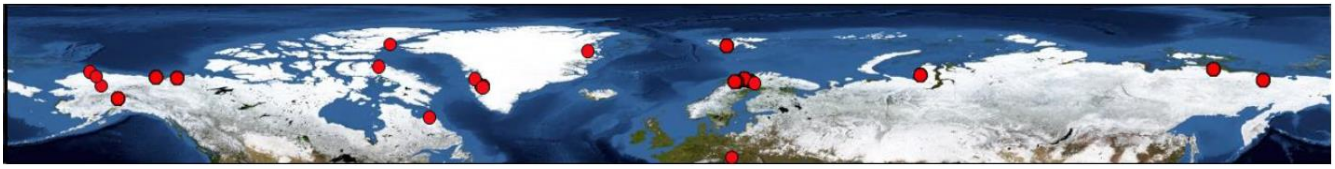
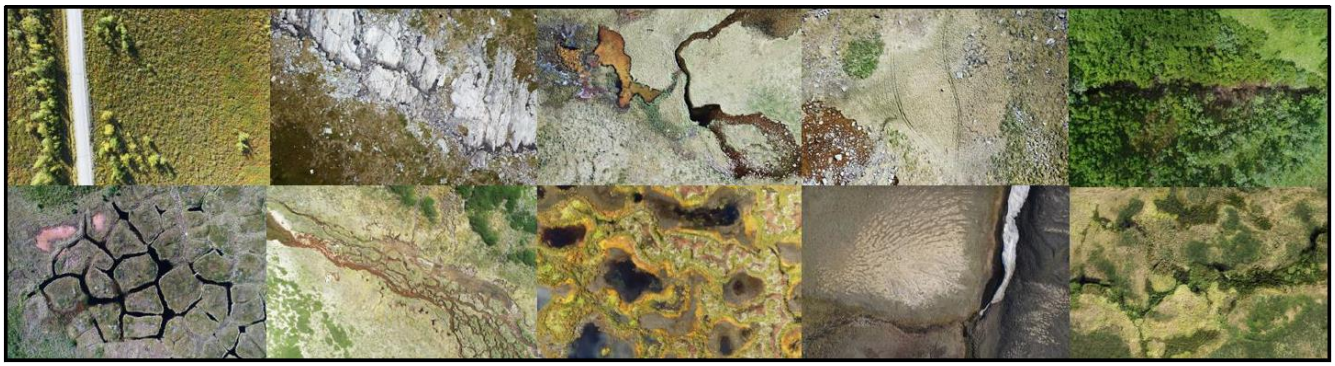
HiLDEN Data Collection: Summer 2019

With greater complexity being identified in tundra greening patterns and trends observed by satellites, the HiLDEN network was established to characterize landcover, conduct satellite validation, and to test emerging scaling questions in landscape ecology in high latitude ecosystems.



Since 2017, the HiLDEN Network has collected data and advanced analyses from 42 high latitude landscapes, and that number continues to grow. We are soliciting additional data for the first manuscript that was outlined at the HiLDEN working group meeting at Dartmouth College, in March 2019. These protocols detail the types of data that will be prioritized for this manuscript and reflect inputs from field teams and from ongoing analyses. This manuscript will focus on scaling patterns of vegetation greenness (specifically via NDVI) from ultra-fine grain to coarse satellite grain across diverse tundra environments.

These protocols are a simplified version of the 2018 protocols, but we emphasize the importance of high-quality data paired with high quality metadata acquisition. New sites are especially encouraged to contribute data, as are revisits to already mapped landscapes. Carefully following these protocols will produce data suitable for this synthesis, but also for your own ongoing work.



If you are interested in contributing data for the 2019 HiLDEN field campaign, please contact Jeff Kerby (Jeffrey.t.kerby@dartmouth.edu).

HiLDEN Protocols: Summer 2019

For the 2019 field season, HiLDEN data collection will be structured into 2 levels of opt-in involvement (Level 1, 2). We will aim to incorporate data from both levels into tundra syntheses as described above, though Level 2 data is greatly prioritized.

Each protocol level will require different investments of time, resources, and/or operator expertise - giving groups will all backgrounds and hardware an opportunity to contribute meaningful data while simultaneously being able to adapt HiLDEN protocols to their own project needs. All levels incorporate ground data collection to allow for ground validation of the drone data.

Level 1 - High resolution tundra surface mapping

Objective: Generate high resolution land surface maps used to characterize tundra heterogeneity at sub-satellite pixel extents.

Skill level required: beginner to moderate
Time investment: 1-2 field days for data collection.

Scientific Objectives: This level of the protocol allows for simple classifications of surface cover types, assessment of impacts of herbivory, 3D surface model creation and simple flower counts. It can be applied across many sites to ask questions about shrub cover, size, and spatial distribution in different tundra types, landcover associations with topographic features and more.

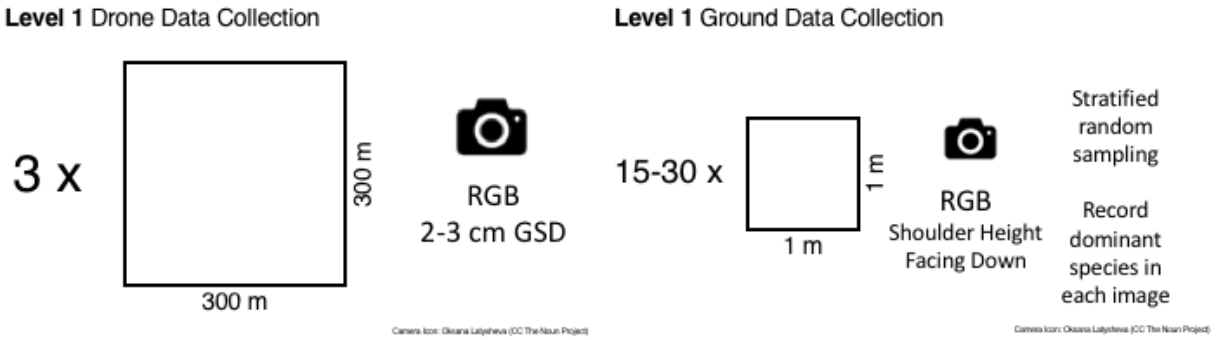


Figure 2. Imagery products: RGB only orthomosaics (300 x 300m orthomosaics, ~2-3 cm ground sampling distance). 3+ spatial replicates during peak season. Time-series also valuable. Ideally 3+ GCP (geolocated using RTK GPS if possible) per ortho.

Ground data collection: 15-30 on the ground photographs of vegetation from shoulder height (of 1 x 1m quadrat frame placed on ground). Canopy height measurements at the four corners and centre of all 1 x 1m plots. Description of vegetation cover including dominant species in all 1 x 1m plots. Stratified randomly across main land cover types in the mapped areas. Notations of dominant species/communities found across images.

Typical hardware ($): Stock Phantom 4 Advance/Pro using freely available mission planning software. Widely adaptable to most any system.

Level 2 - Multispectral land surface mapping - PRIORITY

Objective: Generate spectrally calibrated multispectral land surface maps.

Skill level: Moderate to Experienced
Time investment: 1-3 field days (or more)

Scientific Objectives: This level of the protocol can be used to generate vegetation indices (like NDVI), validate satellite datasets, and develop linkages between biomass and local-scale remote sensing metrics. Furthermore, it enables more sophisticated classifications of surface cover types.

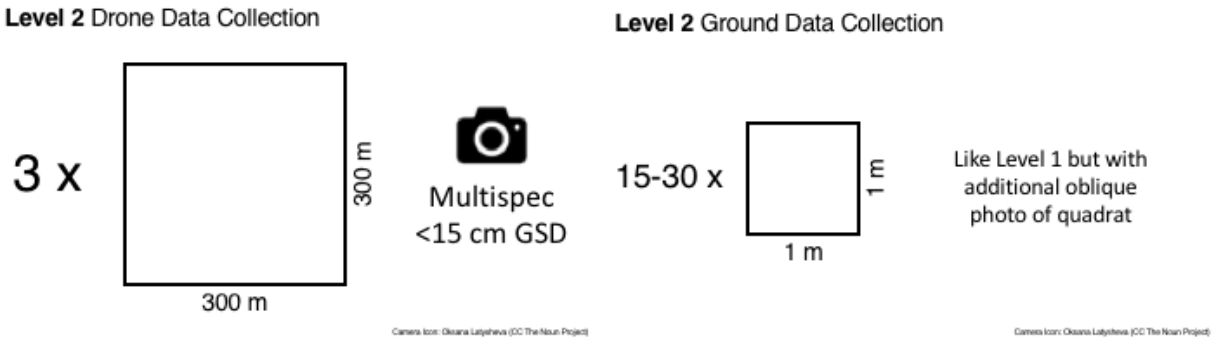


Figure 3. Imagery products: 2 - 5 band orthomosaics (ideally 300 m x 300m+, aim for 500m x 500m) with spectral calibration measures taken pre- and/or post-flight. <15cm GSD. 3+ replicates per seasonal window. Any seasonal window useful, time-series even more useful. It is critical that the attached matadata forms are filled out completely for each multispectral mapping flight. We have also found that data are of SIGNIFICANTLY higher spectral quality on days with NO clouds. Please prioritize flights for these days.

Ground data collection: 15-30 on the ground photographs with handheld RGB camera of vegetation from shoulder height (of 1 x 1m quadrat frame placed on ground with oblique photo showing veg height). Canopy height measurements at the four corners and centre of all 1 x 1m plots. Description of vegetation cover including dominant species in all 1 x 1m plots. Stratified randomly across main land cover types. Notations of dominant species/communities found across images. If available, a field spectrometer or handheld NDVI sensor may be used to measure reflectance / NDVI of each quadrat. If time allows destructive harvests to build relationships between biovolume and biomass would be very valuable, but this is beyond the scope of the current paper.

Typical hardware ($$$): Any platform (multi-rotor or fixed wing) set up to carry a multi-band camera (e.g. Parrot Sequoia, MicaSense Red Edge, and other options) Note: not designed for modified NIR cameras. Widely adaptable.

Processing: When submitting Level 2 data after the field season, please submit both the raw imagery AND a fully processed set of single band and NDVI orthomosaics using standard Pix4D workflows. Photos should be geotagged, with GCP markers visible in some. Full metadata sheets and coordinates for GCPs are required, in addition to the processing report. Details/limitations/alternatives can be discussed case-by-case. Reach out to jeffrey.t.kerby@dartmouth.edu with any questions.