

The Arctic-Boreal Vulnerability Experiment (ABOVE)

Context, Partners and Stakeholders

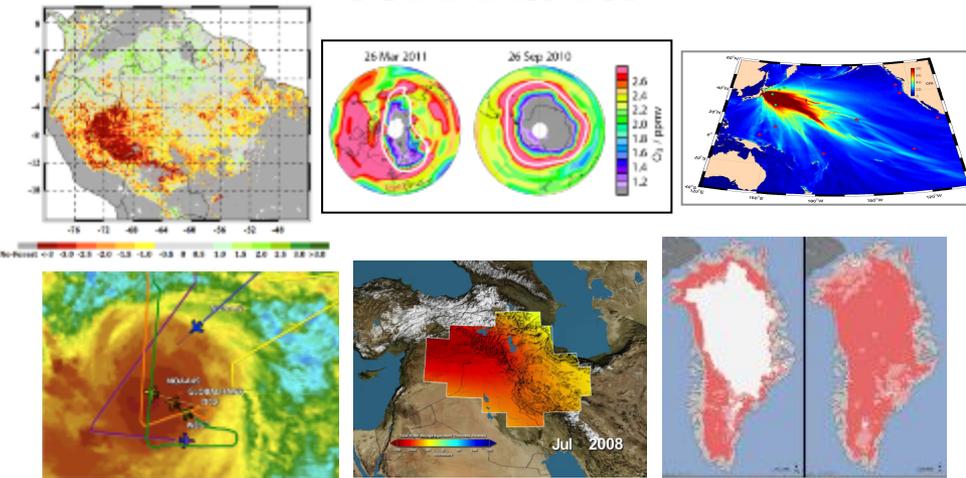
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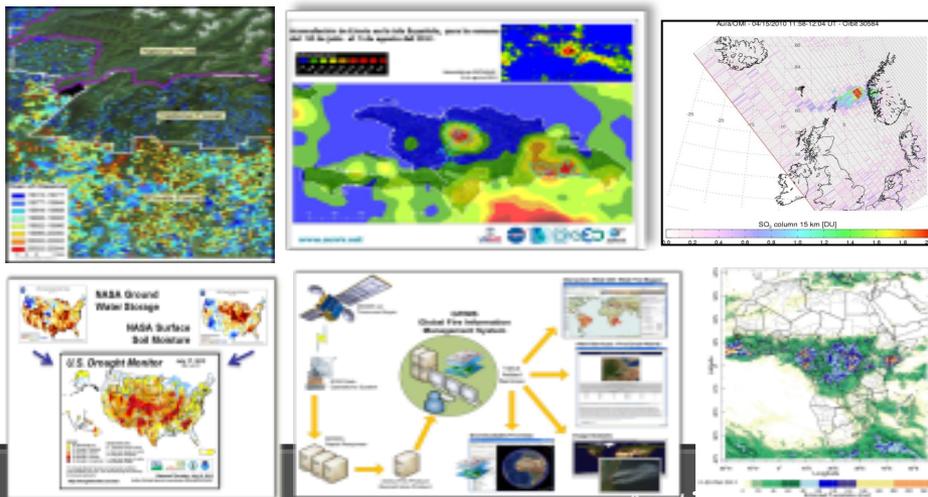
Research



Flight



Applied Sciences



Technology



NASA Terrestrial Ecology (TE) Program and Field Campaigns

Terrestrial Ecology (TE) is primarily a basic research program in the Earth Sciences Division of the Science Mission Directorate:

- Part of the Carbon Cycle and Ecosystems Focus Area (also includes Biodiversity and Ecological Forecasting, Land-Use Land-Cover Change, Ocean Biology and Biochemistry)
- Competitive, peer-reviewed research funding to PIs at universities, NASA research centers, other Federal research facilities, private companies, etc.
- We conduct “large-scale TE field campaigns” – periods of funding focused on a particular region/topic (e.g. FIFE, BOREAS, LBA-Eco)

Carbon Cycle & Ecosystems Focus Area

How are ecosystems changing in response to environmental change and human actions?

How will they change in the future?

How do changes to ecosystems impact the other components of the Earth system?

How can carbon cycle and ecosystem science improve our capacity for mitigation and adaptation to environmental change?



ABOVE Timeline

- October 2009 Workshop (Fairbanks) to prepare a scoping study for an arctic-boreal field experiment for the NASA TE Program.
- October 2010 Scoping Study Report submitted to NASA.
- June 2012 ABoVE Workshop in Colorado.
- February 2013 Science Definition Team formed for ACEP.
- May 2014 ABoVE Concise Experiment Plan (ACEP) submitted.
- December 2014 First NASA Research Announcement for ABoVE.
- August 2015 Awards made to 21 research projects.
- September 2015 First ABoVE Science Team Workshop (Minneapolis).
- January 2016 Second ABoVE Stakeholder and Science Team Workshop (Anchorage).
- Also in 2016 Second NASA Research Announcement for ABoVE (airborne campaign).

2016 TE-Related NASA Research Announcements

- ABoVE Airborne Campaign
- Carbon Monitoring System (CMS)
- Carbon Cycle Science (Interagency)
- Inter-Disciplinary Studies (IDS)

Other NASA Activities Linked to ABoVE

- NASA is currently developing the NISAR satellite mission
 - L- and S-band SAR developed jointly with the Indian Space Res. Org.
 - Quad-polarization system with 6-12 day repeat cycle
 - Launch ca. 2021
- Important ecosystem products to be developed for NISAR include
 - aboveground woody biomass
 - wetland mapping and dynamics
 - permafrost active layer via monitoring of surface deformation
- Pre-launch activities could include using airborne and satellite data to develop specific algorithms, including data collected as part of ABoVE projects

- ***Partnerships in scientific research***
- ***Partnerships in research support and logistics***
- ***Stakeholders***

A. *Partnerships in scientific research* include activities that will help shape and conduct the research that will be carried out during ABoVE:

- a. Establishment of collaborations with NASA-sponsored research projects (including synthesis of research), and
- b. Individual, sponsored research projects (Partnership Projects) that address ABoVE scientific questions and objectives.

B. Partnerships in research support and logistics:

- a. Activities that facilitate the exchange of scientific data and data products,
- b. Education and outreach activities involving ABoVE research questions and results,
- c. Access to sites and infrastructure, and
- d. Assistance with permitting.

US Institutional Participation in ABOVE to Date

Landscape Conservation Cooperatives

- Arctic
- Northwest Boreal
- Western Alaska

National Park Service

- Alaska Region
- Alaska Region Network Inventory and Monitoring Program
- Arctic Network Inventory and Monitoring Program
- Central Alaska Network Inventory and Monitoring Program
- Southwest Alaska Network Inventory and Monitoring Program
- Denali National Park and Preserve
- Lake Clark National Park and Preserve
- Upper Koyukuk National Park
- Wrangell St. Elias National Park
- Yukon Charley National Park

U.S. Fish and Wildlife Service

- Branch for Alaska Region Fire Management
- Raptor Management Unit
- Arctic National Wildlife Refuge
- Yukon Delta National Wildlife Refuge
- Yukon Flats National Wildlife Refuge

U.S. Forest Service

- Boreal Cooperative Research Unit (Bonanza Creek LTER)
- Pacific Northwest Research Station (Anchorage)

U.S. Geological Survey

- Alaska Science Center

State of Alaska

- Department of Natural Resources
- Department of Fish and Game

Alaska Native Organizations

- Calista Elders Council
- Council of Athabaskan Tribal Governments

Canadian Participation in ABoVE to Date (27 Total Organizations, 43 Team Members, 16 NASA-Funded Projects)

Federal Agencies

- Canadian High Arctic Research Station
- Canadian Forest Service
- Environment Canada
- Geologic Survey of Canada
- Parks Canada
- Polar Knowledge Canada

Provincial/Territorial Agencies

Alberta

- Environment and Sustainable Resource Development
- Royal Alberta Museum

Northwest Territories

- Centre for Geomatics
- Department of Environment and Natural Resources
- Forest Management Unit
- Geological Survey

Yukon

- Department of Environment
- Department of Community Services, Wildland Fire Management

Universities

- McMaster University
- Trent University
- University of Alberta
- University of British Columbia
- University of Guelph
- University of Montreal
- University of Quebec at Montreal
- University of Saskatchewan
- University of Toronto
- Wilfrid Laurier University

NGO/Private

- Gwich'in Renewable Resources Board
- Lesser Slave Lake Bird Observatory
- NOR-EX Ice Engineering Inc

NASA Seeks to Create Meaningful Partnerships

- There is a strong interest at NASA to form partnerships during the ABoVE Field Campaign
- However, we are only interested in creating partnerships that are ***beneficial to both organizations***
- Types of partnership activities include
 - Coordination of NASA funded research with ongoing research and monitoring activities in Partner Organizations
 - Jointly developing approaches to provide the results from ABoVE to a range of stakeholders

ABOVE should be a 9- to 10-year activity

- NASA plans to release a series of Research Announcements to provide additional opportunities to participate in ABOVE
- Partnership participation in the ABOVE Science Team from the beginning will influence the future direction of ABOVE
 - Identify specific activities where funding will enhance synergistic collaborative activities
 - Identify opportunities for researchers from Partner Organizations to join research proposal teams

There is no “Partnership Playbook”

- The success of past NASA Terrestrial Ecology Field Campaigns has been based in large part through the establishment of partnerships
- Each field campaign has had its own unique circumstances, requiring development of different types of partnerships
- The presentations and discussions at this Science Team Meeting are an important step in continuing the discussions needed to form the partnerships needed for the eventual success of ABoVE

ABOVE is the next TE field campaign, focused on environmental change in the **Arctic and boreal regions of western North America and the implications for ecological systems and society.**

- **Overarching Science Question:**

How vulnerable or resilient are ecosystems and society to environmental change in the Arctic and boreal region of western North America?

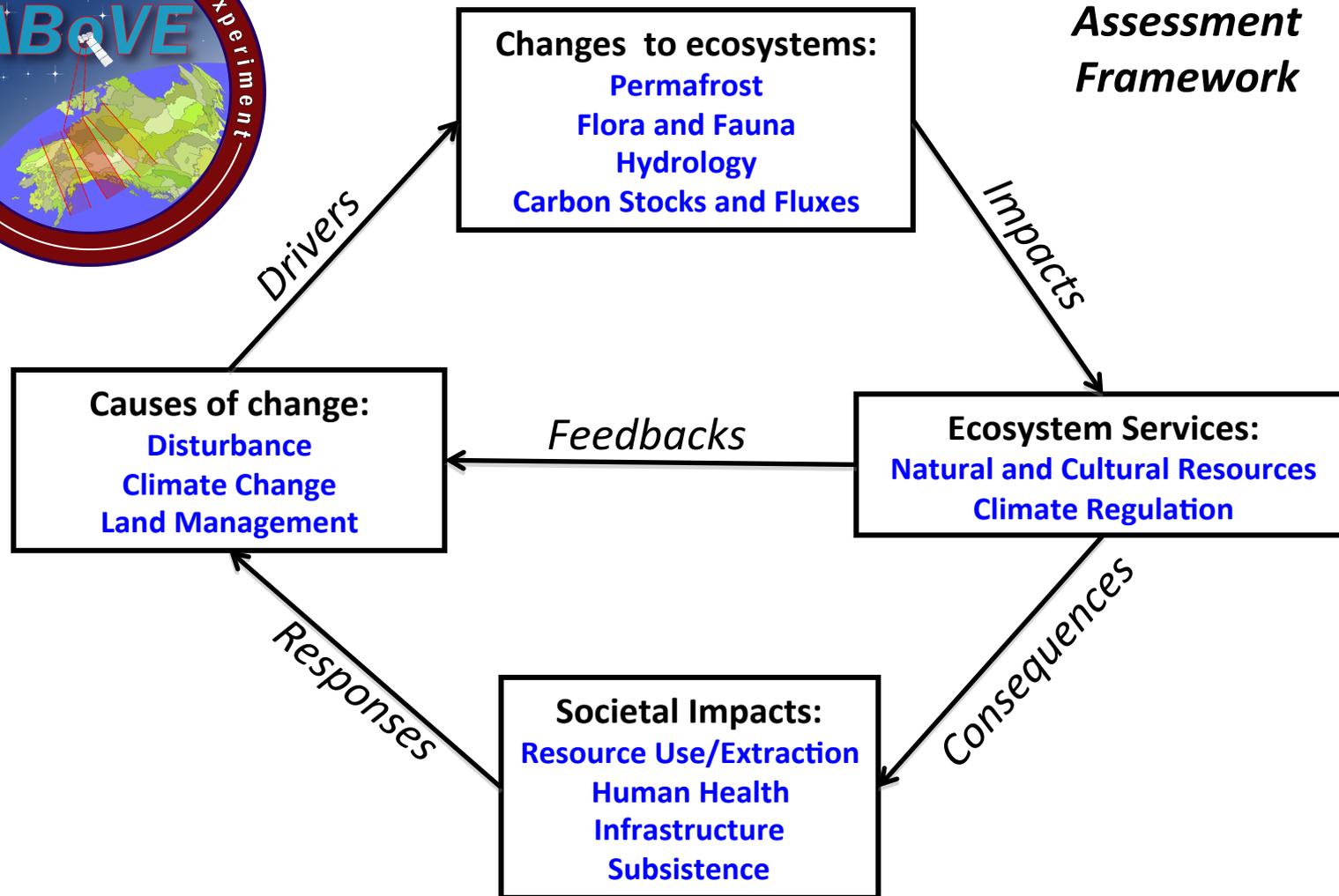
- **Overarching Science Objective:**

To investigate the underlying processes and their interactions that control vulnerability and resilience in Arctic and Boreal ecosystems of western North America to environmental change, and to assess how people within and beyond this region may respond to changes in these processes and interactions.

Global-Scale Climate Forcing



Vulnerability Assessment Framework



(Governance, Policy, Economics)

(Culture, Governance, Policy, Economics)

Regional-Scale Disturbances

1. Determine how interactions among vegetation, hydrology & disturbances **mediate permafrost vulnerability and resilience** to climate change.
2. Determine how **biological controls** influence **ecosystem responses** to **climate change and disturbances**.
3. Understand how **vegetation** attributes and **hydrologic** conditions interact and **influence disturbance**.
4. Quantify how changes in the spatial and temporal distribution of **snow properties** impact ecosystem structure and function.
5. Determine the causes of **vegetation productivity changes** and their **impacts** on ecosystem form and function.
6. Elucidate how climate change and disturbances interact.. to alter **carbon biogeochemistry**
7. Determine how **fish and wildlife habitat** co-vary across gradients of **climate and disturbance**.



ABOVE Science Questions

- How are environmental changes affecting critical **ecosystem services** - natural and cultural resources, human health, infrastructure, and climate regulation - and how are **human societies** responding
- What processes are contributing to changes in **disturbance regimes** and what are the impacts of these changes?
- What processes are controlling changes in the distribution and properties of **permafrost** and what are the impacts of these changes?
- What are the causes and consequences of changes in the **hydrologic system**, specifically the amount, temporal distribution, and discharge of surface and subsurface water?
- How are **flora and fauna** responding to changes in biotic and abiotic conditions, and what are the impacts on ecosystem structure and function?
- How are the magnitudes, fates, and land-atmosphere exchanges of **carbon pools** responding to environmental change, and what are the biogeochemical mechanisms driving these changes?

Ecosystem Dynamics Objectives

1. Determine how interactions among vegetation, soil characteristics, hydrology, and disturbances influence surface energy exchange and mediate **permafrost vulnerability and resilience** to climate change.
2. Determine how and where interactions among microbes, plants, and animals exert control over **ecosystem responses to climate change and disturbances**.
3. Understand how **vegetation attributes and hydrologic conditions** interact, and **respond and feedback to disturbance**.
4. Quantify how changes in the spatial and temporal distribution of **snow impacts ecosystem structure and function**.
5. Determine the **causes of greening and browning trends** and their **impacts on ecosystem** form and function.
6. Elucidate how **climate change and disturbances interact** with above and belowground communities and processes to **alter carbon biogeochemistry**, including the release to surface waters and the atmosphere.
7. Determine how the spatial and temporal dynamics in both **faunal abundance and characteristics of fish and wildlife habitat** co-vary across gradients of climate and disturbance.