & international organizations.
ABoVE Partners/Collaborators

Advanced discussions
• Dept of Energy Next Generation Ecosystem Experiment
• Dept of Interior Landscape Conservation Cooperatives
• North Slope Science Initiative
• Bonanza Creek and Arctic LTERs
• Natural Resources Canada/Canadian Forest Service
• US Geological Survey
• Bureau of Land Management
• Alaska Fire Science Consortium
• Alaska Center for Climate Assessment and Policy

Ongoing discussions
• Changing Cold Regions Network (NSERC)
• Ducks Unlimited
• Government of the NWT
• Government of the Yukon Territory
• International Arctic Research Center/ Japanese Research Community