Vegetation Dynamics and Distribution
Bruce Cook and Mike Goulden

Jennifer Baltzer, Uma Bhatt, Elizabeth Campbell, Abhishek Chatterjee, Wenjun Chen, Mark Chopping, Jan Eitel, Sarah Elmendorf, Howard Epstein, Josh Fisher, Robert Fraser, Nancy French, Mark Friedl, John Gamon, Scott Goetz, Heather Greaves, Peter Griffith, Amy Hendricks, Ted Hogg, Fred Huemmrich, Jill Johnstone, Kelseyann Kremers, Matthew Macander, Franz Meyer, Chip Miller, Paul Morin, Douglas Morton, Isla Myers-smith, Jon Ranson, Adrian Rocha, Brendan Rogers, Hank Shugart, Jacquelyn Shuman, Damien Sulla-Menashe, Sander Veraverbeke, David Verbyla, Lee Vierling, Skip Walker, Curtis Woodcock

Working Group goals

- Facilitate communication – spread science results, ideas and approaches within working group – a mechanism to learn what parallel or complementary projects are doing - posters today - science focused telcons every ~3 months

- Catalyze collaboration – help groups identify opportunities for collaboration

- Eventually move toward a few "summary", "synthesis" or "consensus" meeting sessions and papers, where multiple groups pursuing broadly parallel questions point out and discuss the areas of agreement and disagreement – goal is to distill, clarify and communicate "big picture" findings to the broader community including stake holders

ARCTIC BOREAL VULNERABILITY EXPERIMENT

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Common science themes	Groups	ABoVE Tier 2 Science Objectives
1) Mechanistic controls on plant physiology and soil biogeochemistry, including changing phenology, growing season length, permafrost and hydrologic conditions, and drought	Eitel, Gamon, Rocha, Morton	How climate change and disturbances interact with communities and processes to alter carbon biogeochemistry [SO6]
2) Shifting patterns of tundra vegetation, with an emphasis on greening, shrub encroachment or treeline dynamics	Chopping, Frost, Goetz, Greaves/Vierling, Rocha, Prugh, Ranson, Vierling	Causes of greening and browning trends [SO5]
3) Shifting patterns of boreal forest vegetation density and extent, with an emphasis on greening and browning trends, fire and insect mortality	Cook, Eitel, Goetz, Goulden, Ranson, Campbell	Causes of greening and browning trends [SO5], and How vegetation attributes interact, and respond and feedback to disturbance [SO3]
4) Relationships between disturbance and recovery, including effects on soil properties and vegetation composition, structure, and function	Cook, Frost, Goulden, Morton, Rocha (affiliated), Rogers, Bourgeau-Chavez/French	How vegetation attributes interact, and respond and feedback to disturbance [SO3]
5) Distribution of vegetation structure and type	Cook, Eitel, Frost, Goetz, Greaves/Vierling, Morton, Ranson, Walker, Woodcock/Friedl, Bourgeau-Chavez/French	Important for all Tier 2 questions [including SO3, SO5, SO6]

Progress and early findings

Shifting patterns of tundra vegetation density, with an emphasis on greening, shrub encroachment or treeline dynamics

- LiDAR, passive spectral, and ecophysiological approaches to link Forest Tundra Ecotone structure and function (Eitel et al)

- Evaluating relationships between seedling establishment and microtopography at the Forest-Tundra Ecotone using terrestrial lidar (Maguire et al)

- Should the arctic be greening? Coupled CN model and MODIS show similar rates of greening, but spatial patterns don't always agree (Wright and Rocha)

- Changes in Shrub Abundance in Arctic Tundra and Impacts on Albedo - How shrubs responding to changing environmental conditions and what are the impacts on ecosystem structure and surface albedo? (Chopping et al)

- How are vegetation and snow conditions changing in alpine ecosystems throughout the ABoVE domain? (Verbyla and Prugh)

- Drivers and Impacts of Ecological Change on the Yukon-Kuskokwim Delta, Alaska (Frost et al)

- Mapping and Modeling Attributes of an Arctic – Boreal Biome Shift - Arctic Vegetation Mapping (Macander et al)

- Causes and Consequences of Arctic Greening" (Huemmrich et al)

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Progress and early findings

<u>Shifting patterns of boreal forest vegetation density and extent, with an emphasis on greening and browning trends, fire and insect mortality</u>

- Forest change at the southern limits boreal zone - What are the cumulative effects of climate change on boreal forests of northern BC and Yukon? (Campbell et al)

- Assessing drought impacts on western Canadian aspen forests - Recent, severe droughts coupled with insect damage and climatic warming are leading to extensive dieback and decline of forests across large areas of the western Canadian interior (Hogg et al)

- Geostatistical estimation of forest biomass in interior Alaska combining Landsat derived tree cover, sampled airborne lidar and field observations (Babcock et al)

- Mapping and Modeling Attributes of an Arctic – Boreal Biome Shift - Boreal productivity & tree mortality patterns linked with remote sensing (Goetz et al)

- Landscape-Scale Histories of Greenness Trends for ABoVE from Landsat (Sulla-Menashe et al)

- Landsat analyses of boreal forest browning/greening in SK/MB in relationship to recent fires (Goulden et al)
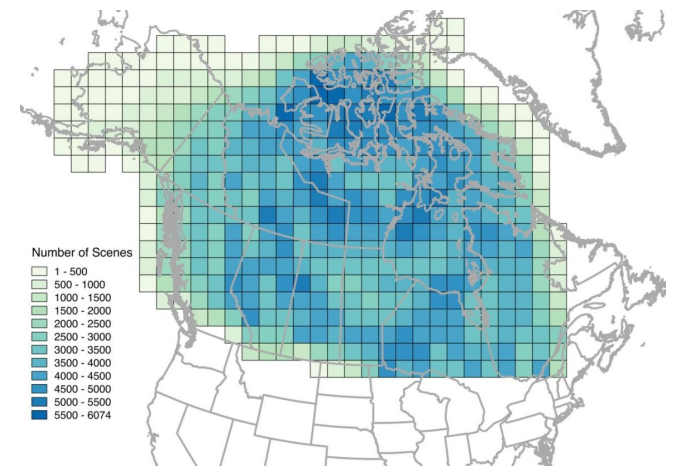

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Progress and early findings

Distribution of vegetation structure and type/Relationships between disturbance and recovery, including effects on soil properties and vegetation composition, structure, and function

- Landscape-Scale Histories and Active Monitoring of Disturbance and Seasonality Trends for ABoVE from Landsat (Sulla-Menashe et al)

- Using Landsat to characterize the patterns of Boreal Forest succession in Manitoba over the Last 30 Years (Goulden et al)

- Spatially explicate regional map of boreal forest biomass and uncertainties using a novel, computationally efficient and statistical robust algorithm (Babcock et al)

- Understanding the vulnerability and resiliency of boreal-taiga ecosystems to wildfire in a changing climate (Bourgeau-Chavez, French et al.)

- Developing a spatially-explicit understanding of fire-climate forcing and their management implications across the ABoVE domain (Rogers et al)

- Characterizing and evaluating the Arctic Digital Elevation Model product with LiDAR data for spatial modeling (Arjan Meddens et al.)

Number of Scenes
- 1 - 500
- 500 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 2500
- 2500 - 3000
- 3000 - 3500
- 3500 - 4000
- 4000 - 4500
- 4500 - 5000
- 5000 - 5500
- 5500 - 6074

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Airborne Remote Sensing

Eitel et al – using LVIS and chlorophyll fluorescence from the CFIS campaign - cal/val measurements may include soil temperature, PRI, wind, air temperature, ground based lidar

Bourgeau-Chavez, French et al - using LVIS at NWT sites for biomass in unburned sites to account for confounding variable for SAR-based soil moisture retrieval; using AVIRIS at NWT sites to assess post-fire vegetation regrowth and vegetation moisture status

Huemmrich et al – using AVIRIS to look at causes and consequences of arctic greening

Frost et al - using AVIRIS to characterize landscape dynamics on the Yukon-Kuskokwim Delta