Jan Eitel

LiDAR, passive spectral, and ecophysiological approaches to link Forest Tundra Ecotone structure and function
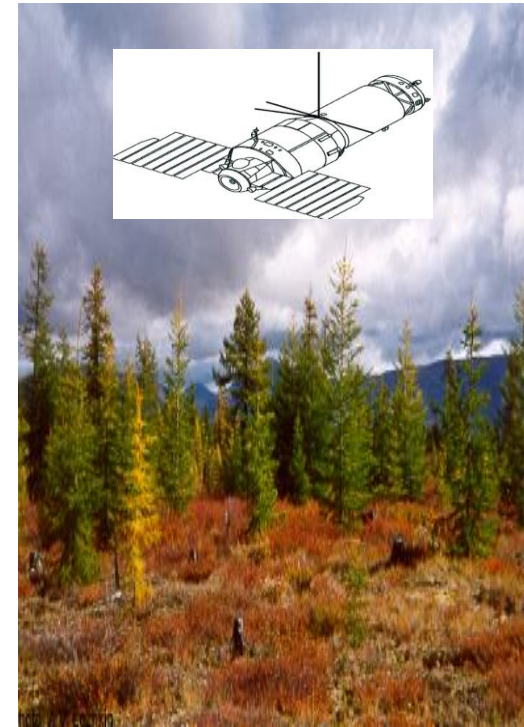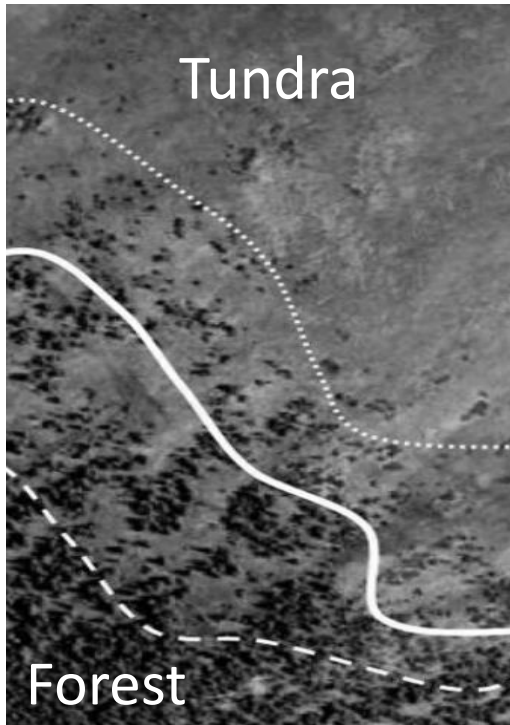
Eitel-01

Jan Eitel, Natalie Boelman, Lee Vierling, Kevin Griffin

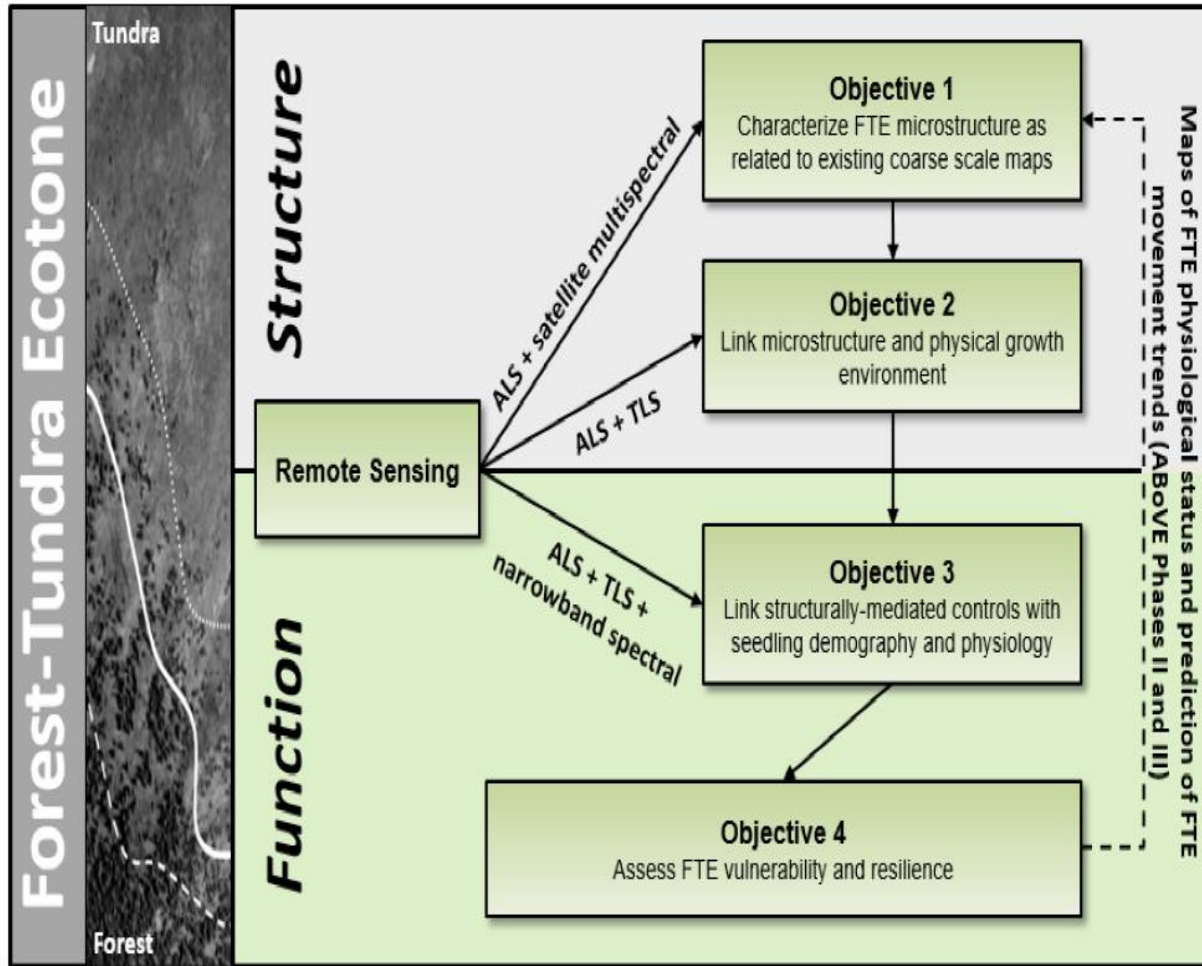ARCTIC BOREAL VULNERABILITY EXPERIMENT

Institutional Collaborations

- Dr. Mukesh Kumar, Nicholas School of Environment, Duke University

- Dr. Michael A. Wulder, Canadian Forest Service

- NOR-Ex Ice Engineering

- Tibbit to Contwoyto Winter Road Joint Venture

Motivation

Tundra

Forest

Change Ahead

Sources left to right: Berdanier, 2010, Wikipedia

ARCTIC BOREAL
VULNERABILITY
EXPERIMENT

Science Questions & Objectives

Field Studies

Alaska Dalton LiDAR dataset
Canada Yellowknife LiDAR dataset
Canada *Wulder et al.* LiDAR transect dataset
FTE *Ranson et al. 2011* Class 1: 5-20% tree cover
FTE *Ranson et al. 2011* Class 2: < 5% tree cover

Source: Ranson et al., 2011

ARCTIC BOREAL
VULNERABILITY
EXPERIMENT

above.nasa.gov @NASA_ABoVE

5

Field Studies (cont.)

Forest-Tundra Ecotone (FTE) — Tundra / Forest
(Ranson et al. 2011 classification)

Example Study Transect
(n = 6 for entire project)

<5% tree cover
5-20% tree cover

- Structure-Physiology Monitoring Sites
  (n= 20 per transect except *)

  Continuous measurements
  - PRI
  - Soil temperature
  - Air temperature
  - Dendrometers (*n=10)

  Repeat manual measurements
  - Chlorophyll fluorescence (*n=300)

  Single manual measurements
  - Terrestrial LiDAR
  - Forest Inventory Analysis

- ★ Autonomous Terrestrial LiDAR Sites
  (n=2 per transect)

  Continuous measurements
  - Snow depth
  - Plant structure
  - Surface structure

  Hyper-temporal LiDAR
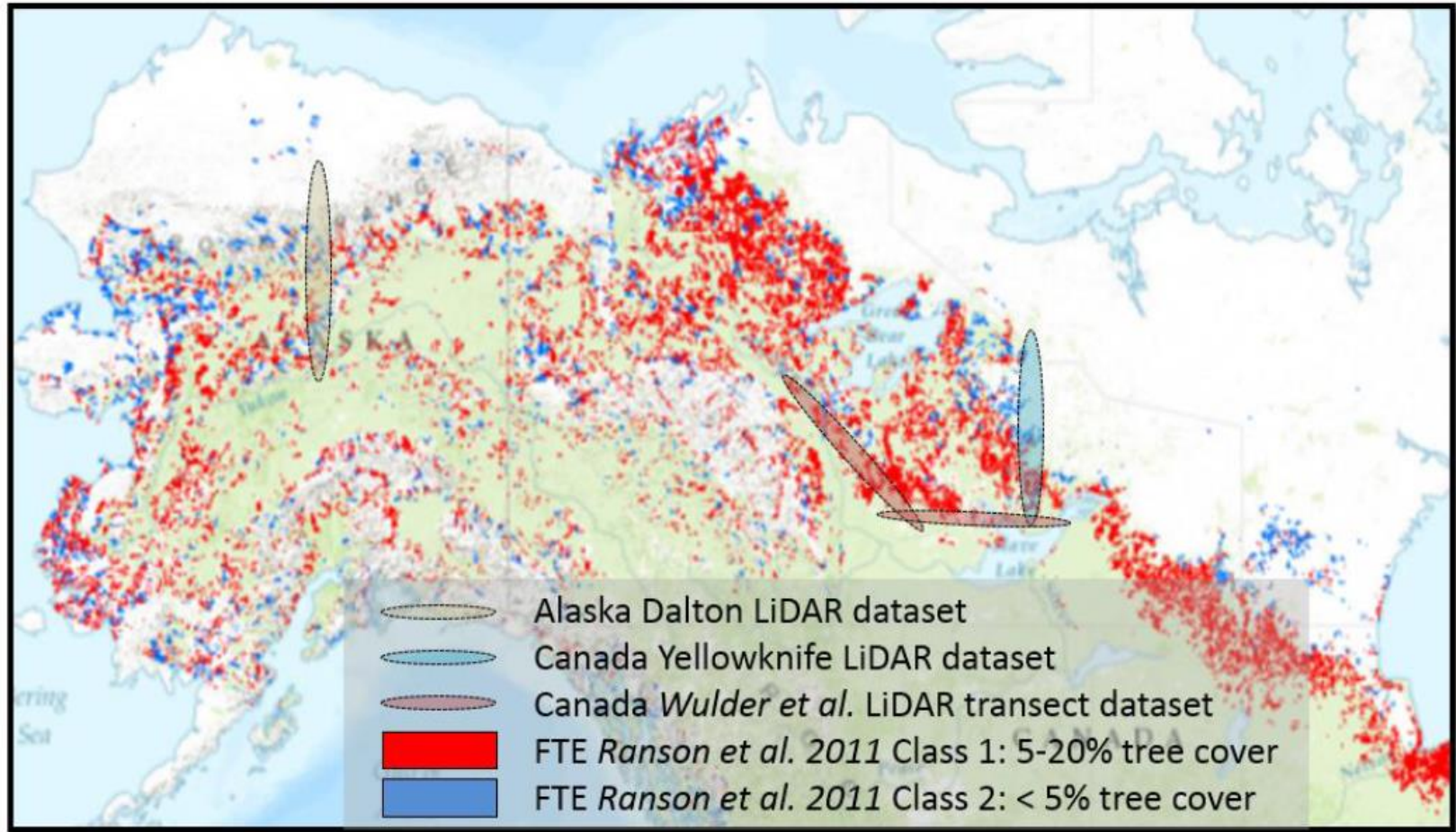
ARCTIC BOREAL VULNERABILITY EXPERIMENT

Spaceborne Remote Sensing

- Recent MODIS and Landsat satellite data for study sites to update FTE maps (Ranson et al. 2011).
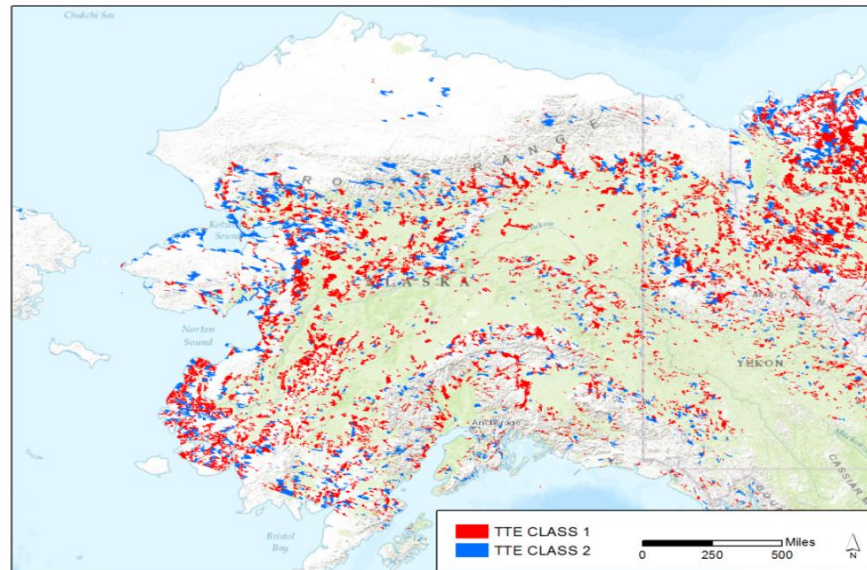
Source: Ranson et al., 2011

Airborne Remote Sensing

- **Alaska Dalton LiDAR dataset:** Dalton Highway, freely available

- **Yellowknife LiDAR dataset:** Tibbitt to Contwoyto Winter Road, NOR-Ex Engineering and the Tibbitt to Contwoyto Winter Road Joint Venture Ltd.

- **25000 km of LiDAR transect data:** across Boreal regions in Canada, Dr. Wulder

- **Desired:** FTE regions

ARCTIC BOREAL VULNERABILITY EXPERIMENT

Modeling Approaches

- **Modeling:** Parametric statistics

- **Driver data needed:** Microtopographic data (LiDAR)

- **Data formats:** Tabular data (tab or comma delimited), Geospatial data (ISO 19115 and Federal Geographic Data Committee standards)

- **Metadata standards:** Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata (FGDC CSDGM) and the FGCD Biological Data Profile (BDP)

Geospatial Data Products

- **Geospatial datasets:** vegetation structure, snowpack dynamics, radiative transfer, tree physiology, and FTE vulnerability and resiliency

- **Geographic coverage:** Areas where FTE crosses 28,000 km of available LiDAR data

- **Stakeholder/user base:** future ABoVE studies, decision makers, local communities

ARCTIC BOREAL
VULNERABILITY
EXPERIMENT