Flora: Structure, Function, Dynamics – Getting organized (~15% of the way!)

Dimensions/axes to discuss and organize along/around

- Common science themes/big questions
- Common measurement protocols
- Common remote sensing needs/products
- Common experimental design(s) (nest/scaling/hierarch, Jenny gradients; individual process focus, biological, scaling, tool/model development/testing…..)
- Common field sites (either/both local and regional)

Science themes (map to/always think about ABoVE objectives/science questions)

- Greening/shrub encroachment/expansion/biome shift
- Browning/dieback/stress
- Physiology/phenology/growing season length
- Veg mapping
- Veg dynamics – biogeography and climate impacts
- Veg dynamics – disturbance and recovery
- Emerging tools – RS for plant physiology,
- Emerging tools – RS for structure

Once around the table on where each group fits on these axes

Needs/next steps/priorities

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Common Measurement Protocol Discussion

- Adopting similar GPS measurement standards facilitates common use across projects
- Recommendation for each project to collect very high accuracy GPS data (<1m) at all field sites, e.g. geolocating each of the field plots. Utilize survey-grade GPS at all sites. Cost ~$10K per pair of high resolution GPS units.
- Two issues survey-grade GPS will help to address: (1) validating DEMs, (2) geolocating measurement plots.
- Report absolute accuracy and precision of our measurements
- Flux tower site desirable by several projects for co-location (with both E-C and optical measurements)
- Adopt common protocol for forest inventory sampling?
    - protocol used by Morton et al. is available (with goal of consistency across projects)
    - pre-disturbance measurements for application to projects focused on fire

Core Site Discussion

- Core sites desirable to facilitate intercomparisons and collaborative efforts, assist with logistics
- Choosing core sites within footprints/flightlines where high resolution aerial imagery/lidar data are already available may be desirable…this would create critical mass of measurements within various focal sites (e.g. Tanana Valley, Toolik Lake, Dalton Highway).
- However, the approach of choosing core site(s) based on existing aircraft data may lead to undue bias, so…
- Further discussion of science gaps needed to identify highest priority field locations (based combining science questions, experimental design, remote sensing, model runs) (for example, look for remote sensing anomalies in albedo, phenological time series, disturbance histories, and/or modeling outputs)
- Recommend a coordinated effort at core sites to provide basic science support infrastructure (e.g. technician support, transportation support, storage facilities)
- Data collected at core sites need to be complemented by other sites (specific to each study) to increase representativeness of work
- Parallel scaling/hierarchical/nested experimental design/approach in fieldwork/ remote sensing and modeling

Key Needs Identified (1 of 2)

- Develop standardized hierarchical legend for mapping products, site characterization, and to support field site selection/sampling locations (i.e. actual vegetation, including functional groups of e.g. lichen, graminoids, shrub, tree)
- Core Site concept: e.g. find location(s) that reveal specific trends (e.g. "browning"). Need to analyze existing RS products and model outputs to identify locations along a (NPP, LAI, forest cover, total/tall shrub cover) gradient at which to test range of hypotheses. Perhaps establish additional infrastructure at highly desirable site(s)? Consider logistics cost/benefit. Coordinate with existing plans/site-based studies.
- Compile protocols for best practices in field data collection (e.g. forest inventory, geolocation protocols, ecosystem classification). Include a list of core vs. desired measurements. Include sampling goals to help across projects (e.g. tree cores, soil cores, other plant tissue samples, etc.) Develop a mechanism for submitting sampling requests to various teams across the ABoVE project.

Flora: Structure, Function, Dynamics

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Key Needs Identified (2 of 2)

- Compile a list of best practices of satellite data product use (bibliography describing recent advances in products, e.g. MODIS Collection 6)
- Evaluation of flux tower data availability—these data are desirable by several projects (both archival data and ongoing measurements). New tower data should include optical measurements (details TBD).
- Airborne data are important—allow targeted sampling at key/core site(s). (Adopt common sampling protocols/specs for LiDAR data acquisition?) Ensure that acquisitions are justified/defined by science questions.
- Develop strategy for opportunistic data collection in case of unexpected unusual/estreme events (e.g. natural disasters (fire, thermokarst, insect outbreak, severe drought), areas of model/observational disagreement) for targeted (airborne, satellite, field), focusing on targeted sampling across the 10-year ABoVE experiment.

Flora: Structure, Function, Dynamics

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Common experimental design(s) (chronosequences – climosequences -- toposequences…)

- Coordinated temporally (both with field campaigns and in automated sampling strategy)

Discussion about possibility of common field sites

Study site overview:

- Goulden et al.: TBA, likely a forest chronosequence over a large LAI gradient, in addition to 1-2 core sites.
- Eitel et al.: Precise locations TBA, likely (1) along Dalton Highway near Coldfoot, and (2) near Yellowknife. Locations chosen due to available lidar data and logistical considerations (logistical ease). Focus on forest-tundra ecotone. Intensive core site sampling in early years, extending the sampling across larger area in the out years.
- Woodcock et al: opportunities esp. in side-laps of Landsat archive; temporally interesting in the shoulder seasons/ transition seasons. Synchronize field sampling if possible.
- Ranson et al: Tanana Valley focus, within G-LiHT flightlines (other potential sites: Scotty Creek, near CHARS (Neal Scott's site)). Producing point clouds of veg structure using stereo photogrammetry using high res (<1m) satellite imagery.
- Goetz et al: Many/most field measurements already exist. Shrub mapping across large tundra area (North Slope), trees sampled (evaluating greening and browning) in S Central AK and Interior AK, Western Canada interior (Alberta, Manitoba, Sask). Modeling will occur to capture the entire ABoVE domain.
- Chopping et al: Field work completed (26 of 1039 sites sampled using belt transects across 250 m Albers grid cells) with shrub reference data distributed across the North Slope. Will select new sites to coordinate with other ABoVE projects. Interested in historical high resolution imagery, if these can be geolocated to ~5 m.
- Gamon et al: Field sampling already occurred during period of MODIS dataset (~2000-2015), retrospective analysis, may calibrate PRI/NDVI/CCI using sensors on existing or new flux towers. Interested in specific veg types. Primarily interested in interior boreal forest, but possibly to work across a tree cover/LAI gradient. Potential interest to sample within the FTE and tundra as well.
- Greaves: No new field data. N. Slope of AK, foothills region near Toolik Lake, including Imnavait, locations around Toolik. Fine scale mapping of shrub biomass, vegetation classification using range of data at Toolik and potentially across broader Brooks Range foothills.
- Kremers: No new field data. Using flux towers across N. Slope, modeling applied across various validation sites. Potential to expand model validation to Y-K delta
- Cook/Morton et al.: Extensive field data and airborne data across Tanana Valley. Plots mostly capture bottomlands.

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Common remote sensing needs/products

Airborne Data:

- G-LiHT
  - Transects (to sample systematically, capturing as much biomass variability and disturbances
  - 350m swath width, long flightlines, efficient data collection
- Aerial Photos
- L-Band InSAR (Available for parts of AK, e.g. Yukon Valley, N. Slope, Tanana Valley—to support DEM development)
- Non-G-LiHT LiDAR
  - Dalton Highway (~8 pts/m^2)
  - PALS (profiling data, R. Nelson et al.)

Satellite Data:

- Landsat: Cloud screened data as a standard product?
- MODIS (Be sure to use Collection 6! Or use Aqua.)
- High res data from PGC/NGA archive

Products:

- Surface water map (30m)
- *Consistent vegetation classification unit nomenclature/legend to populate maps spanning AK and Canada (Walker et al./ CHARS coordination). Stratify using common ecological units, utilizing information such as site index. High quality DEM necessary.

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Science themes

- Greening/shrub encroachment/expansion/biome shift
- Browning/dieback/stress
- Physiology/phenology
- Veg mapping
- Veg dynamics – biogeography and climate impacts
- Veg dynamics – disturbance and recovery
- Emerging tools – plant physiology
- Emerging tools - structure

- Links w/ BGC
- Links w/ fire
- Links w/ hydrology/permafrost/redox/flows/drought

Needs

Aircrafts

ARCTIC BOREAL VULNERABILITY EXPERIMENT