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**Title:** Scaling Arctic leaf functional traits with reflectance spectroscopy

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**Abstract**

To be completed

**Introduction**

**Global change in the Arctic, current impacts, future projections**

Northern high latitudes, including shrub and coastal tundra ecosystems, are experiencing substantial changes in temperature and precipitation patterns in response to ongoing global change (REFS). These high latitude ecosystems are experiencing some of the greatest warming on the planet (REFS) and this trend is expected to continue (IPCC ref). Altered temperature and precipitation has led to decreased permafrost cover and deeper seasonal thaw, changes in vegetation greenness patterns, reduced snowpack, …….

**Ecosystem models in the Arctic, uncertainties, data needs**

Vegetation dynamics, carbon cycling, and albedo are highly sensitive to climate change in the Arctic (REFS), however these processes are currently poorly represented in process models designed to simulate these ecosystems ((REFS).

**Remote sensing of Arctic ecology/physiology**

Synoptic remote sensing observations have also provided strong evidence of the ongoing changes in the Arctic. Normalized Difference Vegetation Index (NDVI) observations from global Earth-observing satellites have shown substantial changes in the inter- and intra-annual signals of vegetation “greenness” (REFS), however exact attribution of these changes has been challenging (REFS).

Prediction of traits relevant for models using remote sensing

Summary of research – focus on developing spectra-trait models for arctic species, develop/test scaling algorithms

**Materials and Methods**

*Study site*

Our field sampling was conducted on the coastal tundra within the Barrow Environmental Observatory (BEO), near Barrow Alaska (71.3°N, 156.5°W; note that on December 1st 2016 Barrow was officially renamed Utqiaġvik following the original Inupiat name). The landscape within the BEO is characterized as acidic coastal plain tundra with small thaw ponds and low- to high-centered polygonal tundra features and a low vascular plant species diversity, dominated by *Carex aquatilis* (Brown *et al.*, 1980). Mean annual air temperature is −12 °C (annual range, 31°C) and mean annual precipitation is 106 mm, with the majority falling as rain during the short summer. Soils are generally classified as Gelisols, underlain by permafrost which extends to depths of 300 m or greater, with active layer thickness of 20 to 70 cm (Bockheim et al., 1999, Brown et al., 1980, Shiklomanov et al., 2010).

*Plant material*

Measurement of leaf traits, gas exchange, and spectra were conducted over an area of approximately 1 km2 centered at 71.28°N, 156.65°W.

*Tissue chemistry*

Samples were dried at 70°C for a minimum of three days before weighing to calculate LMA and leaf water content. Carbon, nitrogen and hydrogen of dried, ground samples were measured using a Perkin Elmer CHNO/S Series II 2400 elemental analyzer on 1.50 – 2.50 mg of each sample following standard procedures as per the instrument manual and xxReferencexx.

*Leaf spectroscopy*

**Results**

Leaf traits – leaf scale

**Discussion**