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ABOVE: Vegetation Composition across Fire History Gradients on the Y-K Delta, Alaska

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Documentation Revision Date: 2020-05-15

Dataset Version: 1

Summary

This dataset provides ecological field data that were collected during July 2017 and July 2018 from 43 plots spanning gradients of fire history in the upland tundra of the Yukon-Kuskokwim (Y-K) Delta, Alaska. Plot-level data include vegetation species composition and structure, leaf area index (LAI), topography, thaw-depth, and soil characteristics collected at plots burned in 1971-1972, 1985, 2006-2007, 2015, or unburned controls. Vegetation species were sampled along transects using the vegetation point-intercept (VPI) sampling approach and summarized by three metrics of vegetation cover: (1) top-hit cover, (2) any-hit cover, and (3) multi-hit cover. Each metric is the total number of hits for a species divided by the total number of sample points. The VPI any-hit cover metric data were combined with Landsat imagery to develop fractional maps of any-hit cover for four aggregated plant functional types (PFTs); bryophytes, herbs, lichen, and shrubs for the upland tundra area. Photographs of vegetation transects and soil pits are included as companion files.

These data characterize multi-decadal succession and landscape change across the Izaviknek and Kingaglia uplands of the Y-K Delta following extensive historical fire events.

There are 10 primary dataset files: 2 files in *.csv format, 4 files in GeoTIFF (*.tif) format, 2 shapefiles (*.zip), and 2 files in (*.kmz) format. 244 companion files are also included: 2 files in (*.csv) format and 242 plot photos in Joint Photographic Experts Group (*.jpg) format.

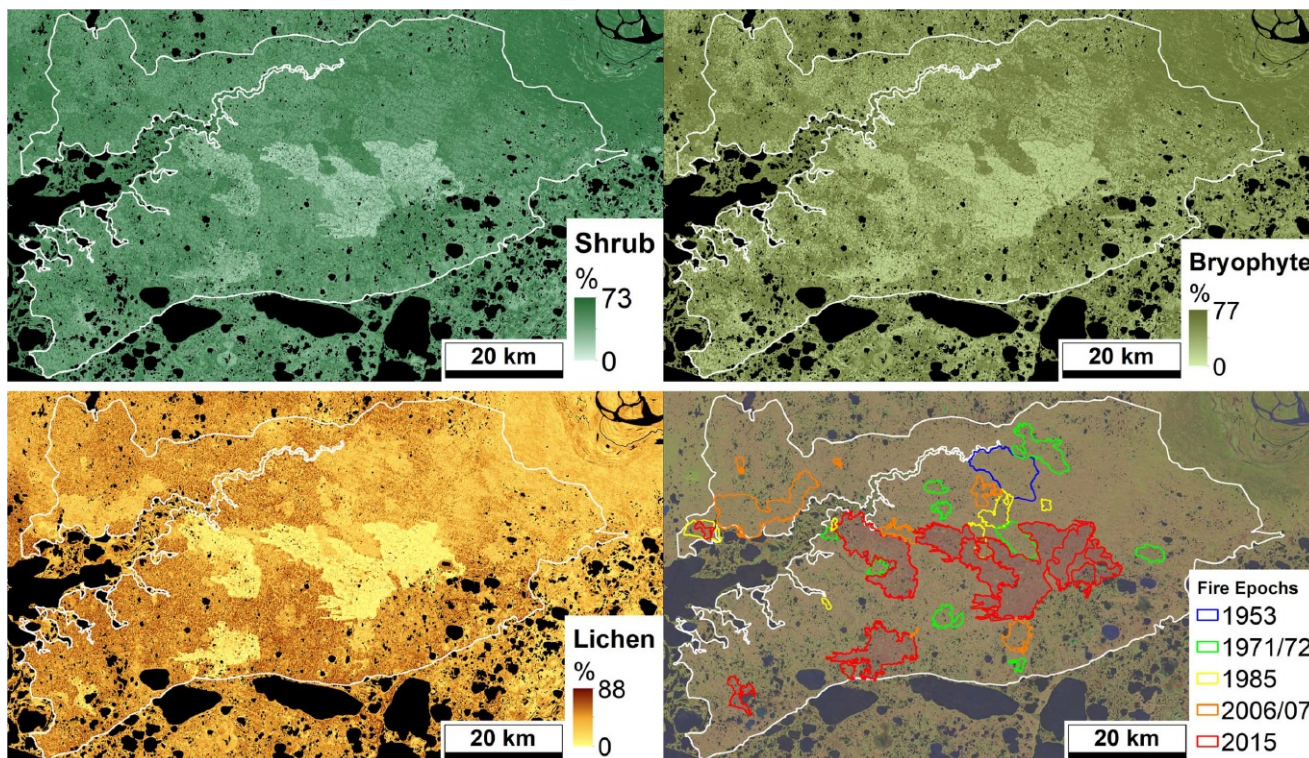


Figure 1. Vegetation point-intercept (VPI) any-hit cover metric data were combined with Landsat imagery to develop fractional maps of any-hit cover for four aggregated plant functional types (PFTs); bryophytes, herbs, lichen, and shrubs for the upland tundra area of the Y-K Delta, Alaska. VPI data were collected from plots in areas burned in 1971, 1985, 2005, and 2015. Source: Frost et al. 2020.

Citation

Frost, G.V., R.A. Loehman, P.R. Nelson, and D.P. Paradis. 2020. ABOVE: Vegetation Composition across Fire History Gradients on the Y-K Delta, Alaska. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1772>

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1. Dataset Overview

This dataset provides ecological field data that were collected during July 2017 and July 2018 from 43 plots spanning gradients of fire history in the upland tundra of the Yukon-Kuskokwim (Y-K) Delta, Alaska. Plot-level data include vegetation species composition and structure, leaf area index (LAI), topography, thaw-depth, and soil characteristics collected at plots burned in 1971-1972, 1985, 2006-2007, 2015, or unburned controls. Vegetation species were sampled along transects using the vegetation point-intercept (VPI) sampling approach and summarized by three metrics of vegetation cover: (1) top-hit cover, (2) any-hit cover, and (3) multi-hit cover (Karl et al. 2017). Each metric is the total number of hits for a species divided by the total number of sample points (Karl et al. 2017). The VPI any-hit cover metric data were combined with Landsat imagery to develop fractional maps of any-hit cover for four aggregated plant functional types (PFTs); bryophytes, herbs, lichen, and shrubs for the upland tundra area. Photographs of vegetation transects and soil pits are included as companion files.

These data characterize multi-decadal succession and landscape change across the Izaviknek and Kingaglia uplands of the Y-K Delta following extensive historical fire events.

Project: [Arctic-Boreal Vulnerability Experiment](#)

The Arctic-Boreal Vulnerability Experiment (ABoVE) is a NASA Terrestrial Ecology Program field campaign conducted in Alaska and western Canada between 2016 and 2021. Research for ABoVE links field-based, process-level studies with geospatial data products derived from airborne and satellite sensors, providing a foundation for improving the analysis, and modeling capabilities needed to understand and predict ecosystem responses to, and societal implications of, climate change in the Arctic and Boreal regions.

Related Dataset:

Whitley, M., G. Frost, M.T. Jorgenson, M. Macander, C.V. Maio, and S.G. Winder. 2018. ABoVE: Permafrost Measurements and Distribution Across the Y-K Delta, Alaska, 2016. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1598>

Related Publication:

Frost, G.V., R.A. Loehman, L.B. Saperstein, M.J. Macander, P.R. Nelson, D.P. Paradis, and S.M. Natali. 2020. Multi-decadal patterns of vegetation succession after tundra fire on the Yukon-Kuskokwim Delta, Alaska. *Environmental Research Letters* 15:025003. DOI: <https://doi.org/10.1088/1748-9326/ab5f49>

Acknowledgments:

This work was supported by NASA's ABoVE grant NNN16CP09C and Western Alaska Landscape Conservation Cooperative (WALCC) award F16AC01215.

2. Data Characteristics

Spatial Coverage: Izaviknek and Kingaglia uplands, central Yukon-Kuskokwim Delta (YKD), Alaska

ABoVE Reference Locations:

Domain: Core ABoVE

State/territory: Alaska

Above Grid cell(s): Ah000v000 ;

Bh001v003, Bh002v003, Bh002v004;

Ch014v019, Ch013v019, Ch011v020, Ch012v020, Ch013v020, Ch014v020, Ch015v020, Ch011v021, Ch012v021, Ch013v021, Ch014v021, Ch015v021, Ch012v022, Ch013v022, Ch014v022, Ch015v022, Ch016v022, Ch012v023, Ch013v023, Ch014v023, Ch015v023, Ch016v023, Ch013v024, Ch014v024

Spatial Resolution: plot measurements various, vegetation cover maps 30m²

Temporal Coverage: plot vegetation measurements 2017-07-20 to 2018-07-16

Temporal Resolution: annual

Study Area: Latitude and longitude are given in decimal degrees.

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Yukon-Kuskokwim Delta	-164.688	-160.938	62.0883	60.3598

Data File Information

This dataset includes 10 files: 2 files in Comma Separated Value (*.csv) format, 4 files in GeoTIFF (*.tif) format, 2 shapefiles (*.zip), and 2 files in Keyhole Markup Language Zipped (*.kmz) format.

Table 1. File names and descriptions.

File Name	Description
vegetation_cover.csv	plot-level vegetation cover
plot_details.csv	plot-level characterization data

bryophyte_any_hit_cover.tif	Continuous cover map of bryophyte PFT, percentage of points where bryophyte species occurred combined with 60 spectral predictors derived from Landsat data. Included bryophyte species: acrocarpus mosses, liverworts, mosses, pleurocarpus mosses, and Sphagnum.
lichen_any_hit_cover.tif	Continuous cover map of lichen PFT, percentage of points where lichen species occurred combined with 60 spectral predictors derived from Landsat data.
herbaceous_any_hit_cover.tif	Continuous cover map of herbaceous PFT, percentage of points where herbaceous species occurred combined with 60 spectral predictors derived from Landsat data. Included herbaceous species: forbs, grasses, sedges, and rushes.
shrub_any_hit_cover.tif	Continuous cover map of shrub PFT, percentage of points where shrub species occurred combined with 60 spectral predictors derived from Landsat data, including deciduous shrubs and evergreen shrubs.
plot_centers.zip	locations of plots
bounding_rectangle.zip	bounding rectangle around all plots
plot_centers.kmz	locations of plots
bounding_rectangle.kmz	bounding rectangle around all plots

Data File Details

For GeoTIFF files, values are the percentage of sampled points where the respective PFT occurred, missing values are represented by 255, and each file contains 4,912 rows and 4,583 columns.

For CSV files, missing values are represented by -9999 for numeric data and NA for text data.

The projection is "Canada_Albers_Equal_Area_Conic", EPSG: 102001.

Table 2. Variable names and descriptions of file **vegetation_cover.csv**, also included as the companion file **vegetation_cover_data_dictionary.csv**.

Variable Name	Description
plot_id	<p>Naming syntax: region_burn status-epoch-unique plot ID_sample year, where: region: YKDE = Yukon-Kuskokwim Delta burn status: B = burned, UB = unburned epoch (last burn): 1971, 1985, 2005, 2015 (only for plots with "B" burn status) unique plot ID = KX-X or XX (burned plots), XXXX (unburned plots), where X is a digit (e.g., "K4-01" or "0672" within a region and burn status) sample year: YYYY</p> <p>Examples: YKDE_B-2015-K3-01_2018 (burned), YKDE_UB-1026_2017 (unburned)</p>
date	date of data collection in YYYY-MM-DD format
longitude	X coordinate of plot center in decimal degrees
latitude	Y coordinate of plot center in decimal degrees
species	vegetation taxon or ground cover type; vegetation nomenclature follows Viereck & Little (2010) for shrubs, Skinnner et al. (2012) for grasses, and Hulten (1969) for all other vascular taxa
modifier	indicates standing dead (i.e., leaves and branches projecting above surface) or dead down (i.e., dead plant forms ground surface) status of vegetation; none = no modifier (i.e., live vegetation, detached litter, water, bare ground, etc.)
plant_functional_type	categorical class for plant functional type; note that Equisetum spp. are treated as forbs in this classification
any_hit_cover	the number of sample points where the species was intercepted ("hit") by a vertically mounted laser beam, divided by the total number of sample points (0-100%)
multi_hit_cover	the number of times the species was intercepted ("hit") by a vertically mounted laser beam, divided by the total number of sample points (can exceed 100%)
top_hit_cover	the number of sample points where the species was the first element intercepted ("hit") by a vertically mounted laser beam (i.e., formed the top of the canopy), divided by the total number of sample points (0-100%)

Table 3. Variable names and descriptions of file **plot_details.csv**, also included in the companion file **plot_details_data_dictionary.csv**.

Variable Name	Description
plot_id	<p>Naming syntax: region_burn status-epoch-unique plot ID_sample year, where: region: YKDE = Yukon-Kuskokwim Delta burn status: B = burned, UB = unburned epoch (last burn): 1971, 1985, 2005, 2015 (only for plots with "B" burn status) unique plot ID = KX-X or XX (burned plots), XXXX (unburned plots), where X is a digit (e.g., "K4-01" or "0672" within a region and burn status) sample year: YYYY</p> <p>Examples: YKDE_B-2015-K3-01_2018 (burned), YKDE_UB-1026_2017 (unburned)</p>

date	date of data collection in YYYY-MM-DD format
longitude	X coordinate of plot center in decimal degrees
latitude	Y coordinate of plot center in decimal degrees
fire_year	year of last fire; burn status determined from AICC database and review of satellite imagery (Landsat and/or DigitalGlobe)
years_since_fire	number of years elapsed between last fire and field sampling
plot_radius	radius of plot in meters
percent_burned	percent of plot area that actually burned; visually estimated from post-fire DigitalGlobe imagery (where available; 2015 burn scars only)
mtbs_class	dominant fire severity class in Monitoring Trends in Burn Severity (MTBS) classification for burn (where available; burns after 2005 only; data gaps exist for some burns); see Eidinshink et al. 2007
slope	slope angle at plot center in degrees; measured using an inclinometer
aspect	slope aspect at plot center in degrees; measured using a compass
pH	soil pH; measured from free water in soil pit excavated near the center of each plot
elec_cond	soil electrical conductivity in microsiemens; measured from free water in soil pit
surf_org_thick	total thickness of surface organic material in soil profile in centimeters
water_depth	water depth at the soil pit in centimeters; negative values indicate sub-surface
LAI_mean	mean of leaf area index (LAI) measurements; measured at every fifth point along each transect using a LAI-2000 Plant Canopy Analyzer (LI-COR Biosciences, Lincoln NE, USA)
LAI_stderr	standard error of mean LAI
LAI_n	total number of LAI measurements at each plot; each measurement consisted of the mean of five LAI readings collected in an "X" pattern directly above each sample point and at four points 1 meter away
woody_ht_mean	mean maximum shrub height in centimeters; measured within a 20 centimeter radius of every fifth point along each transect
woody_ht_stddev	standard deviation of mean maximum shrub height in centimeters
woody_ht_n	total number of maximum shrub height measurements at plot
thaw_depth_mean	mean thaw depth in centimeters; measured at every fifth point along each transect
thaw_depth_stddev	standard deviation of mean thaw depth in centimeters
thaw_depth_n	total number of thaw depth measurements at plot
veg_pt_intercept_n	total number of vegetation point-intercept sample points at plot
veg_class_AVC	vegetation class for plot; adapted from Alaska Vegetation Classification (AVC), Level IV (Viereck et al. 1992)
notes	field notes

Companion Files

This dataset includes 244 companion files: 2 files in Comma Separated Value (*.csv) format and 242 files in Joint Photographic Experts Group (*.jpg) format.

The 242 files in *.jpg format are plot photos and follow a similar naming convention as plot_ID described in the first row of Table 2.

Vegetation Transect Photos

Naming syntax: region_burn status-last burn epoch-plot ID_sample year_photo info.jpg, where:

region: YKDE = Yukon-Kuskokwim Delta

burn status: B = burned, UB = unburned

epoch (last burn): 1971, 1985, 2005, 2015 (only for plots with "B" burn status)

plot ID: KX-X or XX (burned plots), XXXX (unburned plots), where X is a digit

sample year: YYYY

photo info: transect line = 1-3, photo direction = C (from center) or E (end of transect towards center)

Example: YKDE_B-2005-02_2017_3E.JPG

Soil Pit Photos

Naming syntax: region_burn status-last burn epoch-plot ID_sample year_photo info.jpg, where:

region: YKDE = Yukon-Kuskokwim Delta

burn status: B = burned, UB = unburned

epoch (last burn): 1971, 1985, 2005, 2015 (only for plots with "B" burn status)

plot ID: KX-X or XX (burned plots), XXXX (unburned plots), where X is a digit

sample year: YYYY

photo info: XXXX (a unique ID)

Example: YKDE_B-1971-08_2017_0907.JPG

Table 4. Companion file names and descriptions.

File Name	Description
	column names and descriptions for file

vegetation_cover_data_dictionary.csv	vegetation_cover.csv
plot_details_data_dictionary.csv	column names and descriptions for file plot_details.csv
region_burn_status-last burn epoch-plot ID_sample year_photo info.jpg	242 plot vegetation transect and soil pit photos

3. Application and Derivation

The data were collected to characterize multi-decadal succession and landscape change following extensive fire events in a lichen-dominated upland tundra of central Yukon-Kuskokwim Delta, Alaska.

4. Quality Assessment

Measures of dispersion are provided for some quantitative measurements for which multiple measurements were taken at a plot (e.g., leaf area index). However, many measures were collected only once per site. QA/QC on the field data was obtained by reviewing plot photographs and field notes, and performing logical checks on the point-intercept data.

5. Data Acquisition, Materials, and Methods

Alaska's Yukon-Kuskokwim Delta (YKD) is one of the warmest parts of the Arctic tundra biome and tundra fires are common in its upland areas. Approximately 20% (789 km²) of the IKU has experienced fire since 1953, with about half of all fire occurring in 2015 (AICC 2019).

Following is a brief synopsis of methods and analyses provided in Frost et al. (2020).

Plot Selection

Plot locations were selected across a fire gradient using a stratified-random approach, with priority given to points within ABoVE remote-sensing flight lines and points in 2015 burn scars (i.e., sampled 2-3 years post-fire).

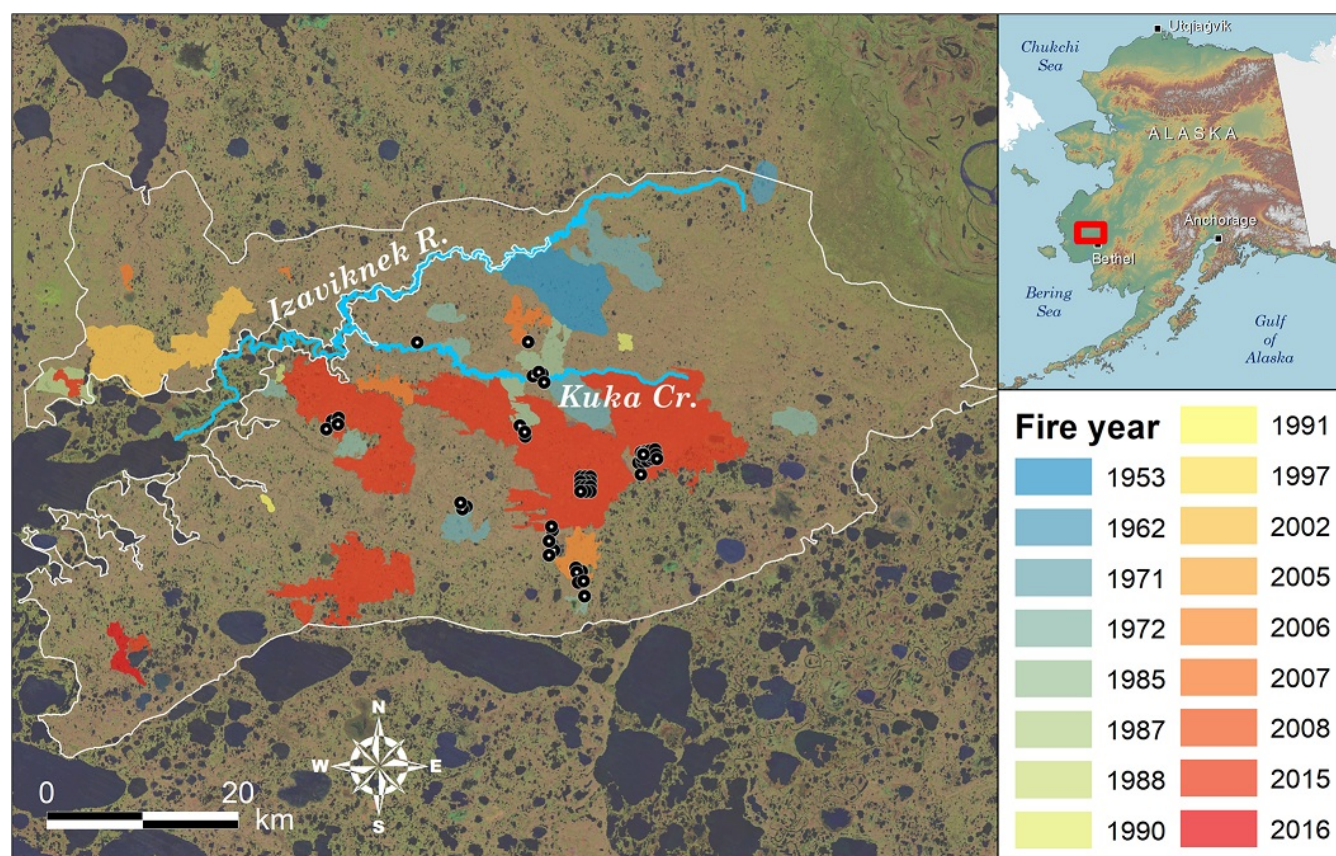


Figure 2. Map of Izaviknek-Kingaglia uplands study area, field plot locations, and perimeters of known tundra fires (1953-2016), Yukon-Kuskokwim Delta, Alaska. Fire perimeters adapted from AICC (2019). Source: Frost et al. 2020.

Sampling Design

Within plots, sampling occurred along three 30 m linear transects radiating at 120° intervals from the plot center, except for locations sampled 2-3 years post-fire, which consisted of four parallel 20 m transects oriented from east to west and spaced 5-10 m apart.

Soil Characterization

- Soil thaw depth (42 plots) was measured at 5 m intervals along transects.
- A soil pit was excavated to 40 cm depth near the center of each plot to record the thickness of the surface organic layer.
- Photos of each soil pit are included as companion files.

Vegetation Characterization

- Maximum shrub height (35 plots) was measured at 5 m intervals along transects.
- Leaf area index (LAI) was measured at every fifth point along each transect using a LAI-2000 Plant Canopy Analyzer (LI-COR Biosciences, Lincoln NE, USA). The value for each plot consisted of the mean of five LAI readings collected in an "X" pattern directly above each sample point and at four points 1 meter away.
- Vegetation cover data were collected once using a vegetation point-intercept (VPI) sampling approach within circular plots (15 or

35 m radius) from July 20-31, 2017 (24 plots) and July 8-16, 2018 (18 plots).

- Vegetation was sampled along the transects at 0.5-1 m intervals by recording all species "hit" (i.e., intercepted) by the beam from a vertically mounted laser pointer.
- Photos of vegetation transects are included as companion files.

Vegetation Cover Metrics

1. Top-hit cover (THC) is the percentage of sample points within a plot where a species was the first hit. THC represents the top-of-canopy and could be calculated at all 56 plots; the THC of all species sums to 100% per plot. THC was also calculated for litter (dead vegetation and detached leaves), water, and bare ground.

2. Any-hit cover (AHC) is the percentage of sample points within a plot where a species occurred. The total AHC for a plot can exceed 100% (i.e. in multi-layered vegetation); AHC was calculated for live vegetation at 46 plots.

3. Multi-hit cover (MHC) is the total number of hits for a species, divided by the number of sample points within a plot. MHC is a metric of canopy density and can include multiple hits of a species at a single point. MHC thus can exceed 100%; MHC was calculated for live vegetation at 38 plots.

Plant Functional Types

The vegetation cover (species and cover type) was aggregated into categorical "plant functional types" including acrocarpous mosses, bare ground, deciduous shrubs, evergreen shrubs, forbs, grasses, lichens, litter, liverworts, mosses, pleurocarpous mosses, sedges and rushes, shrubs, Sphagnum, and water.

PFT Cover Maps

Vegetation cover metrics were aggregated into four plant functional types (PFT): bryophytes (acrocarpous mosses, liverworts, mosses, pleurocarpous mosses, Sphagnum), herbs (forbs, grasses, sedges, rushes), lichen, and shrubs (deciduous shrubs, evergreen shrubs). The vegetation cover metrics were combined with 60 spectral predictors derived from Landsat data to develop continuous cover maps for the four PFTs at 30 m resolution. The spectral predictors consisted of percentile-based surface reflectance composites for 6 bands and 6 indices (e.g. Normalized Difference Vegetation Index) derived from Tier 1 Landsat 7 Enhanced Thematic Mapper and Landsat 8 Operational Land Imager data from June to September 2016–2018.

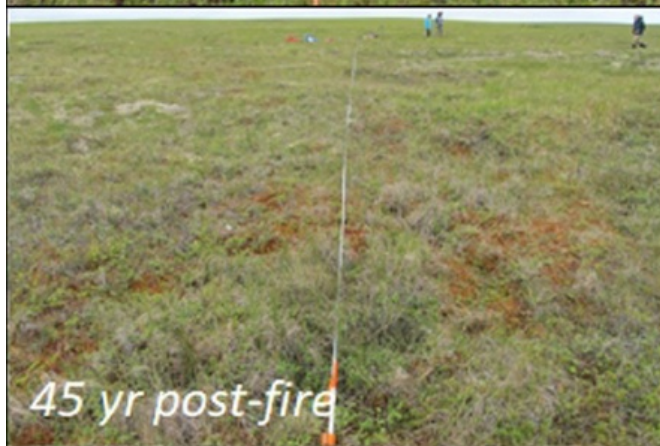
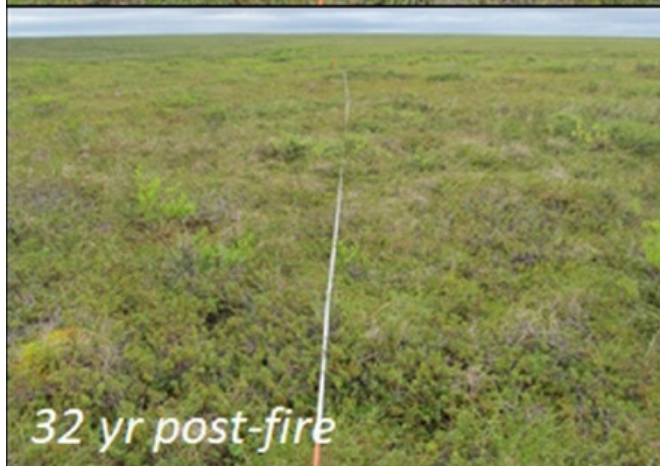
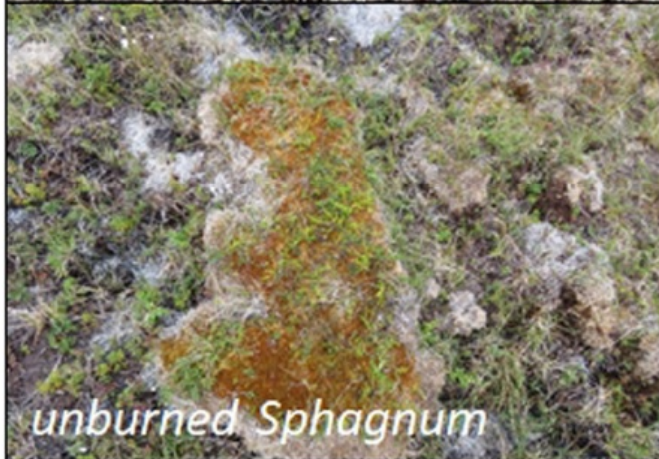
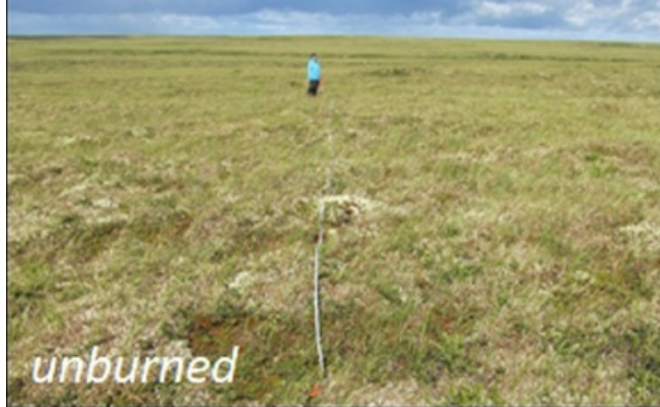


Figure 3. Field photos of transects (left) and typical vegetation (right) taken along a 45 years fire history gradient, Yukon-Kuskokwim Delta, Alaska. Source: Frost et al. 2020.

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[ABoVE: Vegetation Composition across Fire History Gradients on the Y-K Delta, Alaska](#)

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

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